ORDER	U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

SUBJ:	TERMINAL AREA OPERATIONS AVIATION RULEMAKING COMMITTEE

1. PURPOSE. This order constitutes the charter for the Terminal Area Operations Aviation Rulemaking Committee that is designated and established pursuant to the Administrator's authority under 49 USC 106(p)(5).

2. DISTRIBUTION. This order is distributed to the director level in the Offices of Rulemaking; International Aviation; Chief Counsel; Airport Safety and Standards; Airport Planning and Programming; Aviation Research; Budget; Financial Management; Cost and Performance Management; Communications, Navigation, and Surveillance Systems; the Air Traffic, Flight Standards, and Aircraft Certification Services; and the Aviation Systems Standards.

3. BACKGROUND. Safety issues and recommendations identified by the Commercial Aviation Safety Team (CAST) relating to Controlled Flight Into Terrain (CFIT) accidents and incidents, and airport capacity constraints with associated delays, dictate a need for improvements in terminal area operations. There is a need to fully utilize the capabilities of modern aircraft, specifically the use of area navigation (including the global positioning system). Evolving technologies and potential equipment upgrades provide increased operational and safety benefits not realized unless a practical means is established to direct and facilitate new criteria and implementation. The international aspects of aviation operations and aircraft production require that terminal area operational procedures and associated equipage be consistent.

4. OBJECTIVES AND SCOPE. This committee will provide a forum for the United States aviation community to discuss and resolve issues, provide direction for U.S. flight operations criteria, and produce U.S. consensus positions for global harmonization.

a. The general goal of the committee is to develop a means to implement improvements in terminal area operations that address safety, capacity, and efficiency objectives, as tasked, that are consistent with international implementation. In the context of this committee, terminal area means the airspace that services arrival, departure, and airport ground operations. This committee provides a forum for the Federal Aviation Administration (FAA), other government entities, and affected members of the aviation community to discuss issues and to develop resolutions and processes to facilitate the evolution of safe and efficient terminal area operations. This committee supports the international harmonization process.

b. To achieve these objectives, the committee's initial task is to identify and resolve outstanding issues pertaining to draft Advisory Circular (AC) 120-29A and other draft required navigation performance (RNP) materials including, but not limited to, AC 20-RNP, AC 90- RNP RNAV, AC 120-xxx (airport obstacle analysis), and FAA Order 8260.RNP. The committee will develop draft AC language and a strategy, process, and schedule for the implementation of new or revised criteria. The committee will make its recommendations, including any recommendations for rulemaking and additional tasking, to the Administrator through the Associate Administrator for Regulation and Certification.

5. PROCEDURES.

a. The committee provides advice and recommendations to the Associate Administrator for Regulation and Certification. The committee acts solely in an advisory capacity.

b. The committee shall discuss and present whatever input, guidance, and recommendations the members of the committee consider relevant to the ultimate disposition of issues. Discussion will include, but is not limited to, the following:

(1) Operational objectives, recommendations, and requirements.

(2) Airworthiness criteria and means of compliance to meet the operational objectives.

(3) Recommendations for rulemaking necessary to meet objectives.

(4) Guidance material and the implementation processes.

(5) International harmonization issues and recommendations.

(6) Documentation and technical information to support recommendations

c. Fourteen months from the issuance of this Order, the committee shall present an initial report and written recommendations to the Administrator, through the Associate Administrator for Regulation and Certification. This does not prohibit the committee from making interim recommendations. These recommendations should take the form of documented issue resolutions, recommended policy decisions, draft guidance material, and/or proposed rulemaking, as appropriate. Specific implementation planning and processes will be established to ensure that recommendations meet these objectives.

6. ORGANIZATION AND ADMINISTRATION.

a. The Associate Administrator for Regulation and Certification shall have the sole discretion to appoint members or organizations to the committee. The committee shall consist of members of the aviation community, including the public and/or other Federal Government entities representative of various viewpoints. The FAA shall provide participation and support from all affected lines of business.

b. The Associate Administrator for Regulation and Certification shall receive all committee recommendations and reports. The Associate Administrator, through the Flight Standards Service, shall also be responsible for providing administrative support for the committee. The Flight Standards Service will provide the designated Federal official for this committee. The designated Federal official will attend all meetings of the committee.

c. The Associate Administrator for Regulation and Certification is the sponsor of the committee, and shall select an industry co-chair from the membership of the committee. Also, the Associate Administrator shall designate the FAA co-chair of the committee. Once designated, the co-chairs—

(1) Determine, in coordination with the other members of the committee, when a meeting is

required.

(2) Arrange notification to all committee members of the time and place for each meeting.

(3) Formulate an agenda for each meeting and conduct the meeting.

d. Minutes of committee meetings will be kept.

7. MEMBERSHIP.

a. The committee membership consists of approximately 15 associations and organizations selected by FAA. The membership shall be balanced in points of view, interests, and knowledge of the objectives and scope of the committee.

b. The members of the committee shall include the following organizations:

(1) Aviation associations such as- –

(a) Air Transport Association.

(b) Aircraft Owners and Pilot Association.

(c) General Aviation Manufacturers Association (typographical error corrected 2/25/02)

(d) Helicopter Association International.

(e) National Business Aviation Association.

(f) Regional Airline Association.

(2) Employee unions/groups such as—

(a) Pilots associations.

(b) National Air Traffic Controllers Association.

(c) Professional Airways Systems Specialists.

(d) American Federation of State, County, and Municipal Employees.

(3) Air carriers, manufacturers, and otber aviation industry participants.

(4) The Federal Aviation Administration lines of business such as—

(a) Regulation and Certification.

(b) Air Traffic Services.

(c)Airports.

(5) Other Federal Government agencies such as--

(a) National Aeronautics and Space Administration

(b) Department of Defense

8. COST AND COMPENSATION. The estimated cost to the Federal government of the Terminal Area Operations Aviation Rulemaking Committee is approximately $20,000. Non-Government representatives serve without Government compensation and bear all costs related to their participation on the committee.

9. PUBLIC PARTICIPATION. Interested persons or organizations planning to attend a meeting who are not members of this committee must request and receive approval in advance of the meeting from the Associate Administrator for Regulation and Certification or his/her delegate.

10. AVAILABILITY OF RECORDS. Subject to the conditions of the Freedom of Information Act, 5 U.S.C. Section 522, records, reports, agendas, working papers, and other documents that are made available to or prepared for or by the committee shall be available for public inspection and copying at the FAA Flight Standards Service, 800 Independence Avenue, SW., Washington, D.C. 20591. Fees shall be charged for information furnished to the public in accordance with the fee schedule published in part 7 of title 49, Code of Federal Regulations.

11. PUBLIC INTEREST. The formation of the Terminal Area Operations Aviation Rulemaking Committee is determined to be in the public interest in connection with the performance of duties imposed on FAA by law.

12. EFFECTIVE DATE AND DURATION. This committee is effective February 19, 2002. The committee shall remain in existence until February 19, 2004, unless sooner terminated or extended by the Administrator.

/s/Jane F. Garvey

Administrator

This notice shall be published in the **Federal Register**.

Richard L. Armitage,

Deputy Secretary of State, Department of State.

[FR Doc. 03–29735 Filed 11–25–03; 8:45 am]

BILLING CODE 4710–07–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Notice Before Waiver With Respect to Land at Hamilton Municipal Airport, Hamilton, NY

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of intent of waiver with respect to land.

SUMMARY: The FAA is publishing notice of the proposed release of approximately 3.966 acres of land located at Hamilton Municipal Airport, to allow its sale for non-aviation development. The parcel was part of the airport property acquired with federal funding support under the Airport Improvement Program. The Village of Hamilton proposes to sell the land to a developer who will develop it as a 63-room motel.

FAA's action is to release the land from a deed provision requiring aeronautical use of the property. The Village of Hamilton has stated that it has no aeronautical use for the parcel now or in the near future according to the Hamilton Municipal Airport Layout Plan.

The Fair Market Value of the land will be paid to the Village of Hamilton to be used for the capital development of Hamilton Municipal Airport.

Any comments the agency receives will be considered as a part of the decision.

DATES: Comments must be received on or before December 26, 2003.

ADDRESSES: Comments on this application may be mailed or delivered in triplicate to the FAA at the following address: Philip Brito, Manager, FAA New York Airports District Office, 600 Old Country Road, Suite 446, Garden City, New York 11530.

In addition, one copy of any comments submitted to the FAA must be mailed or delivered to Mr. Charles Getchonis, Mayor, Hamilton, New York, at the following address: Mr. Charles Getchonis, Mayor, Village of Hamilton, P.O. Box 119, 3 Broad Street, Hamilton, New York 13346.

FOR FURTHER INFORMATION CONTACT: Mr. Philip Brito, Manager, New York Airports District Office, 600 Old Country Road, Suite 446, Garden City, New York 11530; telephone (516) 227–3803; FAX (516) 227–3813; e-mail *Philip.Brito@faa.gov*.

SUPPLEMENTARY INFORMATION: On April 5, 2000, new authorizing legislation became effective. That bill, the Wendell H. Ford Aviation Investment and Reform Act for the 21st Century, Pub. L. 10–181 (Apr. 5, 2000; 114 Stat. 61) (AIR 21) requires that a 30 day public notice must be provided before the Secretary may waive any condition imposed on an interest in surplus property.

Issued in Garden City, New York, on November 14, 2003.

Philip Brito,

Manager, New York Airports District Office, Eastern Region.

[FR Doc. 03–29457 Filed 11–25–03; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Aviation Rulemaking Advisory Committee; Air Carrier Operations Issues—New Task

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of a new task for the Aviation Rulemaking Advisory Committee (ARAC).

SUMMARY: Notice is given of new tasks assigned to and accepted by the Aviation Rulemaking Advisory Committee (ARAC). This notice tells the public of the activities of ARAC.

FOR FURTHER INFORMATION CONTACT: Kathy Abbott, Federal Aviation Administration, Regulation and Certification, 800 Independence Ave., SW., Washington, DC 20591; telephone: 202–267–7192.

SUPPLEMENTARY INFORMATION:

Background

The FAA established the Aviation Rulemaking Advisory Committee to provide advice and recommendations to the FAA Administrator, through the Associate Administrator for Regulation and Certification, on the full range of the FAA's rulemaking activities about aviation-related issues. This includes getting advice and recommendations on the FAA's commitment to harmonize its Federal Aviation Regulations (FAR) and practices with its trading partners in Europe and Canada.

One area ARAC deals with is air carrier operations issues. These issues involve the operational requirements for air carriers, including crewmember requirements, airplane operating performance and limitations, and equipment requirements.

The Task

This notice is to tell the public the FAA has asked ARAC to provide advice and recommendation on the following harmonization task:

Harmonize positions on issues related to low-visibility operations. The ARAC Working Group will work on operational and airworthiness issues that apply to air carrier operations in low visibility conditions. The ARAC Working Group will identify harmonization issues in the following areas and will work to reach and document consensus on those issues: Maintenance of harmonization of all weather operations criteria based on experience gained from recent certification programs and operations; evolution of criteria to support Global Navigation Satellite System Landing Systems (GLS); new technologies that are being applied to low visibility operations, and complete harmonization of operating minima criteria and implementation processes. The Group will coordinate information with the FAA/Industry Terminal Area Operations Aviation Rulemaking Committee (TAOARC), JAA All Weather Operations Steering Group (AWOSG), and European Aviation Safety Agency (EASA) for consideration during its activities. This coordination will occur before the All Weather Operations Harmonization Working Group (AWO HWG) presents recommendations to ARAC. By March 2004, the Group will complete and document in a technical report the activity underway to harmonize low visibility operating minima between Europe and the United States.

ARAC Acceptance of Task

ARAC has accepted the task and has chosen to assign the task to the All Weather Operations Harmonization Working Group. Because a new task is being assigned to the working group, membership will be reopened. The working group will serve as staff to ARAC to aid ARAC in the analysis of the assigned task. Working group recommendations must be reviewed and approved by ARAC. If ARAC accepts the working group's recommendations, it forwards them to the FAA as ARAC recommendations.

Working Group Activity

The All Weather Operations Harmonization Working Group is expected to comply with the procedures adopted by ARAC. As part of the procedures, the working group is expected to:

1. Recommend a work plan for completion of the tasks, including the reason supporting such a plan. The work plan should be presented for consideration at the first meeting of the ARAC on air carrier operations issues held following publication of this notice.

2. Give a detailed presentation of the proposed recommendations, before continuing with the work stated in item 3 below.

3. For each task, draft suitable documents with supporting analyses. Draft any other related material or collateral documents the working group determines to be suitable.

4. Provide a status report at each meeting of ARAC held to consider air carrier operations issues.

Participation in the Working Group

The All Weather Operations Harmonization Working Group will be composed of technical experts having an interest in the assigned task. A working group member need not be a representative of a member of the full committee.

An individual who has expertise in the subject matter and wishes to become a member of the working group should write to the person listed under the caption FOR FURTHER INFORMATION CONTACT expressing that desire, describing his or her interest in the tasks, and stating the expertise he or she would bring to the working group. All requests to participate must be received by December 10, 2003. The assistant chair, the assistant executive director, and the working group chair will review the requests, and the individuals will be advised whether the request can be granted.

Individuals chosen for membership on the working group will be expected to represent their aviation community segment and participate actively in the working group (for example, attend all meetings, provide written comments when asked to do so, etc.). They also will be expected to devote the resources necessary to ensure the ability of the working group to meet any assigned deadline(s). Members are expected to keep their management chain advised of working group activities and decisions to ensure the agreed technical solutions do not conflict with their sponsoring organization's position when the subject being negotiated is presented to ARAC for a vote.

Once the working group has begun deliberations, members will not be added or substituted without the approval of the assistant chair, the assistant executive director, and the working group chair.

The Secretary of Transportation has determined the formation and use of ARAC is necessary and in the public interest in connection with the performance of duties imposed on the FAA by law.

Meetings of ARAC will be open to the public. Meetings of the All Weather Operations Harmonization Working Group will not be open to the public, except to the extent those individuals with an interest and expertise are selected to participate. No public announcement of working group meetings will be made.

Issued in Washington, DC, on November 17, 2003.

Anthony F. Fazio,

Executive Director, Aviation Rulemaking Advisory Committee.

[FR Doc. 03–29450 Filed 11–25–03; 8:45 am]

BILLING CODE 4910–13–P

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

RTCA Government/Industry Free Flight Steering Committee Meeting

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of RTCA/Industry Free Flight Steering Committee meeting.

SUMMARY: The FAA is issuing this notice to advise the public of a meeting of the RTCA Government/Industry Free Flight Steering Committee.

DATES: The meeting will be held December 4, 2003, 1–3 p.m.

ADDRESSES: The meeting will be held at FAA Headquarters, 800 Independence Avenue, SW., Bessie Coleman Conference Center (Rm. 2AB), Washington, DC, 20591.

FOR FURTHER INFORMATION CONTACT: (1) RTCA Secretariat, 1828 L Street, NW., Suite 805, Washington, DC 20036; telephone (202) 833–9339; fax (202) 833–9434; Web site *http://www.rtca.org.*

SUPPLEMENTARY INFORMATION: Pursuant to section 10(a)(2) of the Federal Advisory Committee Act (Pub. L. 92–463, 5 U.S.C., appendix 2), notice is hereby given for Free Flight Steering Committee meeting. Note: *Non-Government attendees to the meeting must go through security and be escorted to and from the conference room.*

Issued in Washington, DC, on November 20, 2003.

Robert Zoldos,

FAA System Engineer, RTCA Advisory Committee.

[FR Doc. 03–29595 Filed 11–25–03; 8:45 am]

BILLING CODE 4910–13–M

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

Change Notice for RTCA Program Management Committee

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Notice of RTCA Program Management Committee meeting.

SUMMARY: The FAA is issuing this notice to advise the public of a meeting of the RTCA Program Management Committee.

DATES: The meeting will be held December 9, 2003 starting at 9 a.m.

ADDRESSES: The meeting will be held at RTCA, Inc., 1828 L Street, NW., Suite 805, Washington, DC 20036.

FOR FURTHER INFORMATION CONTACT: RTCA Secretariat, 1828 L. Street, NW., Suite 850, Washington, DC 20036; telephone (202) 833–9339; fax (202) 833–9434; Web site *http://www.rtca.org.*

SUPPLEMENTARY INFORMATION: Pursuant to section 10(a)(2) of the Federal Advisory Committee Act (Pub. L. 92–463, 5 U.S.C., Appendix 2), notice is hereby given for a Program Management Committee meeting. The revised agenda will include:

- December 9:
- Opening Session (Welcome and Introductory Remarks, Review/Approve Summary of Previous Meeting)
  - Publication Consideration/Approval:
  - Final Draft, *Aircraft Surveillance Applications (ASA) MASPS, RTCA Paper No. 208–03/PMC–303, prepared by SC–186.*
- Discussion:
  - Special Committee 147, TCAS
  - Discuss/Approve Revised Terms of Reference
  - Special Committee 181
  - Final Report
  - Special Committee Chairman's Report
  - Action Item Review:
  - Review/Status—All open action items
  - Closing Session (Other Business, Document Production, Date and Place of Next Meeting, Adjourn)

Attendance is open to the interested public but limited to space availability.

Report of the

Terminal Area Operations Aviation Rulemaking Committee (TAOARC)

Executive Summary

June 6, 2003

June 6, 2003

Mr. Nicholas A. Sabatini
Associate Administrator for Regulation and Certification
AVR-1
800 Independence Ave., SW
Washington, DC 20591

Subject: Executive Summary - TAOARC Interim Report – June 6, 2003

Dear Mr. Sabatini:

This letter accompanies the Executive Summary of the Terminal Area Operations Rulemaking Advisory Committee (TAOARC) Interim Report. This is the first formal report from the TAOARC.

The formation of the TAOARC is seen as a milestone in building a cooperative forum to collectively support recommendations regarding future development and implementation of FAA policy. These recommendations support safety and efficiencies by enabling the development and growth of supporting functions of the air transportation industry, with specific interest in NAS modernization.

We appreciate your continued interest and involvement in the process, and expect to achieve higher levels of productivity regarding important decisions in the future.

Sincerely,

John McGraw
FAA Co-Chair

James McKie
Industry Co-Chair

CC: JSC
TAOARC Website

Report of the Terminal Area Operations Aviation Rulemaking Committee (TAOARC)

Issue 1	June 6, 2003

Executive Summary

The Terminal Area Operations Aviation Rulemaking Committee (TAOARC) was chartered by the Federal Aviation Administration (FAA) Administrator on February 19, 2002 to provide a forum for the United States aviation community to discuss and resolve issues, provide direction for U.S. flight operations criteria, and produce U.S. consensus positions for global harmonization. The general goal of the TAOARC is to develop a means to implement improvements in terminal area operations that address safety, capacity, and efficiency objectives that are consistent with international implementation.

The charter required the TAOARC to provide, 14 months from the issuance of the charter, an initial report and written recommendations to the Administrator, through the Associate Administrator for Regulation and Certification (AVR-1). The charter specified that the recommendations should take the form of documented issue resolutions, recommended policy decisions, draft guidance material, and/or proposed rulemaking, as appropriate.

This report is the vehicle by which the TAOARC makes recommendations to the FAA. As specified in the charter, the report is being provided to the Administrator, through AVR-1. The TAOARC will be pleased to provide the report to other FAA officials when requested.

Before the expiration of the charter on February 19, 2004, the report will be updated periodically with recommendations for consideration and possible action.
Additionally, the TAOARC requests that the FAA report back to the committee within 90 days regarding its decisions on implementing the recommendations contained in this report. This is necessary as each recommendation is a building block for further discussions.

Committee Work Summary

To date, the TAOARC has accomplished two significant tasks and formulated seven key recommendations:

Accomplishments

1. The TAOARC identified and resolved outstanding issues pertaining to draft AC120-29A. The AC was issued on August 12, 2002.
2. The TAOARC reached consensus on the issues pertaining to the draft FAA Order 8260.51 (a.k.a. 8260.RNP), ***U.S. Standard for RNP Instrument Approach Procedure Construction*** that was issued on December 30, 2002.

Summary of Recommendations

1. The TAOARC recommends that its charter be expanded to include en-route operations. See recommendation GEN-001.
2. The TAOARC recommends that the FAA explore the initiation of a Strategy Team to work with European Organization for Safety for Air Navigation (EUROCONTROL) and the Joint Aviation Authorities (JAA)/European Aviation Safety Agency (EASA) to explore the level of commonality that can be achieved between Europe and the United States in the evolution of airspace planning, airspace management and associated factors such as service provision and expected aircraft functionality. See recommendation RNP-001.
3. The TAOARC recommends that the FAA produce a top level RNP Transition Plan, in conjunction with the airspace users that identifies how RNP will be expanded, the key transition sequences, key assumptions, and a plan for addressing issues and concerns. See recommendation RNP-002.
4. The TAOARC recommends that the FAA produce a detailed RNP Implementation Plan, in conjunction with the airspace users, that identifies the key decisions, major work items and priorities, significant dependencies, schedule, roles and responsibilities, and tracking methods. See recommendation RNP-003.
5. The TAOARC recommends that as the FAA and industry proceed with performance based RNP implementation (particularly for approach operations), the relationship of performance-based procedure criteria to aircraft/systems performance requirements will need to be established. See recommendation RNP-004.
6. The TAOARC recommends that the FAA support the following strategic approach to accommodate various capabilities and uses for RNAV and RNP operations:
   - Order 8260.51 will be dedicated to RNP operations that support RNP certificated aircraft
   - Order 8260.48 will remain as an Area Navigation (RNAV) vehicle but will include linear criteria

- Special Aircraft and Aircrew Authorization Requirements (SAAAR) criteria will be added to the Orders to realize appropriate operational benefits for suitably equipped aircraft

See recommendation RNP-005

7. The TAOARC recommends that the FAA accept the All Weather Operations Harmonization Working Group (AWOHWG) model for a Ground Based Augmentation System (e.g., Local Area Augmentation System (LAAS)) and include the model in the next update to AC 120-28D. This model will be used in aircraft certification projects. See recommendation GLS-001.

This report is intended to be an evolving document that will reflect the activity and conclusions of the TAOARC on a periodic basis.

Committee Report

Content

The content of this report is as follows:

1. Background
2. Initial Tasking
3. Additional Tasking (none at this time)
4. Overview of the Work of the TAOARC
5. TAOARC Work Process
6. Periodic Reports – this section contains the report to AVR-1 in the form of a summary of the committee's activities, its accomplishments and a list of recommendations for the current reporting period.
7. Recommendations – this section can be considered an open "loose leaf" folder that contains specific TAOARC recommendations and expectations on various items.
8. Supplemental Information - it is anticipated that the TAOARC may wish to provide supplemental information on subjects that may not be directly in the form of a recommendation. Again, a "loose leaf" folder format is used.
9. References – additional sources of supporting information.

Background

On November 13, 2001, the FAA announced in the *Federal Register* a public meeting to discuss the draft charter, tasking, and organization of the proposed Terminal Area Operations Aviation Rulemaking Committee (TAOARC) (66 FR 56897). The public meeting was held on December 5 and 6, 2001.

After the public meeting, the Administrator chartered the TAOARC because safety issues and recommendations identified by the Commercial Aviation Safety Team (CAST) relating to Controlled Flight Into Terrain (CFIT) accidents and incidents, and airport capacity constraints with associated delays, dictate a need for improvements in terminal area operations. There is a need to fully utilize the capabilities of modern aircraft, e.g., the use of area navigation (including the Global Positioning System (GPS)), which are not fully utilized today. Evolving technologies and potential equipment upgrades provide increased operational and safety benefits which cannot be realized unless a practical means is established to direct and facilitate new criteria and implementation. The international aspects of aviation operations and aircraft production require that terminal area operational procedures and associated equipage be consistent.

The general goal of the TAOARC is to develop a means to implement improvements in terminal area operations that address safety, capacity, and efficiency objectives that are also consistent with international implementation.

The TAOARC provides a forum for the FAA, other government entities, and the aviation industry to discuss issues, develop resolutions, and develop processes to facilitate the evolution of safe and efficient terminal area operations. TAOARC supports the international harmonization process.

Initial Tasking

The TAOARC's initial task was to identify and resolve outstanding issues pertaining to draft Advisory Circular (AC) 120-29A and other draft required navigation performance (RNP) materials. The committee would develop draft AC language, a strategy, process, and schedule for the implementation of new or revised criteria. The committee is to make its recommendations, which may include rulemaking and additional tasking, to the Administrator through the Associate Administrator for Regulation and Certification.

Additional Tasking

The TAOARC may be provided with additional tasks. Currently, Approach with Vertical Guidance (APV), (including LPV) and FAA Order 8260.31, Foreign Terminal Instrument Procedures, and other added tasks have been identified.

Overview of the Work of the TAOARC

The task assigned to the TAOARC is significant and complex. The committee developed structured methods to manage and progress its work. There are many stakeholders and parties affected by the work that is to be accomplished, and it is recognized that reaching full consensus on all aspects will be difficult. The TAOARC will document significant aspects of its meetings, provide background information and identify areas where consensus and full agreement cannot be achieved.

The TAOARC is developing an underlying strategy to identify the work to be accomplished and will provide incremental progress reports. The TAOARC will produce specific recommendations and supplemental information to support policy, decision-making and direction by the FAA.

This report contains the progress report, recommendations and supplemental information produced by the committee.

TAOARC Work Process

The TAOARC's working process is described in Figure 1.

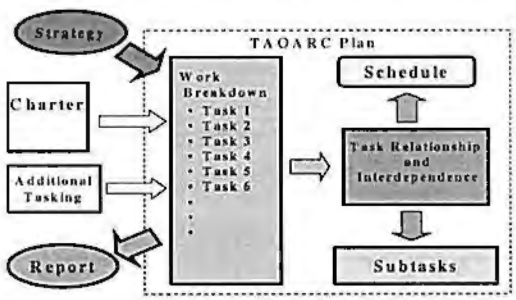


Figure 1: TAOARC Tasking/Work Process

The TAOARC will determine the relationships and interdependence of the tasks provided to the group and will break the work down into manageable subtasks that can be progressed. This report will contain recommendations resulting from the group's work and will provide a status report on the major tasks.

The TAOARC formed a management group called the Joint Steering Committee (JSC) to facilitate the process. The process is represented in the following Figure 2:

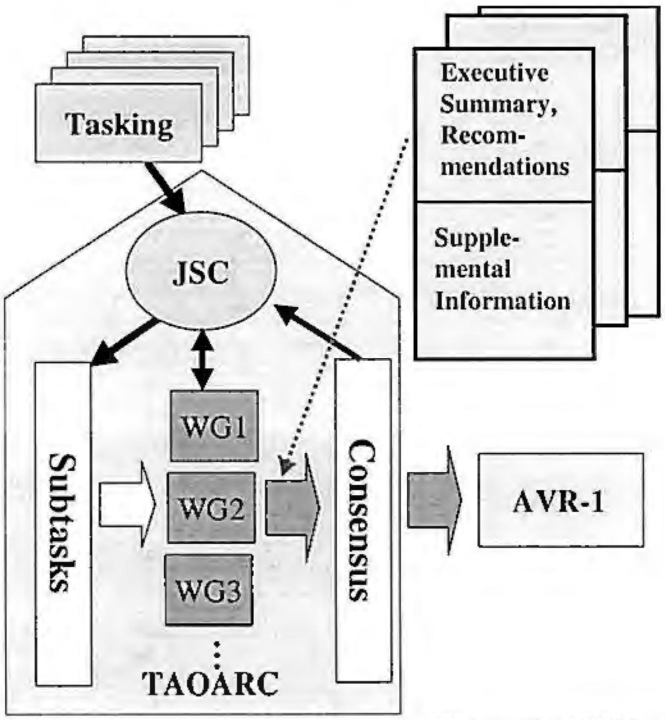


Figure 2: JSC Process

Subtasks are assigned by the JSC to working groups. These working groups will produce recommendations for review by the full TAOARC.

The TAOARC will document its work in project papers. These project papers will contain major stakeholder perspectives, issues, considerations, and factors that lead up to the generation of recommendation(s) by the committee, including any lack of consensus within the group. Any lack of consensus will also be noted in the TAOARC Recommendation form. These project papers will be available to AVR-1 and other FAA staff to provide additional background to the discussion that supports the TAOARC recommendations. Briefing papers will also be available for less extensive projects undertaken by the group. It is expected that these papers will provide a historical rationale to support FAA strategic and policy decisions. Each project paper will contain an executive summary, which will form the basis for the recommendations contained in this Report to AVR-1. The project papers will also provide supplemental information, to support FAA management's and the greater aviation community's understanding of TAOARC recommendations, and to provide a historical record of the work of the group.

Periodic Reports

Periodic reports of the TAOARC are provided in this section.

Period One – Initiation through April 2003

Before the TAOARC was formally chartered, the FAA held a public meeting on December 5-6, 2001. The public meeting was announced in the *Federal Register* on November 13, 2001 (66 FR 56897). The first meeting after the TAOARC was formally chartered was held February 20-22, 2002. It became apparent that the TAOARC would have difficulty processing all of the work in its tasking in a forum of up to 100 people. It was decided to form a Joint Steering Committee (JSC) to manage and steer the tasks.

The JSC formally met in May 2002, August 2002, November 2002, February 2003, and April/May 2003. In addition to formal meetings, the JSC convenes weekly telcons to discuss on-going activities.

A special meeting to define the relationship between Required Navigation Performance (RNP) and the TSO-C129 community was held in January 2003.

The full TAOARC met in February 2002, June 2002, August 2002, and November 2002. Originally, a full TAOARC meeting was scheduled for February 2003. This meeting was cancelled to facilitate a change to the February 2003 JSC meeting.

Accomplishments for period one:

1. The TAOARC identified and resolved outstanding issues pertaining to draft FAA AC 120-29A. The AC was issued on August 12, 2002.

2. The TAOARC identified and reached an understanding on the issues pertaining to the draft FAA Order 8260.51 (a.k.a. 8260.RNP) concerning the U.S. Standard for RNP Instrument Approach Procedure Construction. The FAA issued an initial release of the Order on December 30, 2002 with an understanding that there would be a 'quick' revision in the form of a Change 1 – see item 7 below.

3. The discussion on planning for the evolution of RNP led to a realization that the TAOARC format may provide the FAA with the necessary resources and methods to address operations other than terminal area. A Recommendation has been developed to expand the TAOARC Charter. This Recommendation is identified as GEN-001.

4. The TAOARC developed issues and considerations related to RNP and, with consideration of the tasking to develop a U.S. consensus position for global harmonization, developed a recommendation relating to international coordination. This recommendation is more extensive than RNP but is documented as RNP-001.

5. The TAOARC produced two recommendations related to the Administrator's policy statement regarding the evolution to RNP and a performance based

National Airspace System (NAS). These recommendations address the navigation aspects but could be equally applicable to communication, surveillance and air traffic management aspects. The recommendations are identified as RNP-002 and RNP-003.

6. There was discussion within the TAOARC on how to establish the most efficient and useful relationship between aircraft functionality and approach operational capability. The TAOARC has developed a strategic approach to this item and plans on developing this strategy further. The recommendation associated with this strategic methodology is identified as RNP-004.

7. There was significant discussion within the committee on the most effective way to move forward with RNP for Approach. Operations: These discussions covered the application of linear and angular criteria, the needs of the various segments of the aviation community and realizing operational benefits in an equitable way. The concept of using Special Aircraft and Aircrew Authorization Requirements (SAAAR) for more demanding operations was discussed. This process has been used in the air carrier community for low visibility operations (e.g., Category II/III). Key aspects of the discussion included:

    - The initial release of Order 8260.51 does not meet the needs of the end-users and the initial release was made with the understanding that a Change 1 would be progressed as soon as possible. The TAOARC supports the development of a Change 1 to Order 8260.51 as soon as possible.
    - The goal of the proposed Change 1 to Order 8260.51 and a revision to Order 8260.48 is to include criteria to support RNAV and RNP operations for a range of aircraft functionality (e.g., TSO-C129 avionics, RNP certified FMS). The TAOARC notes that the decision to publish Order 8260.51 in its current form will not delay publication of procedures that provide benefit to the aviation community.
    - Highlights of the Recommendation are:
        a. Order 8260.51 Change 1 criteria will be developed to support DO 236 and/or Airplane Flight Manual (AFM) certified RNP aircraft.
        b. Order 8260.51 will first be developed to support SAAAR with such tools as 2x RNP and RF legs.
        c. Order 8260.51 will also have a "public RNP" placeholder for use as additional RNP capable aircraft emerge and RNP becomes more public in nature.
        d. Order 8260.48 will have "linear" segments added to it in support of the non-DO 236 and/or AFM certified RNP aircraft (RNAV aircraft). These criteria will support aircraft with Instrument Flight Rules (IFR) approach approved GPS functionality (e.g., TSO C 129) and many/most Flight Management System (FMS) equipped aircraft:
            - There will also be a placeholder in these criteria for "SAAAR" approaches to ensure that all RNAV aircraft can maximize their capability.

- Criteria will be added that enables general aviation aircraft to maximize their slow, maneuverable aircraft capabilities.

The TAOARC believes that the majority of the FAA resources should be placed on modifying and implementing area navigation procedures described above for GPS and most FMS RNAV systems at NAS locations first, to achieve the greatest benefit by the largest number of aircraft. RNP SAAAR needs to be fully supported by the FAA and industry and immediately implemented at key airports where the operators with such navigation capabilities can realize results.

It should be noted that there may be follow-on issues such as charting which need to be discussed and resolved pursuant to this recommendation. The TAOARC will provide more specific recommendations for change to the Orders at a later date.

The recommendation associated with this activity is identified as RNP-005.

8. The AWOHWG has met a number of times since the TAOARC was chartered and has an active work program defined and under way. This work will provide recommendations to the JAA/EASA All Weather Operations Steering Group (AWOSG) and the TAOARC for consideration and action.

The AWOHWG completed its first item in the current phase of its work program with the closure of the Allweather Harmonization Item (AHI) 1001 – GLS Model. This AHI provides a generic model of a Ground Based Augmentation System (GBAS), the LAAS for example, that is consistent with current International Civil Aviation Organization (ICAO) standards. This model will be used in the certification of airborne elements of a GLS. Details of this model can be found in Appendix 1 of the GLS Project Paper.

The TAOARC has considered this input from the AWOHWG and has produced a recommendation identified as GLS-001.

References

The following references may be useful in understanding the context of specific Recommendation and Supplemental Information provided by the TAOARC:

1. RNP Project Paper
2. GLS Project Paper
3. RNAV Project Paper

A number of the Industry Working Groups provide status reports on their work on their web sites. This information can be found at:

1. General Aviation Working Group (GAWG) - http://ksn-team.faa.gov/taoarc/gawg
2. Vertical Flight Working Group (VFWG) - http://ksn-team.faa.gov/taoarc/vftaoarc
3. Regional Airlines Association Working Group (RAAWG) - http://ksn-team.faa.gov/taoarc/raawg

Recommendations

The following table contains a list of the recommendations made by the TAOARC. Specific recommendations are provided on TAOARC recommendation forms following this table:

No.	Recommendation Title	Disposition
GEN-001	Expand the Terms of Reference of the TAOARC Charter to Include Enroute Operations	
RNP-001	United States/Europe Strategy Team	
RNP-002	Concept for a RNP Transition Plan	
RNP-003	Detailed RNP Implementation Plan	
RNP-004	Performance Based RNP Approach Implementation	
RNP-005	TSO-C129 and RNP	
GLS-001	GBAS Model	

***Note:** These recommendations may include recommended rulemaking, advisory, or policy material. It may also include a proposal for tasking other groups, such as the AWOHWG.*

Recommendation No. GEN-001

TAOARC Recommendation

Date: 1 May 2003	Title: Expand the Scope of the TAOARC
Recommendation: The Required Navigation Performance (RNP) program plan provides a roadmap for the implementation of RNP within the United States National Airspace System (NAS). This includes the terminal and en route domains; and, the development of Standard Instrument Departures (SIDs), Standard Terminal Arrivals (STARs), and Instrument Approach Procedures (IAPs). Utilizing the expertise within the TAOARC in all domains/operations (including en route) more fully supports RNP implementation. Further, channeling these resources provides an important foundation toward the harmonization of RNP as part of the global concept of Communication Navigation Surveillance/Air Traffic Management (CNS/ATM) supporting an international airspace system. To provide a stable path for near, mid, and long term implementation, the role of the TAOARC should be expanded to include the en route domain.	
Date:	Action:

Recommendation No. RNP-001

TAOARC Recommendation

Date: April 2, 2003	**Title:** United States/European Strategy Team

Recommendation:

The FAA should explore the initiation of a Strategy Team to work, initially, with European Organization for Safety for Air Navigation (EUROCONTROL) and the Joint Aviation Authorities (JAA)/European Aviation Safety Agency (EASA) to explore the level of commonality that can be achieved between Europe and the United States in the evolution of airspace planning, airspace management and associated factors such as service provision and expected aircraft functionality.

It is expected that RNP would be a part of that strategic discussion.

The TAOARC recognizes that there is operational diversity between Europe and the United States, particularly as the operation related to the General Aviation community. The TAOARC requests that before any significant decision or agreement is made between the United States and the European members, the FAA will coordinate these proposals with organizations representing all facets of the aviation community in the United States.

The TAOARC also recognizes that domestic airspace needs may dictate a unique United States solution in certain areas and that full harmonization on all aspects may be impractical.

The primary objective of the harmonization process should be to minimize operational differences for international operators and to minimize any unique equipage or aircraft functionality for operations around the world.

Date:	**Action:**

Recommendation No. RNP-002

TAOARC Recommendation

Date: April 2, 2003	**Title:** Concept for an RNP Transition Plan
Recommendation: The FAA should produce a concept for a top level Required Navigation Performance (RNP) Transition Plan in conjunction with the airspace users that identifies how RNP will be expanded, the key transition sequences, key assumptions and a plan for addressing issues and concerns.	
Date:	**Action:**

Recommendation No. RNP-003

TAOARC Recommendation

Date: April 2, 2003	**Title:** Detailed RNP Implementation Plan
Recommendation: The FAA should produce a detailed Required Navigation Performance (RNP) Implementation Plan in conjunction with the airspace users that identify the key decisions that need to be made, major work items that need to be accomplished, and the prioritization of work, significant dependencies, schedule, roles, responsibilities, accountability, and tracking methods.	
Date:	**Action:**

Recommendation No.RNP-004

TAOARC Recommendation

Date: 1 May 2003	**Title:** Performance Based RNP Approach Implementation

Recommendation:

As the FAA and Industry proceed with performance based Required Navigation Performance (RNP) implementation (particularly for approach operations), the relationship of performance-based procedure criteria to aircraft/systems performance requirements will need to be established by:

1) Defining operational criteria
2) Qualifying the operation against those criteria, including the aircraft and operational mitigations, as appropriate

To facilitate operational qualification, aircraft capabilities should be grouped together into categories of similar capability.

The operational criteria should be sufficient to evaluate new aircraft technologies, capabilities, or mitigations without re-consideration of the obstacle clearance criteria or flight inspection criteria.

The TAOARC recommends that this strategy be accepted and implemented through the provision of guidance to the aviation community (e.g., AC 90-RNP).

If accepted, the TAOARC will produce further detailed recommendations in support of this strategy.

Date:	Action:

TAOARC Recommendation

Date: 1 May 2003	**Title:** TSO-C129 and RNP

Recommendation:
The TAOARC recommends that the FAA support the following strategic approach to accommodating various capabilities and uses for Area Navigation (RNAV) and Required Navigation Performance (RNP) operations:

- Order 8260.51 should be dedicated to RNP operations
- Order 8260.48 should remain as a RNAV document but should include linear criteria
- Special Aircraft and Aircrew Authorization (SAAAR) criteria should be added to the Orders to realize appropriate operational benefits for suitably equipped aircraft.

Specifically, Order 8260.51 be updated to Change 1 and Order 8260.48 be revised as follows:

a. Order 8260.51 Change 1 criteria should be developed to support DO 236 and/or Airplane Flight Manual (AFM) certified RNP aircraft
b. Order 8260.51 should first be developed to support Special Aircraft and Aircrew Authorization Requirements (SAAAR) with such tools as 2x RNP and RF legs
c. Order 8260.51 should also have a "public RNP" placeholder for use as additional RNP capable aircraft emerge and RNP becomes more public in nature
d. Order 8260.48 should have "linear" segments added to it in support of the non-DO 236 and/or AFM certified RNP aircraft (RNAV aircraft). This criteria will support aircraft with IFR approach approved GPS functionality (e.g., TSO C 129/145/146) and many/most Flight Management System (FMS) equipped aircraft
   - There should also be a placeholder in these criteria for "SAAAR" approaches to ensure that all RNAV aircraft can maximize their capability.
   - Criteria should be added that enables general aviation aircraft to maximize their slow, maneuverable aircraft capabilities.

The TAOARC believes that the majority of the FAA resources should be placed on modifying and implementing area navigation procedures described above for GPS and most FMS RNAV systems at National Airspace System (NAS) locations first, to achieve the greatest benefit by the largest number of aircraft. RNP SAAAR needs to be fully supported by the FAA and industry and immediately implemented at key airports where the operators with such navigation capabilities can realize results.

It should be noted that there may be follow-on issues such as charting which need to be discussed and resolved pursuant to this recommendation. The TAOARC will provide more specific recommendations for changes to the Orders at a later date.

Date:	Action:

Recommendation No. GLS-001

TAOARC Recommendation

Date: 15 April, 2003	**Title:** **GBAS Model**
Recommendation: The All Weather Operations Harmonization Working Group (AWOHWG) has completed the development of a Ground Based Augmentation System (GBAS) model. This model has been described in a form that would easily transition into AC 120-28D as a new Appendix. The model has been coordinated with European authorities and industry within the AWOHWG. The proposed GBAS Model is available from the AWOHWG, and will be identified in the Global Navigation Satellite System (GNSS) Landing System (GLS) Project Paper. The TAOARC recommends that the FAA accept the model as provided and include the model in the next update to AC 120-28D.	
Date:	**Action:**

Supplemental Information

The following table contains a summary of the Supplemental Information by the TAOARC. Specific information is provided in TAOARC Supplemental Information forms following this table:

No.	Supplemental Information	Disposition
SUP 1	General Aviation Working Group Report	

Date: 4 June, 2003	Title: General Aviation Working Group Report

General Aviation Working Group Report

June 4, 2003

This report is provided to show general aviation operational perspective for Category A and B aircraft.

The General Aviation Working Group (GAWG) of the Terminal Area Operations Aviation Rulemaking Committee (TAOARC), consisting of several general aviation organizations met several times during the past year.

In that time, the GAWG has acknowledged the safety and utility that instrument access provides to general aviation operations. The Federal Aviation Administration (FAA) has stated that, "Flying Instrument Flight Rules (IFR) improves the safety of all operations over flying Visual Flight Rule (VFR) in marginal weather conditions" (61 FR 64230, 64233 (December 3, 1996)). The Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation safety review, "General Aviation Weather Accidents," published in 1995, reviewed over 5,800 accidents, including 1,750 fatal accidents. According to the report (p. vi), "the biggest causes or factors in fatal weather accidents were scenarios where pilots initiated, continued, or attempted VFR flight into Instrument Meteorological Conditions (IMC)." It is generally accepted that providing general aviation pilots with the best instrument access possible increases the likelihood that the pilot will elect to fly under IFR rather than marginal VFR.

The TAOARC GAWG determined that an instrument procedure without Vertical Navigation (VNAV) guidance may provide a greater safety margin for general aviation operations than an instrument procedure with VNAV but higher minima at the same location. A MITRE CAASD modeling simulation demonstrated that 55 percent of the time adding vertical guidance to non-precision approaches (called LNAV) raised the approach minima. This has been verified with the implementation of a Commercial Aviation Safety Team initiative, promoting the proliferation of non-Category I approaches with VNAV to every runway in the National Airspace System (NAS).

The GAWG quickly recognized that the biggest safety benefit to encourage general aviation to use instrument approach procedures in lieu of marginal VFR operations is to offer the lowest possible Area Navigation (RNAV) Global Positioning System (GPS) instrument approach procedure minima (ceiling and visibility) for Category A and B aircraft.

It is the recommendation of the GAWG that the continued proliferation of RNAV procedures as part of the FAA's ongoing Required Navigation Performance (RNP) program should include the performance and functionality of GPS equipment based on FAA Technical Standard Orders (TSO) C 129 and TSO 145/146. GAWG research has revealed and FAA survey data confirmed that over 70,000 of these IFR, approach approved GPS navigators have been installed for operational use (with 50,000 in the United States). The implementation must support hand-flown, single pilot operations. Such a high level of equipage must be supported, and included in the TAOARC plan for RNAV and implementation of en route, terminal and approach procedures. As RNP implementation planning continues, similar basic equipage scenarios must also be addressed. General aviation operators are rapidly investing in GPS equipment, consistent with the FAA's plan for the transition to an RNAV (previously called a SATNAV) capability in the NAS. This equipage began nearly 10 years ago and continues today.

With over 180,000 single engine piston aircraft in the general aviation fleet, and to remain consistent with the TAOARC recommendation to proliferate RNAV procedures as a top priority, the following characteristics should be applied to RNAV procedures and optimized for Category A and B aircraft. For LNAV nonprecision (or RNAV or GPS) approaches (without VNAV or Wide Area Augmentation System (WAAS)) begin the aggressive use of, for example, the following tool set:

- Step down fix(es) inside the final approach fix.

- Use of current ground based NAVAID course where the access to the airport benefit.
- Airspace size for turns (Cat A/B only radius turn protection).
- Immediate climbing turns at the Missed Approach Point.
- Changes for RNP should address a criteria discrepancy at the Missed Approach Point between GPS and current RNP Terminal Instrument Procedures (TERPS) criteria.

RNAV approach procedures that are optimized for the performance and functionality of TSO C 145/146 (but not necessarily mandating users to equip with WAAS) must be included in the NAS-wide RNAV implementation strategy being developed by the FAA's RNP program office.

Additional TAOARC activities have included discussion about the use of existing IFR certified GPS equipment performance to create RNAV routes where NAVAID citing creates limited low-altitude (IFR) access. Specific locations should be identified and an implementation strategy begun for the use of RNAV at low altitudes where general aviation receives a safety and operational benefit.

The TAOARC GAWG has also begun discussions on how to achieve benefits from emerging "glass cockpit" technologies. Some of these technologies may mitigate errors commonly associated with hand-flown operations. The GAWG anticipates continued discussion throughout the next year in support of both the existing navigation capabilities as well as pursuing new benefits for those with substantially increased performance characteristics.

Date:	**Action:**

December 19, 2003

Nicholas A. Sabatini,
Associate Administrator for Regulation and Certification
Federal Aviation Administration
800 Independence Ave SW
Washington, DC 20591

Dear Nick:

On behalf of the Terminal Area Operations Aviation Rulemaking Committee (TAOARC), and in response to the tasking given to us, please find enclosed the recommended disposition of comments to the RNAV Notice of Proposed Rulemaking Docket No. FAA-2002-FR14002.

The TAOARC also recommends that the effects of these rule changes be disseminated into the appropriate Federal Aviation Administration (FAA) documents, such as operations specifications, FAA Orders providing inspector guidance, and others as needed to assure consistency with the updated rule language. The TAOARC also recommends that guidance for complying with the referenced rules be provided in a timely way.

Thank you for the opportunity to recommend these dispositions.

Sincerely,

Dave Nakamura
Chairman, Terminal Area Operations Aviation Rulemaking Committee

TAOARC Recommendations for RNAV NPRM Comment Disposition

Overview

The material contained in this document provides a summary of the Terminal Area Operations Aviation Rulemaking Committee (TAOARC) recommended dispositions to the Area Navigation (RNAV) Notice of Proposed Rulemaking (NPRM) comments. For each 14 CFR Part proposed for change in the NPRM, the following information is provided below:

- The text of the rule change proposed in the NPRM (enclosed in <<...>>) and in some cases a brief explanation for the change as proposed in the NPRM
- The recommended disposition of the comments received for that specific change.

Options for the disposition of each comment:

- Accept the NPRM proposed change, possibly with minor changes
- Withdraw the NPRM proposed change
- Withdraw the NPRM proposed change and make a proposal that would be the subject of supplemental rulemaking or,
- Withdraw the NPRM proposed change and assign the topic to a working group (such as TAOARC or AWO HWG) for further action.

The Appendix contains comments received on the NPRM.

14 CFR Part 1

Sec. 1.1 General definitions

The FAA proposes the following definitions or terms as additions to, or amendments of § 1.1:

Air Traffic Service (ATS) route: The FAA is proposing to adopt the term ''Air Traffic Service (ATS) route'' to describe the U.S. route structure. The term ATS route would include jet routes, area navigation (RNAV) routes, and arrival and departure routes. An ATS route would be defined by route specifications. These route specifications may include an ATS route designator, the path to or from fixes, distance between fixes, reporting requirements, and the lowest safe altitude determined by the appropriate authority.

<< *Air Traffic Service (ATS) route* is a specified route designated for channeling the flow of traffic as necessary for the provision of air traffic services. The term ''ATS route'' refers to a variety of airways, including jet routes, area navigation (RNAV) routes, and arrival and departure routes. An ATS route is defined by route specifications, which may include:
(1) An ATS route designator;
(2) The path to or from significant points;
(3) Distance between significant points;
(4) Reporting requirements; and
(5) The lowest safe altitude determined by the appropriate authority. >>

Recommended Disposition and Explanation: Accept NPRM change. The definition is already in the 14 CFR Ch.1-Part 1, as published in Docket No. FAA-2003-14698. TAOARC does not recommend supplementary rulemaking.

Approach procedure with vertical guidance (APV): This new term would mean an instrument approach procedure based on lateral path and glide path. These approach procedures are flown to a decision altitude (DA). Although these procedures include glide path information, they may not meet the requirements currently established for precision approach and landing operations. This includes the vertical navigation performance and airport infrastructure requirements (i.e., ICAO Annex 14 and FAA Advisory Circular (AC) 150/5300–16). Safety for these procedures is maintained by increasing the required obstacle clearance height or required visibility. An example of an APV approach is the LNAV/VNAV (lateral navigation/ vertical navigation) approach minima currently published on RNAV approach plates.

<<*Approach procedure with vertical guidance (APV)* is an instrument approach procedure based on lateral path and vertical glide path. These procedures may not conform to requirements for precision approaches. >>

<u>Recommended Disposition and Explanation</u>: Withdraw NPRM proposed change. US should make categorization and/or classification of approaches a priority for TAO/PARC to pass through AWOHWG to ICAO as soon as possible. Determination of a clear and enabling approach categorization concept is a key requirement for the evolution of a performance-based NAS. The recent commitments by the aviation industry to the implementation of performance-based operations are significant reasons to be quite sure that definitions and terms are enabling rather than possibly constraining. JSC should recommend that FAA file Notification of Difference with ICAO regarding APV and others approach related outstanding differences. US should recommend and support ICAO's proposed further study of approach categorization issues and possible removal of APV from ICAO annexes.

Area navigation low route and Area navigation high route: These terms would be removed and replaced with the term ''area navigation (RNAV) route.'' See discussion of ''area navigation (RNAV) route'' below.
<< Removed and Replaced with RNAV route as stated below. >> TAOARC does not recommend supplementary rulemaking.

Area navigation (RNAV): The definition of ''area navigation (RNAV)'' would be broadened by removing the words ''station-referenced navigation signals,'' which refer to ground-based signals, and adding the words ''flight path'' to cover operations in both the lateral and vertical planes (*i.e.* lateral navigation (LNAV) and vertical navigation (VNAV)).
<< *Area navigation (RNAV)* is a method of navigation that permits aircraft operations on any desired flight path. >>

<u>Recommended Disposition and Explanation</u> This definition is already in the 14 CFR Ch.1-Part 1. TAOARC did not recommend supplementary rulemaking.

Area navigation (RNAV) route: The new term ''area navigation (RNAV) route'' would refer to those ATS routes established for aircraft capable of using area navigation equipment suitable for those routes.

<< *Area navigation (RNAV) route* is an ATS route based on RNAV that can be used by suitably equipped aircraft. >>

<u>Recommended Disposition and Explanation:</u> This definition already included in CFR14 Ch.1-Part 1. TAOARC did not recommend supplementary rulemaking.

Category I (CAT I) operation: The term ''Category I operation'' commonly has been used in the aviation industry and in the preambles of FAA regulatory documents for years, but it has never been defined in the CFR. The FAA is therefore proposing to add a definition of this term. The proposed definition of ''Category I (CAT I) operation'' is ''a precision approach with a decision altitude that is not lower than 200 feet (60 meters) above the threshold and with either a visibility of not less than one half statute mile (800 meters) or a runway visual range (RVR) of not less than 1,800 feet (550 meters).''

<< *Category I (CAT I) operation* is a precision instrument approach and landing with a decision altitude that is not lower than 200 feet (60 meters) above the threshold and with either a visibility of not less than 1/2 statute mile (800 meters), or a runway visual range of not less than 1,800 feet (550 meters). >>

<u>Recommended Disposition and Explanation</u>: The TAOARC recommends withdrawal. See APV discussion above for recommended TAO/POARC action. Discussions of definitions for "Category (I) operation,

precision, decision altitude, decision height and a concept for evolved categories of approach procedures are required to support the evolution of a performance-based NAS.

Category II (CAT II) operation, Category III (CAT III) operation, Category IIIa (CAT IIIa) operation, Category IIIb (CAT IIIb) operation, and Category IIIc (CAT IIIc) operation: These definitions would be revised to incorporate the concept of precision RNAV. In each of these definitions, the terms ''ILS approach'' or ''ILS instrument approach'' would be replaced with the terms ''precision approach'' and ''precision instrument approach,'' respectively. The definitions would also be updated to be compatible with the Joint Aviation Authorities (JAA) terminology.

<< *Category II (CAT II) operation* is a precision instrument approach and landing with a decision height lower than 200 feet (60 meters), but not lower than 100 feet (30 meters), and with a runway visual range of not less than 1,200 feet (350 meters).
Category III (CAT III) operation is a precision instrument approach and landing with a decision height lower than 100 feet (30 meters) or no DH, and with a runway visual range less than 1,200 feet (350 meters).
Category IIIa (CAT IIIa) operation is a precision instrument approach and landing with a decision height lower than 100 feet (30 meters), or no decision height, and with a runway visual range of not less than 700 feet (200 meters).
Category IIIb (CAT IIIb) operation is a precision instrument approach and landing with a decision height lower than 50 feet (15 meters), or no decision height, and with a runway visual range of less than 700 feet (200 meters), but not less than 150 feet (50 meters).
Category IIIc (CAT IIIc) operation is a precision instrument approach and landing with no decision height and with a runway visual range less than 150 feet (50 meters). >>

<u>Recommended Disposition and Explanation</u> The TAOARC recommends withdrawal. See APV and Cat I recommendation above with reasons for action. A thorough study of definitions for "Category (I) operation, precision, decision altitude, decision height and a concept for an evolved categorization of approach procedures are going to be required to support the evolution of a performance-based NAS. It is recognized that all of the Cat II/III definitions will need to be included in the study.

Decision altitude (DA): The FAA proposes to add the definition for ''decision altitude (DA)'' to describe the mean sea level altitude at which the decision to continue the approach below the authorized minima or make a missed approach is made. This term would be consistent with ICAO terminology.

<< *Decision altitude (DA)* is a specified altitude at (by) which a person (pilot) must initiate a missed approach if the person (pilot) does not see the required visual reference. Decision altitude is expressed in feet above mean sea level. >>

<u>Recommended Disposition and Explanation</u> TAOARC recommends withdrawal. The addition of this definition at this time may create charting, training, and performance-based systems implementation problems in the near term. A study of definitions for "Category (I) operation, precision, decision altitude, decision height and a concept for an evolved categorization of approach procedures are all going to be required to support the evolution of a performance-based NAS. It was also noted that use of "person" in place of "pilot" in this definition is inappropriate.

Decision height (DH): The definition of ''decision height'' would be revised to specify that it applies only to Category II and III approaches rather than Category I approaches, which would refer to decision altitude. References to "decision height" and "DH" are being replaced with references to "decision altitude" and "DA", respectively, where minimums are based upon barometric altitude, which is expressed in feet above mean sea level (MSL). In contrast, where minimums are based upon height above ground level (AGL), the term decision height (DH) is used. These changes are being proposed to make the FAA's regulations consistent with ICAO terminology and to more accurately describe when **(the point by which)** the decision to continue the approach below the authorized minima or make a missed approach is (must be) made.

<< *Decision height (DH)* is a specified height above the ground level at (by) which a person (pilot) must initiate a missed approach during a Category II or III approach if the person (pilot) does not see the required visual reference. >>

Recommended Disposition and Explanation The JSC Task group recommends withdrawal. The addition of this definition at this time may create charting, training, and performance-based systems implementation problems in the near term. A study of definitions for "Category (I) operation, precision, decision altitude, decision height and a concept for an evolved categorization of approach procedures are all going to be required to support the evolution of a performance-based NAS. It was also noted that use of "person" in place of "pilot" in this definition is inappropriate.

Final approach fix (FAF): This term would be added to indicate that a final approach fix is associated with a nonprecision approach.

<< *Final approach fix (FAF)* defines the beginning of the nonprecision final approach segment and the point where final segment descent may begin. >>

Recommended Disposition and Explanation JSC task group recommends withdrawal. Discussions of definitions for "Category (I) operation, precision, decision altitude, decision height and a concept for an evolved classification of approach procedures are required to support the evolution of a performance-based NAS. The action team also noted the need to determine appropriate definitions and proper usage for the terms glide slope, glide path, electronic glide slope, vertical glide path, vertical profile, vertical path, and other similar forms.

Instrument approach procedure (IAP): This term would be added. It is a general term that applies to all types of approach procedures.

<< *Instrument approach procedure (IAP)* is a predetermined ground track and vertical profile that provides prescribed measures of obstruction clearance and assurance of navigation signal reception capability. An IAP enables a person to maneuver a properly equipped aircraft with reference to approved flight instruments from a specified position and altitude to— (1) A position and altitude from which a landing can be completed; or (2) A position and altitude at which holding or en route flight may begin. >>

Recommended Disposition and Explanation The TAOARC recommends replacing this NPRM definition with the current ICAO definition as follows:
ICAO Definition: INSTRUMENT APPROACH PROCEDURE - A series of predetermined maneuvers by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en route obstacle clearance criteria apply.

Minimum descent altitude (MDA): The definition of ''minimum descent altitude'' would be revised to change the words ''final approach'' to ''nonprecision final approach,'' and to remove the references to ''standard instrument approach procedure'' and ''electronic glide slope.'' This change would clarify the definition, as an MDA is applicable to a SIAP without electronic glide slope.

<< *Minimum descent altitude (MDA)* is the lowest altitude to which a person may descend on a nonprecision final approach, or during a circle-to-land maneuver, until the visual reference requirements of § 91.175(c) of this chapter are met. Minimum descent altitude is expressed in feet above mean sea level. >>

Recommended Disposition and Explanation: The TAOARC recommends withdrawal. The current definition would be kept until the categorization issues can be resolved.

Night: The FAA is proposing to revise the definition of the term ''night'' to reflect that local night may differ from the times published in the American Air Almanac. This concept of local night could limit operations at a particular location when the FAA determines it to be necessary for the safety of operations, for example, when terrain causes sunset significantly earlier than the Almanac indicates.

<< *Night* is the time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the American Air Almanac, converted to local time or such other period between sunset and sunrise, as may be prescribed by the FAA. >>

<u>Recommended Disposition and Explanation</u> The TAOARC recommends withdrawal. The team understands the NTSB's recommendation to create rulemaking that might preclude situations similar to the Aspen accident. The team does not consider the proposed change to be an appropriate solution to a very complex and often site specific problem. The team recommends that the FAA explore alternate methods that might address local determination of hours of darkness, appropriate assignment or limiting conditions for approach procedures and how to impose those limitations.

Nonprecision approach procedure (NPA): The FAA is proposing to revise the definition of this term so that there would be no reference to ''electronic glide slope.'' The term would apply to navigation systems that provide lateral (but not vertical) path deviation guidance.

<< *Nonprecision approach procedure (NPA)* is an instrument approach procedure based on a lateral path and no vertical glide path. >>

<u>Recommended Disposition and Explanation:</u> The TAOARC recommends withdrawal. US should make categorization and/or classification of approaches a priority for TAO/POARC to pass through AWOHWG to ICAO asap... Determination of a clear and enabling approach categorization concept is a key requirement for the evolution of a performance-based NAS. The recent commitments by the aviation industry to the implementation of performance-based operations are significant reasons to be quite sure that definitions and terms are enabling rather than possibly constraining. JSC should recommend that FAA file Notification of Difference with ICAO regarding APV and others approach related outstanding differences. US should recommend and support ICAO's proposed further study of approach categorization issues and possible removal of APV from ICAO annexes.

Precision approach procedure (PA): The FAA is proposing to revise the definition so that there would be no references to ''standard instrument approach procedure'' and ''electronic glide slope.'' The revised term, however, would still be based on lateral course and track information with vertical glide path information. Currently, ILS, microwave landing systems (MLS), Global Navigation Satellite System (GNSS) landing systems (GLS) and precision approach radar (PAR) are recognized precision approach systems.

<< *Precision approach procedure (PA)* is an instrument approach procedure based on a lateral path and a vertical glide path. >>

<u>Recommended Disposition and Explanation</u> TAOARC recommends withdrawal. US should make categorization and/or classification of approaches a priority for TAO/POARC to pass through AWOHWG to ICAO asap... Determination of a clear and enabling approach categorization concept is a key requirement for the evolution of a performance-based NAS. The recent commitments by the aviation industry to the implementation of performance-based operations are significant reasons to be quite sure that definitions and terms are enabling rather than possibly constraining. JSC should recommend that FAA file Notification of Difference with ICAO regarding APV and others approach related outstanding differences. US should recommend and support ICAO's proposed further study of approach categorization issues and possible removal of APV from ICAO annexes.

Precision final approach fix (PFAF): This term would be added to indicate that a precision final approach fix is associated with a precision or APV approach procedure.

<< *Precision final approach fix (PFAF)* defines the beginning of the precision or APV final approach segment, and denotes the location where the glide path intersects the intermediate segment altitude; *i.e.*, where final segment descent on glide path may begin. >>

Recommended Disposition and Explanation JSC task group recommends withdrawal. US should make categorization and/or classification of approaches a priority for TAO/POARC to pass through AWOHWG to ICAO asap... Determination of a clear and enabling approach categorization concept is a key requirement for the evolution of a performance-based NAS. The recent commitments by the aviation industry to the implementation of performance-based operations are significant reasons to be quite sure that definitions and terms are enabling rather than possibly constraining. JSC should recommend that FAA file Notification of Difference with ICAO regarding APV and others approach related outstanding differences. US should recommend and support ICAO's proposed further study of approach categorization issues and possible removal of APV from ICAO annexes.

RNAV waypoint: The FAA proposes to remove the definition of ''RNAV way point (W/P)'' because it is overly restrictive.
<< Has been REMOVED by previous rulemaking>>.

TAOARC does not recommend supplementary rulemaking.

Route segment: The definition of ''route segment'' would be revised to mean a portion of a route bounded on each end by a fix or NAVAID. The proposed change would facilitate the development of RNAV routes.

<< *Route segment* is a portion of a route bounded on each end by a fix or navigation aid (NAVAID). >>

Recommended Disposition and Explanation This definition already included in CFR14 Ch.1-Part 1. TAOARC does not recommend supplementary rulemaking.

Sec. 1.2 Abbreviations and Symbols
The FAA proposes to add the following acronyms to the list of abbreviations and symbols in § 1.2:

APV means approach procedure with vertical guidance.
Recommended Disposition and Explanation TAOARC recommends withdrawal. Disposition as above for categorization.
NM means nautical mile.
Recommended Disposition and Explanation TAOARC recommends accept.
NPA means nonprecision approach.
Recommended Disposition and Explanation TAOARC recommends withdrawal. Disposition as above for categorization.
PA means precision approach.
Recommended Disposition and Explanation TAOARC recommends withdrawal. Disposition as above for categorization.
RNAV means area navigation.
Recommended Disposition and Explanation TAOARC recommends accept.

14 CFR Part 71

Docket No. FAA-2003-14698 published this rule as final. Except for the modification to 71.11 as recommended below in the disposition to 97.20, no further action is recommended.

14 CFR Part 91

Sec. 91.129

Recommended Disposition and Explanation: Withdraw changes to definitions (and corresponding abbreviations – APV, NPA, PA, PFAF) of precision and nonprecision approaches, Cat I, Cat II, Cat III, APV, and related terms to allow for detailed discussion/harmonization.
Use of "glide" within the text of 91.129 will be considered in the definition changes.
Withdraw change except for change to section 91.129(e) (2), rewritten as follows: "A large or turbine-powered airplane approaching to land on a runway served by an instrument landing system (ILS), if the airplane is ILS equipped, shall fly that airplane at an altitude at or above the glide slope between the outer marker (or point of interception of glide slope, if compliance with the applicable distance from clouds criteria requires interception closer in) and the point at which (if necessary) a missed approach must be initiated; and"
This removed the reference to middle marker.

Sec. 91.131 Operations in Class B airspace.

The FAA is proposing to revise the rule as follows:
<< (c) * * *
(1) For IFR operation. An operable and suitable RNAV system, or VOR or TACAN receiver; and
* * * * *
17. Amend Sec. 91.175 by amending paragraphs (e) introductory text and (j) by removing the word ``pilot'' and adding in its place the word ``person,'' by revising paragraphs (a), (b), (c) introductory text, (e)(1)(ii), (f) introductory text, (h), and (k) to read as follows:>>

Recommended Disposition and Explanation: Withdraw changes to definitions (and corresponding abbreviations – APV, NPA, PA, PFAF) of precision and nonprecision approaches, Cat I, Cat II, Cat III, APV, and related terms to allow for detailed discussion/harmonization.
Withdraw change from "pilot" to "person." Retain as "pilot."
In a cover letter that provides recommendations, note that the industry requests the FAA to provide timely guidance on systems that can be used to meet this rule.

Sec. 91.175 Takeoff and landing under IFR.

The FAA is proposing to revise the rule as follows:
<<(a) Instrument approaches to civil airports. Unless otherwise authorized by the FAA, when it is necessary to use an instrument approach to a civil airport, each person operating an aircraft must use a standard instrument approach procedure prescribed in part 97 of this chapter for that airport. This paragraph does not apply to United States military aircraft.
(b) Authorized DA/DH or MDA. For the purpose of this section, when an approach procedure requires the use of DA/DH or MDA, the authorized DA/DH or MDA is the highest of the following--
(1) The DA/DH or MDA prescribed by the approach procedure.
(2) The DA/DH or MDA prescribed for the pilot in command.
(3) The DA/DH or MDA for which the aircraft is equipped.
(c) Operation below DA/DH or MDA. Where a DA/DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, at any airport below the authorized MDA or continue an approach below the authorized DA/DH unless--
* * * * *

(e) * * *
(1) * * *
(ii) Upon arrival at the missed approach point, including a DA/DH where a DA/DH is specified and its use is required, and at any time after that until touchdown.>>

Recommended Disposition and Explanation: Withdraw changes to definitions (and corresponding abbreviations – APV, NPA, PA, PFAF) of precision and nonprecision approaches, Cat I, Cat II, Cat III, APV, and related terms to allow for detailed discussion/harmonization.

<< (f) Civil airport takeoff minimums. Unless otherwise authorized by the FAA, no person operating an aircraft under part 121, 125, 129, or 135 of this chapter may takeoff from a civil airport under IFR unless weather conditions are at or above the weather minimums for IFR takeoff prescribed for that airport under part 97 of this chapter. Where published civil takeoff minimums are based on a specified route, persons operating that aircraft must comply with that route unless an alternative route has been assigned by ATC. If takeoff minimums are not prescribed under part 97 of this chapter for a particular airport, the following minimums apply to takeoffs under IFR for aircraft operating under part 121, 125, 129, or 135 of this chapter:>>

Recommended Disposition and Explanation: Withdraw the entire NPRM change to paragraph (f) based on the need to clarify the relationship with air carrier 121.189 departure flight track operations approval. In addition, there was no explanation provided for adding the phrase "unless an alternative route has been assigned by ATC."

(h) Comparable values of RVR and ground visibility. Except for Category II or Category III minimums, if RVR minimums for takeoff or landing are prescribed in an instrument approach procedure, but RVR is not reported for the runway of intended operation, the RVR minimum must be converted to ground visibility in accordance with the Comparable Values of RVR and Ground Visibility table in FAA Order 8260.3, `United States Standard for Terminal Instrument Procedures (TERPS)" (incorporated by reference in Sec. 97.20 of this chapter). This visibility is the minimum for takeoff or landing on that runway.>>

Recommended Disposition and Explanation: Accept change as shown in the NPRM. It is determined that TERPS is regulatory by reference and as such will affect content in the other publications such as AIM and Flight Information Publications.

<< (k) ILS components. The basic components of an ILS are the localizer, glide slope, and outer marker, and, when installed for use with Category II or Category III instrument approach procedures, an inner marker. The following means may be used to substitute for the outer marker: compass locator; precision approach radar (PAR) or airport surveillance radar (ASR); DME, VOR, or nondirectional beacon fixes authorized in the standard instrument approach procedure; and a suitable RNAV system in conjunction with a fix identified in the standard instrument approach procedure. Applicability of, and substitution for, the inner marker for a Category II or III approach is determined by the appropriate 14 CFR Part 97 approach procedure, letter of authorization, or operations specification pertinent to the operation.>>

Recommended Disposition and Explanation: Accept the proposed revision as shown in the NPRM with a minor change, as follows;
"fixes authorized in the standard instrument approach procedure or a suitable RNAV system in conjunction"

In addition: Add new paragraph (l) with the following proposed text as supplemental rule making:

(l) The administrator may approve use of systems and procedures meeting requirements other than those specified if;

1) The systems and procedures proposed are shown to have equivalent or better performance than other FAA approved systems, are operationally safe, effective, and reliable for approach, landing, missed approach, or a takeoff as applicable; and,

2) If visual reference requirements apply, the pilot is able to determine that flight visibility is adequate for safe takeoff or landing.

Sec. 91.177 Minimum altitudes for IFR operations.

The FAA is proposing to revise the rule as follows:
<< (a) Operation of aircraft at minimum altitudes. Except when necessary for takeoff or landing, no person may operate an aircraft under IFR below--
(1) The applicable minimum altitudes prescribed in parts 95 and 97 of this chapter. However, if both a MEA and a MOCA are prescribed for a particular route or route segment, a person may operate an aircraft below the MEA down to, but not below, the MOCA, provided the applicable navigation signals are available. For aircraft using VOR for navigation, this applies only when the aircraft is within 22 nautical miles of that VOR (based on the reasonable estimate by the pilot operating the aircraft of that distance); or
(2) If no applicable minimum altitude is prescribed in parts 95 and 97 of this chapter, then--
(i) In the case of operations over an area designated as a mountainous area in part 95 of this chapter, an altitude of 2,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown; or
(ii) In any other case, an altitude of 1,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown.>>

Recommended Disposition and Explanation: Accept NPRM proposal for 91.177 as written (except replace person with pilot and add the phrase in italics "(a) ... Except when necessary for takeoff or landing, ***or when otherwise authorized by the administrator,"***).

In response to a comment received, delete the last sentence of the preamble and add a sentence "This is not intended to be a requirement for surveillance."

Sec. 91.189 [Amended]

The FAA is proposing to revise the rule as follows:
<<23. Amend Sec. 91.189 (c) by removing the term ``DH'' and adding in its place the term ``DA/DH'' wherever it appears, and amend paragraph (d) by removing: the word ``pilot'' and inserting the word ``person.''
>>

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization. Retain the term "pilot." Change "person" to "pilot" in (f).

Sec. 91.205 Powered civil aircraft with standard category U.S. airworthiness certificates: Instrument and equipment requirements.

The FAA is proposing to revise the rule as follows:
<< (d) * * *
(2) Two-way communication and navigation equipment suitable for the route to be flown.
* * * * *
(e) Flight at and above 18,000 feet MSL (FL 180). If VOR navigation equipment is required under paragraph (d)(2) of this section, no person may operate a U.S.-registered civil aircraft within the 50 states and the District of Columbia at or above FL 180 unless that aircraft is equipped with approved DME or a suitable RNAV system. When the DME or RNAV system required by this paragraph fails at and above FL 180, the pilot in command of the aircraft must notify ATC immediately, and then may continue operations at and above FL 180 to the next airport of intended landing where repairs or replacement of the equipment can be made.>>

Recommended Disposition and Explanation: Accept NPRM proposal except retain the altitude above which DME is required – that is, keep it at the value currently described in the regulation. A sufficient justification was not provided and comments identified additional costs that would be imposed as a result.

Sec. 91.219(b)(5)

The FAA is proposing to revise the rule as follows:
Amend Sec. 91.219(b)(5) by removing the term ``DH" and adding in its place the term ``DA/DH."

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization.

14 CFR Part 97

Part 97.1 (b):

FAA is proposing the following rule revision:
<< (b) Departure procedures. This part also prescribes departure procedures (DPs) developed for aircraft operating under parts 121, 125, 129, and 135 of this chapter to avoid obstacles, and establishes weather minimums that apply for takeoff under IFR at civil airports. Where published civil takeoff weather minimums are based on a specified route, persons operating that aircraft must comply with that route unless an alternative route has been assigned by ATC.

Recommended Disposition and Explanation: Withdraw, pending resolution of 91.175. Editor's comment: NPRM text has significant ramifications for 121.189, which could invalidate air carrier takeoff analysis. Must be consistent with 91.175. The question has been raised as to whether or not the proposed NPRM language even belongs in Part 97.

Part 97.3 Symbols and Terms used in Procedures
"Helipoint":
Recommended Disposition and Explanation: Publish: with minor word change of term to "heliport reference point" in accordance with AC150/5390-2B.

MSA "Minimum Safe Altitude":

Recommended Disposition and Explanation: Accept the definition.

Height Above Touchdown (HAT): Height Above Touchdown is the US/FAA form of HAT. The description or definition of ''HAT'' (height above touchdown), which currently appears in Part 97 paragraph (i), would be revised to read, ''height above threshold expressed in feet.'' This would be a nomenclature change to make the FAA's regulations consistent with ICAO and the JAA/FAA harmonized definition of HAT is currently Height Above Threshold and is not considered operationally significant. Changes to approach charts and affected FAA documents will be made during regular review process.

<< *HAT* "Height Above Touchdown" will be amended to Height Above Threshold. >>

Recommended Disposition and Explanation Accept the NPRM change.

"Visibility Minimum"
Recommended Disposition and Explanation: Withdraw, and retain existing definition.

Part 97.10

Recommended Disposition and Explanation: Withdraw the change to 97.10, and retain existing version with minor wording change to remove reference to Form 3139
Note: Even though the references to FAA Form 3139 are obsolete, this section provides the opportunity to implement future procedures such as internationally harmonized criteria. Suggested revised wording to this section should consider "...on forms acceptable to the FAA" rather than specifying Form numbers.

Part 97.20

Recommended Disposition and Explanation: Implement supplemental rulemaking to remove the incorporation of these two Orders by reference, to support flexibility in updating the criteria. And while this flexibility is important, so is the opportunity for the public to comment and review dispositions of comments. It is therefore recommended that any modification to these Orders be made available for public review in the Federal Register, and comments and their disposition to be provided to the Docket system.

In addition, Part 71 must be updated to be consistent with the supplemental rulemaking for 97.20, since Part 71.11 refers to Part 97.20 and the Orders currently incorporated by reference.

14 CFR Part 121

Sec. 121.99 Communications facilities.

FAA is proposing the following rule revision:
<< (a) Each certificate holder conducting domestic or flag operations must show that a two-way communication system, or other means of communication approved by the FAA, is available over the entire route under normal operating conditions. The communications may be direct links or via an approved communication link that will provide reliable and rapid communications under normal operating conditions between each airplane and the appropriate dispatch office, and between each airplane and the appropriate air traffic control unit, except as specified in Sec. 121.351(c). For non-normal and emergency operation conditions, the communication system for use between each airplane and the appropriate dispatch office and between each airplane and the appropriate ATC unit must have two-way voice communication capability. For the purpose of communications between the airplane and the dispatch office under this section, the term ``rapid communications" means that the caller must be able to establish communications with the called party in less than four minutes.>>

Recommended Disposition and Explanation: Accept the NPRM proposal for removal of the word "radio" in "two-way radio communication."
Accept the NPRM addition of the phrase "other means of communication approved by the FAA" except change the FAA to "the Administrator."
Modify the requirement for "rapid communication under normal operating conditions" to be defined as "the communication system must have been demonstrated to be capable of establishing communications with the called party in approximately ten minutes, unless otherwise authorized by the Administrator."
Withdraw NPRM requirement to have voice communication with dispatch in non-normal and emergency situations.

121.99 (a) would then read:

(a) Unless otherwise authorized by the administrator, each certificate holder conducting domestic or flag operations must show that a two-way communication system, or other means of communication, each approved by the Administrator, is suitable and available over the entire route under normal operating conditions as follows:
    (1) The communications may be direct links or via an appropriate communication link through a communication service provider that will provide reliable and rapid communications under normal operating conditions between each airplane and the

appropriate dispatch office, if applicable, and between each airplane and the appropriate air traffic service unit.

(2) For communications with ATS units and dispatch offices during the conduct of extended overwater and certain remote area operations, the term ``rapid communications under normal operating conditions'' means that the communication system must have been shown to be capable of establishing communications with the called party within approximately ten minutes, unless otherwise authorized by the Administrator, and

(3) Notwithstanding the requirements in subparagraphs (a)(1) and (a)(2), at least one of the communication systems for use between each airplane and the appropriate ATS unit has two-way voice communication capability.

The TAOARC recommends adding words from the relevant legal interpretation to the preamble and guidance material about this definition of rapid communications is not intended to be an absolute. Also the preamble should clearly state that this is not intended to change or impose any additional requirement for either a dispatch function, or for COM function or capability beyond that currently required for FAR 121 operators.

Sec. 121.103 En route navigation systems.

FAA is proposing the following rule revision:
<< (a) Except as provided in paragraph (b) of this section, each certificate holder conducting domestic or flag operations must show, for each proposed route (including to any regular, provisional, refueling or alternate airports), that suitable navigation aids are available over the route to navigate the airplane along the route with the required accuracy. Navigation aids required for approval of routes outside of controlled airspace are listed in the certificate holder's operations specifications except for those aids required for routes to alternate airports.

(b) Navigation aids are not required for any of the following operations--

(1) Day VFR operations that the certificate holder shows can be conducted safely by pilotage because of the characteristics of the terrain;

(2) Night VFR operations on routes that the certificate holder shows have reliably lighted landmarks adequate for safe operation; and

(3) Other operations approved by the FAA.>>

Recommended Disposition and Explanation: Accept the NPRM proposed changes except remove the word "System" from the title. Make the wording identical to 121.121. Add explanatory text to the preamble to clarify that navigations are not restricted to ground-based navigation aids as per handbook.

Sec. 121.121 En route navigation systems.

FAA is proposing the following rule revision:
<< (a) Except as provided in paragraph (b) of this section, no certificate holder conducting supplemental operations may conduct any operation over a route (including to any destination, refueling or alternate airports) unless suitable navigation aids are available over the route to navigate the airplane along the route with the required accuracy. Navigation aids required for routes outside of controlled airspace are listed in the certificate holder's operations specifications except for those aids required for routes to alternate airports.

(b) Navigation aids are not required for any of the following operations--

(1) Day VFR operations that the certificate holder shows can be conducted safely by pilotage because of the characteristics of the terrain;

(2) Night VFR operations on routes that the certificate holder shows have reliably lighted landmarks adequate for safe operation; and

(3) Other operations approved by the FAA.>>

Recommended Disposition and Explanation: Accept the NPRM proposed changes except remove the word "System" from the title. Make the wording identical to 121.103. Add explanatory text to the preamble to clarify that navigations are not restricted to ground-based navigation aids as per handbook.

Sec. 121.344 [Amended]

FAA is proposing the following rule revision:
<<41. Amend Sec. 121.344 by removing the words ``decision height'' and adding in their place the words ``decision altitude/decision height'' in paragraph (a)(54).>>

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization.

Sec. 121.347 Communication and navigation equipment for operations under VFR over routes navigated by pilotage.

FAA is proposing the following rule revision:
<< (a) No person may operate an airplane under VFR over routes that can be navigated by pilotage unless the airplane is equipped with the communication equipment necessary under normal operating conditions to fulfill the following:

(1) Communicate with at least one appropriate station from any point on the route; and

(2) Communicate with appropriate air traffic control facilities from any point within Class B, Class C, or Class D airspace, or within a Class E airspace surface area designated for an airport in which flights are intended.

* * * * *

(b) No person may operate an airplane at night under VFR over routes that can be navigated by pilotage unless that airplane is equipped with>>

Recommended Disposition and Explanation: Accept the proposed change except replace "person" with "pilot."

Sec. 121.349 Communication and navigation equipment for operations under VFR over routes not navigated by pilotage or for operations under IFR or over the top.

FAA is proposing the following rule revision:
<< (a) Navigation equipment requirements. Except as provided in paragraph (c) of this section, no person may conduct operations under VFR over routes that cannot be navigated by pilotage, or operations conducted under IFR or over the top, unless the airplane used in those operations is equipped with at least two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. However, only one navigation system need be provided for precision approach and APV operations. Equipment used to receive signals en route also may be used to receive signals on approach, if it is capable of receiving both signals.

(b) Communication equipment requirements. No person may operate an airplane under VFR over routes that cannot be navigated by pilotage, and no person may operate an airplane under IFR or over the top, unless the airplane is equipped with--

(1) For normal operating conditions, at least two independent communication systems that fulfill the functions specified in Sec. 121.347(a); and

(2) Except as required in Sec. 121.99, for non-normal and emergency operating conditions, at least one of the two independent communication systems that fulfills the functions specified in Sec. 121.347(a), and has two-way voice communication capability.

(c) Use of a single independent navigation system. Notwithstanding the requirements in paragraph (a) of this section, the airplane may be equipped with a single independent navigation system suitable for the route to be flown if:

(1) The airplane is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for navigating safely to a suitable airport and completing an instrument approach;

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The airplane has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(d) Use of VOR navigation equipment. If VOR navigation equipment is used to comply with paragraph (a) or (c) of this section, no person may operate an airplane unless it is equipped with at least one approved DME or suitable IFR approved RNAV system.

(e) Additional communication system equipment requirements. In addition to the requirements in paragraph (b) of this section, no person may operate an airplane having a passenger seat configuration of 10 to 30 seats, excluding each crewmember seat, and a maximum payload capacity of 7,500 pounds or less, under IFR, over the top, or in extended over-water operations unless it is equipped with at least--

(1) Two microphones; and

(2) Two headsets, or one headset and one speaker.>>

Recommended Disposition and Explanation: Accept with the following modifications to the rule language (changes highlighted) and to the preamble:

(a) Navigation equipment requirements. Except as provided in paragraph (c) of this section, no person may conduct operations under VFR over routes that cannot be navigated by pilotage, or operations conducted under IFR or over the top, unless the airplane used in those operations is equipped with at least two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. ~~However, only one navigation system need be provided for precision approach and APV operations~~. However, only one marker beacon receiver providing visual and aural signals and one ILS receiver need be provided. Equipment used to receive signals en route also may be used to receive signals on approach, if it is capable of receiving both signals.

(b) Communication equipment requirements. No person may operate an airplane under VFR over routes that cannot be navigated by pilotage, and no person may operate an airplane under IFR or over the top, unless the airplane is equipped with--

(1) For normal operating conditions, at least two independent communication systems that fulfill the functions specified in Sec. 121.347(a); and

(2) Except as required in Sec. 121.99, ~~for non-normal and emergency operating conditions,~~ at least one of the two independent communication systems that fulfills the functions specified in Sec. 121.347(a), and has two-way voice communication capability.

(c) Use of a single independent navigation system. Notwithstanding the requirements in paragraph (a) of this section, the airplane may be equipped with a single independent navigation system suitable for the route to be flown if:

(1) The airplane is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for proceeding safely to a suitable airport and completing an instrument approach;

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The airplane has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(d) Use of VOR navigation equipment. If VOR navigation equipment is used to comply with paragraph (a) or (c) of this section, no person may operate an airplane unless it is equipped with at least one approved DME or suitable IFR approved RNAV system.

e) Additional communication system equipment requirements. In addition to the requirements in paragraph (b) of this section, no person may operate an airplane having a passenger seat configuration of 10 to 30 seats, excluding each crewmember seat, and a maximum payload capacity of 7,500 pounds or less, under IFR, over the top, or in extended over-water operations unless it is equipped with at least--

(1) Two microphones; and

(2) Two headsets, or one headset and one speaker.

Change preamble to include the following:

The FAA is proposing to revise Section 121.349 to recodify and clarify existing requirements. The proposed paragraph (a) would replace the requirement for two independent receivers with a requirement for two independent navigation systems. The intent is to be enabling for new types of navigation systems such as highly capable INS and this is not intended to require two FMSs. A VOR and an FMS would satisfy the requirement. The two independent navigation systems must be suitable for the route to be flown, so that they both support compliance with the requirements proposed in Sec. 121.103(a) or Sec. 121.121(a). There would be no requirement for the two systems to be identical, so that a single VOR and a single suitable RNAV system would satisfy this requirement on a Victor airway. Systems are considered independent if there is no probable failure or event that could affect both systems. The intent of this rule is to ensure that there is no single point of failure or event affecting aircraft navigation systems that causes loss of the ability to navigate along the intended route or to proceed safely to a suitable diversion airport.

The change is also intended to address the characteristics of GPS, which uses very weak signals that could be susceptible to interference. At the present time, the threat of interference to GPS is not considered to be probable and GPS systems can be considered, for the purposes of this rule, as independent navigation systems. However, unforeseen future events might make interference more likely for some GPS systems. If this should occur, then actions might be needed to assure that it is improbable that an aircraft would lose the ability to proceed along the intended route or to proceed to a suitable diversion airport. Under this scenario, operations of aircraft that are not equipped for this contingency may be severely limited. Presently the FAA sees a need for a full DME infrastructure and a minimal VOR network to remain for the foreseeable future. However, as the NAS evolves and navigation technology improves, a satellite-based system may become the core of the aviation navigation infrastructure.

Sec. 121.351 Communication and navigation equipment for extended over-water operations and for certain other operations.

FAA is proposing the following rule revision:
<< (a) Except as provided in paragraph (c) of this section, no person may conduct an extended over-water operation unless the airplane is equipped with at least two independent communication systems that meet the following requirements--

(1) The communication equipment necessary under normal operating conditions to communicate with at least one appropriate station from any point on the route;

(2) The communication equipment necessary under normal operating conditions to receive meteorological information from any point on the route by either of two independent communication systems. One of the communication systems used to comply with this paragraph may be used to comply with paragraphs (a)(1) and (a)(3) of this section;

(3) For non-normal and emergency operating conditions, one communication system having two way voice communication capability; and

(4) Two LRNSs when VOR or ADF radio navigation equipment is unusable along a portion of the route.

* * * * *

(c) * * *

(1) The ability of the flightcrew to navigate the airplane along the route with the required accuracy,

* * * * *

(3) The duration of the very high frequency communications gap, if only very high frequency communication equipment is installed. >>

<u>Recommended Disposition and Explanation:</u> Accept the NPRM change and add to the preamble an explanation to clarify that the intent of this change is to be enabling and accommodate existing exemptions. If an aircraft has the systems mentioned in the Boeing comment (SATCOM, broadband, or other specialized communication system gaps, as well as VHF), they are already covered.

Sec. 121.419 [Amended]

FAA is proposing the following rule revision:
Amend Section 121.419(a)(1)(vii) by removing the term ``DH'' and adding in its place the term ``DA/DH''.

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization.

Sec. 121.579 [Amended]

FAA is proposing the following rule revision:
Amend Sec. 121.579(b) introductory text by removing the words ``decision height'' and adding in their place the term ``DA/DH'' and amend paragraphs (b)(1) and (b)(2) by removing the term ``ILS'' and adding in its place the word ``precision''.
Amend Sec. 121.651 by replacing the term ``DH'' with the term ``DA/DH'' wherever it appears in paragraph (c) and by revising paragraph (d) introductory text to read as follows:

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization.

In addition, propose supplemental rulemaking to modify 121.579 as follows (as recommended by the Flight Guidance Systems Harmonization Working Group):

> **"§ 121.579 Minimum heights for use of autopilot.**
>
> Unless otherwise approved by the administrator, an autopilot may not be used lower than the applicable heights specified below. Enroute altitudes or heights are considered to be above terrain as applicable to the route flown. For takeoff, approach, or landing, the heights are above the runway touchdown zone elevation, runway elevation, or airport elevation, as applicable.
>
> **(a) Takeoff and initial climb.**
>
> An autopilot may not be used for takeoff or initial climb below the following height:
>
> (1) Below the value specified in the approved AFM for takeoff, or
>
> (2) If a minimum engagement height is not specified by the AFM, an autopilot may not be used below 500'above the departure airport elevation.
>
> Not withstanding (1) or (2) above, the Administrator may determine that an autopilot engagement height lower than 500 feet above airport elevation, or an engagement height different than that specified by the AFM may be used by issuing operations specifications authorizing an alternate minimum engagement height.
>
> **(b) Enroute.**
>
> (1) For autopilots certificated in accordance with AC 25.1329 (dated ....), as amended, the autopilot may not be used during cruise at a height less than twice the demonstrated height loss, or 500 feet above applicable terrain, which ever is higher. For autopilots that do not specify a height loss or specify a negligible height loss, the autopilot may not be used during cruise at a height less than 500 feet above applicable terrain.
>
> (2) For autopilots not certificated in accordance with paragraph (1) above, the autopilot may not be used during cruise at a height less than twice the demonstrated height loss, or 500 feet above applicable terrain, which ever is higher. For autopilots that do not specify a height loss, the autopilot may not be used during cruise at a height less than 750 feet above applicable terrain.
>
> **(c) Approach.**

Except in accordance with section (d) below, no person may use an autopilot during approach at a height that is less than the following, as applicable:

(1) The minimum height specified in the AFM for autopilot approach for the mode(s) used, or

(2) Not lower than a height equal to twice the maximum height loss specified in the Airplane Flight Manual for a malfunction of the autopilot under applicable approach conditions, or less than 50 feet above the landing runway touchdown zone, whichever is higher, or

(3) For systems that are demonstrated to have negligible or zero height loss (below the intended descent flight path) for applicable failure conditions, the autopilot may not be used below 50 feet above the landing runway touchdown zone, runway elevation or airport elevation; or

(4) For systems where a minimum use height, or height loss for approach is not specified in the AFM, an autopilot may not be used at any altitude less than 50 feet below the lowest applicable DA(H) or MDA(H) for the instrument procedure being used, except as follows:

(i) If the pilot determines that suitable visual reference, as specified in § 91.175 of this chapter, has been established during an instrument approach, and can reasonably be expected to be maintained, or

(ii) If weather conditions do not require use of an approved instrument approach procedure, an autopilot may be used for approach no lower than the greatest of the applicable minimum use height specified in the AFM, or twice the applicable height loss, or 50 feet above the landing runway touchdown zone elevation, runway elevation, or airport elevation, as applicable, or

(iii) If an approved and appropriately functioning autoland capability is used in accordance with section (d) below, or

(iv) If the Administrator issues operations specifications authorizing use of a lower autopilot minimum use height, but not less than 50 feet above the landing runway touchdown zone elevation, runway elevation, or airport elevation, as applicable. Issuance of operations specifications based on this provision requires that the certificate holding office determine that a lower minimum use height can be safely used by that operator, for that operators type(s) of aircraft, authorized airport(s), underlying approach terrain, instrument procedures used, applicable DA(H) or MDA(H), and flight crew procedures, or

(v) If executing an autopilot coupled go-around or missed approach, using an appropriately certificated and functioning autopilot with go-around capability.

(d) Landing.

Notwithstanding paragraph (c) of this section, autopilot minimum use height provisions do not apply to autopilot operations when an approved automatic landing system mode is used. Automatic landing systems may not be used except in accordance with approved operations specifications.

(e) Go-Around.

Following a go-around, unless an automatic go-around is accomplished, an autopilot may not be engaged below the minimum height specified in section (a) above for takeoff or initial climb. For an automatic go-around initiated with an autopilot already engaged, an autopilot minimum use height does not apply. Use of automatic go-around capability must not adversely affect safe obstacle clearance. "

Sec. 121.651 Takeoff and landing weather minimums: IFR: All certificate holders.

FAA is proposing the following rule revision:
<<* * * * *
(d) A pilot may begin the final approach segment of a Category I precision approach procedure at an airport when the visibility is less than the visibility minimums prescribed for that procedure if that airport is

served by an operative PAR and another operative precision instrument approach system, and both the PAR and the precision approach are used by the pilot. However, no person may continue an approach below the authorized DA, unless>>
Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization.

Sec. 121.652 [Amended]

FAA is proposing the following rule revision:
<<Amend Section 121.652(a) by removing the term ``DH" wherever it appears and adding in its place the term ``DA/DH".>>

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization.

Appendix M to Part 121 [Amended]

FAA is proposing the following rule revision: <<Amend Appendix M by removing the words ``Selected decision height" and adding in their place the words ``Selected decision altitude/decision height" in Parameter number 54.>>

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization.

14 CFR Part 125

Sec. 125.203 Communication and navigation equipment.

FAA is proposing the following rule revision:
<< (a) No person may operate an airplane unless it has two-way communication equipment able, at least in flight, to transmit to, and receive from, appropriate facilities 22 nautical miles away.

(b) No person may operate an airplane over the top unless it has navigation equipment suitable for the route to be flown.

(c) No person may operate an airplane carrying passengers under IFR or in extended over-water operations unless the airplane has at least the following equipment:

(1) Two transmitters;

(2) Two microphones;

(3) Two headsets or one headset and one speaker;

(4) Two independent communication systems, one of which must have two-way voice communication capability, capable of transmitting to, and receiving from, at least one appropriate facility from any place on the route to be flown; and

(5) Two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. However, only one navigation system need be provided for precision approach and APV operations. Equipment used to receive signals en route also may be used to receive signals on approach, if it is capable of receiving both signals.

(d) Use of a single independent navigation system. Notwithstanding the requirements in paragraph (c) of this section, the airplane may be equipped with a single independent navigation system suitable for the route to be flown if--

(1) The airplane is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for navigating safely to a suitable airport and completing an instrument approach;

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The airplane has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(e) Use of VOR navigation equipment. If VOR navigation equipment is required by paragraph (c) or (d) of this section, no person may operate an airplane unless it is equipped with at least one approved DME or a suitable IFR approved RNAV system.

(f) Notwithstanding the requirements of paragraph (c) of this section, installation and use of a single LRNS and a single LRCS for extended over-water operations in certain geographic areas may be authorized by the Administrator and approved in the certificate holder's operations specifications. The following are among the operational factors the Administrator may consider in granting an authorization:

(1) The ability of the flight crew to navigate the airplane along the route with the required accuracy;

(2) The length of the route being flown with a single navigation or communication system; and

(3) The duration of the very high frequency communications gap, if only very high frequency communication equipment is installed.

57. Amend Sec. 125.321 by revising the heading to read as set forth below and by removing the words ``ground or navigational facility'' and adding in their place the words ``ground facility or navigation aid''.>>

Recommended Disposition and Explanation: Withdraw the use of APV etc. pending update of definitions and approach categorization. In addition, make the following revisions:

(a) No person may operate an airplane unless it has two-way communication equipment able, at least in flight, to transmit to, and receive from, appropriate facilities 22 nautical miles away.

(b) No person may operate an airplane over the top unless it has navigation equipment suitable for the route to be flown.

(c) No person may operate an airplane carrying passengers under IFR or in extended over-water operations unless the airplane has at least the following equipment:

(1) Two transmitters;

(2) Two microphones;

(3) Two headsets or one headset and one speaker;

(4) Two independent communication systems, one of which must have two-way voice communication capability, capable of transmitting to, and receiving from, at least one appropriate facility from any place on the route to be flown; and

(5) Two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. ~~However, only one navigation system need be provided for precision approach and APV operations.~~ Equipment used to receive signals en route also may be used to receive signals on approach, if it is capable of receiving both signals.

(d) Use of a single independent navigation system. Notwithstanding the requirements in paragraph (c) of this section, the airplane may be equipped with a single independent navigation system suitable for the route to be flown if--

(1) The airplane is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for ~~navigating~~ proceeding safely to a suitable airport and completing an instrument approach;

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The airplane has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(e) Use of VOR navigation equipment. If VOR navigation equipment is required by paragraph (c) or (d) of this section, no person may operate an airplane unless it is equipped with at least one approved DME or a suitable IFR approved RNAV system.

(f) Notwithstanding the requirements of paragraph (c) of this section, installation and use of a single LRNS and a single LRCS for extended over-water operations in certain geographic areas may be authorized by the Administrator and approved in the certificate holder's operations specifications. The following are among the operational factors the Administrator may consider in granting an authorization:

(1) The ability of the flight crew to navigate the airplane along the route with the required accuracy;

(2) The length of the route being flown with a single navigation or communication system; and

(3) The duration of the very high frequency communications gap, if only very high frequency communication equipment is installed.

57. Amend Sec. 125.321 by revising the heading to read as set forth below and by removing the words ``ground or navigational facility'' and adding in their place the words ``ground facility or navigation aid''

Sec. 125.379 [Amended]

FAA is proposing the following rule revision: Amend Sec. 125.379(a) by removing the term ``DH'' wherever it appears and adding in its place the term ``DA/DH''.

FAA is proposing the following rule revision: Amend Sec. 125.381 (a) and (b) by removing the word ``pilot'' and adding in its place the word ``person'', and by revising paragraph (c) to read as follows:

Recommended Disposition and Explanation: Withdraw the change pending update of definitions and approach categorization and do not replace "pilot" with "person."

Sec. 125.381 Takeoff and landing weather minimums: IFR.

FAA is proposing the following rule revision:
<< (c) If a pilot initiates an instrument approach procedure based on a weather report that indicates that the specified visibility minimums exist and subsequently receives another weather report that indicates that conditions have worsened to below the minimum requirements, then the pilot may continue with the approach and landing only if both of the following conditions are met--

(1) The later weather report is received when the airplane is in one of the following landing phases:
(i) The airplane is on a precision approach or APV and has passed the precision final approach fix.
(ii) The airplane is on the final approach segment using a nonprecision approach procedure.
(iii) The airplane is on a PAR final approach and has been turned over to the final approach controller.
(2) The pilot in command finds, on reaching the authorized MAP or DA/DH, that the actual weather conditions are at or above the minimums prescribed in the certificate holder's operations specifications.>>

Recommended Disposition and Explanation: Withdraw the changes pending update of definitions and approach categorization.

14 CFR Part 129

Sec. 129.17 Aircraft communication and navigation equipment for operations under IFR or over the top.

FAA is proposing the following rule revision: << (a) Aircraft navigation equipment requirements. No person may conduct operations under IFR or over the top unless the aircraft used in those operations is equipped with at least two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. However, only one navigation system needs to be provided for precision approach and APV operations. However, only one marker beacon receiver providing visual and aural signals and one ILS receiver need be provided. Equipment used to receive signals en route also may be used to receive signals on approach, it if is capable of receiving both signals.

(b) Aircraft communication equipment requirements. No person may operate an aircraft under IFR or over the top, unless it is equipped with--

(1) For normal operating conditions, at least two independent communication systems that fulfill the functions specified in Sec. 121.347(a) of this chapter; and

(2) For non-normal and emergency operating conditions, at least one of the two independent communication systems that fulfills the functions specified in Sec. 121.347(a) of this chapter must have two-way voice communication capability.

(c) Use of a single independent navigation system. Not withstanding the requirements in paragraph (a) of this section, the aircraft may be equipped with a single independent navigation system suitable for the route to be flown if--

(1) The aircraft is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for navigating safely to a suitable airport and completing an instrument approach.

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The aircraft has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(d) VOR navigation equipment. If VOR navigation equipment is required by paragraph (a) or (c) of this section, no person may operate an aircraft unless it is equipped with at least one approved DME or suitable IFR approved RNAV system.>>

Recommended Disposition and Explanation: Accept the changes except for the revisions described below to make it compatible with the disposition to 121.349, for the same reasons.

(a) Aircraft navigation equipment requirements. No ~~person~~ foreign air carrier may conduct operations under IFR or over the top unless the aircraft used in those operations is equipped with at least two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. ~~However, only one navigation system needs to be provided for precision approach and APV operations.~~ However, only one marker beacon receiver providing visual and aural signals and one ILS receiver need be provided. Equipment used to receive signals en route also may be used to receive signals on approach, it if is capable of receiving both signals.

(b) Aircraft communication equipment requirements. No person may operate an aircraft under IFR or over the top, unless it is equipped with--

(1) For normal operating conditions, at least two independent communication systems that fulfill the functions specified in Sec. 121.347(a) of this chapter; and

(2) Except as required in 121.99, ~~For non-normal and emergency operating conditions~~, at least one of the two independent communication systems that fulfills the functions specified in Sec. 121.347(a) of this chapter must have two-way voice communication capability.

(c) Use of a single independent navigation system. Not withstanding the requirements in paragraph (a) of this section, the aircraft may be equipped with a single independent navigation system suitable for the route to be flown if--

(1) The aircraft is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for ~~navigating~~ proceeding safely to a suitable airport and completing an instrument approach.

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The aircraft has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(d) VOR navigation equipment. If VOR navigation equipment is required by paragraph (a) or (c) of this section, no person may operate an aircraft unless it is equipped with at least one approved DME or suitable IFR approved RNAV system.

14 CFR 135

Sec. 135.161 Communication and navigation equipment for aircraft operations under VFR over routes navigated by pilotage.

FAA is proposing the following rule revision:

<< (a) No person may operate an aircraft under VFR over routes that can be navigated by pilotage unless the aircraft is equipped with the communication equipment necessary under normal operating conditions to fulfill the following:

(1) Communicate with at least one appropriate station from any point on the route.

(2) Communicate with appropriate air traffic control facilities from any point within Class B, Class C, or Class D airspace, or within a Class E airspace surface area designated for an airport in which flights are intended.

(3) Receive meteorological information from any point en route.

(b) No person may operate an aircraft at night under VFR over routes that can be navigated by pilotage unless that aircraft is equipped with--

(1) Communication equipment necessary under normal operating conditions to fulfill the functions specified in paragraph (a) of this section; and

(2) Navigation equipment suitable for the route to be flown.>>

Recommended Disposition and Explanation: Accept but replace "person" with "pilot."

Sec. 135.165 Communication and navigation equipment: Extended over-water or IFR operations.

FAA is proposing the following rule revision:
<< (a) Aircraft navigation equipment requirements. No person may conduct operations under IFR or extended over-water unless the aircraft used in those operations is equipped with at least two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. However, only one navigation system need be provided for precision approach and APV operations. Equipment used to receive signals en route also may be used to receive signals on approach, if it is capable of receiving both signals.

(b) Use of a single independent navigation system. Notwithstanding the requirements in paragraph (a) of this section, the aircraft may be equipped with a single independent navigation system suitable for the route to be flown if:

(1) The aircraft is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for navigating safely to a suitable airport and completing an instrument approach;

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The aircraft has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(c) VOR navigation equipment. Whenever VOR navigation equipment is required by paragraph (a) or (b) of this section, no person may operate an aircraft unless it is equipped with at least one approved DME or suitable IFR approved RNAV system.

(d) Aircraft communication equipment requirements. Except as permitted in paragraph (e) of this section, no person may operate a turbojet airplane having a passenger seat configuration, excluding any pilot seat, of 10 seats or more, or a multiengine airplane in a commuter operation, as defined in part 119 of this chapter, under IFR or in extended over-water operations unless it is equipped with—

(1) For normal operating conditions, at least two independent communication systems that fulfill the functions specified in Sec. 121.347(a) of this chapter; and

(2) For non-normal and emergency operating conditions, at least one of the two independent communication systems that fulfills the functions specified in Sec. 121.347(a) of this chapter must have two-way voice communication capability.

(e) IFR or extended over-water communications equipment requirements. A person may operate an aircraft other than that specified in paragraph (d) of this section under IFR or in extended over-water operations if it meets all of the requirements of this section, with the exception that only one communication system transmitter is required for operations other than extended over-water operations.

(f) Additional aircraft communication equipment requirements. In addition to the requirements in paragraphs (d) and (e) of this section, no person may operate an aircraft under IFR or in extended over-water operations unless it is equipped with at least:

(1) Two microphones; and

(2) Two headsets or one headset and one speaker.

(g) Extended over-water exceptions. Notwithstanding the requirements of paragraphs (a), (b), (d) and (e) of this section, installation and use of a single LRNS and a single LRCS for extended over-water operations in certain geographic areas may be authorized by the Administrator and approved in the certificate holder's operations specifications. The following are among the operational factors the Administrator may consider in granting an authorization:

(1) The ability of the flight crew to navigate the airplane along the route with the required accuracy,

(2) The length of the route being flown with a single navigation or communication system; and

(3) The duration of the very high frequency communications gap, if very high frequency communications equipment is installed.>>

Recommended Disposition and Explanation: Accept the changes except for the revisions described below to make it compatible with the disposition to 121.349, for the same reasons.

(a) Aircraft navigation equipment requirements. No person may conduct operations under IFR or extended over-water unless the aircraft used in those operations is equipped with at least two approved independent navigation systems suitable for the route to be flown and authorized in the certificate holder's operations specifications. ~~However, only one navigation system need be provided for precision approach and APV operations.~~ Equipment used to receive signals en route also may be used to receive signals on approach, if it is capable of receiving both signals.

(b) Use of a single independent navigation system. Notwithstanding the requirements in paragraph (a) of this section, the aircraft may be equipped with a single independent navigation system suitable for the route to be flown if:

(1) The aircraft is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single system at any point along the route, for ~~navigating~~ proceeding safely to a suitable airport and completing an instrument approach;

(2) Both navigation systems are authorized by the FAA in the certificate holder's operations specifications; and

(3) The aircraft has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(c) VOR navigation equipment. Whenever VOR navigation equipment is required by paragraph (a) or (b) of this section, no person may operate an aircraft unless it is equipped with at least one approved DME or suitable IFR approved RNAV system.

(d) Aircraft communication equipment requirements. Except as permitted in paragraph (e) of this section, no person may operate a turbojet airplane having a passenger seat configuration, excluding any pilot seat, of 10 seats or more, or a multiengine airplane in a commuter operation, as defined in part 119 of this chapter, under IFR or in extended over-water operations unless it is equipped with—

(1) For normal operating conditions, at least two independent communication systems that fulfill the functions specified in Sec. 121.347(a) of this chapter; and

(2) ~~For non-normal and emergency operating conditions,~~ at least one of the two independent communication systems that fulfills the functions specified in Sec. 121.347(a) of this chapter must have two-way voice communication capability.

(e) IFR or extended over-water communications equipment requirements. A person may operate an aircraft other than that specified in paragraph (d) of this section under IFR or in extended over-water operations if it meets all of the requirements of this section, with the exception that only one communication system transmitter is required for operations other than extended over-water operations.

(f) Additional aircraft communication equipment requirements. In addition to the requirements in paragraphs (d) and (e) of this section, no person may operate an aircraft under IFR or in extended over-water operations unless it is equipped with at least:

(1) Two microphones; and

(2) Two headsets or one headset and one speaker.

(g) Extended over-water exceptions. Notwithstanding the requirements of paragraphs (a), (b), (d) and (e) of this section, installation and use of a single LRNS and a single LRCS for extended over-water operations in certain geographic areas may be authorized by the Administrator and approved in the certificate holder's operations specifications. The following are among the operational factors the Administrator may consider in granting an authorization:

(1) The ability of the flight crew to navigate the airplane along the route with the required accuracy,

(2) The length of the route being flown with a single navigation or communication system; and

(3) The duration of the very high frequency communications gap, if very high frequency communications equipment is installed.

Sec. 135.225 IFR: Takeoff, approach and landing minimums.

FAA is proposing the following rule revision:

<< (c) * * *

(1) On a precision or APV approach and has passed the precision final approach fix; or

* * * * *

(3) On a nonprecision final approach; and the aircraft--

* * * * *

(ii) Where a final approach fix is not specified, has completed the procedure turn and is established inbound toward the airport on the final approach course within the distance prescribed in the procedure. The approach may be continued, and a landing made, if the pilot finds, upon reaching the authorized MDA or DA/DH, that actual weather conditions are at or above the minimums prescribed for the procedure.

(d) For each pilot in command of a turbine-powered airplane who has not served at least 100 hours as pilot in command in that type of airplane, the MDA or DA/DH and visibility landing minimums prescribed in part 97 of this chapter or in the certificate holder's operations specifications for a particular approach must be increased by 100 feet and one half statute mile, respectively, but not to exceed the ceiling and visibility minimums for that approach when used as an alternate airport.>>

Recommended Disposition and Explanation: The TAOARC recommends withdrawal of the change using the terms APV, precision, nonprecision, DA/DH, etc. until definitions and terminology issues are resolved as dispositioned in 14 CFR Part 1. In addition, the TAOARC recommends withdrawal of the change from "pilot" to "person."

Sec. 135.345 [Amended]

FAA is proposing the following rule revision:
Amend Sec. 135.345(a)(7) by removing the term ``DH'' and adding in its place the term ``DA/DH''.

Recommended Disposition and Explanation: The TAOARC recommends withdrawal of the change until definitions and terminology issues are resolved as dispositioned in 14 CFR Part 1.

Appendix F to Part 135 [Amended]

FAA is proposing the following rule revision: Amend Appendix F by removing the words ``Selected decision height'' and adding in their place the words ``Selected DA/DH'' in Parameter number 54.

Recommended Disposition and Explanation: The TAOARC recommends withdrawal of the change until definitions and terminology issues are resolved as dispositioned in 14 CFR Part 1.

Appendix

This Appendix summarizes comments received on the RNAV NPRM. The submitted comments also can be found on the Department of Transportation Docket Management System, associated with Docket No. 14002. For disposition and discussion of the comments, see the main body of this document.

	Comments
	General
1.	We have found the proposed rule to be very complex and involve many issues with ramifications affecting crewmember training and aircraft equipage requirements. (RAA—5)
2.	May impose significant navigation equipment requirements to NAS users—(RAA—5)
3.	The need to corroborate the indicated language within the proposed rule against current operational practices, and expected future program goals, is critical to the further enabling of effective transitions and changes implied or required by the proposed rule. (ATA—7)
4.	There is very little language regarding Required Navigation Performance (RNP), a cornerstone of our future airspace system, endorsed by the FAA Administrator. (Continental—13)
5.	Delta requests additional information to determine if this regulation is intended for all operators in US airspace or only US operators. Delta believes the intent of this rule should also be required by foreign-registered operators operating in the US (NOTAM) - especially if the FAA is trying to make the US skies safer. Specifically, if US operators flying in the Gulf are mandated to install and carry extra equipment, so should others operating within US Gulf airspace. (Delta—18)
6.	I am opposed to the change of any rule, regulation or standard for the purpose of conforming to the ICAO standards. For example, the change to the weather reporting (METAR/TAF) has destroyed this medium for the majority of pilots, who like me, do not speak, nor want to learn french. The US acquiescence to the French pressures in that instance is nothing short of a disaster. Fortunately, there are other sources of weather information available today that has mitigated the impact of this misguided action. To the extent that these proposed changes are not being driven by ICAO standardization, I do not object to them. However, in each and every instance, I urge you to reexamine the proposed change to assure that they are not being made to conform to the ICAO standards. If the ICAO member countries really want uniformity, then they can easily adopt out methods. Keeping in mind that the vast majority of aviation activity occurs in the US, we should not allow ourselves to be whipped around by a minority. Especially when those same countries have screwed their systems up so that the affordable freedom of flight is all but gone, general aviation is dead or dying, bureaucracy, astronomical user fees, privatization of ATC, and oppressive restrictions prevail. That is not my vision of aviation in this country and adherence to the ICAO standards is a major step in that direction. While some ICAO standards are in fact harmless, e.g., the reclassification of airspace, (I really don't mind calling a TCA Class B airspace), we need to… [Sic]—(Brock 21)
7.	While many pilots anticipate utilizing the proposed capabilities, the majority of general aviation aircraft do not currently have the necessary equipment. Instead, they use the existing infrastructure and route system with existing avionics equipment. Those operations must not be adversely impacted at the expense of these proposed changes. (AOPA—23)
8.	*General Impression: The NPRM contains serious flaws both in its concepts and execution.* If enacted in its present form, the rules will have a disastrous affect upon the global harmonization achieved in AC120-28D and AC120-29A, and will corrupt and subvert both the intent and guidance offered by these two Advisory Circulars, as well as Operations Specifications. *The NPRM will in effect establish a second, parallel set of regulations and definitions that will be confusing to operators, avionics and equipment manufacturers, and instrument procedure developers. The NPRM is going in the opposite direction of worldwide aviation harmonization.* AC120-28D and AC120-29A were developed by industry, FAA, and JAA experts through numerous meetings over a period of years, and with the investment of hundreds of thousands of dollars, and thousands of man-hours. These documents were painstakingly crafted and harmonized by the brightest, most knowledgeable minds in aviation. The NPRM is an affront to the efforts expended for harmonization and standardization by the AWOHWG. The NPRM creates serious contradictions with these Advisory Circulars in terminology, definitions, and

	Comments
	philosophy. The definitions and content in the NPRM create a "definitional box" which appears to support a presupposed outcome: namely WAAS and LAAS (the concept of precision RNAV). The NPRM creates and/or defines three basic classes of instrument approaches: Non-Precision Approach (NPA), Approach Procedure with Vertical guidance (APV), and Precision Approach (PA). This contradicts the classifications and intent of AC120-29A. AC120-29A (Section 4.3.7.1.c.5) discontinues the use of the former terminology "precision" and "nonprecision", explicitly states that these terms can be confusing and ambiguous, and their use is discouraged in favor of the common generic term "instrument approach". AC120-29A (Sections 4.3.2, 4.3.3, and 4.3.7.1.c.1) establishes three general classifications of instrument approaches: • xLS • ILS • MLS • GLS • RNAV • Based on RNP (3D or 2D) • "Other" RNAV (3D or 2D) • Note: • 3-D RNAV (suitable for LNAV/VNAV) • 2-D RNAV (suitable for LNAV only) • "other than xLS or RNAV" • Includes traditional or classic procedures such as: • VOR or VOR/DME • NDB or NDB/DME • LOC and LOC/BC • ASR • LDA and SDF • These approaches may be flown using (Section 4.3.3.b. and c.): • Vertical Navigation Path Guidance (VNAV) • Constant Vertical Descent Rate AC120-29A also approves criteria for approaches to be operated to the minima described as CAT I through CAT IIIc, depending upon the lowest DA (or MDA), and the required visibility. *The single greatest failing of the NPRM is its divergence from this classification of approaches. The FAA and US aviation industry should not go down this path! The NPRM should be rewritten to conform to the classification of approaches as described in AC120-29A. The NPRM should also be rewritten to adopt the definitions and terminology of AC120-28D and AC120-29A. The terms "APV, nonprecision, and precision approaches" should be scrapped entirely.* Another area of great concern involves the intended rewriting of Part 91.175 (f) "Civil airport takeoff minimums". The indicated language may disallow the Engine Failure Turn Procedures used by air carriers at many of their airports. ((Kim Rackley—24)
9.	American Trans Air does not support new definitions/specification that contradict industry/FAA/JAA agreed language contained in Operations Specifications, Advisory Circular 120-29A, or changes not coordinated with industry/users. (Amer Trans—25)
10.	If this NPRM is adopted as it stands it will be inconsistent with these painstakingly created AC's that have been developed over a period of several years as harmonized documents between the FAA and JAA in Europe. This NPRM will set the aviation industry back 5 to 10 years and may require years to iron out the inconsistencies. The airline industry, which will be directly affected by the NPRM, cannot afford to spend hundreds of thousands of dollars and hundreds of man hours over the next couple years trying to iron out these problems. FAA 2002 14002 if enacted will provide contradictory guidance information to Airline operators, avionics equipment manufacturers, and flight procedure developers, from the guidance that has been promulgated in the above named Advisory Circulars. The NPRM sets a divergent path from the guidance developed in the AC's, and calls the entire matter of global harmonization into question. In these desperate economic conditions, airlines cannot afford to make badly needed capital investments in state of the art

	Comments
	avionics systems when none of us can determine which systems and procedures will be the ones to be supported in the end. WE MUST HAVE THE OPPORTUNITY TO HARMONIZE the language of FAA 2002 14002 with the recently adopted Advisory Circulars. This is going to require very careful scrutiny of the NPRM and a determination of which sections of it conflict with specific sections of ACI 20-28D and ACI 20-29A. Sections of the NPRM that conflict have got to be fixed! If the NPRM is adopted as currently written, I expect that Alaska Airlines will pay at least $30,000 in manpower costs to participate in industry groups that will have to iron out the discrepancies that it will create. (Rackley--Alaska Airlines—28)
11.	This NPRM does not meet with the intent of established rule-making practices by moving RNAV regulatory guidance through the rule-making process outside of the TAOARC (Terminal Area Operations Aviation Rule-Making Committee). From FAA Order 1110.132 (TAOARC Charter): *"There is a need to fully utilize the capabilities of modern aircraft, specifically the use of area navigation (including the global positioning system). Evolving technologies and potential equipment upgrades provide increased operational and safety benefits not realized unless a practical means is established to direct and facilitate new criteria and implementation. The international aspects of aviation operations and aircraft production require that terminal area operational procedures and associated equipage be consistent.* *"This committee provides a forum for the Federal Aviation Administration (FAA), other government entities, and affected members of the aviation community to discuss issues and to develop resolutions and processes to facilitate the evolution of safe and efficient terminal area operations. This committee supports the international harmonization process."* We respectfully request that the issues of this NPRM be sent to the TAOARC for review and discussion as part of the rule-making process. The issues raised within this NPRM merit further discussion and are within the scope of the TAOARC's charter. In the event that the FAA deems it unnecessary to send this issue through the established RNAV rule-making process, we have submitted our comments below on this NPRM. (RAA-31)
12.	General Discussion, paragraph II.D.4 Approach and Landing Using Instrument Approach Procedures. 1. General question on approaches and vertical guidance information. There are references to vertical glide path information based upon electronic glideslope and GLS as well as PAR. Additionally, there are proposed changes to approach minimums defined as an MDA, which are applicable to an instrument approach procedure without electronic glideslope. Where does barometric VNAV fit into these definitions? With baro-VNAV, approach minimums defined with a DA in lieu of MDA may be used. The question is; what determines "glide path"? Does this include all of the following? 1. ILS glideslope 2. Augmented GPS APV 3. Barometric VNAV If baro-VNAV is intended to be included as a glide path, then 91.129 (e)(2) must be affected. Additionally, requirements for recurrent proficiency check include 2 precision approaches, 2 non-precision approaches and if the crew is GPS qualified, a GPS approach may be counted as one of the required non-precision approaches. By including a GPS-based approach with barometric VNAV, is this now a precision approach and must be performed in addition to the other 2 precision approaches? The goal should be to establish within the Practical Test Standard document a priority of what constitutes precision and non-precision approaches along with the number of each procedure to be performed. (RAA—31)
13.	*In re discussions II.D.1, II.D.4, III.1.1* Category I is a positive change in that it will include precision RNAV like Alaska is doing in Juneau and opens the door for a precision DH instead of having to use a nonprecision MDA. (RAA—31)
14.	As GPS-based area navigation moves closer to being the standard in the U.S., the FAA needs to streamline procedures for installation of approved GPS-based navigation systems in aircraft -- to harmonize them with current procedures applicable to the current standard, VOR and ILS. As is now the case with standard VOR and ILS receivers, validation flights, STCs, individual aircraft/radio model approvals should no longer be needed. (Ameriflight—32)
15.	We also recommend that the NPRM clearly state whether there is any change to WAAS or LPV and their role in the NAS as a result of this proposed rulemaking. (Rockwell Collins—33)

	Comments
16.	AOPA is concerned that this NPRM attempts to comply with the International Civil Aviation Organization (ICAO) harmonization objectives without regard to the negative impacts that some of the changes could have on civil aviation in the United States. There are significant differences between the United States and European operating environments that make harmonization less than an ideal model for future changes to the domestic system. The Most important of these differences is the role and impact of general aviation in the United States. On issues of global harmonization, the FAA should ensure that the NAS reflects the diverse capabilities of the United States general aviation community, as demonstrated here in the United States. As an ICAO member nation, the United States has a stake in aviation matters within the international community. However, ICAO harmonization should only occur when there is an operational benefit to the users of the United States National Airspace System (NAS). The FAA must meet the challenge of balancing individual state needs against the overall objective of producing a seamless global traffic management system. (AOPA—34)
17.	AVR-1 signed out AC 120-29A in August of 2002, after many experts worked for years on that document. The All Weather Operations Harmonization Working Group, consisting of internationally recognized experts, drafted this AC. The AC provides a revised set of definitions that provide the flexibility needed for current and future airspace utilization based on current aircraft technology. The FAA now proposes different definitions that really are steps backward. The FAA needs to embrace the definitions of AC 120-29A. It needs to provide leadership for this national airspace system and for the world. (Vaughn—Continental—37)
18.	Air Transport Association recommends that an in-depth study be conducted by the Terminal Area Operations Aviation Rulemaking Committee ("TAOARC"). UPS believes that a study by a government-industry working group is imperative to determining whether the proposed changes to Rule 121.99 are appropriate and whether there may be other amendments that would be more beneficial to the balance of safey and operations within the industry. However, UPS is concerned that under TAOARC's charter, it is generally limited to airspace issues regarding arrival, departure, and airport ground operations. Rule 121.99 addresses an issue that is germane primarily to en route communications. If TAOARC is the best entity to study and address prospective changes to rule 121.99, UPS asks only that TAOARC ensure that it brings to the table experts and analysis regarding en route communications. (UPS—38)
19.	Required Navigational Performance (RNP) operation: The NPRM should be revised to make specific accommodations for RNP operation in its preamble and throughout the associated rules. As written, the FAA is missing an opportunity in this NPRM to leverage advancements in flight management systems (there have been numerous successful implementations of this valuable development). Specific mention of RNP should be made in several locations (as noted in Enclosure 2). Provisions especially should be made to allow RNP-based route width considerations, instead of specifying a 4nm lateral clearance requirement. (Boeing—43)
20.	Lowering Altitude Above Which DME is Required: The altitude above which DME is required should not be lowered from FL240 to FL180, as proposed in the NPRM [i.e., §91.205(e)]. The reason DME was originally specified above FL240 was to address lead turn radius at high true airspeed, not necessarily to correlate with airspace definition. FL240 should be retained, and RNAV methods should also be permitted in lieu of DME as proposed. (Boeing--43)
21.	Pilot vs. Person: We maintain that it is not necessary to change the word "pilot" to "person" in various locations in the proposed text. Pilots fly aircraft. The present term and definition are perfectly clear and adequate. (Boeing—43)
22.	In general, the intent of these amendments is excellent. Amendments to the Federal Aviation Regulations are sorely needed to accommodate the safety and efficiency benefits that modern technology can provide when combined with new operating and air traffic management concepts. While the vast majority of these amendments are fully appropriate and suitable to achieve the objectives of this rulemaking proposal, several of the proposals require amendment to achieve those objectives without adversely impacting the industry or potentially reducing the safety and efficiency benefits that can be achieved with modern technology. Airbus fully supports changes in navigation and communication requirements which facilitate more efficient use of the modern technology that is incorporated in its aircraft. Airbus also fully supports the safety enhancements recommended by the Commercial Aviation Safety Team (CAST), including those related to enhanced navigation and instrument flight procedures. Airbus also supports the recommendations of the Free Flight Executive Steering Committee and the FAA efforts

	Comments
	to modernize the NAS by transforming it to a performance based system. Airbus sees the recommendations of CAST and the Free Flight Executive Steering Committee as essential guidelines to achieving the optimum safety and efficiency benefits that modern technology and new operating and air traffic management concepts can provide. The provisions of any rulemaking effort needs to be fully compatible with the government and industry consensus that have been developed within these two efforts. (Airbus—44)
23.	The NPRM proposes to make a number of changes to FAR Part 1 by adding or amending definitions related to instrument flight operations. Some of these changes also have a very undesirable "ripple effect" in many of the operating rules. A significant number of the changes do not appear to be related to the implementation of RNAV. There also does not appear to be any safety or operating efficiency reason for these changes. In fact, some of these changes adversely affect concepts and operations that have been used safely and efficiently for many years and remain fully suitable for operations in a performance based RNAV NAS. Due to the high degree of connectivity and many very subtle relationships with other regulations as well as numerous evaluation and approval criteria and commonly accepted safe operating practices, it is not possible to understand the significance of a change to a single definition without examining all of the rules and criteria affecting instrument flight operations as a whole. (Airbus—44)
24.	In summary, the intent of these amendments is excellent. Amendments to the Federal Aviation Regulations are sorely needed to accommodate the safety and efficiency benefits that modern technology can provide when combined with new operating and air traffic management concepts. While the vast majority of these amendments are fully appropriate and suitable to achieve the objectives of this rulemaking proposal, several of the proposals require amendment to achieve those objectives without adversely impacting the industry or potentially reducing the safety and efficiency benefits that can be achieved with modern technology. Those amendments include many of the definitions proposed for Part 1. These amendments also include Sections 91.129, 91.175, 91.189, 97.1, 97.20, 121.99, and 121.349. Plus, many other changes are required in the other operating rules due to a "ripple effect" from the inappropriate definitions in FAR Part 1. Airbus fully supports changes in navigation and communication requirements which facilitate safer and more efficient use of the modern technology that is incorporated in its aircraft. Airbus also fully supports the safety enhancements recommended by the Commercial Aviation Safety Team (CAST), the recommendations of the Free Flight Executive Steering Committee, and FAA efforts to modernize the NAS by transforming it to a performance based system. Airbus is willing to assist the FAA in any way it can to implement a performance based national airspace system that optimizes the safety and efficiency benefits that can be achieved from the introduction of modern technology and new operating and air traffic management concepts. RNAV and RNP are both essential elements of this future NAS, which is why the regulatory requirements must assist and encourage this transformation while maintaining the level of safety everyone currently enjoys. (AIRBUS—44)
	Economic
25.	The events of 9/11/2001 and subsequent economic down-turn in our industry have significantly altered industry fleet sizes. This was not reflected in the latest (April 2002) document. Since your analysis is projecting what the fleet will look like 20 years into the future, we believe it is significant that your future fleet projection be based upon current fleet sizes. RAA will provide current data for the regional fleet (RAA—5)
26.	Delta believes this NPRM is definitely significant, would have significant impact on small entities (as well as large), and would impose an unfunded mandate. This rule would likely mandate SATCOM on international aircraft or high frequency radios. (Delta—18)
27.	This NPRM may require additional navigation systems and communications systems (SATCOM, HF). American Trans Air believes this NPRM would have significant impact on small and large entities that would impose an unfunded mandate. (American Trans Air—25)
28.	In the "Benefits and Costs" section of the NPRM, the FAA fails to address the costs to be borne by the aircraft owners in the event of the new rule. (See NPRM at p. 52-54.) This omission reveals an incomplete understanding of the consequences of the changes being proposed. In the regulatory impact analysis, the FAA states that there is no cost to aircraft operators because they already have voice radios on the planes. This might indicate that ATC has been confused with AOC Further, the omission also completely ignores the fact that there

	Comments
	has to exist an infrastructure on the ground as well as in the air, and in much of the world, there is not a corresponding build out. As such, under the proposed rule, the operational options are limited to either expecting someone to bear the capital expense of installing such equipment, or not flying routes over or near the unserved areas. (UPS—38)
29.	In addition, as indicated in the comments to the initial NPRM and the amendments remaining open for comment, the meaning and application of aspects of the proposal are unclear. It, therefore, is very difficult for the industry to comment on FAA's cost benefit analysis. The industry is particularly concerned about the scope of the proposed amendment to 14 CFR Section 121.99(a) concerning communication systems between an airplane and the appropriate dispatch office, specifically the proposed definition of "rapid communications." After review and clarification of the proposed requirements by the TAOARC, particularly the regulatory and/or safety benefits, we urge the FAA to conduct a robust economic analysis of the proposal and to permit additional analysis by the industry, if necessary. Even if the FAA decides not to refer the proposal to TAOARC, we urge the FAA to reevaluate its analysis in light of the additional comments to the docket. There are many uncertainties and unanswered questions; their resolution will determine the ultimate benefit and impact of the proposal. In addition to these preliminary comments, ATA submits the following comments on specific provisions. All references are to the Federal Register Volume 67 (December 17, 2002), with specific item number and page numbers listed. (ATA—41)
	International
30.	The NPRM states there is no ICAO standards that correspond to the proposed rule. American Trans Air believes certain equipment requirements could place US Operators at an economic disadvantage, and questions if the NPRM applies to foreign operators in US Gulf of Mexico airspace. (Amer Trans—25)b
	Part 1
31.	RNAV, PA, PFAF: These all appear to be charting acronyms and not necessary for this section of the CFR. Part-97 may be more appropriate. Drop the definition of area navigation (RNAV). This requires more industry input and rational. (Amer Trans—25)
32.	The definitions of precision and non-precision approaches, definitions of CAT1/2/3, and lack of harmonization with international authorities need more detailed discussion by industry experts, as there will be far reaching changes in our airspace system when these changes are incorporated. (Fred Abbott/Continental—13)
33.	The changes in definitions and terminology can be expected to have significant impact on training materials and equipment manuals. Equipment design can also be affected. For example, the new definition of DH does not include Cat I approaches. However, there are controls, displays and dedicated annunciators in flight decks that use this term without the new distinction. This will cause consistency problems and potentially confusion for the crews. We recommend the NPRM language clearly address: (a) whether it is FAA intent that training manuals, equipment manuals, etc be revised to reflect the new definitions and terminology, (b) whether charts will now be revised to use these terms, (c) whether there will be strict compliance between the new definitions, the type of approach being flown, and all control/display functions, (d) whether new terminology requirements will be applied retroactively in any way, e.g., if existing equipment [without any modification] were to be applied to another certification. (Rockwell—33)
34.	Remove the definitions of Area navigation high route, Area navigation low route, Category II operations, Category III operations, Category IIIa operations, Category IIIb operations, Category IIIc operations, Decision height, Minimum descent altitude, Nonprecision approach procedure, Precision approach procedure, and RNAV waypoint. NPRM Proposal: Replacement of current definitions by new definitions and abbreviations for the referenced terms. Comments: The proposal includes definitions of terms and concepts that have limited future application or are defined differently in other FAA technical guidance. Continued use of these terms will result in confusion and

	Comments
	inconsistencies for operators, and is contrary to FAA's longstanding commitment to harmonization and simplicity. For example, Advisory Circular 120-29A, Page 2, Paragraph 3.4 Category I, II, and III Terminology provides: "The use of the term "non-precision" has been dropped within this AC to reduce confusion which exists with use of this term with current and future systems and authorizations, particularly with Vertical Navigation (VNAV) and Area Navigation (RNAV), and with other approaches that may incorporate the use of barometric VNAV to provide a stabilized descent path to a runway." Resolution: Include language in the preamble to the FAR Part 1 DEFINITIONS AND ABBREVIATIONS stating that the terms "nonprecision approach procedure" (NPA), "precision approach" (PA), and "precision final approach fix" (PFAF) have been deleted as these definitions no longer provide clarification nor correct context to future approach implementation strategies. Use of the terms "authorized" or "approved" in relation to approach, departure, or arrival procedures would give the needed regulatory authority, while allowing future developments and inherent flexibilities. Further definitions can be included within an air carrier's Operations Specifications. Continue to coordinate the development of wording compatible with existing harmonized guidance, specifically, AC 120-28D, and AC 120-29A, to enable the implementation of future approach strategies without creating conflicts (as do the proposed changes). (ATA—41
35.	Remove the definitions of Area navigation high route, Area navigation low route, Category II operations, Category III operations, Category IIIa operations, Category IIIb operations, Category IIIc operations, Decision height, Minimum descent altitude, Nonprecision approach procedure, Precision approach procedure, and RNAV waypoint. Comments: The proposal definitions are confusing and unnecessary. In accordance with AC120-29A, American Airlines has adopted the terminology "Non-ILS" approach procedure in recognition of the high degree of accuracy of RNP RNAV equipped aircraft, particularly when coupled with vertical navigation (VNAV). Regulators and industry should continue to develop wording compatible with existing harmonized guidance, specifically, AC 120-28D, and AC 120-29A, to enable the implementation of future approach strategies without creating conflicts (as do the proposed changes). (AA—42)
36.	Category I, II, and III Definitions: Definitions for Category I, II, and III should be deleted entirely from the regulations and retained only in guidance materials, such as AC 120-28D, AC 120-29A, the Airman's Information Manual (AIM) and, as necessary, new or revised ACs related to RNP (such as the upcoming revision to AC 90-45A, "Approval of Area Navigation Systems for use in the U.S. National Airspace System." If adopted, this NPRM will likely cause significant harm to evolution of low visibility landing programs and airborne systems. Category I is not currently limited to, and should not in the future be limited to, use of only one sensor system or technique, such as ILS. This is to ensure consistent application of harmonized criteria for minima across systems, procedures, and methods. Additionally, the definitions in the NPRM are inconsistent with current standard Operations Specifications usage, and are different from those used in current FAA Advisory Circulars AC 120-28D and AC 120-29A (which contain appropriate and correct definitions). (Boeing—43)
37.	*Approach Classification Definitions:* As an example, the proposed definition of "precision approach procedure" appears to be right and reasonable for both current operations and operations in the future performance based NAS. However, when other proposed definitions are considered, such as "Approach Procedure With Vertical Guidance", contradictions, conflicts, and confusion occurs. The proposed language for the three relevant definitions is shown below. Precision approach procedures (PA) is an instrument approach procedure based on a lateral path and a vertical glide path. Approach Procedure with vertical guidance (APV) is an instrument approach procedure based on lateral path and vertical glide path. These procedures may not conform to requirements for precision approaches. Nonprecision approach procedure is an instrument approach procedure based on lateral path and no vertical path. These definitions would lead one to conclude that an APV approach is a "non precision" approach procedure even though it otherwise appears to meet the definition of a "precision approach". But the relationship between the rules is more complex than just a conflict with the definitions. The operational consequences of this distinction are very significant due the connectivity and subtle relationships between the definitions and the operating rules and training requirements. The issue is further confused by the introduction of the term "precision final approach fix" which "is associated with a precision or APV approach procedure". Even though the piloting tasks for a "precision approach" and an "APV" approach are fundamentally the same (tracking lateral and vertical guidance) and the flight instrument displays are equivalent, the apparent

	Comments
	classification of an APV approach as a "non precision approach" (since that is the only other choice in the definitions) would require each air carrier pilot to perform the very same tasks twice in each training sessions and continue to do so for the rest of the pilots flying career. This is very inefficient use of a valuable training resource and the time could be much better spent on much more relevant issues, such as CFIT or Loss of Control prevention. This also creates a large economic burden of the air carrier without achieving any significant safety or operational benefit. Modern technology has reached the point where the old classification schemes are not truly relevant anymore. Current production large transport airplanes currently provide a lateral and vertical navigation capability that uses a combination of GPS, IRS, and barometric information. Currently this LNAV / VNAV capability is approved for instrument approach operations as low as 250 feet above the touchdown zone. However, many believe that this capability will be eventually demonstrated to be safe for operations below 200 feet. Therefore, it makes no sense to call this a "non precision" approach, especially when the piloting tasks are equivalent to an ILS approach. In fact, CAST has recommended that nonprecision approaches should be eliminated to significantly reduce the potential for CFIT and Approach and Landing accidents. Airbus strongly believes that any instrument approach that provides both lateral and vertical guidance should be classified as a precision approach or just as a Category I approach, which raises another issue with the definitions. The proposed definition is in direct conflict with the definition of a Category I operation that has been used safely and successfully in the air carrier operations specification since the mid 1980's. The Operations Specifications and the accompanying Air Carrier's Handbook defines a Category I operation as any instrument approach operation that is not a Category II or Category III operation. In other words, Category I operations include both "precision" and "non precision" approaches. The proposed change would limit Category I operations to "precision approaches" and would exclude "nonprecision" and "APV" approaches. There is no safety or operating efficiency reason for the change. In fact, there is no safety or operating efficiency reason why definitions for the various categories of approaches need to be defined in the regulations. In fact, Category I has never been defined in the FARs and there is more than 40 years of safe operation with it being defined in ACs and Orders. Plus, Category II and Category III operations were safely conducted for decades without a definition in the FARs. Airbus believes that navigation technology is evolving so fast that the old NAS terms "precision approach" and "nonprecision approach" are rapidly losing utility or meaning. Therefore, for the future performance based NAS, Airbus believes that there should only be three ways to classify instrument approach operations, Category I, Category II, and Category III. These classifications should be based solely on operating minima (DA/DH and RVR/VIS). Others have also made the argument that even these three categories are dated, since they arose to support an ILS based infrastructure and have limited meaning in a performance based NAS, which is independent of any particular sensor. These persons have argued that modern technology supports operating minima that is a continuum, where the same basic equipment fit can support a wide range of operating minima, based on the runway and approach lighting provided, the training of the flight crew, the maintenance program for a particular operator, and the software options purchased by the operator. In summary, Airbus opposes the proposal to include the proposed definition of Category I operation in FAR Part 1. Airbus also opposes any definition or other regulatory requirement that would not permit an instrument approach that provided both lateral and vertical path guidance to be used in the same manner as ILS approaches have been traditionally used, including pilot training requirements. It is acknowledged that the operating minima and obstacle clearance requirements may not be equivalent to an ILS operation and that these factors would be based on the characteristic of the system. Airbus strongly opposes any definition or other regulatory requirement that would not permit systems that provide both lateral and vertical path guidance to be used for Category II and Category III operations, if the system met the total system performance requirements that have been traditionally required of ILS based systems used in these operations. The classification system for instrument approaches, in specific, and instrument operations, in general, should not be locked in the past but must be focused on operations in the future performance based NAS and the transition to that state. Airbus recommends the elimination of all reference to "precision" and nonprecision" approaches. Instead of using these terms, all instrument approaches should be referred to as Category I, Category II, or Category III. Airbus also recommends the elimination of all references to APV or LPV approaches, which should be considered in the continuum of Category I approaches. Airbus also recommends that the definitions of Category

	Comments
	II and Category III approaches be removed from Part 1 to eliminate any adverse operational consequences or unnecessary operational restrictions that could be encountered in the future during the introduction on modern technology (such as enhanced vision, LAAS, etc) or the introduction of new operating concepts and capabilities. (Airbus—44)
38.	Approach Procedure with Vertical Guidance (APV): AC120-29A does not support this terminology, but rather uses the term "CAT I". (Rackley—24)
39.	The terms "Approach procedure with vertical guidance (APV), Nonprecision approach (NPA), and Precision Approach (PA)" are contradictory to AC120-29A and should be removed. (Rackley—24)
40.	**Approach procedure with vertical guidance (APV)** This definition is not supported by AC120-29A, Appendix 1 "Definitions and Acronyms". AC120-29A simply uses the term "CAT I". See AC120-29A Section 3.4.b. "APV…a procedure based on lateral path and *glide path.* These procedures are flown to a decision altitude. Although these procedures include glide path information, they may not meet the requirements currently established for precision approach and landing operations. This includes the vertical navigation performance and airport infrastructure requirements….*Safety for these approaches is maintained by increasing the required obstacle clearance height or required visibility.* An example of an APV approach is the LNAV/VNAV approach minima currently published on RNAV approach plates." **Question**: what is the definition of "glide path"? It is a critical definition that will include or exclude a number of things. **Comment**: (These questions and comments point to a good reason to scrap the term APV and use AC120-29A concepts.) 1) Any conventional (VOR/NDB/DME) approach flown with a constant rate descent could be considered an APV. So could an RNP 0.15 with coded vertical angle and flown using Baro VNAV. The RNP approach is far more accurate both laterally and vertically. 2) Exactly how much is the obstacle clearance height and visibility increased? Need an explicit reference for this so we know what we are getting. 3) There are varying degrees of LNAV/VNAV capability. What you have on a Cessna is much different from the complete dual systems on a jet, especially those systems that are RNP capable. 4) Does a RNP approach flown in LNAV/VNAV even belong here, or is it in reality a precision approach? 5) Specific examples of what is considered an APV approach should be cited: --RNAV (GPS) --VOR/NDB/DME/LOC/LOC BC/LDA/SDF etc. flown with a constant rate descent. --Conventional approach flown in LANV/VNAV using a coded angle. There are differences in system abilities to fly VNAV – these need to be pointed out. There are high and low end systems. --What about RNP flown in LNAV/VNAV? (Rackley—24)
41.	Remove the definition or term APV. How does this serve the public? There is no difference in training or how the approach is flown. This definition appears only to serve the interest of FAA and avoid airport ancillary requirements heretofore associated with ILS. The language should simply read, "served by an instrument approach providing vertical guidance". Further classifying approach procedures should not be applied in the rules. If FAA requires added categories for internal processing, changes should be applied to internal documents and orders—not the rules. Otherwise full disclosure as to exactly why we require the new term and how it's used should be included in the preamble. Simply stating to recognize LNAV/VNAV isn't an acceptable rational, as we've operated with LNAV/VNAV for several years without the rule. (Amer Trans—25)
42.	*Approach Procedure with Vertical Guidance (APV):* The definition as currently written potentially leads the pilot to believe that APV approach types have lower minima than today's non precision approaches when in fact substantial evaluation has determined that in many cases, non precision approaches are still providing the lowest possible ceiling and/or visibility minima. The definition vaguely discusses the fact that these procedures do not produce instrument approach minimums associated with traditional vertically guided approaches such as an Instrument Landing System (ILS). There should be clear, specific acknowledgement that these procedures are not intended to replace ILS approaches but rather are intended to offer pilots a "VNAV option" in lieu of nonprecision approaches without vertical guidance. (AOPA—34)
43.	*Approach procedure with vertical guidance (APV), Item 2, 77339* Current: APV is not currently defined in Part 1. NPRM Proposal: Include APV in Part 1. Comments: Current terminology allows for the incorporation of vertical path into an applicable approach. The inclusion of the term APV only further limits the ability to gain the effective coordination and implementation of

	Comments

	LNAV, VNAV, and future implementation of RNP when applied to vertical path. Resolution: Delete proposed APV definition in the NPRM. (ATA—41)
44.	**Approach procedure with vertical guidance (APV), Item 2, 77339** Comments: Existing terminology is adequate for approach operations utilizing vertical path guidance. Creating an additional term for an already recognized capability presents a training and cost burden that's unnecessary. Do not incorporate APV verbiage; continue to evolve AC120-29A terminology as required to support RNP RNAV both laterally and vertically. (AA—42)
45.	*Approach Procedure with Vertical Guidance (APV):* The new term "approach procedure with vertical guidance (APV)" and the criteria proposed to be used in conjunction with it are unnecessary and contradictory to existing harmonized guidance material. Further, they are not consistent with other important criteria related to RNAV and RNP that are either currently entering use, or have already been used for aircraft design for key elements of the future air carrier fleet (including RNP and Baro VNAV). The term "APV" and text related to it should be removed from this NPRM. (Boeing—43)
46.	While ADF generally approves of the NPRM, ADF expresses concern that the definition of an Air Traffic Service route included in the definitions section of the NPRM does not concur with other regulatory requirements. The route of flight and flight level a Part 121 aircraft is planned at, and/or actually flies, is the joint responsibility of the Aircraft Dispatcher and Pilot-In-Command, and is based on consideration of a number of safety and operational issues, including but not limited to ATC requirements. (ADF—15)
47.	ATS Route: Aligning terminology with IACO is OK. Question: Do we continue to call these new ATS routes "Jet" or "Victor" airways? Is there a new term to be used for day to day communications? "ATS Route XYZ" is a mouthful. Need an example of what these new ATS routes are to be called. (Rackley—24)
48.	Change the definition of ATS Route: The regulation should simply state ATS Route is a route or procedure approved by the Administrator. Why is it necessary to list examples of routes included under ATS Route? This will only serve to restrict any future naming convention. e.g., like the change to 91.205 (Amer. Trans—25)
49.	*Area Navigation (RNAV) route:* "…would refer to ATS routes established for aircraft operators capable of using area navigation…"
50.	Question: What are we going to call these in day to day operations? Are they "ATS RNAV Route XXX"? (Rackley—24)
51.	<u>RNAV</u>: Drop the definition of area navigation (RNAV). This needs more industry input. (Vaughn/Continental—19)
52.	The definitions listed include the word or phrase "precision", "precision approaches", precision instrument approaches", "nonprecision", and "Nonprecision approach". As the use of these are not in agreement with current practice, as defined in AC 120-28D and AC120-29A, the terms should simply indicate an instrument procedure and the specific type be determined and defined through other guidance material allowed and applied by the Rule. This will enable the progressive implementation of future abilities and concepts as authorized by the Administrator. *Proposed resolution:* Develop wording compatible with existing harmonized guidance, specifically, AC 120-28D, and AC 120-29A, to enable the implementation of future approach strategies without becoming in conflict with the Rule. (ATA—20)
53.	The use of the word "glide" in subsequent definitions should be reviewed for clarity. With the advent of additional means to determine the desired and expected path of an aircraft, the word "glide" does not add nor contain a meaning or a purpose. The removal of the word "glide" enables a more useful phrase, vertical path, instead of a specified "glide path" which may be wrongly correlated with a specific approach capability, such as an ILS, which has a "glide slope." *Proposed resolution*: Remove the word "glide" from definitions and uses within the Rule, unless it is determined that specific reasoned results are required and directed by the application of the word "glide" to the text.
54.	The numerical designations for Category IIIa (CAT IIIa) and Category IIIb (CAT IIIb) of "not less than 700 feet" should be revised to the currently understood and approved values. These are currently applied by air carrier Operations Specifications, as amended and updated by Handbook Bulletins (HBAT). Revising them to be consistent with current applications will remove conflicting information. *Proposed resolution*: Coordinate with the Operations Specifications Working Group or other industry/FAA groups to determine the current applicable values. This will enable the guidance to be located in one location, instead of adding possible confusion due to having the information in multiple locations. (ATA—20)

	Comments
55.	Category I (CAT I) operation: The proposed definition includes the words "CAT I is a precision approach". This definition is inconsistent with both AC 120-29A (which includes non-precision in Category I approaches) and Operations Specification group CAT I approaches (e.g., see Operations Specification C053). (Delta—18)
56.	*Category I Operation: "The FAA therefore proposing to add a definition of this term. The proposed definition of CAT I operation is "a* ***precision approach*** *with a decision height altitude that is not lower than 200' (60 meters) above the threshold and with either a visibility of not less than one half statute mile (800 meters) or a RVR of not less than 1800 feet (550 meters)."* This definition is not supported by AC120-29A, and is contradictory to the AC which defines a CAT I (US) as "an instrument approach….". The ICAO definition does specify "a precision approach…" AC120-29A does not specify a precision approach in the US. This is a major problem. (Rackley—24)
57.	*Category I (CAT I): "…a precision instrument approach and landing…" Category II: "…a precision instrument approach and landing…" Category III: "…a precision instrument approach and landing…" Category IIIa: "…a precision instrument approach and landing…" Category IIIb: "…a precision instrument approach and landing…" Category IIIc: "…a precision instrument approach and landing…"* These definitions are not supported by AC120-29A. (Rackley—24)
58.	*Category II Category III Category IIIa Category IIIb Category IIIc*--"These definitions would be revised to incorporate the concept of *precision RNAV*. In each of these definitions, the terms "ILS approach" or "ILS Instrument approach" would be replaced with the terms "precision approach" and "precision instrument approach"…" These definitions are not supported by AC120-29A. The AC simply specifies an "instrument" approach. Comment: Exactly what is a "precision RNAV" approach? Is it WAAS? LAAS? RNP 0.3 or less? (Rackley—24)
59.	*Category 1 (CAT I) operation*: The definition creates inconsistencies and will generate pilot confusion when used in conjunction with the new proposed "precision approach" definition. For example, if an ILS has approach minimums with a 300 foot DH and ¾ mile visibility will it be a CAT I operation? If an APV approach has the *same* minimums (to the same or a different runway) will it then be considered a CAT I operation? AOPA would expect the answer to be YES. This scenario raises additional questions pertaining to the currency requirements stated in 14 CFR Part 61 for instrument proficiency and training. AOPA would expect the FAA to permit pilots to receive training and proficiency credit when using any approaches that end at a DA/DH, including APV approaches. (APOA—34)
60.	"*Category I (CAT I) operation: The term ``Category I operation'' commonly has been used in the aviation industry and in the preambles of FAA regulatory documents for years, but it has never been defined in the CFR. The FAA is therefore proposing to add a definition of this term. The proposed definition of ``Category I (CAT I) operation'' is "a precision approach with a decision altitude that is not lower than 200 feet (60 meters) above the threshold and with either a visibility of not less than one half statute mile (800 meters) or a runway visual range (RVR) of not less than 1,800 feet (550 meters)."* This definition should be changed to read: "Category I (CAT I) operation: The term ``Category I operation'' commonly has been used in the aviation industry and in the preambles of FAA regulatory documents for years, but it has never been defined in the CFR. The FAA is therefore proposing to add a definition of this term. The proposed definition of "Category I (CAT I) operation" is "a precision approach with a decision altitude that is not lower than 200 feet (60 meters) above the threshold for airplanes, and not lower than 100 feet for helicopters, and with either a visibility of not less than one half statute mile (800 meters) or a runway visual range (RVR) of not less than 1,800 feet (550 meters) for airplanes, and not less than one quarter statute mile or a runway visual range (RVR) of not less than 1,200 feet for helicopters." (HAI—40)
61.	Category II (CAT II) operation, Category III (CAT III) operation, Category IIIa (CAT IIIa) operation, Category IIIb (CAT IIIb) operation, and Category IIIc (CAT IIIc) operation: This NPRM should align with JAROPS standards referencing CAT 1, CAT II, and CAT III. The need to separate CATIIIa, CATIIIb and CATIIIc should be reviewed with respect to JAROPS, AC120-29, AC120-28D and HBAT 99-17. We may be better served to eliminate reference to CAT a, b, c, and consider publishing the lowest minimums to which a fail-operational aircraft may operate and the lowest minimums to which a fail-passive aircraft may operate. (Delta—18)
62.	*Category II (CAT II)* Comment on Cat II operations and use of decision height (DH) and 1200 RVR. Some airports with irregular terrain, such as Seattle (KSEA) must use a DA rather than DH for minimums. Some exceptions must be made to this definition. For example, the CAT II minimums in KSEA are defined as "Inner Marker Passage" some operators choose to discontinue the approach if the Baro DA is reached prior to inner marker passage in accordance with AC 120-29A 4.3.8.5. The JAA harmonized OpSpecs define Cat II minimum

	Comments
	visibility with suitably equipped runways as 1000 RVR, not 1200 RVR. The 1200 RVR minimum visibility definition needs to be harmonized. (RAA—31)
63.	*Category II (CAT II)* Cat II harmonization with JAA. - Category II should be defined as a precision instrument approach and landing with a decision height lower than200 feet (60 meters), but not lower than 100 feet (30 meters) and with a runway visual range of not less than 1,000 feet. (RAA—31)
64.	*Category III (CAT III)* There are no definitions of CAT IIIa, IIIb, and IIIc required due to international harmonization. - Category III should be defined as a precision instrument approach and landing with a decision height lower than 100 feet (30 meters) or no DH, and with a runway visual range less than 1,000 feet. (RAA—31)
65.	The terms ``Category I/II/III operation'' has been used in the aviation industry and in the preambles of FAA regulatory documents for years, but it has never been clearly defined in the CFR. Why now is the FAA is therefore proposing to add a definition of these terms? Also, the proposed definitions of Category II/III reflect 1970 capability and thinking. CFR Definitions should not specify the navigation source e.g. ILS, and, if implemented, they should only specify DA/DH in order to allow future enhancements and technology without rule change. Change definitions as follows: Category I operations, with respect to the operation of aircraft, means an approach to the runway of an airport under a instrument approach procedure issued by the Administrator or other appropriate authority with a minimum descent altitude (height) (MDA (H) not lower than 250 feet (75 meters) or a decision altitude (height) (DA (H)) not lower than 200 feet (60 meters). Category II operations, with respect to the operation of aircraft, means an approach to the runway of an airport under a Category II instrument approach procedure with a decision height (DH) lower than 200 feet (60 meters) but not lower than 100 feet (30 meters) issued by the Administrator or other appropriate authority. Category III operations, with respect to the operation of aircraft, means an instrument approach to, and landing on, the runway of an airport using a Category III instrument approach procedure with a decision height (DH) below 100 feet (30 meters) or no decision height (DH) issued by the Administrator or other appropriate authority. (Amer Trans—25)
66.	Category II (CAT II) through Category IIIc (CAT IIIc) The FAA and JAA had previously harmonized the definitions of Category I, II and III approaches. The CAT II and CAT III definitions presented in the NPRM are not consistent with previous harmonization efforts. (RAA--31)
67.	*Category I/II/III, Item 2, 77339* ***Resolution:*** Remove and allow for specific guidance to be provided in the appropriate Advisory Circulars, AC-120-28D, AC 120-29A. Revise the numerical designations for Category IIIa (CAT IIIa) and Category IIIb (CAT IIIb) of "not less than 700 feet" to the currently understood and approved values. These values are applied by air carrier Operations Specifications, as amended and updated by Handbook Bulletins (HBAT). These revisions will ensure consistency and remove conflicting information. Coordination by FAA, and specifically through the TAOARC, with the All Weather Operations (AWO), the Operations Specifications Working Group and other industry/FAA groups to determine the appropriate values. This will enable consistent guidance to be located in the applicable guidance document. Review the use of the word "glide" in subsequent definitions to ensure clarity. With the advent of additional means to determine the desired and expected path of an aircraft, the word "glide" does not add nor contain a meaning or a purpose. The removal of the word "glide" enables a more useful phrase, "vertical path," instead of a specified "glide path" which may be wrongly correlated with a specific approach capability, such as an ILS, which has a "glide slope." Further, in discussion on page 77331, Section 91.129 Operations in Class D Airspace, paragraph (2), the indication is that "glide path" includes both ILS and APV. This should be extended to all applicable procedures, including ILS. The term needs to be applicable to additional applications without deterring continued development of procedures. Remove the term "approach" from the title "Instrument approach procedure (IAP)". The statement in paragraph (2) of the text allows for the application where "...en route flight may begin", which is not necessarily restricted to being on an "approach". This could be confusing in developing future airspace enhancement strategies and applications of technology. (ATA—41)
68.	*Category I/II/III,* Item 2, 77339 Comments: Utilize existing guidance in Advisory Circulars, AC-120-28D and AC 120-29A. If changes are desired they should be coordinated through the TAOARC, with other appropriate

	Comments
	technical groups and committees. (AA—42)
69.	*Decision Height (DH)* The changes in definitions and terminology can be expected to have significant impact on training materials, equipment manuals, and even equipment design. For example, the new definition of DH does not include Cat I approaches. However, there are controls and displays in flight decks that use this term. This will cause consistency problems and potentially confusion for the crews. (RAA--31)
70.	*Decision altitude (DA), Item 2, 77339* Comments: Use of Decision height (DH) and Decision altitude (DA): The industry has been utilizing the term DA(H) and MDA(H) for a significant period of time, with great success. Reverting back to separate descriptors (DA,DH) is not in the interest of human factors issues nor does it add any value to the procedure. DA(H) and MDA(H) allow for additional flexibility to defining the minimums by use of other functioning equipment. The ICAO definition is included here as a ready reference: DA: A specified altitude in an instrument approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. (Adapted from ICAO - IS&RP Annex 6). Resolution : Use of DA(H) as the term to include both DA and DH. Continue use of HAT as indicated in the current ICAO definition. • *Reference Decision height (DH), Item 2, 77339* Comments: Use of DH and DA: The industry has been utilizing the term DA(H) and MDA(H) for a significant period of time, with great success. Reverting back to these separate descriptors is not in the interest of human factors issues nor does it add any value to the procedure. DA(H) and MDA(H) allow for additional flexibility to defining the minimums by use of other functioning equipment. The ICAO definition is included here as a ready reference: DH: A specified height in an instrument approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established (Adapted from ICAO - IS&RP Annex 6). Additionally, the text from the ICAO manual regarding the use of DA(H) is included: DA(H): For Category I, a specified minimum altitude in an approach by which a missed approach must be initiated if the required visual reference to continue the approach has not been established. The "Altitude" value is typically measured by a barometric altimeter or equivalent (e.g., Inner Marker) and is the determining factor for minima for Category I Instrument Approach Procedures. The "Height" value specified in parenthesis is typically a radio altitude equivalent height above the touchdown zone (HAT) used only for advisory reference and does not necessarily reflect actual height above underlying terrain. For Category II and certain Category III procedures (e.g., when using a Fail-Passive autoflight system) the Decision Height (or an equivalent IM position fix) is the controlling minima, and the altitude value specified is advisory. The altitude value is available for cross reference. Use of a barometrically referenced DA for Category II is not currently authorized for 14 CFR part 121, 129, or 135 operations at U.S. facilities (Adapted from ICAO - IS&RP Annex 6). Resolution: Use of DA(H) as the term to include both DA and DH. Continue use of HAT as indicated in the current ICAO definition. (ATA—41)
71.	*Decision altitude (DA),* Item 2, 77339 Comments: The terms DA(H) and MDA(H) are widely used and understood by the aviation community. Change to these terms does not add anything of value and simply creates confusion for no apparent benefit. (AA—42)
72.	*Decision height (DH),* Item 2, 77339 Comments: The terms DH and DA are widely used and understood by the aviation community. Change to these terms does not add anything of value and simply creates confusion for no apparent benefit. (AA—42)
73.	*Decision Height (DH):* All references to "decision height" and "DH" should be replaced with "decision altitude (height)" or "DA(H)." Similarly, usage of the term "minimum decision height" would become "minimum decision altitude (height)" or "MDA(H)." Further, the use of "DA/DH" should be dropped, as well as the distinction of its definition with respect to non-precision approaches. This would clearly cover situations where minimums are based upon barometric altitude (decision altitude) in feet above mean sea level (MSL) and where minimums are based upon height above ground level (AGL) or height above the touchdown zone (decision height.) With these changes, the FAA's regulations would then be consistent with ICAO and harmonized terminology, and would more accurately describe when visual reference requirements apply to continue an approach below the authorized minima or make a missed approach. Further, use of the commonly applied terms "DA(H)" and "MDA(H)" in existing operators procedures manuals and training programs would save any unnecessary economic burden of revision of large numbers of existing documents unnecessarily. (Boeing—43)
74.	*Definition of Decision Height (DH)* Airbus opposes the proposed definition of Decision Height (DH). This definition has at least two significant flaws. First, it prohibits the use of radio altimeters to define the missed approach point in any future Category I approach, even if modern technology could provide a more precise and

	Comments
	therefore safer decision point than having to rely on barometric information and its many limitations, especially in mountainous and precipitous terrain areas. Secondly, it eliminates some Category II operations that have been safety and effectively conducted for more than 40 years. It has always been permissible to conduct certain Category II operations that used a decision point that was defined either by a barometric altimeter or an inner marker. This proposed definition would eliminate those operations. There is no accident or incident history that justifies this proposal and the economic consequences could be very large, especially in the future. Airbus opposes any definition or other regulatory requirement that would prevent, in the future, using a DH in Category I operations or a DA or Inner Marker (or equivalent fix) in Category II operations to define the decision point. The proposed change could have an adverse impact of aircraft design, flight operations, and training. The definitions for the decision points in instrument approaches should not be locked in the past but must be focused on operations in the future performance based NAS and the transition to that state. (Airbus—44)
75.	*Final approach fix (FAF): "This term would be added to indicate that a final approach fix is associated with a nonprecision approach."*--AC 120-29A removes the term non-precision approach. (Delta—18)
76.	*Final Approach Fix (FAF):* "…a final approach fix is associated with a *nonprecision* approach." **This definition is not supported by AC120-29A:** "The fix from which the final approach to the airport is executed…." AC120-29A does not differentiate between a nonprecision and a precision approach. (Rackley—24) **Final Approach Fix**: "..beginning of a *nonprecision* final approach segement…" This definition is not supported by AC120-29A. (Rackley—24)
77.	IAP Within the title Instrument approach procedure (IAP), the word "approach" could be removed. The statement in paragraph (2) of the text allows for the application where "...en route flight may begin", which is not necessarily restricted to being on an "approach". This could be confusing in developing future airspace enhancement strategies and applications of technology. *Proposed resolution:* Review the context of the phrase to determine if "approach" is required. If not, remove it from the statement. (ATA—20)
78.	*Instrument Approach Procedure (IAP):* This is included in AC120-29A Appendix 1 Acronyms. (Rackley—24)
79.	**Minimum Descent Altitude (MDA):** "The definition of MDA would be revised to change the words "final approach" to "*nonprecision* final approach"…." **This definition is not supported by AC120-29A**, and is contradictory to the AC which in Section 3.4.a. explicitly drops use of the term "nonprecision" to reduce confusion which exists with use of this term. (Rackley—24) **Minimum Descent Altitude (MDA)**: "…on a *nonprecision* final approach…" This definition is not supported by AC120-29A (Rackley—24)
80.	Night: If accepted, the revision of the definition of "night" has the potential to affect operations. Delta is concerned how the FAA intends to disseminate actual night time information at specific locations to the users for the purposes of MEL and legality considerations. (Delta—18)
81.	Night: The FAA is proposing to revise the definition of the term ``night'' to reflect that local night may differ from the times published in the American Air Almanac. This concept of local night could limit operations at a particular location when the FAA determines it to be necessary for the safety of operations, for example, when terrain causes sunset significantly earlier than the Almanac indicates. American Trans Air is concerned how the FAA intends to disseminate regulatory night time information at these unique locations for the purposes of MEL and other CFR night requirements. (Amer Trans—25)
82.	Night Where would local night be published? How does the FAA calculate this? Without a definitive source, a pilot is left wondering when night begins. This concept will be very difficult for pilots to comply with. (RAA—31)
83.	**Night:** AOPA opposes the proposed change to (the definition) of night without clarification of the FAA's intent. AOPA's involvement in various forums and advisory committees has not revealed any plan by the FAA to support this change. Before changing the definition, the FAA should carefully evaluate the operational impacts that will be imposed on the service providing elements of the FAA. How will the FAA disseminate information on "local night" for over 18,000 landing facilities in the NAS? AOPA urges the FAA to delay any changes to this definition until a better understanding of the operational implementation of "local night" would be applied. (AOPA—34)
84. 85.	**Night, Item 2, 77340** Comments: Leave as currently defined because the revision has the potential to limit operations at a particular location at the discretion of the FAA, and will lead to confusion and inconsistencies at different locations. There is concern as to how the FAA intends to disseminate actual nighttime information at specific locations for the purpose of MEL and legal considerations. **Resolution:** Delete proposed change to definition. (ATA—41)
86.	Night, Item 2, 77340 Comments: The term night is widely used and understood by the aviation community. Change to this term does not add anything of value and simply creates confusion for no apparent benefit. (AA-

	Comments
	42)
87.	"Night": The proposed redefinition of "night" is unnecessary and should be removed from this NPRM. The distinctions being drawn or inferred between day and night for instrument procedure design or specification are inappropriate. If instrument procedures are properly designed, there is no need to draw this subtle distinction or make a change. Either the visual reference requirements of §91.175 are met at minima, or they are not. This re-definition of "night" risks introducing retroactive confusion with millions of pilots' and operators' logbook systems and time calculations, and provides no safety benefit. (Boeing—43)
88.	<u>Nonprecision approach procedure (NPA)</u>: AC120-29A removed the term non-precision. As written now, the NPRM would be developing a new definition. (Delta 18)
89.	**Nonprecision Approach Procedure**: "FAA is proposing to revise the definition of this term so there is no reference to "electronic glide slope." **This definition is not supported by AC120-29A**, and is contradictory to the AC which in Section 3.4.a. explicitly drops use of the term "nonprecision" to reduce confusion which exists with use of this term. (Rackley—24)
90.	*Nonprecision approach procedure (NPA),* Precision approach procedure (PA), and Precision final approach fix (PFAF) ...Ref: AC 120-29A, Page 2, Paragraph 3.4 Category I, II, and III Terminology: "The use of the term "non-precision" has been dropped within this AC to reduce confusion which exists with use of this term with current and future systems and authorizations, particularly with Vertical Navigation (VNAV) and Area Navigation (RNAV), and with other approaches that may incorporate the use of barometric VNAV to provide a stabilized descent path to a runway." *Proposed resolution*: Include in the preamble to the FAR Part 1 – Definitions and Abbreviations that the terms NPA, PA and PFAF, while being part of the terminology used in the past, the do not add clarification nor correct context to the future approach implementation strategies and thus have been removed. (ATA—20)
91.	• Nonprecision approach procedure (NPA) The term NPA would now apply only to a procedure with NO vertical guidance. This is a change from long-standing practice, and also will impact training and other documentation throughout the industry. (RAA-31)
92.	**Non-precision Approach:** AOPA concurs that a non-precision approach is traditionally considered an approach without vertical guidance (glide slope or VNAV functionality). The comments pertaining to the relationship of APV procedures and "precision approaches" create concerns that need to be addressed by the FAA prior to issuing a final rule. (AOPA—34)
93.	**Reference Nonprecision approach procedure (NPA), Precision approach procedure (PA), and Precision final approach fix (PFAF), Item 2, 77340** Comments: Review the proposed definitions of terms and concepts for consistency with their use in other FAA technical guidance, particularly terms that have limited future application. If the terms are not used consistently, the discrepancies will be contrary to FAA's longstanding commitment to harmonization and simplicity. For example, Advisory Circular 120-29A, Page 2, Paragraph 3.4 Category I, II, and III Terminology provides: "The use of the term "non-precision" has been dropped within this AC to reduce confusion which exists with use of this term with current and future systems and authorizations, particularly with Vertical Navigation (VNAV) and Area Navigation (RNAV), and with other approaches that may incorporate the use of barometric VNAV to provide a stabilized descent path to a runway." It seems appropriate to continue the policy contained in AC 120-29A, rather than to continue to include the terms in the regulation. Current changes in TERPs will enable the use of linear criteria for an approach construction. This will enable a higher level of precision to be applied to the approach, and will further blend the differences currently held between precision and nonprecision. The future use of a required navigation performance will more specifically and qualitatively define the procedure and associated minimums as applied to the approach. The terms lose their meaning when examined against thecurrent developments and implementations planned. Continuing use of these terms will only add further confusion as the new procedures are developed and applied. The legacy of these terms will continue, but the FAA should minimize their usage. Despite the adage that "Old habits die hard," the FAA should not continue to encourage use of these terms. **Resolution:** Delete the proposed terms. Additionally, coordination with text to the draft of Order 8260.RNP should be consistent with the adopted language. **Resolution for Comments 7 and 8:** Include language in the preamble to the FAR Part 1 DEFINITIONS AND ABBREVIATIONS stating that the terms "nonprecision approach procedure" (NPA), "precision approach" (PA), and "precision final approach fix" (PFAF) have been deleted as these definitions no longer provide clarification nor correct context to future approach implementation strategies. Use of the terms "authorized" or "approved" in relation to approach, departure, or arrival procedures would give the needed regulatory authority, while allowing future developments and inherent flexibilities. Further definitions can be included within air carriers Operations

	Comments
	Specifications. Continue to coordinate the development of wording compatible with existing harmonized guidance, specifically, AC 120-28D, and AC 120-29A, to enable the implementation of future approach strategies without creating conflicts (as do the proposed changes). (ATA-41)
94.	Reference Nonprecision approach procedure (NPA), Precision approach procedure (PA), and Precision final approach fix (PFAF), Item 2, 77340. Comments: The terms ILS approach and non-ILS approach as specified in AC120-29A are being incorporated by many airlines due to their relevance to existing fleet capabilities and for their future benefits with proliferation of RNP RNAV. The term non-precision should be dropped due to its antiquated and inappropriate application in modern jet transports. Advisory Circular 120-29A, Page 2, Paragraph 3.4 Category I, II, and III Terminology provides: "The use of the term "non-precision" has been dropped within this AC to reduce confusion which exists with use of this term with current and future systems and authorizations, particularly with Vertical Navigation (VNAV) and Area Navigation (RNAV), and with other approaches that may incorporate the use of barometric VNAV to provide a stabilized descent path to a runway." It seems appropriate to continue the policy contained in AC 120-29A, rather than to continue to include them in the regulation. (AA—42)
95.	Precision Approach (PA) and Non-Precision Approach (NPA): The terms "precision approach" and "non-precision approach" are outdated and have lost their meanings. Their use should be discontinued beginning with this rule, and they should be removed from the NPRM. These obsolete terms and concepts do not appropriately address modern avionic systems, flight procedure methods, criteria used (e.g., linear versus angular criteria), safety risk, path-following performance, necessary flight path provisions, failure responses, or navaids/ sensor systems used. We suggest the use instead of the more general term "instrument approach" where necessary in the rule. Until removed or revised, any references to "non-precision approach" that remain in other sections of 14 CFR should now be interpreted to mean any type of instrument approach other than Instrument Landing System (ILS), Microwave Landing System (MLS), or GPS Landing System (GLS). (Boeing—43)
96.	Precision approach procedure (PA): AC120-29A definition is different. (Delta-18)
97.	**Precision Approach procedure**: AC120-29A does not use this terminology, but rather uses CAT I, II, III, etc. (Rackley—24)
98.	Precision approach procedure (PA). The inclusion of VASI, PAPI, etc. is not contained within this discussion. In accordance with existing precision approach systems, including VASI, PAPI, etc, this must be added. (RAA-31)
99.	**Precision approach:** This definition should be revised in such a way to clearlydifferentiate between an approach procedure with vertical guidance and a precision approach. An ILS and APV procedure could have the same minimums. What differentiates the two operationally? If a pilot flies an APV approach, he should be given the same operational credit as having flown an ILS approach (except for CAT II/ CAT III operations). AOPA proposes that the FAA add "APV" to the list of precision approach types. (AOPA—34)
100.	**Precision Final Approach Fix (PFAF)**: "...a PFAF is associated with a precision or APV approach procedure." **This definition is not supported by AC120-29A**, which uses only the term FAF to apply to all approaches. AC120-29A also does not use Precision approach or APV. (Rackely—24) **Precision Final Approach Fix (PFAF)**: "...defines the beginning of the *precision* or *APV* final approach segment..."--This definition is not supported by AC120-29A. (Rackley—24)
101.	Nonprecision approach procedure (NPA), *Precision approach procedure (PA),* and *Precision final approach fix (PFAF)* ...Ref: AC 120-29A, Page 2, Paragraph 3.4 Category I, II, and III Terminology: "The use of the term "non-precision" has been dropped within this AC to reduce confusion which exists with use of this term with current and future systems and authorizations, particularly with Vertical Navigation (VNAV) and Area Navigation (RNAV), and with other approaches that may incorporate the use of barometric VNAV to provide a stabilized descent path to a runway." *Proposed resolution*: Include in the preamble to the FAR Part 1 – Definitions and Abbreviations that the terms NPA, PA and PFAF, while being part of the terminology used in the past, the do not add clarification nor correct context to the future approach implementation strategies and thus have been removed. (ATA—20)
102.	Precision final approach fix (PFAF) Nonprecision approach procedure (NPA), Precision approach procedure (PA), and *Precision final approach fix (PFAF)* ...Ref: AC 120-29A, Page 2, Paragraph 3.4 Category I, II, and III Terminology: "The use of the term "non-precision" has been dropped within this AC to reduce confusion which exists with use of this term with current and future systems and authorizations, particularly with Vertical Navigation (VNAV) and Area Navigation (RNAV), and with other approaches that may incorporate the use of barometric VNAV to provide a stabilized descent path to a runway." *Proposed resolution*: Include in the preamble to the FAR Part 1 – Definitions and Abbreviations that the terms NPA, PA and PFAF, while being part of the terminology used in the past, the do not add clarification nor correct context to the future approach

	Comments
	implementation strategies and thus have been removed. (ATA—20)
103.	**Route Segment definition:** The FAA should include in the definition, the fact that the "FIX" will be named, charted and available in navigation databases. (AOPA—34)
	§1.2
104.	The listings need to reflect the appropriate changes proposed in [comments to 1.1]a above (ATA on "precision/nonprecision"). *Proposed resolution*: Include appropriate changes when resolving the issues indicated in [comments to 1.1] above. (ATA—20)
105.	**APV—NPA—PA**—These (definitions nor abbreviations) are not supported by AC120-29A. (Rackley—24)
106.	Is it FAA's intent that the introduction of terms such as APV, PFAF and ATS will now appear throughout equipment and training materials? Will charts now be revised to use these terms? Will the term PFAF now be required on things like FMS CDUs in order to be consistent with charting and training materials? What assurance does industry have that these changes will not be demanded in the future, resulting in significant costs to the industry? (RAA—31)
107.	The NPRM does not mention LPV. How will it be used in the context of the redefinition of approaches and terminology? (RAA-31)
108.	**APV, NPA, and PA, Item 3, 77340** Comments: Delete the proposed terms. The inclusion of APV, with the proposed definition, appears designed to designate specific attributes that are currently acceptable to the FAA. Listing these specific attributes as specific approach criteria limits the future application that may be similar, but not the same. Listing and defining these and other specific applications in another document, such as an Advisory Circular, is a better alternative than the prescriptive listing of various approach types. **Resolution:** Include language in the preamble to the FAR Part 1 DEFINITIONS AND ABBREVIATIONS stating that the terms "nonprecision approach procedure" (NPA), "precision approach" (PA), and "precision final approach fix" (PFAF) have been deleted as these definitions no longer provide clarification nor correct context to future approach implementation strategies. Use of the terms "authorized" or "approved" in relation to approach, departure, or arrival procedures would give the needed regulatory authority, while allowing future developments and inherent flexibilities. Further definitions can be included within air carriers Operations Specifications. Continue to coordinate the development of wording compatible with existing harmonized guidance, specifically, AC 120-28D, and AC 120-29A, to enable the implementation of future approach strategies without creating conflicts (as do the proposed changes). (ATA—41)
109.	APV, NPA, and PA, Item 3, 77340 Comments: Existing terminology in AC120-29A and AC120-28D make the proposed terms unnecessary and confusing. Additionally, future applications using AC120-29A terminology and concepts may be inappropriately constrained by these definitions. (AA—42)
	PART 71
110.	AOPA submits the following comments to the proposed changes to 14 CFR part 71. AOPA urges the FAA to use the term "ATS routes" or Air Traffic Service Routes sparingly, and only in internal orders and procedures design guidance. This term, if broadly utilized, increases the potential for confusion and creates the need for new training without benefit. In order to avoid undermining the use of existing navigation systems, AOPA recommends that the FAA maintain the use of phraseology and terminology such as Victor and Jet airways, in pilot educational materials and on all charting products as well as in air traffic control communications. AOPA encourages the FAA to include charting and air traffic control phraseology information where "RNAV routes" are included as a new airway type in FAA educational materials. Failure to do so may negatively impact general aviation use of RNAV routes. Since December 2000, AOPA has urged the FAA to create GPS based RNAV routes in all airspace (including non-radar airspace) with existing non-precision GPS navigation equipment certified and installed for IFR operations. AOPA requested them because they enable IFR operations at lower altitudes, increase available IFR airspace, and increase direct routing in all airspace areas. Besides the tremendous safety and efficiency benefits, RNAV routes encourage equipage with GPS, consistent with the FAA's long term strategic planning of National Airspace System modernization. Specifically, AOPA has identified several applications for GPS based RNAV routes, and AOPA expects to see the following capabilities emerge concurrent with the publication of this final

	Comments
	rule. Should this not be the case, the FAA should modify additional portions of 14 CFR part 71, sufficient to enable the following benefits to general aviation: 1. Reduce the minimum en route altitude required on victor airways when using GPS. The reduction should be to the minimum altitude necessary for minimum communication with ATC and/or terrain clearance limits. 2. Increase access to Class B airspace by establishing RNAV routes between 3,000-8,000 feet Above Ground Level (AGL) through the lateral and vertical limits of the class B airspace. Additional access to Class B airspace is also attainable by establishing specific routes for ingress/degress to satellite airports by small, slow general aviation aircraft equipped with GPS. 3. Increase access to special use airspace by publishing routes independent of NAVAID citing. This permits more efficient IFR operations at altitudes below 18,000 feet. 4. Enable RNAV access to geographic areas where failing navigation infrastructure is preventing pilots to access airports IFR (e.g. the outer banks of North Carolina). Without RNAV routes, this situation can result in marginal VFR operations, which traditionally have higher safety risks over IFR operations. While many in general aviation anticipate the new capabilities that the rulemaking should enable, AOPA emphasizes that the rules should not adversely impact the majority of the general aviation operations which are not equipped with IFR GPS navigation equipment. (AOPA—23)
	§71.11
111.	Drop paragraphs a, b, and c. Rewrite the whole 71.11 to read as follows: "Unless otherwise specified, ATS routes include the protected airspace dimensions as determined acceptable by the Administrator." (Vaughn/Continental—19)
112.	Paragraph (b) "…would differ from the text of 71.75 by referencing FAA Order 8260.3 (TERPS) as the source for criteria regarding ATS route dimensions and protected airspace. Comment: There is no mention of giving ATS routes an RNP value. Part 71.75 discusses the extent of Federal airways, the airspace within 4nm of the centerline, the 4.5 degree diverging angles beyond 51nm from the navaid, etc. With the advent of RNP these definitions may be obsolete and should at least be looked at. (Rackley—24)
113.	Drop paragraphs a, b, and c. Rewrite the whole 71.11 to read as follows: "Unless otherwise specified, ATS routes include the protected airspace dimensions as determined acceptable by the Administrator." (Amer Trans—25)
114.	The introduction to FAR 71.11 should be revised to include language to allow the FAA to use alternative criteria when necessary, or alternative means of authorization, or alternative provisions in addition to Order FAA 8260.3 (Boeing—43)
	§71.13
115.	Paragraph (b), rewrite as follows: "(b) In subpart E of this part: (1) Federal Airways. (2) RNAV Routes." (Vaughn/Continental Airlines—19)
116.	71.13 Classification of Air Traffic Service (ATS) Routes. Under 71.13 (b)--rewrite as follows: (b) In subpart E of this part: (1) Federal Airways. (2) RNAV Routes. (Amer Trans—25)
	§71.75
117.	Section 71.75 **Extent of Federal Airways** "…would be removed and used as the basis for a new Part 71.11. See comments [Rackley's on §71.11] concerning ATS routes and their extent. (Rackley—24)
	PART 91
	§91.129
118.	Further, in discussion of the proposed Rule on page 77331,Section 91.129 Operations in Class D Airspace, paragraph (2), the indication is that "glide path" includes both ILS and APV. This should be extended to all applicable procedures, including ILS. The term needs to be applicable to additional applications without deterring continued development of procedures. *Proposed resolution:* Remove the word "glide" from definitions

	Comments
	and uses within the Rule, unless it is determined that specific reasoned results are required and directed by the application of the word "glide" to the text. (ATA—20)
119.	Section 91.129 : The phrase "served by an ILS" would read "served by and *APV* or *precision approach"*. This terminology is not supported by AC120-29A. (Rackley—24)
120.	Section 91.129: The term "glide slope" would read "glide path" because ..."glide path" includes both ILS and APV. This terminology is not supported by AC120-29A. Comment: "Glide Path" is not explicitly defined in AC120-29A. Glide Path Angle is defined. (Rackley—24)
121.	**Section 91.129:** "Reference to outer marker would be replaced with "*Precision Final Approach Fix.*" This terminology is not supported by AC120-29A. (Rackley—24)
122.	91.129 (2): "...operations with *vertical guidance (APV) or a precision approach*..." This terminology is not supported by AC120-29A. (Rackley—24)
123.	91.129 (2)(i): "...the published *Precision Final Approach Fix (PFAF)...* " This terminology is not supported by AC120-29A. (Rackley—24)
124.	91.129 and 91.131 Revise to delete APV and ILS as follows: A large or turbinepowered airplane approaching to land on a runway served by an instrument approach providing vertical guidance shall, if the airplane is equipped, fly that airplane at an altitude at or above the glide path between the final approach fix (or point of interception of glide path, if compliance with the applicable distance from clouds criteria requires interception closer in) and the DA/DH; and..." (Amer Trans—25)
125.	(e)(2), (e)(2)(i), Item 15, 77340 Comments: Include language in the preamble to the FAR Part 1 DEFINITIONS AND ABBREVIATIONS stating that the terms "nonprecision approach procedure" (NPA), "precision approach" (PA), and "precision final approach fix" (PFAF) have been deleted as these definitions no longer provide clarification nor correct context to future approach implementation strategies. Use of the terms "authorized" or "approved" in relation to approach, departure, or arrival procedures would give the needed regulatory authority, while allowing future developments and inherent flexibilities. Further definitions can be included within an air carrier's Operations Specifications. Continue to coordinate the development of wording compatible with existing harmonized guidance, specifically, AC 120-28D, and AC 120-29A, to enable the implementation of future approach strategies without creating conflicts (as do the proposed changes). Discussion on page 77331, Section 91.129 Operations in Class D Airspace, paragraph (2), indicate that "glide path" includes both ILS and APV. This should be extended to all applicable procedures, including ILS. The term used to define the vertical path needs to be applicable to other procedures without deterring continued development. **Resolution:** Remove the word "glide" from definitions and uses within the proposal, unless it is determined that specific reasoned results are required and directed by the application of the word "glide" to the text. The title Instrument approach procedure (IAP) may need to be revised to allow application to other than an "approach." The statement in paragraph (2) of the text allows for the application where "...en route flight may begin", which is not necessarily restricted to being on an "approach". This could be confusing when developing future airspace enhancement strategies and applications of technology. During the final review, determination should be made if the word "approach" is applicable and necessary for clarification. (ATA—41)
	§91.131
126.	(See comment to 91.129 from American Trans Air—25 above) Revise to delete APV, etc.
127.	In the preamble of the regulations, AOPA requests that the FAA include IFR certified GPS equipment as an example of a "suitable RNAV system". Such clarifying language establishes a regulatory approval for the use of this equipment as an option to meet existing mandated equipage requirements in lieu of the equipment (VOR, DME etc.) currently required to operate in certain airspace areas such as Class B airspace and at altitudes of Flight Level 240 and above. (AOPA—34)
	§91.175
128.	Paragraph (f) Normally, takeoff minimums are published with respect to an obstacle DP if needed to ensure a safe departure. However, most airports also have published Standard Instrument Departure (SID) procedures which may or may not be used for terrain avoidance. Additionally, there is inconsistency in the manner which minimums are published on these procedures. Some have takeoff minimums published, some refer to the airport

	Comments
	page takeoff minimums, and others say nothing. It is very rare that ATC assigns an obstacle departure procedure. The FAA would need to clearly indicate on each departure procedure, SID or Obstacle DP, the appropriate minimums. If taken literally, the only procedure to fly in IMC would be the obstacle departure procedure. Delta does not believe this is what the FAA intended. (Delta --18)
129.	(f) Civil airport takeoff minimums: "...where takeoff minimums are based on a specified route, persons operating the aircraft must comply with that route unless an alternative route has been assigned by ATC."-- Comment: This may well be a sleeper: Does this invalidate our 10-7 Engine Failure Turn Procedure Programs? (Rackley—24)
130.	Paragraph (h) Delta recommends the table be kept in the FAR to ensure operations are based on a regulatory source. (Delta—18)
131.	(h): "...would be amended by *removing* the RVR table from paragraph (h)(2) and replacing it with a reference to TERPS which contains the RVR table." Comment: This refers to TERPS Paragraph 335, Table 7. We have the opportunity to harmonize a number of documents at this juncture. AC120-29A Sections 4.3.5 and 4.3.6 point the operator to the Ops Specs detailed in Appendix 7, Ops Spec 051, which harmonizes the RVR and Visibility. Let's update TERPS, the AIM, the Instrument Flying Handbook, and the Flight Information Publication, so that they all agree. Rather than removing the RVR table, reproduce Table 1 and 2 from AC120-29A, Appendix 7, Ops Spec 051. (Rackley—24)
132.	(h) Do not move the RVR conversion to an FAA Order that can be changed without public notice. If the table is removed it should be relocated to the operational Advisory Circulars for operations requiring RVR (Acs 120-28 &29). This would ensure change, if any, would be coordinated with affected users. Additionally, the table should be updated with the values currently in AC120-28 &29. Note the RVR table also appears in the Aeronautical Information Manual (AIM), the Instrument Flying Handbook, and in the Flight Information Publications. (Amer Trans—25)
133.	The change to Paragraph (h) should not solely reference FAA Order 8260.3, but should list all publications where the FAA makes the RVR table available for pilots. At a minimum, the Aeronautical Information Manual (AIM) should be mentioned in the regulation. (AOPA—34)
134.	(k): The change to Paragraph (k) should include additional clarifying information to ensure that the intent of the regulation is understood: RNAV equipment, to include IFR approved GPS, can be used to identify certain locations on the ILS. However, AOPA is also concerned that the FAA doesn't rely on the use of such database derived FIXES as the sole means of identifying the key locations on the ILS. Less than one-third of all general aviation aircraft have the equipment necessary to identify a database derived FIX. Therefore, no such use of a FIX (exclusively without other identification options) should be applied to existing ILS installations. AOPA is strongly opposed to any ILS implementation where RNAV equipage (or the ability to identify a FIX from a database) is a required component for completion of the approach. This virtually mandates the use of GPS for general aviation aircraft desiring to access "non-GPS" procedures. Lastly, AOPA requests that Paragraph (K) also permit the pilot to use the glide slope and altitude crosscheck as a viable and acceptable means to substitute for an outer marker on an ILS. (AOPA—34)
135.	91.175 and 97.10. These two sections provide for alternate means of developing instrument procedures. This capability must be maintained. New technologies may come forward that allow an operator with advanced avionics to accomplish something for which there is no criteria today. Continuing with these two sections will allow future technologies to find early implementation, instead of waiting for formal TERPS criteria to be developed providing Part 97 procedures using this new technology. (Vaughn—Continental—37)
136.	The proposed changes to 91.175 dealing with DA(H) are not necessary. Implementing the proposed changes would mean changing every ILS approach plate. There is no benefit gained by the proposed changes. (Vaughn—Continental—37)
137.	**§91.175** Comments: The ATA supports the comments submitted by The Boeing Company, cited here in their entirety. Proposed Revision Language to §91.175: § 91.175 Takeoff and landing under IFR. (a) Instrument approaches to civil airports. Unless otherwise authorized by the Administrator, when an instrument approach to a civil airport is necessary, each person operating an aircraft, except a military aircraft of the United States, shall use a standard instrument approach procedure prescribed for the airport in part 97 of this chapter. (b) Authorized DA(H) or MDA(H). For the purpose of this section, when the approach procedure being used provides for and requires the use of a DA(H) or MDA(H), the authorized DA(H) or MDA(H) is the highest of the

	Comments
	following: (1) The DA(H) or MDA(H) prescribed by the approach procedure. (2) The DA(H) or MDA(H) prescribed for the pilot in command. (3) The DA(H) or MDA(H) for which the aircraft is equipped. (c) Operation below DA(H) or MDA(H). Where a DA(H) or MDA(H) is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, at any airport below the authorized MDA(H) or continue an approach below the authorized DA(H) unless - (1) The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and for operations conducted under part 121 or part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing; (2) The flight visibility is not less than the visibility prescribed in the standard instrument approach being used; and (3) Except for a Category II or Category III approach where any necessary visual reference requirements are specified by the Administrator, at least one of the following visual references for the intended runway is distinctly visible and identifiable to the pilot: (i) The approach light system. (ii) The threshold. (iii) The threshold markings. (iv) The threshold lights. (v) The runway end identifier lights. (vi) The visual approach slope indicator. (vii) The touchdown zone or touchdown zone markings. (viii) The touchdown zone lights. (ix) The runway or runway markings. (x) The runway lights. (d) Landing. No pilot operating an aircraft, except a military aircraft of the United States, may land that aircraft when the flight visibility is less than the visibility prescribed in the standard instrument approach procedure being used. (e) Missed approach procedures. Each pilot operating an aircraft, except a military aircraft of the United States, shall immediately execute an appropriate missed approach procedure when either of the following conditions exist: (1) Whenever the requirements of paragraph (c) of this section are not met at either of the following times: (i) When the aircraft is being operated below MDA(H); or (ii) Upon arrival at the missed approach point, including a DA(H) where a DA(H) is specified and its use is required, and at any time after that until touchdown. (2) Whenever an identifiable part of the airport is not distinctly visible to the pilot during a circling maneuver at or above MDA(H), unless the inability to see an identifiable part of the airport results only from a normal bank of the aircraft during the circling approach. (f) Civil airport takeoff minimums. Unless otherwise authorized by the Administrator, no pilot operating an aircraft under parts 121, 125, 127, 129, or 135 of this chapter may takeoff from a civil airport under IFR unless weather conditions are at or above the weather minimum for IFR takeoff prescribed for that airport under part 97 of this chapter. If takeoff minimums are not prescribed under part 97 of this chapter for a particular airport, IFR takeoff minima for aircraft operating under those parts are ½ statute mile visibility. (g) Military airports. Unless otherwise prescribed by the Administrator, each person operating a civil aircraft under IFR into or out of a military airport shall comply with the instrument approach procedures and the takeoff and landing minimum prescribed by the military authority having jurisdiction of that airport. (h) Comparable values of RVR and ground visibility. (1) Except for Category II or Category III minimums, if RVR minimums for takeoff or landing are prescribed in an instrument approach procedure, but RVR is not reported for the runway of intended operation, the RVR minimum shall be converted to ground visibility in accordance with approved Operations Specifications for that operator, if Operations Specifications are applicable, or in accordance with the following table. RVR (feet) Visibility (statute miles) 1,600 1/4 2,400 1/2 3,200 5/8

	Comments
	4,000 3/4 4,500 7/8 5,000 1 6,000 1 1/4 (i) Operations on unpublished routes and use of radar in instrument approach procedures. When radar is approved at certain locations for ATC purposes, it may be used not only for surveillance and precision radar approaches, as applicable, but also may be used in conjunction with instrument approach procedures predicated on other types of radio navigational aids. Radar vectors may be authorized to provide course guidance through the segments of an approach to the final course or fix. When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, shall, in addition to complying with § 91.177, maintain the last altitude assigned to that pilot until the aircraft is established on a segment of a published route or instrument approach procedure unless a different altitude is assigned by ATC. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Upon reaching the final approach course or fix, the pilot may either complete the instrument approach in accordance with a procedure approved for the facility or continue a surveillance or precision radar approach to a landing. (j) Limitation on procedure turns. In the case of a radar vector to a final approach course or fix, a timed approach from a holding fix, or an approach for which the procedure specifies "No PT," no pilot may make a procedure turn unless cleared to do so by ATC. (k) Instrument Procedure Component substitution. Fixes, components, or navigation methods may be substituted in an instrument approach procedure as noted by that instrument procedure, as noted by Operations Specifications, or as otherwise authorized by the administrator. If not otherwise restricted or limited, a compass locator or precision radar may be substituted for the outer or middle marker. RNAV, DME, VOR, or non-directional beacon fixes authorized in the standard instrument approach procedure or surveillance radar may be substituted for the outer marker. Applicability of, and substitution for an inner marker for Category II or III approaches is determined by the appropriate part 97 approach procedure, letter of authorization, or operations specification pertinent to the operations. (l) Notwithstanding provisions of paragraphs c(2), (d), and (e) above, the Administrator may approve use of systems and procedures meeting requirements other than those specified, if: 1) The systems and procedures proposed are shown to have equivalent or better performance than other approved systems, are operationally safe, effective, and reliable for approach, landing, missed approach, or takeoff, as applicable, and, 2) If visual reference requirements apply, the pilot is able to determine that flight visibility is adequate for safe takeoff or landing. (ATA—41)
138.	§91.175f Comments: The proposed revision to 91.175(f) implies that only an all-engine departure procedure may be flown. In the event of an engine failure, the crew should be allowed to fly a special engine-out departure procedure as evaluated and published by individual airlines. (AA—42)
139.	Section 91.175 should be restructured to accommodate comments in this letter. We have provided proposed version in Enclosure 2. Further, an additional paragraph should be added to explicitly facilitate introduction of new technology for low visibility approach and landing, when it can be shown to be safe and appropriate, and specifically allowing the Administrator to make such authorizations through Operations Specifications or other means. (Boeing—43)
140.	Section 91.175 and Section 97.1 Airbus disagrees with the proposed change to Section 91.175 (f) and the intent stated in the preamble that "Takeoff minimums are determined from the analysis of a particular runway environment. Thus the departure procedure must be followed for a particular runway to ensure adequate obstacle clearance." Airbus also disagrees with the proposed change to Section 97.1 and the intent stated in the preamble that "Proposed 97.1 would clarify that published civil takeoff weather minimums are based on a specified route, and that pilots must comply with that route unless an alternative route has been assigned by ATC." For air carrier operations, the proposed changes are fundamentally flawed and create significant safety problems and impose unreasonable economic burdens on the air carriers. These changes are not compatible with the way air carriers have been safely and efficiently operating for more than 40 years. The changes are not justified by any air carrier accident or incident history.

	Comments
	Airbus acknowledges that pilots and dispatchers need to know that the takeoff minimums developed in accordance with Part 97 assume that the aircraft will adhere to the published flight track. However, it is unnecessary, unsafe, and economically onerous to require air carrier pilots to adhere to these tracks under certain circumstances. It has been a commonly accepted safe operating practice for many decades for air carriers to use a flight track in determining compliance with FAR 121.189 that is significantly different from the track published in the FAR Part 97 procedure. Compliance with FAR 121.189 is demonstrated on an aircraft-by-aircraft and flight-by-flight basis, based on the specific circumstances associated with that flight. If it is necessary to use an alternate flight track during a portion of the departure to demonstrate compliance with FAR 121.189, the alternate route and the commit point are defined prior to takeoff. In such a case, it would be unsafe for the pilot to continue to fly the published departure flight path if an engine failure occurred prior to passing the commit point. In these situations, it is unreasonable to require the pilot to immediately request and receive a new ATC clearance to comply with the FAR 121.189 routing. It is also unreasonable to expect the pilot to immediately exercise "emergency authority" in these cases since the route is preplanned and ATC has knowledge of the alternative routing. When an engine failure occurs, the pilots immediate actions must always be to maintain aircraft control, establish the aircraft on the proper flight path, perform the immediate action items on the checklist, and then communicate with ATC, as required. (Airbus—44)
	§91.177
141.	Change to read: However, if both a MEA and a MOCA are prescribed for a particular route or route segment, a person may operate an aircraft below the MEA down to, but not below, the MOCA. Except when using VOR navigation, operations at MOCA beyond 22 NM of the VOR concerned (based on the pilot's reasonable estimate of that distance) is not permitted. This change allows other navigation without further specifying types of avionics RNAV, GPS etc. (Amer Trans—25)
142.	The preamble discussion pertaining to a broad and comprehensive requirement for surveillance and/or communication on published routes is a significant change and severely impacts general aviation operations. Many IFR general aviation operations are conducted outside of radar contact while en route. Many more approach and departure procedures are flown to and from airports in non-radar environments. Non-radar separation procedures enable pilots of general aviation aircraft to enjoy the flexibility and freedom of general aviation. While en route, general aviation aircraft remain at lower altitudes to access useable, safe airspace. AOPA members indicate that with approval to operate at the Minimum Obstruction Clearance Altitude (MOCA) -as enabled by changes to this very section- the use of minimum altitudes along airways will increase. Whether to avoid adverse weather conditions (icing or strong head-winds) or to utilize certain performance characteristics of the aircraft they fly, the use of low-altitude IFR routes will expand with RNAV (GPS) equipage. Suffice to say, non-radar air traffic control services remain an integral part of general aviation operations. Many of these operations are and will be outside surveillance service levels. Therefore, the FAA should make every effort to accommodate area navigation operations (when either on routes, when on random flight trajectories or when conducting terminal area procedures) outside of radar coverage. The regulatory proposal appears to revoke these capabilities and not expand them. Clarification from the FAA is needed to ensure that the intent of these changes is to support new services to persons operating with new, beneficial equipment. (AOPA—34)
143.	§91.177, Minimum altitudes for IFR operations (a)(2)(i), and (a)(2)(ii), Item 18, 77341 Comments: Applications should allow the inclusion of RNP values, and not just a specific value of 4 nm for all instances. When applicable navigation requirements are established, the ability to reduce the acceptable tolerances should be offered or allowed due to increased navigation accuracy prescribed by applying RNP requirements. (ATA—41)
144.	§91.177, Minimum altitudes for IFR operations (a)(2)(i), and (a)(2)(ii), Item 18, 77341 Comments: Applications should allow the inclusion of RNP values, and not just a specific value of 4 nm for all instances. When applicable navigation requirements are required the ability to reduce the acceptable tolerances should be offered or allowed due to increased navigation accuracy prescribed by applying RNP requirements. (AA—42)
	§91.205

	Comments
145.	AOPA objects to the FAA's proposal to reduce the altitude at which Distance Measuring Equipment (DME) is required. Contrary to the FAA's statements on page 77337 of the Federal Register (Vol. 67, No. 242 / Tuesday, December 17, 2002) this proposed change would impose an obligation to change (or supplement) current navigation systems on certain aircraft and the proposed changes *would* impose costs. The FAA fails to disclose the benefit to users of their mandated equipage, and the FAA fails to acknowledge any system efficiency gains or safety enhancements that would accompany such a mandatory equipage requirement at that reduced altitude. In short, the FAA has failed to justify the necessity of this change, other than to briefly mention consistency with ICAO derived airspace designs. AOPA objects to such rational and reemphasizes the fact that it appears the United States is following global trends instead of setting them. (AOPA—34)
146.	The altitude above which DME is required should not be lowered from FL240 to FL180, as proposed in the NPRM [i.e., §91.205(e)]. The reason DME was originally specified above FL240 was to address lead turn radius at high true airspeed, not necessarily to correlate with airspace definition. FL240 should be retained, and RNAV methods should also be permitted in lieu of DME as proposed. (Boeing)
	PART 97
	§97.1
147.	Proposed Section 97.1(b), Departure Procedures: The proposed §97.1(e) is in conflict with §121.189 (Airplanes: Turbine engine powered: Takeoff limitations) and should not be adopted without major revision. It would create significant air carrier safety problems and takeoff weight penalties with no safety benefit in return. It essentially invalidates current air carrier takeoff analyses at many locations where §121.189 compliance requires use of a different safe engine-out flight path than is specified for ATS departure procedures, or by an all-engine departure defined path using criteria of U.S. TERPS. As written, it does not appear to accommodate elements of safe flight, including necessary weather deviations and non-normal situations such as engine failure. If the objective is intended to be coordinated with air traffic control, then it would not be appropriate to be specified in Part 97. If specified at all, it would need to be cited in Part 91, or alternatively in Part 121, 135, 125, or 129. (Boeing—43)
148.	SEE AIRBUS COMMENT (#44) TO 91.175 above.
	§97.3
149.	97.3(b) should include a statement clarifying the expected aircraft performance when flying a Departure Procedure, i.e. all-engine, normal aircraft performance for TERPS-based procedures. (Boll—30)
150.	Under Section 97.3 Symbols and Terms Used in Procedures: As currently proposed, "This proposal would also add the term "helipoint," which is normally the center point of the touchdown and lift-off area (TLOF). It is usually a designated arrival and departure point located in the center of an obstacle-free area, 150-feet square, overlying an approved landing area, where the approach may be terminated in a hover or touchdown. The helipad of intended landing may not be located at the helipoint, however." This wording is troublesome in that many heliports do not have a 150-foot square "obstacle free area" that complies with this change. Instead, this wording should be changed to "heliport reference point", with an accompanying definition, as worded: "This proposal would also add the term "heliport reference point (HRP)," which is the geographic position of the heliport expressed as the latitude and longitude at: (1) The center of the FATO, or the centroid of multiple FATO's for heliports having visual and nonprecision instrument approach procedures; or (2) The center of the Final Approach Reference Area (FARA) when the heliport has a precision instrument approach procedure." This change is word for word from the latest draft version of the Advisory Circular AC 150/5390-2B Heliport Design. (HAI—40)
151.	Under Section 97.3 Symbols and Terms Used in Procedures (continued): Additional changes that are included in AC 150/5390-2B should also be included to conform in this proposed rulemaking: Recommended Change 1, add: "This proposal would also add the term "Final Approach and Takeoff Area (FATO)," which is defined as an area over which the final phase of the approach to a hover, or a landing, is completed and from which the takeoff is initiated." Recommended Change 2, add: "This proposal would also add the term "Final Approach Reference Area (FARA)", which is defined as an obstacle-free area with its center aligned on the final approach course. It is located at the end of a precision instrument FATO."

	Comments
	Recommended Change 3, add: "This proposal would also add the term "Helipoint", which is defined as the aiming point for the final approach course. It is normally the center point of the TLOF." Recommended Change 4, add: "This proposal would also add the term "Heliport", which is defined as the area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters, together with appurtenant buildings and facilities." Recommended Change 5, add: "This proposal would also add the term "Touchdown and Liftoff Area (TLOF)", which is defined as a load bearing, generally paved area, normally centered in the FATO, on which the helicopter lands or takes off." HAI urges adoption of these recommended changes that take into account the capabilities of helicopters and better define the parameters of helicopter operations. (HAI--40)
152.	While it would appear that the use of "any NAVAID or FIX to be the reference point" for Minimum Safe Altitudes (MSA) is beneficial, poor selection criteria may increase confusion to pilots if the Fix or NAVAID is not consistent in application. Significant safety issues could develop quickly with poor application of this change. The FAA should simultaneously supplement this change with regulatory guidance that establishes a consistent application of MSA. It should be codified to ensure that there is a regulatory basis driving the selection of the MSA fix or NAVAID. The proposed change of the term "HAT" to Height Above Threshold creates inconsistencies with other terminology used to discuss instrument approach procedures. The glossary indicates that the touchdown zone is, "*The first 3,000 feet of the runway beginning at the threshold. The area is used for determination of Touchdown Zone Elevation in the development of straight-in landing minimums for instrument approaches.*" The FAA defines "threshold" as, "*The beginning of that portion of the runway usable for landing.*" AOPA disagrees with the FAA's assertion that the definition of "HAT" is not operationally significant. Height Above Touchdown provides pilots with much more information about the portion of the runway that a landing will be conducted. The height when only referring to the threshold is misleading because the threshold height may not be the highest point in the "touchdown zone". General aviation pilots are trained that the "touchdown zone" as defined in the FAA's Pilot/Controller glossary is substantially larger than the runway threshold and that the highest point in that area provides information about the runway slope characteristics. Therefore AOPA recommends that the current definition of HAT be preserved. (AOPA—34)
153.	The proposed change of meaning of "height above touchdown (HAT)" should not be adopted via this NPRM. It needs additional discussion among the AWO and TAOARC. It is not merely a terminology change. For applications like procedure construction, autoland, or head-up display (HUD) landing capability design, or other uses, it could have adverse consequences that need to be technically considered and addressed. If any change is to made at all, it first should be addressed via AWO coordination; then subsequently via coordinated changes to FAA ACs 120-28D and AC120-29A, JAA references; and then finally updated in other related US references, such as FAA Order 8430.6 (Boeing—43)
154.	*Definition of HAT* Airbus disagrees with the proposed amendment to the definition of HAT and the statement in the preamble that this change is insignificant. There are many good reasons for the existing definition of Height Above the Touchdown Zone. Height above the touchdown zone is a major concept in the design of automatic landing systems and one of the basic principles of Category III operations. This change can have many adverse consequences on aircraft design and potentially on the safety of low visibility operations. There is no accident or incident history that justifies the need for this change. And, the only justification given is to make it consistent with ICAO. The most desirable solution is to align the ICAO definition with the way aircraft are designed, certificated, and operated. (Airbus—44)
155.	***Unless otherwise specified,*** visibility minimum means the minimum visibility specified for approach, landing, or takeoff, expressed in statute miles, or in feet where RVR is reported. (Boeing)
	§97.10
156.	Do not delete this. Because these type procedures no longer exist is not sufficient justification. This language does no harm and provides a method of accepting other procedures should the need arise. (Amer Trans—25)
157.	See comments to 91.175 from Vaughn of Continental #37 above
158.	Section 97.10, which describes standard instrument procedures "other than those based on the...TERPS," should be retained, rather than removed as proposed, for later application of internationally harmonized criteria. (Boeing—43)

	Comments
159.	Comments: The FAA proposes deleting this section of the FAR. It is important that this section remain in place as a means for an operator to implement new technology in a timely manner. Recommendation: Do not remove from the Rule as indicated by this NPRM. (ATA—41)
160.	Comments: This reference should be maintained. Since future RNP RNAV implementation in the US and abroad may not be based on TERPS criteria, this guidance may be needed in the future. (AA—42)
	§97.20
161.	97.20 Do not change: FAR's should not hand off regulatory material to FAA Orders. These Orders then in effect become the rule under complete control of the FAA. The current regulation already identifies U.S Terps. Why is the internal filing system number (xxx.3b) required? There is no need to add 8260.19 to the rule any more than the 6750.24 regarding what must be ancillary components must be operating. How would omitting specific orders in the FAR affect the development of procedures? What value is it to FAA, or the public, to expand the list of Orders listed in the rule. (Amer Trans—25)
162.	FAA Orders 8260.3 and 8260.19 should not be incorporated into the Code of Federal Regulations, as proposed in §97.20. The requirements for developing and processing instrument procedures do not need to be included in the regulations, where they would become even more difficult to change, thus unduly constraining procedural and technical evolution. We request that the FAA explain need for the change and the safety benefits to be derived from it, since this is not clearly explained in the preamble and is not otherwise apparent. (Boeing—43)
163.	Airbus opposes the amendment to Section 97.20 which would incorporate FAA Order 8260.3, "U.S. Standard for Terminal Instrument Procedures (TERPS)", and FAA Order 8260.19, "Flight Procedures and Airspace" into the Code of Federal Regulations. There is no accident or significant incident history that suggests that this change is required for safety reasons. These orders are highly detailed and contain many administrative procedures and processes that are not safety related. Instrument flight procedures have been safely developed and safely used throughout the history of FAR Part 97 (about 40 years) without FAA Order 8260.3 or 8260.19 being incorporated into the Code of Federal Regulations. Airbus believes that this amendment would place significant burdens on the industry by unnecessarily delaying the implementation of new technologies and operational capabilities and by making changes to these Orders even more difficult and time consuming than they already are. Airbus acknowledges and fully supports the need for thorough and thoughtful review of changes to these Orders by industry. Airbus also believes that it is essential to preserve the ability to rapidly correct administrative or technical errors or to quickly incorporate new technologies and operating concepts to enhance safety and improve operating efficiency. Airbus believes that there are many other more effective and efficient ways to achieve this objective without undergoing the onerous process associated with rulemaking, as required by the proposed amendment. (Airbus—44)
	PART 121
	§121.99
164.	ADF believes that the FAA proposal to, "add a requirement for a communication system that would have two-way voice communication capability for use between each airplane and the appropriate dispatch office, and between each airplane and the appropriate ATC unit, for non-normal and emergency conditions," is a significant improvement with regard to safety. Further, the technology exists to comply with this requirement. ADF believes that the technology also exists to allow any digital or data link communication passed between Air Traffic Control and a Flight to be transmitted to the relevant Dispatch Office. ADF encourages FAA to include this capability in the future. A voice conversation greatly increases the quantity and quality of information transfer. (ADF—15)
165.	ADF also agrees that the FAA should define what constitutes "rapid" communication. ADF believes that the proposed 4 minute time limit is both reasonable and technologically achievable. (ADF—15)
166.	In closing, ADF believes that the new requirements of the proposed FAR 121. 99 contribute to aviation safety. (ADF—15)

	Comments
167.	Northwest Airlines is concerned over the proposal to add a definition of "rapid communications" based on a legal interpretation as opposed to operational considerations and experience. The legal interpretation does not consider the realities of international aircraft-to-dispatch communications. The concern over this change is the ability to meet the 4-minute requirement while operating in remote/oceanic regions where the primary communication medium is HF Voice. The process used to exchange communication is complex and requires that initial contact be made through a communication service provider (ARINC) who will then establish a voice connection between the aircraft and dispatch. This is a time consuming process. Additionally, the propagation characteristics of HF radio may also prevent the link from being established within the 4-minute time frame. This is out of the control of the operator and therefore we cannot be held responsible for meeting this criterion so we believe that this change is an unreasonable and unachievable objective. (NWA—17)
168.	Section 121.99, "Communications Facilities", introduces new requirements which are costly and timely to implement. The main issue lies with the need to have continuous voice capability with the company. There are some operations where certain portions of the route segment have data link capability but not direct voice with company. The entire route has voice with ATC. With 121.99(b) requiring the communication to be independent of the ATC communication system, leads to the conclusion that data link may be used for normal communication but we must also have voice in case of an emergency communication need. It is our position that in an emergency, the operator should be allowed to use ATC as voice if needed. This would require amendment to 121.99(b). Without this latitude, Flag operators presently using data link communication systems to communicate with crews would require either satellite communication system or high frequency radios. We propose the FAA needs to review the limited route/time exposure before requiring continuous voice coverage. (Delta—18)
169.	121.99 Communications facilities--a. The title Communications facilities could be shortened to Communications as the word "facilities" does not add any descriptive value to the title. Possibly in the past when companies had to establish their own system of radio facilities before the full integration and established airspace control by the government and other service providers this was appropriate. Proposed resolution: Remove the word facilities unless it is determined that the specific wording is required to determine the correct application of the Rule. (ATA—20)
170.	121.99 (a) contains requirements that are in direct conflict with the responsibility of the FAA. To establish an unrealistic requirement of being able to establish communications "over the entire route under normal operating conditions," within a specific time of "less than four minutes" will not support the FAA mandate to promote and support the air transportation infrastructure and encourage the development of air travel. It has not been established that the time requirement is realistic under all normal conditions. It has not been established that four minutes is a necessary time requirement for objective reasons substantiated by data. To invoke this arbitrary time limit as the result of the interpretation included in the supplied Docket information without supporting data is capricious and severely onerous to the portions of the airline industry regulated by the FAA. It does not establish what is possibly intended by the FAA, which could be understood as a reasoned expectation to communicate with the flight crew within a reasonable amount of time. Some determination as to the location of the aircraft, the phase flight, and other operational considerations need to be included in the context of rapidly communicating with the flight crew. Currently, conditions occur in normal operations when the only means of communication is via HF radio. This is operationally acceptable, but may take longer than the prescriptive "four minutes" indicated in the proposed Rule. Many of the current requirements are based on the past unreliability and operational problems of radios. During the final phases of flight it is not reasonable to require the flight crew to respond within four minutes when it is safer to continue the approach to a safe landing and then communicate as requested. Current technologies may have an application to enable communications. Enabling and operational procedures should be included in the discussions establishing the specific requirements. It is suggested that no prescriptive time is accurate, accept that it should be accomplished as appropriate in the interest of the safe operation of the aircraft as determined by the flight crew. Proposed resolution: Review the current operational tasks that require expedited communication with the flight crews and establish a current philosophy of what needs to be communicated, and in what manner will accomplish the required task. When these are determined then an action plan to build on current systems could better support future technologies and related improvements to support these basic philosophies. (ATA—20)

	Comments
171.	121.99 "Communications Facilities": There is some operations where certain portions of the route segment have data link capability but not direct voice with company. NPRM 121.99 introduces a new requirement to have continuous voice capability with the company for non-normal and emergency. This will be costly and take time to implement. The NPRM may be appropriate if 121.351 (c) provided route/time/exposure relief. It's curious why data link may be used for critical normal communication, but we must have voice in the rare event of nonnormal/ emergency. We recommend FAA review the NPRM and provide route/time exposure allowance before requiring continuous voice coverage. The rule should also provide some future effective date that would allow voice equipment to be installed. We also request FAAs assessment of cost estimate to implement this change. Do not include the definition of rapid/reliable < 4-minutes. Legal interpretations made in 1977 may not have considered all the relevant operational issues. While 4-minutes may be a reasonable goal, it's not something to be timed with a stopwatch. Standards like this are better placed as a goal in design standards and certification standards. (Amer Trans—25)
172.	The paragraph below regarding emergency communications is ambiguous. Is the intent that the two types of communication must be capable of being simultaneous? "In addition, the FAA is proposing to add a requirement for a communication system that would have two-way voice communication capability for use between each airplane and the appropriate dispatch office, and between each airplane and the appropriate ATC unit, for non-normal and emergency conditions. The FAA believes it would be necessary from the pilot workload and flight safety standpoints to retain two-way voice communication capability for non-normal and emergency conditions." An operational comment: In reality, there is very little useful info that a crew can obtain from dispatch during the tactical phase of a non-normal / emergency occurrence. There is value, once the emergency is under control, to coordinate further action on a strategic basis with dispatch. Thus the requirement to have simultaneous two-way communication between the aircraft and dispatch & the aircraft and ATC is unwarranted and certainly not worth the cost of the added equipment. The requirement for "rapid communications" needs to be well understood from an operational standpoint. There may be circumstances where this cannot be assured. (RAA—31)
173.	United Airlines is concerned over the proposal to add a definition of "rapid communications" based on a legal interpretation as opposed to operational considerations and experience. The 1977 legal interpretation does not consider the realities of international aircraft-to-dispatch communications. The data used to develop the 4-minute requirement is not applicable, and, therefore, is arbitrary and inappropriate. Our concern over this change is the ability to meet the four-minute requirement while operating in remote/oceanic regions where the primary communication media is HF voice. The process used to exchange communications is complex and requires that initial contact be made through a communications service provider, (such as ARINC), who will then establish a voice connection between the aircraft and dispatch. This is a time consuming process. Additionally, the propagation characteristic of HF radio may also prevent the link from being established within the four-minute time frame. This is out of the control of the operator and, therefore, we should not be held responsible for meeting this criterion. We believe that this change is an unreasonable and unachievable objective. Even with SATCOM-voice capability, there are regions of the world where the four-minute requirement may not be achievable. In addition, this puts an undo economic burden on the carriers to either fully equip with Satcom-voice capability, for those regions where coverage is possible, or invest in new technology that is currently not available. It should also be noted that Controller Pilot Data Link Communications (CPDLC) are the primary communication media in many regions of the world. Aircraft dispatcher data link communications are used extensively as the primary communication link. The use of datalink is consistently faster and more reliable than HF communications. United and other international carriers have conducted Flag operations safely for many years using proven, reliable communication systems and procedures. We know of no compelling operational or safety reason to add this definition of rapid communications and recommend that it be removed from this NPRM. (United--35)
174.	This document is in response to the issue of "Rapid Communications" raised in reference document and directed to clarifying 14 CFR 121.99, intended to "... ensure reliable and rapid communications, under normal operating conditions over the entire route (either direct or via approved point-to-point circuits) between each airplane and

	Comments
	the appropriate dispatch office, and between each airplane and the appropriate air traffic control unit..."

The present Long Distance Operational Control (LDOC) services are in economic, physical and operational shambles. Under the present LDOC structure, the impaired revenue picture prevents the modernization and restructuring that would result in rapid and reliable service performance. In this document, we outline an approach toward an effective and efficient global LDOC service. We believe that the approach we recommend will have compelling economic advantages over other alternatives while meeting the four-minute standard for dispatch contact referred to in reference document.

The causes of the present decrepitude of LDOC services are several:

1. The very triumph in reliability of modern turbine engines over reciprocating engines means that the need for LDOC services per hour of flight is now, and will remain, a small fraction of what it was in 1955. LDOC revenues are permanently reduced.
2. The ease of use of satellite services has further eroded HF LDOC revenues.
3. Because of shrinking revenues, the present HF LDOC infrastructure has atrophied and is totally out of balance with that which is now required. Most service providers use ancient, fixed-tuned transmitters, a multitude of narrow band antennas, frequencies unique to their station, their own operator staff and expensive long-distance dial-up for phone patch. Due to lack of knowledge of current radio propagation conditions, frequencies which would support good service frequently are not guarded.
4. The pilot, who must initiate contact, can be faced with a large choice of service providers and a vast choice of frequencies, many of which either won't work, are not monitored or both. He has no way of knowing which few of the many LDOC frequencies have been chosen by the ionospheric propagation gods to permit reliable communications at the moment between the flight and the desired station. Thus, a desired contact may not be made.

A comment regarding the "four minute" proposal (maximum time to make contact with company dispatch) in reference document). RPSI engineers have examined the practicality of "reliable and rapid" LDOC communications in the north polar region. We modeled the radio circuits between all service providers and north polar routes 1 , 2, 3, and 4. We selected a period of five minutes to make contact as reasonable and allowed one and one-half minutes per contact attempt. We then asked a very senior B474-400 captain to select frequencies and service providers as a typical flight would have progressed along these routes. In these flight examples we considered and absent any reliable propagation information, the station and frequency selections made by this experienced pilot did not once result in contact within five minutes.

The potential for an in-flight emergency always exists. Many regulations have been established which acknowledge the many possibilities. When an emergency occurs, it must be dealt with promptly. Invariably, an emergency is dealt with most effectively if reliable voice communications are available between the pilot and the provider of the service required.

The north polar region is extreme, with difficult radio propagation conditions and a paucity of appropriate station assets. Other regions, such as the South Atlantic, Indian Ocean, Africa and Central and South America have different, but difficult radio propagation challenges and a similar paucity of station assets. In none of these cases does the pilot have any informed help in choosing a frequency -station pair. LDOC services in these regions are generally regarded as unsatisfactory.

The remedies for this unsatisfactory state of affairs are to be found in the application of modern radio and network engineering and in the use of modern management of the choice of operating frequencies.

Contrary to popular belief and general experience, HF can be made quite reliable with good quality. In a landmark HF propagation experiment [1] *([1]Goodman, Ballard and Sharp. A Long-Term Investigation of the HF Communications Channel over Middle and High Latitude Paths. Radio Science Vol32, No. 4 July-August 1997. (Provided in docket #14002, comment #36)* the signal-to-noise ratios of all HF frequencies were measured every half hour over twenty-nine northern paths during an eighteen-month period. It was shown that with adaptive frequency selection using at least eight aeronautical bands and with at least four ground stations within reasonable service range, long term availabilities of 0.9999 on a scale of 1.0 were possible for an HF data circuit of the general characteristics described in ARINC 635 and 753. Each of these circuits was measured directly.

Making allowances for the additional signal-to-noise ratio required for voice and for the fact that frequency management in a practical HF voice service will have to be based initially on the predicted effects of current solar, interplanetary and geophysical observations modulated by extrapolated current propagation measurements (similar to the spectrum management service we supply ARINC for their HF Data Link Service), we can expect long-term availabilities approaching 0.99.

The key to high quality and high availability HF voice is modern, adequate station and spectral assets and near

	Comments
	real time adaptive use of adequate HF spectrum. Both the aircrews and ground stations must know what combinations of frequencies and stations will perform best in light of current, actual radio propagation conditions. Modern, optimized, totally unmanned, all band stations along the lines of the design we suggested for a major service provider can be furnished for around $300,000, plus installation for perhaps $200,000. Such stations are now in service. This station design is quite unlike the traditional design. The antenna covers the 2 to 30 MHz spectrum with an elevation plane pattern which is optimized for air-ground service and with a polarization which couples into the lower loss ordinary wave. The transmitters are highly redundant and can transmit on multiple frequencies simultaneously. The receivers feature DSP squelch permitting all frequencies to be guarded all the time. Moreover, we envision all stations in a region sharing the same frequencies in each of the aviation bands. The use of timely radio propagation data along with the use of common frequencies should guarantee contact in three minutes or less ninety percent of the time. With the use of voice over Internet Protocol (I.P.), the formerly formidable back-haul costs can now be de mimimus. Good global coverage requires a network of seventeen stations. This and the above considerations lead to the suggestion of one global system operating on regional nets of at least eight common frequencies, with one Global Operations Center. We have reason to believe that most of the existing, struggling HF LDOC service providers would contribute spectral and station assets in return for a share of system revenues. Spectral assets abound. They are simply wasted today. A modern, effective global LDOC service with appropriate spectral and station resources could come together quickly. Emergency communications are both a safety of flight and a security issue. While these needs are clear, their attendant economics are not. The system we outline could be supported on revenues of $2.1 million per year. Such revenues might come from a small per remote-region flight fee for US carriers and a per contact fee for foreign carriers. Were these revenues to be guaranteed by the Government in return for a rapid and reliable service, such a service would come to pass. The alternative is effectively to force all carriers to use satellite services. The relative economics of such a strategy are not attractive. As of September 10, 2001, there were approximately 9,000 civilian aircraft suitable and equipped for service in oceanic and remote regions. Of these, approximately 2,500 were equipped with satellite equipment. Not all of these had voice capability. Some were equipped for data link only--not considered adequate for emergency communications by many operators. Not all U.S. international scheduled carriers are satellite equipped. The subject NPRM would require only Part 121 operators to reach their dispatch centers within four minutes. Our estimate of the cost for one major US carrier to convert to satellite services is on the order of $25 million, based on a representative conversion cost of $300,000 per aircraft. No new aircraft equipage is required to implement our approach. The need for reliable and rapid communications during emergencies is real. Ask any pilot who has dealt with a major emergency over water, at night, without communications services and you are likely to hear a rather passionate argument for responsive communications. The support of the dispatch function is essential in developing a safe diversion plan. Timely support is not irrational; it is vital. With the approach we suggest, the "four-minute" proposal can be met 90% of the time. In order to do so, a modest revenue guarantee or its financial equivalent would be necessary to bring about essential structural changes to the LDOC services. There are those who would argue that it is not the responsibility of the FAA to provide communications assets around the world. We would argue that the FAA has a statutory obligation to promote aviation safety, as well as the economic well-being of the aviation industry. We are advocating an incentive so that private industry will develop and operate the needed communications infrastructure and that, while all oceanic carriers will fly more safely and securely, arguably, more than half the beneficiaries will be U.S. operators. (Radio Propagation—36)
175.	In the NPRM, the Administration has proposed to change a number of its rules, including Rule 121.99(a).*** 3. On its face, it may appear that these changes are administrative in nature, merely clarifying the existing rule and its interpretation by the FAA. This, however, is not the case. In fact, the amended rule requires the addition of one or two two-way satellite voice radios to the cockpits of UPS' existing fleet (at a cost of millions of dollars) and it imposes an objective 4-minute contact requirement between an airplane and the carrier's dispatch office otherwise known as an airplane operations center ("AOC"). The proposed 4-minute contact rule is a communications requirement that does not now exist except as an unpublished interpretation of an obscure hand-

	Comments
	written memorandum from the legal files of an FAA regional office. 4. UPS does not support the proposed amendments to Rule 121.99 because they are unwarranted and lack sufficient evidentiary foundation. As such, the proposed amendments may border on arbitrary and capricious changes to existing regulations. The only empirical data on which the proposed changes appear to be based is a 25-year old memorandum interpreting a version of the instant regulation which, at that time, applied to only domestic U.S. operations. Clearly, the nature of global aviation, and the technologies that support it, have changed significantly since the drafting of the 1977 memorandum. UPS believes that further research and evaluation is necessary before any changes may be made to Rule 12 1.99. 5 . Aside from the impracticality of the proposed AOC voice requirements, the addition of a 4-minute contact rule likely presents an impossible regulatory standard. Certain factors make the four-minute contact requirement impractical from an operational point of view. The justification states that there is no cost associated because the aircraft are already equipped with voice radios. Although aircraft are equipped, much of the world lacks the ground infrastructure (radios, telephone line, etc.) to support global connectivity in all area. Aircraft are equipped with different types of communication radios, appropriate to the region of operations. Typically, two systems of a given type are installed for redundancy. For instance, in an oceanic region, the crew must monitor a high frequency ("HF") ATC frequency. If an aircraft uses HFDL for primary AOC communications, it cannot monitor a third HF voice channel simultaneously. 6. For instance, if an aircraft uses HFDL for primary AOC communications, it cannot monitor a third HF long distance operational control ("LDOC") voice channel simultaneously. In most cases, Part 121 carriers are now required to monitor 121.5 MHz (VHF Guard) on the one VHF radio, in addition to ATC on another VHF radio in VHF radio coverage areas. If the rule changes as proposed, a dispatcher will have to contact a flight via data link first, then the crew must switch over to voice and return the call to dispatch. From a transmission time and cockpit workload perspective, a 4-minute requirement for such an action could prove difficult, if not impossible. 7. Although limited in its geographic scope, UPS owns and operates one of the world's largest AOC VHF voice networks. Known commercially as the JetComm Network, this system provides AOC voice communications coverage throughout most of North America, as well as limited parts of Europe, Asia, the Pacific and the Caribbean. UPS also uses a number of external communications service providers who offer additional AOC voice communications coverage via HF radio. The decision by UPS and other commercial carriers to provide voice communications capability between the dispatch office and an aircraft on a given route or particular aircraft type is based upon an analysis of the length and geography of the planned routing and the aircrew's ability to operate safely and communicate and navigate effectively along that route. There is no basis for such a decision to be mandated by regulation. 8. Options for AOC voice coverage are particularly limited in polar and near-polar regions which typically have the worst HF propagation (due to geomagnetic storms and auroral activity). On the other hand, HFDL networks are specifically designed to compensate for poor polar HF propagation and provide reliability that is not achievable by HF voice systems. Further, WMARSAT (the satellite operator used by all U.S. carriers) does not cover the polar regions. As such, the only high-reliability AOC voice coverage option over polar regions is Iridium. Bottom line--there is not a single U.S. carrier that today could have reliable AOC voice communications in the polar regions under a four-minute standard. Accordingly, the proposed rule change is a mandate for aircraft owners to purchase satellite voice communications equipment. 9. While AOC voice communications may provide certain operational benefits to the air carrier, there is no evidence of any safety benefit of voice over data communications when establishing the link between the aircraft and dispatch. The FAA asserts that "reliance on data link communications alone during an emergency could cause an unsafe condition."' This is assertion is overly broad and unsupported by empirical evidence. UPS might agree with this assertion if it were aimed at the link between the aircraft and air traffic control ("ATC"), but the link between the aircraft and dispatch is less critical during an emergency situation. 10. Currently voice communications capability with ATC is required. In an emergency situation, ATC is the primary contact. ATC can provide assistance in the form of revised routes to alternate destinations, separation from nearby aircraft and coordination of emergency equipment and services. None of this assistance can be efficiently provided by the company dispatch office. Airlines establish emergency procedures and crews train in their execution to avoid the necessity of communication and the attendant possibility for error. ATC communication is important in an emergency situation to allocate available resources and mitigate traffic effects. ATC communications are time sensitive because they involve real time control of air traffic. Delays could result in reduced separation between aircraft. ATC communications assure the safe and efficient operation of aircraft within the airspace. Particularly in an emergency situation, AOC communications are given a lower priority than

	Comments
	ATC communications. 11. Unfortunately, VHF AOC voice communication service is not available over most of the world or in many areas over which commercial carriers conduct flights. More importantly, in many regions, there is no longer any HF AOC voice service provider. The economic realities of the HF AOC voice service business are driving many service providers to close their doors. By contrast, HFDL coverage is growing. As a result, the only option for voice communicaticns in many locations has become satellite voice communication, and this trend is likely to continue as more HF voice providers cease providing this service. Thus, in order for UPS to continue to conduct flights over many regions, the proposed AOC voice requirement would appear to be, in fact, a satellite voice communications requirement. 12. The economic impact of being forced to acquire a satellite voice communications system is immense. Aggravating such an imposition, cargo carriers cannot offset such a capital expense because, unlike their passenger carrier counterparts, there is not a market for an ancillary satellite telephone service on cargo flights. 13. The proposed requirement for communications availability "over the entire route" does not provide flexibility but, in fact imposes limits and enormous burdens on an operator. The current wording of Rule 12 1.99 recognizes that long range communications capability and quality is dependent upon local environmental conditions existing at and between the aircraft and the intended point of communication. Defining specific points along the route allows those conditions to be considered when selecting appropriate radio channels to be monitored. Successful communication requires the calling and called equipment to be selected to the same channel. A strict interpretation of the requirement presently could force the operator to add a satellite voice communications system. 14. It must be taken into account that the satellite systems too have limitations. For example, there is no satellite coverage at latitudes greater than about eighty degrees. In these areas, satisfying the requirement for continuous AOC voice communication could be a practical impossibility. Further, although satellite telephone systems have been around for some time, they are complex and cannot meet the four-minute rule 100% of the time. In addition to hardware failures, there are some solar-terrestrial conditions (admittedly somewhat rare) that can cause outages. Additionally, satellite systems have an inherent single point of failure problem, either because of a problem with the satellite itself, or a problem with the operator of the satellite. 15. The FAA must consider the attributes of HFDL communications in any analysis preceding a change to the Rule 121.99. In many cases, HFDL communication is faster and easier than voice communications due to the pre-formatted messages. For common occurrences such as diversions the crew might only make a menu selection and type the four-letter destination identifier (e.g. KSDF). At the Data Link User's Forum held in February of 2003, ARINC reported that 95% of messages were completed in less than 120 seconds. Studies have shown that HF voice communication contacts in remote areas can require four (4) minutes to as much as twenty (20) minutes to accomplish. Practical experience indicates that a four (4) minute requirement will be unrealistic in many remote and over water communication scenarios. In these cases, HFDL communications are decidedly superior to voice communications. (UPS—38)
176.	FAR Section 121.99 has long required air carriers to have "reliable and rapid" two- way communications between their aircraft and dispatch offices "under normal operating conditions" for all domestic operations and flag operations in the 48 conterminous States and the District of Columbia. After March 12,2001 these requirements were extended to flag operations outside the 48 conterminous States and the District of Columbia. To meet this requirement in the 48 conterminous States, ARINC has established nationwide networks of interconnected VHF voice and data radio stations that enable aircraft to communicate with their dispatch offices and other ground operations for the safety and regularity of flight. ARINC has provided similar capabilities in areas of Hawaiian and Alaskan airspace utilized by commercial air transport aircraft. A number of these stations are staffed by ARINC radio operators, while others are staffed by the individual aircraft operating agencies. ARNC also operates HF stations that provide voice and data communications on over-ocean routes beyond the reach of normal VHF communications. Substantively, the FAA's proposal would change 14 C.F.R 121.99 in two respects. First, the FAA proposes, for the first time, to define "rapid communications" to mean that the communications between the aircraft and dispatch office must be established within four minutes, whether the call is initiated by the flight crew or the dispatcher. Second, the FAA specifies the requirement for communications under "non-normal and emergency operation conditions," and, furthermore, the FAA would require that such communications be by voice. ARINC does not believe that either of these changes are necessary. A requirement that 100% of all communications be established within four minutes does not reflect any operational requirements and is unrealistic. The four-minute standard was taken from a 1977 hand-written

	Comments
	"Speed Memo" from the Southern Regional Counsel, responding to an instance involving an air carrier operating in the 48 conterminous States that was staffing the ARINC stations and not using ARINC's voice or data networks. For this particular air carrier, one-third of the communications took thirteen minutes to establish, and two-thirds took longer than four minutes. Under the circumstances described, it certainly appears that communications were not established in a timely manner, however, there is insufficient operational information presented to support the Speed Memo conclusion establishing the four-minute standard. In most instances when operating in the conterminous 48 States, communications initiated by the flight crew contacting the airline dispatcher can be established in less than four minutes. Many communications initiated by the airline dispatcher contacting the flight crew operating within the 48 conterminous States can also be established within four minutes, especially if the aircraft is equipped with aidground data link communications (either ACARS or VDL Mode 2). However, there will be times when the cockpit workload, radio operator workload, and aircraft equipment use will delay the establishment of a communications path initiated by the airline dispatcher beyond this period. The crew may be busy with other concerns, the radios may be in use communicating with ATC and other airline ground personnel and the like. The March 12,2001 extension of the communications requirements of FAR 121.99 to routes outside of the 48 conterminous States and the District of Columbia emphasizes the need to consider operational requirements when considering the establishment of a time standard for "rapid communications." For operations within the 48 conterminous States, line-of-sight VHF radio communications can be used to meet the requirements of FAR 121.99. However, communications between aircraft operating in oceanic and remote airspace and their airline dispatch center usually requires the use of HF radio communications. Due to inherent differences in radio transmission characteristics, HF communications are often more difficult to establish and maintain than VHF communications, a fact that is recognized by the FAA and other air navigation service providers (ANSPs) when establishing the operational requirements for ATC communications in oceanic airspace. These operational requirements should be reviewed when considering whether to establish a time standard for "rapid communications." For five decades ARINC has provided oceanic air traffic control communications services in the New York and Oakland Flight Information Regions (FIRS). The primary means used to provide these communications services is HF voice radio communications. To meet the operational requirements established by the FAA for these communications, ARINC must deliver 95% of ATC clearances within three minutes, 95% of ATC advisories within five minutes, and 90% of ATC requests within five minutes. It is important to note the proposed four-minute time standard for FAR 121.99 communications between aircraft and the airline dispatch office is more demanding than the operationally derived time standards for oceanic ATC communications—a significant inconsistency. Based on our experience as a provider of communications services used to meet the requirements of FAR 121.99, ARINC does not believe that there is an operational justification to define rapid communications more precisely than it is currently defined-especially given the March 200 1 extension of the communications requirements of FAR 121.99 to flag operations outside of the 48 conterminous States. The FAA also proposes to differentiate between communications during "normal operating conditions" and communications during "non-normal and emergency operation conditions." In both cases, the airline must ensure that two-way communications are available both between the aircraft and the airline dispatch office and between the aircraft and the ATC facility. Voice and data link communications would continue to meet the requirements of FAR 121.99 during normal operating conditions, as is the case today. The use of voice communications during normal operating conditions is well known. Data link communications have proven effective under those same conditions both for communications between the ATC facility (e.g., FANS I CPDLC in oceanic airspace, domestic CPDLC in the Miami FIR) and airline dispatch office (e.g., position reports, equipment and maintenance status and data, and other aircraft data and operational communications. However, in revising FAR 12 1.99 the FAA is proposing that two way voice communication must be available between both the ATC facility and the airline dispatch office during "non normal or emergency operation conditions." As a provider of aviation safety communications, ARINC clearly recognizes the importance of voice communications during emergency operations and fully endorses the requirement for the airline to maintain two way voice communications with the ATC facility during non normal and emergency operation conditions. Furthermore, ARINC submits that the utilization of data communications for operational control should also be permitted during non-normal and emergency operations. The use of shorthand and pre-defined short communications is actually a more efficient, more expeditious, and more useful form of communication than relying simply upon voice communications. Additionally, data link communications allows the exchange of

	Comments
	information (e.g., engine performance, maintenance reports, weather conditions, and remedial actions) that are difficult or impossible to convey using voice communications. Consequently, when the flight crew is dealing with an emergency, the ability to receive and send data communications, to the aircraft dispatch office will compliment the ability to have voice communications to the ATC facility directly involved in responding to the in-flight emergency. The global, seamless GLOBALink data link communications systems operated by ARINC (i.e., using VHF, HF, and Satellite communications capabilities), provide efficient and extremely reliable communications capability for a wide range of operational situations. As the world's most experienced aviation safety communications service provider, ARINC believes that each airline should be able to develop its own procedures for voice or for data communications and either form of communications should meet the operational control communications requirements of FAR 121.99 during routine, non normal and emergency conditions. RECOMMENDED ACTION: For the foregoing reasons, we recommend that the FAA delete the words "appropriate dispatch office and" from the penultimate sentence of proposed FAR 121.99 and delete the last sentence of the proposed rule altogether. (ARINC Incorporated—39)

	Comments
177.	§121.99 Communications facilities (a), Item 38, 77344 Comments: The proposed amendments to 121.99(a) contain new requirements relating to communications between aircraft and dispatch, and aircraft and air traffic control. Under normal operating conditions, the operator must show that a two-way communications system is available over the entire route, and that the system will provide reliable and rapid communications between the airplane and the appropriate dispatch office and between the airplane and the appropriate air traffic control unit. Under non-normal and emergency operations conditions, the system for use between the airplane and the appropriate dispatch office and between the airplane and the appropriate ATC Unit must have two-way voice communication capability. In addition, for communications between the airplane and the dispatch office, the caller must be able to establish communications with the called party in less than four minutes ("four minute limit"). ATA and its member airlines do not support the proposed four minute limit voice communications between the airplane and the dispatch office because it is unnecessary, it is without any factual justification, and it is arbitrary and capricious. The NPRM provides no factual premises or supporting data of any nature for this new requirement, but refers to a memorandum written more than twenty-five (25) years ago by the Regional Counsel of the FAA's Southern Region. It is our understanding that an interpretation of FAR121.99 was requested to assist the Southern Region in determining if the communications systems between Southern Airways flight crews and dispatch offices in place in 1977 met the intent of the regulation. At that time, this FAR applied only to domestic operations within the 48 contiguous states. In 2001, the requirements were expanded to international operations. To base the instant requirement solely on a "Speed Memo" written decades before implementation of current technologies that ensure reliable communications is simply not reasonable and fails to consider important aspects of today's sophisticated operational and communications networks. Further, it is inconsistent with prior agency practices and actual carrier operations, and fails to consider other, more practical, alternatives. A requirement that the communications system between aircraft and the appropriate dispatch office must be able to establish communication "as soon as practicable" over the entire route is reasonable and will ensure the requisite level of safety. There is no need to mandate an absolute and arbitrary (four minute) requirement that simply cannot be achieved at all times under all circumstances. Most importantly, there is no basis to conclude that in non normal or emergency conditions crew should or must be able to able to contact the airline dispatch office in less than four minutes. In this type situation, the crew is trained and required by professional skill as well as company policies to focus its full, immediate attention on implementing the safest course of action, communicating with air traffic control and the dispatch office as needed. In some instances, required voice communications in less than four minutes with the dispatch office would be an unwanted and unnecessary distraction for the crew. In addition, for domestic operations, voice communications may be interrupted or delayed due to circumstances outside the operator's control. For example, reliability may be impacted by severe weather, limited frequency availability due to initiation of communications by multiple aircraft or frequency saturation, phase of flight, aircraft location, radio frequency monitoring, and other operating circumstances. For international operations, a four minute limit poses even more difficulties due to the inherent nature of remote/oceanic regions (with intense atmospheric conditions) where the primary communication medium is HF Voice. Today's communications networks are sophisticated, complex, and safe, but due to technological limitations, simply cannot guarantee voice communications between aircraft and the appropriate dispatch office in less than four minutes. For the reasons listed above, ACARS provides a viable, time-proven communications alternative to voice communications systems. Unproven and complex satellite telephone systems would not guarantee voice communications worldwide in less than four minutes 100% of the time under all circumstances, and would be cost prohibitive. Again, it is critical to note that there is no data of any nature that the four minute limit would enhance safety to any degree. Initial cost estimates for satellite communications systems indicate a significant industry wide cost burden. For example, SATCOM would require major aircraft modifications to be completed over a number of years, at a tremendous cost to the operators with no guarantee whatsoever that the four minute limit could be achieved worldwide. Current cost estimates for a nominal satellite communications system from the Honeywell catalog are $300,000 per aircraft, excluding operational downtime and other required costs for implementation and training. In summary, the four minute limit is not based on any operational threshold and is arbitrary. An absolute time requirement is not necessary and is not achievable. Even implementation of extremely costly satellite systems will not ensure the stringent communications capability between an airplane and the appropriate dispatch office proposed in the NPRM. Resolution: As indicated in our preliminary remarks, if FAA believes further study of communications systems and timely communications is required, TAOARC is the appropriate technical forum for this study. We urge the FAA to utilize this existing group of agency and industry experts before proceeding further. This would ensure a robust, well-informed discussion of current system capabilities, technological developments, and reasonable alternatives to the current proposal, safety concerns, operational issues, potential costs and potential benefits, if any. Significant modifications to existing aircraft communications systems should not be considered or proposed in an NPRM without a full analysis of all criteria. We urge the FAA to withdraw the 1977 memorandum to avoid further confusion on this issue.

	Comments
178.	General comment on proposed change to 121.99. This proposed change to require a 4 minute limit to establish communications was obviously written by someone with no operational experience. The proposal is unrealistic. (Vaughn—Continental—37)
179.	§121.99 Communications facilities (a), Item 38, 77344 Comments: The limitation of four-minute voice communications between the airplane and dispatch is arbitrary and unnecessary, especially in light of the fact that it is based on a 25 year old memorandum written regarding communications between Southern Airways flights and their dispatchers. The NPRM should be worded to require communications "as soon as practicable" over the entire route. This 4 minute interpretation fails to address the reality of air operations in that voice communications in remote areas which rely on HF are frequently unreliable or the fact that CPDLC, ACARS, and SATCOM are highly reliable. In US airspace in particular, the use of ACARS for dispatch communications is the preferred tool for many flight crews in lieu of the lengthy process of voice patches, ARINC support, etc. This issue should be addressed by the TAOARC for future recommendations and implementation if appropriate. Utilization of the 1977 FAA memorandum and its initial narrow applicability to a blanket policy for all operators is inappropriate. Full exploitation and implementation for datalink communications (ACARS VHF, HR, or SATCOM) and SATCOM voice equipage should be encouraged by the FAA as opposed to a mandate for voice communications with unrealistic limitations. (AA—42)
180.	The proposed "4-minute" response time stated in this section is arbitrary and is inappropriate for many ordinary circumstances. In the preamble to the FAA, the FAA cites a 26-year-old regional legal opinion as the basis for this time period does not recognize modern operational procedures or technical capabilities. The assumptions made about communication methods, limitations, and capabilities are incorrect – not all Part 121 operators even need have a dispatch function, per se. Further, we maintain that the FAA reconsider requiring "two-way voice communication" as the only permissible communication method, as this unduly restrains use of advancing technologies. (Boeing—43)
181.	Airbus opposes the amendment to Section 121.99 that would define "rapid communications" to mean that the calling party must be able to establish contact with the called party in less than 4 minutes. This proposed regulatory requirement is not realistic, places undue economic burden on operators, and fails to address technical and propagation limitations in communications technology that has been used safely and effectively for many decades. (Airbus—44)
	§121.103
182.	Northwest Airlines is not opposed to the intent of the proposed changes but it appears that all that was done was to change the title of the rule and the body remains focused on establishing requirements for navigation aids, not systems. (NWA—17)
183.	Change the title of the FAR to Enroute Navigation. The use of systems/aids/facilities seems to confuse the rule. (Amer Trans—25)
	§121.121
184.	Northwest Airlines is not opposed to the intent of the proposed changes but it appears that all that was done was to change the title of the rule and the body remains focused on establishing requirements for navigation aids, not systems. (NWA—17)
185.	Delete the proposed change. It appears identical to 121.103. (Amer Trans—25)
	§121.344
186.	Northwest Airlines supports the FAA's action to create a distinction between Decision Height and Decision Altitude. What is not clear in this rule is what changes, if any will be required to sub paragraph (a)(54) of the rule. If we are required to record only the setting and not a discrete that indicates if it is DH or DA, then we support the change. We would however be opposed if this rule change requires that a discrete be added to the parameters differentiating between DH and DA. (NWA—17)
187.	Change to delete term "control" in air traffic control facilities: (a) No person may operate an airplane under VFR over routes that can be navigated by pilotage unless the airplane is equipped with the communication equipment necessary under normal operating conditions to fulfill the

	Comments
	following: (1) Communicate with at least one appropriate station from any point on the route; and (2) Communicate with appropriate air traffic ~~control~~ facilities from any point within Class B, Class C, or Class D airspace, or within a Class E airspace surface area designated for an airport in which flights are intended. (Boeing)
	§121.349
188.	
189.	Northwest Airlines supports the FAA's efforts to make this rule performance based. We believe it will allow the current navigation infrastructure to evolve into a satellite-based system. And given the direction that the FAA is taking toward an RNP-based infrastructure, making the system performance based will allow the operators to utilize both existing navigation aids and any future satellite-based systems as sensors to navigate using the concept of Required Navigation Performance. We do however believe that the rule as currently written does not provide adequate clarification of what combinations of navigation sensors and/or equipment will satisfy the requirements of the rule and would prefer to see some prescriptive examples in the preamble. (NWA—17)
190.	Section 121.349, "Communication and Navigation Equipment for Operations Under VFR Over Routes Not Navigated by Pilotage or Operations Under IFR or Over the Top". The reference to vulnerability of GPS, which uses very weak signals that are susceptible to interference, should be removed. GPS is much more reliable than any other navigational source. GPS NOTAMs are available and published. Considering that a ground based VOR is a single source transmission but FAA allows dual VOR receivers, it does not make sense to restrict GPS. If the aircraft has "anti jamming devices" it still would not preclude the jamming of the signal coming to the aircraft. If, in fact, the FAA believes jamming is a real threat, then guidance should be clear with respect to the need for one additional independent navigation system when used in conjunction with a GPS. (Delta—18)
191.	"*In addition, for non-normal and emergency operating conditions, the FAA proposes to add a requirement for at least one of the independent communication systems to have two-way voice communication capability. The requirement to report DME failures has been removed since it is required in current Sec. 91.187.*" Refer to our comments with respect to 121.99. (Delta—18)
192.	Section 121.349 Communication and Navigation Equipment...Continues on Page 77335 where the very first sentence again references *precision approach and APV*. Section 121.349 (Last Sentence) Comment: FAA should be encouraged to adopt performance based language, rather than narrow prescriptive language. (Rackley—24)
193.	Do not change. The seemingly innocent change from receiver to system may eliminate 1,000's of RNAV aircraft having dual DME a/o GPS receivers feeding a single FMS without good cause. What reliability or (MTBF) is FAA seeking? We do not believe that the rule as currently written provides adequate clarification of what combinations of navigation sensors and/or equipment will satisfy the requirements of the rule and has not appropriately considered the economic impact. Delete the reference to precision and NPV and only reference approaches with vertical guidance. Discussion must be placed in the preamble. (Amer Trans 25)
194.	The NPRM directly addresses GPS vulnerability. The proposal clearly states that two navigation systems that rely solely on GPS are not considered independent. This has significant ramifications on equipage, particularly regarding some of the upcoming RNP RNAV equipment configurations. If GPS is a required NAV sensor, does this mean there is no such thing as dual "independent" navigation capability? Comm and Nav equipment IFR--Comment on adoption of performance versus equipment-based rule for requiring specific systems: Performance is the way to go. However, just as with required report to ATC when DME fails above FL240 (revised to FL 180), there must be some method to determine resultant navigation performance. For example, an aircraft equipped with dual FMS and RNP 0.1 capable reports while enroute that one FMS has failed. The air carrier's MEL may state that single FMS operations are limited to RNP 0.3. In this case, it is incumbent on the flight crew to report new RNP limits, rather than equipment status. (RAA--31)
195.	Depending on the intent, these proposed requirements might impact architecture or levels of redundancy in radio equipage in the future. (RAA—31)
196.	The NPRM section-by-section discussion of proposed changes [to 121.349 (a) and 135.165 (a)] states that changes...are intended to address GPS vulnerability. Without jam-proof GPS receivers, the NPRM suggests that two navigation systems relying solely on GPS are not considered independent. On many procedures today, GPS is a required NAV sensor. Additionally, some operators are required to have dual means of navigation. Therefore,

	Comments
	the NPRM language does not support current operating procedures. We recommend the NPRM clearly state how operators using GPS for dual independent navigation capability will comply with all existing regulations. (Rockwell—33)
197.	**In response to the FAA's specific request for comments on one portion of §121.349, we maintain that the FAA should always strive to adopt a broad performance-based rule language rather than a narrow, prescriptive language requiring specific systems. This principle should be applied in general, and not be limited to §121.349, in order to encourage safe and efficient technical advancements without continually having to revise the regulations to accommodate them.** The proposed language of §121.349 could be construed to restrict operations with GPS to areas that are within the service volume of the VOR/DME network. This would be an unacceptable and unproductive limitation against implementation of RNAV and RNP. Regarding independence of navigation systems, allowance for flying instrument approaches with a single navigation system should place an obligation on operators to ensure safe operations following failure of that single system. There are no standards for determining which systems are independent and which are not. Two GPS (or other satellite navigation) receivers should be considered independent. (Boeing—43)
198.	Airbus opposes the amendment to Section 121.349 which defines "independent navigation systems" in such a way that restricts, for all practical purposes, GPS equipped aircraft to operations that are within the operational service volume of either VOR, DME, or NDB ground stations. This unnecessary and extremely onerous requirement will eliminate many of the benefits of RNAV and the establishment of a performance based NAS. The preamble makes it very clear that the FAA intent is to restrict operations to the service volume of existing navaids. The preamble states that "the intent of this rule is to ensure that there is no single point of failure or event affecting aircraft navigation systems that causes loss of all ability to navigate along the intended route or to navigate to a suitable diversion airport". The preamble further states that "For example, two minimum GPS (or other satellite navigation) receivers may not be considered "independent", since both are so vulnerable to interference." This statement implies that such interference is very common. However, there is no information that defines the severity and the probability of this potential or any steps the FAA or other government agencies might take in the future to reduce or eliminate the generation of interfering signals. The proposed change would mean that GPS operators would have to show that the aircraft has the capability to comply with Section 121.103 following one of the alleged GPS interference events, which hypothetically could occur at any point along the planed route of flight to the destination or any other airport required for the operation by Part 121. In the case of a GPS equipped aircraft, this means that the operators must be able to show at each point along these routes that the aircraft retains the capability to "navigate the airplane along the route with the required degree of accuracy". This means that the aircraft can never be outside the operational service volume of the existing navaid network. This is an unreasonable and unnecessary constraint that will significantly impede implementation of a performance based NAS and the achievement of the safety and efficiency benefits of RNAV systems which use GPS information. It will also impose a huge economic burden on many operators. Additionally, there is no know criteria for industry or the FAA to use to determine which GPS systems can be considered "independent" and which are not. Furthermore, there is more than 10 years experience of using GPS systems as the primary means of navigation in oceanic areas. There are no known accident or serious incident in the operations that justify such an onerous requirement in any operation. (Airbus—44)
	<u>§121.351</u>
199.	"*In addition, for non-normal and emergency operating conditions, the FAA proposes to add a requirement for at least one of the independent communication systems to have two-way voice communication capability. The requirement to report DME failures has been removed since it is required in current Sec. 91.187.*" Refer to our comments with respect to 121.99. (Delta—18)
200.	Proposed §121.351(c)(3), which addresses VHF communication gaps, should be revised to add specific accommodation of SATCOM, broadband, or other specialized communication system gaps, as well as VHF. (Boeing—43)
	<u>§121.579</u>
201.	**References to and coordination with FAR §121.579:** (*<u>NOT IN THIS NPRM</u>*) Comment: Additionally, as the

	Comments
	current provisions in FAR 121.579 require revision to enable the future use of RNP, and the current coordination of the NPRM for RNAV and Misc. Amendments will be affected by the current language in 121.579, the ATA requests that FAA consider including revisions to 121.579 as part of the current NPRM activity. Coordination with ongoing efforts to resolve required and necessary revisions to 121.579 are being engaged by the harmonization efforts of the Flight Guidance Harmonization Working Group (FGSHWG). Their recommendations should be adopted and used as a source for additional activities required by revision as part of this NPRM process. (ATA—41)
202.	It is important that the FAA take the opportunity created by issuing this NPRM to revise §121.579 by adopting text provided by the FAA/JAA/Industry Flight Guidance System Harmonization Working Group. The proposed revision to change only the usage of decision height is not sufficient and does not reflect current industry thinking. The detailed proposed text is provided in Enclosure 2. (Boeing—43)
	§121.651
203.	Section 121.651 (last sentence)--"...and any other *precision* instrument approach system." Comment: This language is not supported by AC120-29A. (Rackley—24)
204.	(d) "*precision*" approach mentioned twice in this section. This terminology is not supported by AC120-29A. (Rackley—24)
	§121.652 & Appendix M
	PART 125
205.	Parts 125 and 135: Part 121 comments apply to companion language in Parts 125 and 135. (Amer Trans—25)
206.	Reference to further proposed revisions to paragraphs related and applicable to Part 125, Part 129, and Part 135 are not indicated, but corresponding review of these issues should be made to reflect consistent application of policy throughout the regulations. (ATA—41)
	§125.381
207.	Section 125.381 Takeoff and Landing Weather Minimums: IFR--Paragraph mentions "*precision final approach fix*" in Paragraph (c)(1). (Rackley—24)
	PART 129
	§129.17
208.	129.17 Aircraft communication and navigation equipment (a): "...for *precision* approach and *APV* operations." This terminology is not supported by AC120-29A. (Rackley—24)
209.	Reference to further proposed revisions to paragraphs related and applicable to Part 125, Part 129, and Part 135 are not indicated, but corresponding review of these issues should be made to reflect consistent application of policy throughout the regulations. (ATA--41)
	PART 135
210.	Parts 125 and 135: Part 121 comments apply to companion language in Parts 125 and 135. (Amer Trans—25)
211.	Reference to further proposed revisions to paragraphs related and applicable to Part 125, Part 129, and Part 135 are not indicated, but corresponding review of these issues should be made to reflect consistent application of policy throughout the regulations. (ATA—41)
	§135.93
212.	Section 135.93 Autopilot: Minimum Altitude--Proposed Paragraph (b) would mention *APV (Rackley—24)* **135.93** Contains "*precision approach*" twice in this paragraph. This terminology is not supported by AC120-29A. (Rackley—24)

	Comments
	<u>§135.165</u>
213.	Makes reference to "*precision approach and APV* operations". This terminology is not supported by AC120-29A. (Rackley—24)
214.	[See Rockwell (#33) comment on §121.349 (a) above.]
	<u>§135.225</u>
215.	In re (c)(1) Want to include terms "*precision or APV approaches*"--This language is not supported by AC120-29A. (Rackley—24)
216.	In re (c)(3) Change wording to "on a *nonprecision* final approach."--This language is not supported by AC120-29A (Rackley—24)

March 10, 2004

Nicholas A. Sabatini,
Associate Administrator for Regulation and Certification
Federal Aviation Administration
800 Independence Ave SW
Washington, DC 20591

Dear Nick:

On behalf of the Terminal Area Operations Aviation Rulemaking Committee (TAOARC), and in response to the tasking given to us, please find enclosed the Executive Summary for the Committee's second and last phase of TAOARC activities since April, 2003.

The report is divided into two sections. The first being the initial phase of activities and report of June, 2003. The second is an update and final report of the activities along with additional recommendations.

The Executive Summary represents the consensus of the committee participants on specific accomplishments, recommendations and information that are provided for Federal Aviation Administration (FAA) consideration. The TAOARC recommends that the FAA update or develop appropriate documents, such as Advisory Circulars, FAA Notices, operations specifications, FAA Orders providing inspector guidance, and others as needed. The TAOARC also requests FAA provide written response to the PARC, including plan of action, for all of the recommendations contained in the Executive Summary by April 22, 2004.

The Committee wishes to thank you for your leadership and support in all of our activities.

Sincerely,

Dave Nakamura
Chairman, Terminal Area Operations
Aviation Rulemaking Committee

Attachments-as

Report of the

Terminal Area Operations Aviation Rulemaking Committee (TAOARC)

Executive Summary

March 4, 2004

Report of the Terminal Area Operations Aviation Rulemaking Committee (TAOARC)

Issue 1	June 6, 2003
Issue 2	March 4, 2004

Executive Summary

The Terminal Area Operations Aviation Rulemaking Committee (TAOARC) was chartered by the Federal Aviation Administration (FAA) Administrator on February 19, 2002 to provide a forum for the United States aviation community to discuss and resolve issues, provide direction for U.S. flight operations criteria, and produce U.S. consensus positions for global harmonization. The general goal of the TAOARC is to develop a means to implement improvements in terminal area operations that address safety, capacity, and efficiency objectives that are consistent with international implementation.

The charter required the TAOARC to provide, 14 months from the issuance of the charter, an initial report and written recommendations to the Administrator, through the Associate Administrator for Regulation and Certification (AVR-1). The charter specified that the recommendations should take the form of documented issue resolutions, recommended policy decisions, draft guidance material, and/or proposed rulemaking, as appropriate.

This report is the vehicle by which the TAOARC makes recommendations to the FAA. As specified in the charter, the report is being provided to the Administrator, through AVR-1. The TAOARC will be pleased to provide the report to other FAA officials when requested.

The report is divided into two sections. The first being the initial phase of activities and report of June, 2003. The second is an update and final report of the activities and recommendations.

The TAOARC views the need for FAA action on the enclosed recommendations as critical to the implementation of a performance-based national airspace that benefits all stakeholders. The FAA plan, priorities and schedule for the TAOARC recommendations are the basis for continuing working in the committee. Therefore, the TAOARC requests that the FAA provide a written response to the committee within 30 days regarding its decisions and plans on implementing the recommendations contained in this report.

Committee Work Summary, June, 2003

To date, the TAOARC has accomplished two significant tasks and formulated seven key recommendations:

Accomplishments

The TAOARC identified and resolved outstanding issues pertaining to draft AC120-29A. The AC was issued on August 12, 2002.

1. The TAOARC reached consensus on the issues pertaining to the draft FAA Order 8260.51 (a.k.a. 8260.RNP), ***U.S. Standard for RNP Instrument Approach Procedure Construction*** that was issued on December 30, 2002.

Summary of Recommendations

1. The TAOARC recommends that its charter be expanded to include en-route operations. See recommendation GEN-001.
2. The TAOARC recommends that the FAA explore the initiation of a Strategy Team to work with European Organization for Safety for Air Navigation (EUROCONTROL) and the Joint Aviation Authorities (JAA)/European Aviation Safety Agency (EASA) to explore the level of commonality that can be achieved between Europe and the United States in the evolution of airspace planning, airspace management and associated factors such as service provision and expected aircraft functionality. See recommendation RNP-001.
3. The TAOARC recommends that the FAA produce a top level RNP Transition Plan, in conjunction with the airspace users that identifies how RNP will be expanded, the key transition sequences, key assumptions, and a plan for addressing issues and concerns. See recommendation RNP-002.
4. The TAOARC recommends that the FAA produce a detailed RNP Implementation Plan, in conjunction with the airspace users, that identifies the key decisions, major work items and priorities, significant dependencies, schedule, roles and responsibilities, and tracking methods. See recommendation RNP-003.
5. The TAOARC recommends that as the FAA and industry proceed with performance based RNP implementation (particularly for approach operations), the relationship of performance-based procedure criteria to aircraft/systems performance requirements will need to be established. See recommendation RNP-004.
6. The TAOARC recommends that the FAA support the following strategic approach to accommodate various capabilities and uses for RNAV and RNP operations:

- Order 8260.51 will be dedicated to RNP operations that support RNP certificated aircraft
- Order 8260.48 will remain as an Area Navigation (RNAV) vehicle but will include linear criteria
- Special Aircraft and Aircrew Authorization Requirements (SAAAR) criteria will be added to the Orders to realize appropriate operational benefits for suitably equipped aircraft

See recommendation RNP-005

7. The TAOARC recommends that the FAA accept the All Weather Operations Harmonization Working Group (AWOHWG) model for a Ground Based Augmentation System (e.g., Local Area Augmentation System (LAAS)) and include the model in the next update to AC 120-28D. This model will be used in aircraft certification projects. See recommendation GLS-001.

This report is intended to be an evolving document that will reflect the activity and conclusions of the TAOARC on a periodic basis.

Committee Report

Content

The content of this report is as follows:
Background
Initial Tasking
Additional Tasking (none at this time)
Overview of the Work of the TAOARC
TAOARC Work Process
Periodic Reports – this section contains the report to AVR-1 in the form of a summary of the committee's activities, its accomplishments and a list of recommendations for the current reporting period.

1. Recommendations – this section can be considered an open "loose leaf" folder that contains specific TAOARC recommendations and expectations on various items.
2. Supplemental Information - it is anticipated that the TAOARC may wish to provide supplemental information on subjects that may not be directly in the form of a recommendation. Again, a "loose leaf" folder format is used.
3. References – additional sources of supporting information.

Background

On November 13, 2001, the FAA announced in the *Federal Register* a public meeting to discuss the draft charter, tasking, and organization of the proposed Terminal Area Operations Aviation Rulemaking Committee (TAOARC) (66 FR 56897). The public meeting was held on December 5 and 6, 2001.

After the public meeting, the Administrator chartered the TAOARC because safety issues and recommendations identified by the Commercial Aviation Safety Team (CAST) relating to Controlled Flight Into Terrain (CFIT) accidents and incidents, and airport capacity constraints with associated delays, dictate a need for improvements in terminal area operations. There is a need to fully utilize the capabilities of modern aircraft, e.g., the use of area navigation (including the Global Positioning System (GPS)), which are not fully utilized today. Evolving technologies and potential equipment upgrades provide increased operational and safety benefits which cannot be realized unless a practical means is established to direct and facilitate new criteria and implementation. The international aspects of aviation operations and aircraft production require that terminal area operational procedures and associated equipage be consistent.

The general goal of the TAOARC is to develop a means to implement improvements in terminal area operations that address safety, capacity, and efficiency objectives that are also consistent with international implementation.

The TAOARC provides a forum for the FAA, other government entities, and the aviation industry to discuss issues, develop resolutions, and develop processes to facilitate the evolution of safe and efficient terminal area operations. TAOARC supports the international harmonization process.

Initial Tasking

The TAOARC's initial task was to identify and resolve outstanding issues pertaining to draft Advisory Circular (AC) 120-29A and other draft required navigation performance (RNP) materials. The committee would develop draft AC language, a strategy, process, and schedule for the implementation of new or revised criteria. The committee is to make its recommendations, which may include rulemaking and additional tasking, to the Administrator through the Associate Administrator for Regulation and Certification.

Additional Tasking

The TAOARC may be provided with additional tasks. Currently, Approach with Vertical Guidance (APV), (including LPV) and FAA Order 8260.31, Foreign Terminal Instrument Procedures, and other added tasks have been identified.

Overview of the Work of the TAOARC

The task assigned to the TAOARC is significant and complex. The committee developed structured methods to manage and progress its work. There are many stakeholders and parties affected by the work that is to be accomplished, and it is recognized that reaching full consensus on all aspects will be difficult. The TAOARC will document significant aspects of its meetings, provide background information and identify areas where consensus and full agreement cannot be achieved.

The TAOARC is developing an underlying strategy to identify the work to be accomplished and will provide incremental progress reports. The TAOARC will produce specific recommendations and supplemental information to support policy, decision-making and direction by the FAA.

This report contains the progress report, recommendations and supplemental information produced by the committee.

TAOARC Work Process

The TAOARC's working process is described in Figure 1.

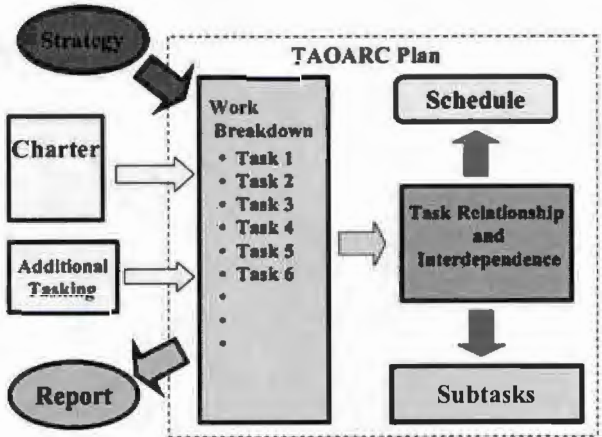


Figure 1: TAOARC Tasking/Work Process

The TAOARC will determine the relationships and interdependence of the tasks provided to the group and will break the work down into manageable subtasks that can be progressed. This report will contain recommendations resulting from the group's work and will provide a status report on the major tasks.

The TAOARC formed a management group called the Joint Steering Committee (JSC) to facilitate the process. The process is represented in the following Figure 2:

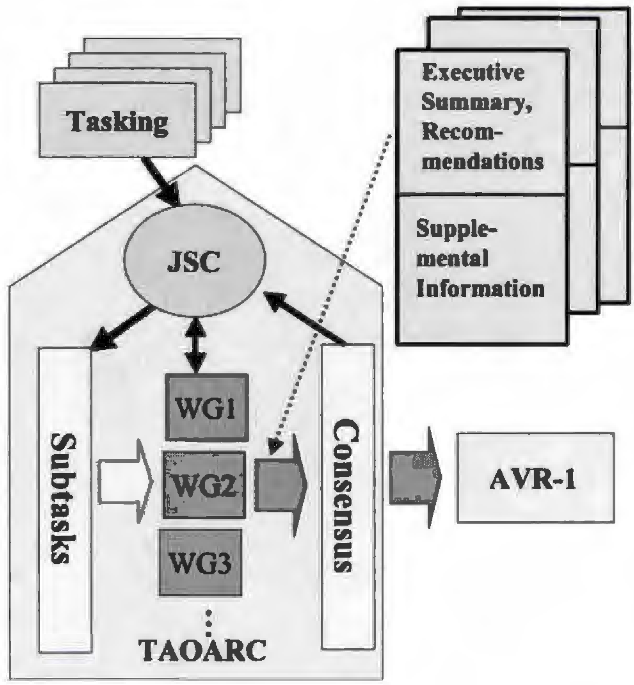


Figure 2: JSC Process

Subtasks are assigned by the JSC to working groups. These working groups will produce recommendations for review by the full TAOARC.
The TAOARC will document its work in project papers. These project papers will contain major stakeholder perspectives, issues, considerations, and factors that lead up to the generation of recommendation(s) by the committee, including any lack of consensus within the group. Any lack of consensus will also be noted in the TAOARC Recommendation form. These project papers will be available to AVR-1 and other FAA staff to provide additional background to the discussion that supports the TAOARC recommendations. Briefing papers will also be available for less extensive projects undertaken by the group. It is expected that these papers will provide a historical rationale to support FAA strategic and policy decisions. Each project paper will contain an executive summary, which will form the basis for the recommendations contained in this Report to AVR-1. The project papers will also provide supplemental information, to support FAA management's and the greater aviation community's understanding of TAOARC recommendations, and to provide a historical record of the work of the group.

Periodic Reports

Periodic reports of the TAOARC are provided in this section.

Phase One – Initiation through April 2003

Before the TAOARC was formally chartered, the FAA held a public meeting on December 5-6, 2001. The public meeting was announced in the *Federal Register* on November 13, 2001 (66 FR 56897). The first meeting after the TAOARC was formally chartered was held February 20-22, 2002. It became apparent that the TAOARC would have difficulty processing all of the work in its tasking in a forum of up to 100 people. It was decided to form a Joint Steering Committee (JSC) to manage and steer the tasks.

The JSC formally met in May 2002, August 2002, November 2002, February 2003, and April/May 2003. In addition to formal meetings, the JSC convenes weekly telcons to discuss on-going activities.

A special meeting to define the relationship between Required Navigation Performance (RNP) and the TSO-C129 community was held in January 2003.

The full TAOARC met in February 2002, June 2002, August 2002, and November 2002. Originally, a full TAOARC meeting was scheduled for February 2003. This meeting was cancelled to facilitate a change to the February 2003 JSC meeting.

Accomplishments for Phase one:

1. The TAOARC identified and resolved outstanding issues pertaining to draft FAA AC 120-29A. The AC was issued on August 12, 2002.

2. The TAOARC identified and reached an understanding on the issues pertaining to the draft FAA Order 8260.51 (a.k.a. 8260.RNP) concerning the U.S. Standard for RNP Instrument Approach Procedure Construction. The FAA issued an initial release of the Order on December 30, 2002 with an understanding that there would be a 'quick' revision in the form of a Change 1 – see item 7 below.

3. The discussion on planning for the evolution of RNP led to a realization that the TAOARC format may provide the FAA with the necessary resources and methods to address operations other than terminal area. A Recommendation has been developed to expand the TAOARC Charter. This Recommendation is identified as GEN-001.

4. The TAOARC developed issues and considerations related to RNP and, with consideration of the tasking to develop a U.S. consensus position for global harmonization, developed a recommendation relating to international coordination. This recommendation is more extensive than RNP but is documented as RNP-001.

5. The TAOARC produced two recommendations related to the Administrator's policy statement regarding the evolution to RNP and a performance based National Airspace System (NAS). These recommendations address the navigation aspects but could be equally applicable to communication, surveillance and air traffic management aspects. The recommendations are identified as RNP-002 and RNP-003.

6. There was discussion within the TAOARC on how to establish the most efficient and useful relationship between aircraft functionality and approach operational capability. The TAOARC has developed a strategic approach to this item and plans on developing this strategy further. The recommendation associated with this strategic methodology is identified as RNP-004.

7. There was significant discussion within the committee on the most effective way to move forward with RNP for Approach. Operations: These discussions covered the application of linear and angular criteria, the needs of the various segments of the aviation community and realizing operational benefits in an equitable way. The concept of using Special Aircraft and Aircrew Authorization Requirements (SAAAR) for more demanding operations was discussed. This process has been used in the air carrier community for low visibility operations (e.g., Category II/III). Key aspects of the discussion included:
    - The initial release of Order 8260.51 does not meet the needs of the end-users and the initial release was made with the understanding that a Change 1 would be progressed as soon as possible. The TAOARC supports the development of a Change 1 to Order 8260.51 as soon as possible.
    - The goal of the proposed Change 1 to Order 8260.51 and a revision to Order 8260.48 is to include criteria to support RNAV and RNP operations for a range of aircraft functionality (e.g., TSO-C129 avionics, RNP certified FMS). The TAOARC notes that the decision to publish Order 8260.51 in its current form will not delay publication of procedures that provide benefit to the aviation community.
    - Highlights of the Recommendation are:
        a. Order 8260.51 Change 1 criteria will be developed to support DO 236 and/or Airplane Flight Manual (AFM) certified RNP aircraft.
        b. Order 8260.51 will first be developed to support SAAAR with such tools as 2x RNP and RF legs.
        c. Order 8260.51 will also have a "public RNP" placeholder for use as additional RNP capable aircraft emerge and RNP becomes more public in nature.
        d. Order 8260.48 will have "linear" segments added to it in support of the non-DO 236 and/or AFM certified RNP aircraft (RNAV aircraft). These criteria will support aircraft with Instrument Flight

Rules (IFR) approach approved GPS functionality (e.g., TSO C 129) and many/most Flight Management System (FMS) equipped aircraft:

- There will also be a placeholder in these criteria for "SAAAR" approaches to ensure that all RNAV aircraft can maximize their capability.
- Criteria will be added that enables general aviation aircraft to maximize their slow, maneuverable aircraft capabilities.

The TAOARC believes that the majority of the FAA resources should be placed on modifying and implementing area navigation procedures described above for GPS and most FMS RNAV systems at NAS locations first, to achieve the greatest benefit by the largest number of aircraft. RNP SAAAR needs to be fully supported by the FAA and industry and immediately implemented at key airports where the operators with such navigation capabilities can realize results.

It should be noted that there may be follow-on issues such as charting which need to be discussed and resolved pursuant to this recommendation. The TAOARC will provide more specific recommendations for change to the Orders at a later date.

The recommendation associated with this activity is identified as RNP-005.

8. The AWOHWG has met a number of times since the TAOARC was chartered and has an active work program defined and under way. This work will provide recommendations to the JAA/EASA All Weather Operations Steering Group (AWOSG) and the TAOARC for consideration and action.

   The AWOHWG completed its first item in the current phase of its work program with the closure of the Allweather Harmonization Item (AHI) 1001 – GLS Model. This AHI provides a generic model of a Ground Based Augmentation System (GBAS), the LAAS for example, that is consistent with current International Civil Aviation Organization (ICAO) standards. This model will be used in the certification of airborne elements of a GLS. Details of this model can be found in Appendix 1 of the GLS Project Paper.

   The TAOARC has considered this input from the AWOHWG and has produced a recommendation identified as GLS-001.

References

The following references may be useful in understanding the context of specific Recommendation and Supplemental Information provided by the TAOARC:

1. RNP Project Paper
2. GLS Project Paper
3. RNAV Project Paper

A number of the Industry Working Groups provide status reports on their work on their web sites. This information can be found at:

1. General Aviation Working Group (GAWG) - http://ksn-team.faa.gov/taoarc/gawg
2. Vertical Flight Working Group (VFWG) - http://ksn-team.faa.gov/taoarc/vftaoarc
3. Regional Airlines Association Working Group (RAAWG) - http://ksn-team.faa.gov/taoarc/raawg

Recommendations
The following table contains a list of the recommendations made by the TAOARC. Specific recommendations are provided on TAOARC recommendation forms following this table:

No.	Recommendation Title	Disposition
GEN-001	Expand the Terms of Reference of the TAOARC Charter to Include Enroute Operations	
RNP-001	United States/Europe Strategy Team	
RNP-002	Concept for a RNP Transition Plan	
RNP-003	Detailed RNP Implementation Plan	
RNP-004	Performance Based RNP Approach Implementation	
RNP-005	TSO-C129 and RNP	
GLS-001	GBAS Model	

Note: ***These recommendations may include recommended rulemaking, advisory, or policy material. It may also include a proposal for tasking other groups, such as the AWOHWG.***

Recommendation No. GEN-001

TAOARC Recommendation

Date: 1 May 2003	Title: Expand the Scope of the TAOARC
Recommendation: The Required Navigation Performance (RNP) program plan provides a roadmap for the implementation of RNP within the United States National Airspace System (NAS). This includes the terminal and en route domains; and, the development of Standard Instrument Departures (SIDs), Standard Terminal Arrivals (STARs), and Instrument Approach Procedures (IAPs). Utilizing the expertise within the TAOARC in all domains/operations (including en route) more fully supports RNP implementation. Further, channeling these resources provides an important foundation toward the harmonization of RNP as part of the global concept of Communication Navigation Surveillance/Air Traffic Management (CNS/ATM) supporting an international airspace system. To provide a stable path for near, mid, and long term implementation, the role of the TAOARC should be expanded to include the en route domain.	
Date:	Action:

Recommendation No. RNP-001

TAOARC Recommendation

Date: April 2, 2003	**Title:** United States/European Strategy Team

Recommendation:

The FAA should explore the initiation of a Strategy Team to work, initially, with European Organization for Safety for Air Navigation (EUROCONTROL) and the Joint Aviation Authorities (JAA)/European Aviation Safety Agency (EASA) to explore the level of commonality that can be achieved between Europe and the United States in the evolution of airspace planning, airspace management and associated factors such as service provision and expected aircraft functionality.

It is expected that RNP would be a part of that strategic discussion.

The TAOARC recognizes that there is operational diversity between Europe and the United States, particularly as the operation related to the General Aviation community. The TAOARC requests that before any significant decision or agreement is made between the United States and the European members, the FAA will coordinate these proposals with organizations representing all facets of the aviation community in the United States.

The TAOARC also recognizes that domestic airspace needs may dictate a unique United States solution in certain areas and that full harmonization on all aspects may be impractical.

The primary objective of the harmonization process should be to minimize operational differences for international operators and to minimize any unique equipage or aircraft functionality for operations around the world.

Date:	**Action:**

Recommendation No. RNP-002

TAOARC Recommendation

Date: April 2, 2003	**Title:** Concept for an RNP Transition Plan
Recommendation: The FAA should produce a concept for a top level Required Navigation Performance (RNP) Transition Plan in conjunction with the airspace users that identifies how RNP will be expanded, the key transition sequences, key assumptions and a plan for addressing issues and concerns.	
Date:	**Action:**

Recommendation No. RNP-003

TAOARC Recommendation

Date: April 2, 2003	**Title:** Detailed RNP Implementation Plan
Recommendation: The FAA should produce a detailed Required Navigation Performance (RNP) Implementation Plan in conjunction with the airspace users that identify the key decisions that need to be made, major work items that need to be accomplished, and the prioritization of work, significant dependencies, schedule, roles, responsibilities, accountability, and tracking methods.	
Date:	**Action:**

Recommendation No. RNP-004

TAOARC Recommendation

Date: 1 May 2003	**Title:** Performance Based RNP Approach Implementation

Recommendation:

As the FAA and Industry proceed with performance based Required Navigation Performance (RNP) implementation (particularly for approach operations), the relationship of performance-based procedure criteria to aircraft/systems performance requirements will need to be established by:

1) Defining operational criteria
2) Qualifying the operation against those criteria, including the aircraft and operational mitigations, as appropriate

To facilitate operational qualification, aircraft capabilities should be grouped together into categories of similar capability.

The operational criteria should be sufficient to evaluate new aircraft technologies, capabilities, or mitigations without re-consideration of the obstacle clearance criteria or flight inspection criteria.

The TAOARC recommends that this strategy be accepted and implemented through the provision of guidance to the aviation community (e.g., AC 90-RNP).

If accepted, the TAOARC will produce further detailed recommendations in support of this strategy.

Date:	Action:

Recommendation No. RNP-005

TAOARC Recommendation

Date:	**Title:**
1 May 2003	TSO-C129 and RNP

Recommendation:

The TAOARC recommends that the FAA support the following strategic approach to accommodating various capabilities and uses for Area Navigation (RNAV) and Required Navigation Performance (RNP) operations:

- Order 8260.51 should be dedicated to RNP operations
- Order 8260.48 should remain as a RNAV document but should include linear criteria
- Special Aircraft and Aircrew Authorization (SAAAR) criteria should be added to the Orders to realize appropriate operational benefits for suitably equipped aircraft.

Specifically, Order 8260.51 be updated to Change 1 and Order 8260.48 be revised as follows:

a. Order 8260.51 Change 1 criteria should be developed to support DO 236 and/or Airplane Flight Manual (AFM) certified RNP aircraft

b. Order 8260.51 should first be developed to support Special Aircraft and Aircrew Authorization Requirements (SAAAR) with such tools as 2x RNP and RF legs

c. Order 8260.51 should also have a "public RNP" placeholder for use as additional RNP capable aircraft emerge and RNP becomes more public in nature

d. Order 8260.48 should have "linear" segments added to it in support of the non-DO 236 and/or AFM certified RNP aircraft (RNAV aircraft). This criteria will support aircraft with IFR approach approved GPS functionality (e.g., TSO C 129/145/146) and many/most Flight Management System (FMS) equipped aircraft

   - There should also be a placeholder in these criteria for "SAAAR" approaches to ensure that all RNAV aircraft can maximize their capability.
   - Criteria should be added that enables general aviation aircraft to maximize their slow, maneuverable aircraft capabilities.

The TAOARC believes that the majority of the FAA resources should be placed on modifying and implementing area navigation procedures described above for GPS and most FMS RNAV systems at National Airspace System (NAS) locations first, to achieve the greatest benefit by the largest number of aircraft. RNP SAAAR needs to be fully supported by the FAA and industry and immediately implemented at key airports where the operators with such navigation capabilities can realize results.

It should be noted that there may be follow-on issues such as charting which need to be discussed and resolved pursuant to this recommendation. The TAOARC will provide

more specific recommendations for changes to the Orders at a later date.	
Date:	Action:

Recommendation No. GLS-001

TAOARC Recommendation

Date: 15 April, 2003	Title: **GBAS Model**

Recommendation:

The All Weather Operations Harmonization Working Group (AWOHWG) has completed the development of a Ground Based Augmentation System (GBAS) model. This model has been described in a form that would easily transition into AC 120-28D as a new Appendix. The model has been coordinated with European authorities and industry within the AWOHWG.

The proposed GBAS Model is available from the AWOHWG, and will be identified in the Global Navigation Satellite System (GNSS) Landing System (GLS) Project Paper.

The TAOARC recommends that the FAA accept the model as provided and include the model in the next update to AC 120-28D.

Date:	Action:

Supplemental Information

The following table contains a summary of the Supplemental Information by the TAOARC. Specific information is provided in TAOARC Supplemental Information forms following this table:

No.	Supplemental Information	Disposition
SUP 1	General Aviation Working Group Report	

Date: 4 June, 2003	**Title:** General Aviation Working Group Report

General Aviation Working Group Report

June 4, 2003

This report is provided to show general aviation operational perspective for Category A and B aircraft.

The General Aviation Working Group (GAWG) of the Terminal Area Operations Aviation Rulemaking Committee (TAOARC), consisting of several general aviation organizations met several times during the past year.

In that time, the GAWG has acknowledged the safety and utility that instrument access provides to general aviation operations. The Federal Aviation Administration (FAA) has stated that, "Flying Instrument Flight Rules (IFR) improves the safety of all operations over flying Visual Flight Rule (VFR) in marginal weather conditions" (61 FR 64230, 64233 (December 3, 1996)). The Aircraft Owners and Pilots Association (AOPA) Air Safety Foundation safety review, "General Aviation Weather Accidents," published in 1995, reviewed over 5,800 accidents, including 1,750 fatal accidents. According to the report (p. vi), "the biggest causes or factors in fatal weather accidents were scenarios where pilots initiated, continued, or attempted VFR flight into Instrument Meteorological Conditions (IMC)." It is generally accepted that providing general aviation pilots with the best instrument access possible increases the likelihood that the pilot will elect to fly under IFR rather than marginal VFR.

The TAOARC GAWG determined that an instrument procedure without Vertical Navigation (VNAV) guidance may provide a greater safety margin for general aviation operations than an instrument procedure with VNAV but higher minima at the same location. A MITRE CAASD modeling simulation demonstrated that 55 percent of the time adding vertical guidance to non-precision approaches (called LNAV) raised the approach minima. This has been verified with the implementation of a Commercial Aviation Safety Team initiative, promoting the proliferation of non-Category I approaches with VNAV to every runway in the National Airspace System (NAS).

The GAWG quickly recognized that the biggest safety benefit to encourage general aviation to use instrument approach procedures in lieu of marginal VFR operations is to offer the lowest possible Area Navigation (RNAV) Global Positioning System (GPS) instrument approach procedure minima (ceiling and visibility) for Category A and B aircraft.

It is the recommendation of the GAWG that the continued proliferation of RNAV procedures as part of the FAA's ongoing Required Navigation Performance (RNP) program should include the performance and functionality of GPS equipment based on FAA Technical Standard Orders (TSO) C 129 and TSO 145/146. GAWG research has revealed and FAA survey data confirmed that over 70,000 of these IFR, approach approved GPS navigators have been installed for operational use (with 50,000 in the United States). The implementation must support hand-flown, single pilot operations. Such a high level of equipage must be supported, and included in the TAOARC plan for RNAV and implementation of en route, terminal and approach procedures. As RNP implementation planning continues, similar basic equipage scenarios must also be addressed. General aviation operators are rapidly investing in GPS equipment, consistent with the FAA's plan for the transition to an RNAV (previously called a SATNAV) capability in the NAS. This equipage began nearly 10 years ago and continues today.

With over 180,000 single engine piston aircraft in the general aviation fleet, and to remain consistent with the TAOARC recommendation to proliferate RNAV procedures as a top priority, the following characteristics should be applied to RNAV procedures and optimized for Category A and B aircraft. For LNAV nonprecision (or RNAV or GPS) approaches (without VNAV or Wide Area Augmentation System (WAAS)) begin the aggressive use of, for example, the following tool set:

- Step down fix(es) inside the final approach fix.
- Increased use of steeper descent gradients.
- Use of current ground based NAVAID course where the access to the airport benefit.
- Airspace size for turns (Cat A/B only radius turn protection).
- Immediate climbing turns at the Missed Approach Point.
- Changes for RNP should address a criteria discrepancy at the Missed Approach Point between GPS and current RNP Terminal Instrument Procedures (TERPS) criteria.

RNAV approach procedures that are optimized for the performance and functionality of TSO C 145/146 (but not necessarily mandating users to equip with WAAS) must be included in the NAS-wide RNAV implementation strategy being developed by the FAA's RNP program office.

Additional TAOARC activities have included discussion about the use of existing IFR certified GPS equipment performance to create RNAV routes where NAVAID citing creates limited low-altitude (IFR) access. Specific locations should be identified and an implementation strategy begun for the use of RNAV at low altitudes where general aviation receives a safety and operational benefit.

The TAOARC GAWG has also begun discussions on how to achieve benefits from

emerging "glass cockpit" technologies. Some of these technologies may mitigate errors commonly associated with hand-flown operations. The GAWG anticipates continued discussion throughout the next year in support of both the existing navigation capabilities as well as pursuing new benefits for those with substantially increased performance characteristics.	
Date:	**Action:**

TAOARC Phase Two Work Progress – April 2003 through January, 2004

Executive Summary, January, 2004

Since April, 2003, a change was made in the organization of TAOARC to improve the process of task management, support operational implementation and develop needed recommendations. A Joint Steering Committee (JSC) was formed, comprised of members representative of TAOARC stakeholders. During the JSC meetings in February 2003, May 2003, July 2003, September 2003 and December 2003, a revised process was used to address issues and tasks. The revised process was to assign tasks and issues, as well as the development of recommendations to small, specialized work groups designated "action teams". The action teams activities were subject to review and discussion during weekly JSC telecons. Results of action teams were posted to the JSC website and TAOARC website for review and comment, as appropriate. The role of TAOARC changed to where it became a forum to present JSC products and recommendations for any follow on discussion. The final meeting of TAOARC took place January, 2004.

Accomplishments

1. Coordinated the review and disposition of comments for the RNAV Notice of Proposed Rulemaking, including recommendations for terminology.
2. Expanded the guidance for the development of special instrument procedures to address the needs of airline, general aviation and helicopter communities.
3. Developed recommendations for updated guidance to Flight Standards personnel for standardizing and authorizing the use of Foreign Terminal Instrument Procedures (FTIP) by U.S. certificate holders operating in foreign airports, Notice 8260.31C.
4. Coordinated the development of SAAAR criteria for RNP Instrument Approach Procedures, and made recommendations to be reflected in either Notice 8260.51A or the appropriate document for initial applications. These changes are intended to completely replace the criteria of Notice 8260.51, providing the guidance expected originally for procedures based upon 2xRNP containment integrity and RNP alerting. Note: The criteria originally contained in Notice 8260.51 is expected to be retained in a separate document, consistent with its application with multi-sensor RNAV, non-SAAAR aircraft.
5. Provided key recommendations and guidance included in the published FAA Roadmap for Performance based Navigation including the types of applications, operations, and phases of implementation.
6. Defined minimum performance standard DME/DME RNAV Systems for en route and terminal operations (RNAV routes, SIDs and STARs) where there is a total system accuracy performance of 2.0 NM (95%). This was also used to enable an essential improvement to the FAA DME infrastructure assessment tool, used to support evaluate procedure designs against the performance requirements and the available navaids.
7. Developed recommendations for the FAA development of AC90-96A for Precision RNAV operational approval. While essentially mirroring the original European

guidance material, the AC also provides necessary guidance to address the set of operating rules that exist for the broader set of US aircraft and operators.

8. Discussed the development of airworthiness and operational approval guidance and criteria for RNP operations. Comments and recommendations were provided to the FAA to enable development of the necessary advisory material. The specific criteria and type of circular remains as a task for the next ARC.
9. Discussed recommendations for guidance material to approve data supplier processes for the production of navigation databases. The guidance material primarily addresses what must be accomplished and demonstrated relative to the data suppliers' data transmission, data preparation, and quality management processes and procedures. This will be concluded in the next ARC activity.
10. A Work Plan was developed in which the committee objectives, organization, process steps and major tasks were defined. In addition, the Work Plan documents the actions team formed, their assigned tasks and any deliverables. Since this took place when the activities were reaching the TAOARC chartered end date, the Work Plan is anticipated to be one of the primary work breakdown and organization tools for the next ARC.

Summary of Recommendations

1. The recommended disposition of comments to the RNAV Notice of Proposed Rulemaking Docket No. FAA-2002-FRI14002 should be reflected in suggested rule changes. The effects of these rule changes should be disseminated into the apppropriate FAA documents such as operations specifications, FAA Orders providing inspector guidance and others as needed to assure consistency with the updated rule language. The guidance for complying with the referenced rules should be provided in a timely way.
2. AC90-FPP should be developed and published to provide guidance and criteria in the development and submission of special instrument procedures, with consideration of:
   - A process and criteria for designated private developers will be developed.
   - Requests for the development of special instrument procedures can originate from within and outside of the FAA.
   - The FAA will authorize individual qualified expert applicants based upon FAA/Industry agreed criteria
   - The FAA will retain a role in quality management and assurance for such procedures
   - Flight inspection will be performed by either the FAA or in the case of advanced procedures and aircraft, via an FAA/Operator/Industry agreed upon Flight Inspection Policy.
3. 8260.31 should be revised to facilitate the use, development and maintenance of FTIP. This should consider the roles and responsibilities of the FAA, certificate holders, and foreign agencies, as well as the need for additional coordination and authorization processes.

4. The FAA should use the performance-based procedure, operational, aircraft and capability criteria, technical recommendations and issues developed by the committee in the development of regulatory guidance such as AC's, Notices, HBAT, etc for RNP systems qualification and operational authorization.
5. SAAAR criteria should allow for the conduct of instrument approach procedures considering:

   - Existing RNP certified aircraft (e.g. Airbus, Boeing), that provide RNP capability, alerting, displays and appropriate indications, flight planning, systems operational integrity, databases and vertical navigation will be the basis for the RNP SAAAR operations.

   - The procedures will have linear lateral obstacle surfaces at 2xRNP, and vertical obstacle identification surfaces that reflect those of AC120-29A and as further described in Attachment 1.

   - Qualification of new aircraft and systems will be based upon both existing RNP certified aircraft and the appropriate performance, functionality and capability elements from industry standard DO-236, AC120-29A and TSO-C145/C146. This is intended to enable participation and benefits to existing capability and to achieve the greatest level of participation by operationally acceptable aircraft and systems.
6. The minimum performance standard (baseline) DME/DME RNAV Systems for en route and terminal operations (RNAV routes, SIDs and STARs) should be established as described in the detailed recommendation. The total system accuracy performance of 2.0 NM (95%) should be the basis. FAA performance and infrastructure assessment procedures and tools, and in any relevant airspace and procedure design criteria should be updated accordingly.
7. Data base process and supplier criteria should be developed to:
   - Enable the FAA to provides data suppliers with a letter of authorization (LOA) for the production of database products.
   - Assure that the LOA from the FAA will follow a supplier application that provides evidence of procedures and processes for the production of databases, along with configuration management/control, and data quality management.
   - Establish that the LOA will remain in effect until changes such as new data content, format, structure warrant changes in tools, production processes and procedures; at which time a revised LOA application and approval will be necessary.
   - Be internationally harmonized, to ensure that a only a one time authorization will be necessary.
   - Consider the potential significant cost impacts for this activity, such that any LOA criteria should be subject to a "field trial" and validation where voluntary participation by data supplier organization(s) is encouraged.

   Note: For others in the aeronautical data chain, such as aircraft manufacturers, system integrators and aircraft operators, consideration is needed in the development of guidance material that will assure configuration control, configuration management and quality management, and balance the problem(s) being solved with appropriate levels for authorized processes and assurance.

8. For harmonization with the AWOHWG, Appendix 2 of AC120-29A should be revised to address two GBAS failure modes, the loss of VDB data for greater than 3.5 seconds, and ground stations that provide data that biases the flight path to a value at or near the Alert Limit.

TAOARC Report

Major Tasks

The following provides a general, tabular summary of the major activities that were identified as requiring Committee action and recommendations. Some have been completed as described in the preceding accomplishment summary. Others are in work, some are new. These are recommended for carry-over to the new Committee that will be formed following the expiration of the TAOARC and its charter on February 19, 2004.

No.	Name	Task Description	Comment
T1	RNP Operations	To significantly improve operations in all phases of flight by integrating and implementing Required Navigation Performance (RNP) capability into the National Airspace System (NAS) - [Reference Roadmap for a Performance-based NAS].	Supports the FAA RNP Program Office
T2	Navigation Data	There is growing reliance in current operations on navigation data. This reliance is expected to increase in the future. The quality and integrity of the navigation data used by the aviation industry has to be appropriate to its intended use. Recommendations should be produced on how to proceed to achieve this objective.	Need to ensure consistency with international communities.
T3	Terminology	There is a proliferation of terms and acronyms that relate to terminal area operations that have the potential to influence the safety and efficiency of future and, to some extent, current operations. Review the terminology and make any recommendation for changes, as appropriate.	Need to ensure consistency for international operations.
T4	Maximize use of current aircraft capability	Maximize the utility of the functionality in current aircraft to the greatest practical extent. Develop and implement a structured plan to move forward with new functionality based on achievable operational benefit. Develop recommendations on how to realize more utilization from current equipage and how to progress to new capabilities in a practical manner.	Significant economic factors to be considered.

T5	Operational Benefits of GNSS Landing System	Global Navigation Satellite System (GNSS) and its augmentation systems can provide significant operational benefits if introduced in a structured and systematic way. Recommendations should be developed that will contribute to creating and increasing operational benefits.	Some new operational paradigms may be necessary
T6	International Harmonization	The PARC should support the FAA/United States actions to provide global leadership. This should include the goal of consistency with respect to international operations. International consistency will minimize implementation costs while maximizing operational benefits and improving safety. The PARC should develop recommendations relating to international coordination and implementation and United States proposals for international discussion (e.g., at the AWOHWG).	
T7	Procedure Development/ Production/ Approval Process	The aviation community needs a viable procedure development and production approval process. The current process needs to be improved. Recommendations should be developed and provided to the FAA on means to improve and/or modify the processes for procedure development and production	
T8	Document Review and comment disposition	The PARC will review and provide comments on key documents as they are produced.	
T9	Criteria Roadmap	The PARC will identify the stakeholders need for 'criteria' related to their day to day operations and will develop recommendations on how to improve the complex and confusing situation that currently exists with ' criteria'. Reference the RTCA Task Force 4 recommendation for 'one stop shopping'	

Subtasks

The PARC will identify specific subtasks, write a Tasking Statement and request support for the task. The PARC will use two working methods dependant upon the type and scope of the work to be accomplished – Working Groups (WG) and Action Teams (AT).

Approach and Landing Working Group and Action Teams

No.	Subtask	Start	Completion Date	Commentary	Status
AL1	T1.1 Determine how to apply Orders 8260.48 and 8260.51 to address the needs or the users	February 2003		Concept agreed and reviewed in the full TAOARC – Recommendation RNP-005 produced. Next step – update criteria in the Orders	Complete
AL2	T1.2 Identify criteria for updated to Orders 8260. 48 and .51	June 2003		Action received from AL1,	Updates to .51A identified. .48 in-work for next ARC
AL3	A Terminology Sub-Group group will: T3.1 Provide general considerations for appropriate application of terminology and identify attributes that cause problems by the use of inappropriate terminology. T3.2 Establish a forum for identifying and discussing terminology related to terminal area operations T3.3 Develop US positions on terminology for the current activity in the AWOHWG.	May 2003		The Group's results will be captured in the Terminology Project Paper	In Work for next ARC

	T3.4 Ensure that a broad stakeholder group has input to RNAV NPRM comment resolution.				
AL4	A GLS Sub-Group will: T5.1 Identify the Operational Benefits that can be realized with GLS and stakeholders expectations for GLS T5.2 Identify the implementation issues associated with GLS			The Group's results will be captured in the GLS Project Paper	Not started

AC90-FPP Working Group

No.	Subtask	Start	Completion Date	Commentary	Status
FP1	T7.1: Identify what is needed for a viable procedure development and production approval process for instrument procedures. The current process needs to be improved.	Feb, 2003?	Aug, 2003	Documented changed in the special instrument procedure development criteria and processes	Complete, Nov, 2003

8260.31C Working Group

No.	Subtask	Start	Completion Date	Commentary	Status
PD1	T7.2: Identify what is needed for a viable procedure	Feb, 2003?	Aug, 2003	Documented changed in the criteria and processes for approval	Complete, Nov, 2003

	development and production approval process for instrument procedures. The current process needs to be improved.			of instrument procedures developed according to TERPS by foreign, non-FAA personnel	

Navigation Data Working Group

No.	Subtask	Start	Completion Date	Commentary	Status
ND1	T2.1 The means to approved data suppliers processes, relative to DO-200A, in the production of navigation data to address navigation data integrity issues need to be identified	May 2003		Developing criteria for Letter of Authorization process for data suppliers	Action Team in process of developing criteria. Estimated completion 1Q04

Technology Working Group

No.	Subtask	Start	Completion Date	Commentary	Status
TG1	T4.1 Identify the operational capability that can be supported by current aircraft equipage	Feb, 2003	Sept, 2003	Documented potential combinations and considerations	FAA draft SAAAR material, Dec, 2003
TG2	T4.2 Identify certification criteria necessary to support current operations.		Sept, 2003	Documented potential combinations and considerations	FAA draft SAAAR material, Dec, 2003

FMS/RNAV Working Group

No.	Subtask	Start	Completion Date	Commentary	Status
FG1	T4.1 Identify the	Feb,	Aug, 2003	Developed criteria for	Complete, Aug,

	means to maximize the utilization of DME in current FMS/RNAV terminal area operations	2003?		DME/DME RNAV system: configuration, performance and capability	2003

General Aviation Working Group

No.	Subtask	Start	Completion Date	Commentary	Status
GA1	Develop issues and recommendations leading to Committee tasks and recommendations		Dec, 2003		Dec, 2003

The General Aviation Working Group (GAWG) of the TAOARC met several times in 2003. The purpose of the meetings was to focus on general aviation's use of non-FMS Area Navigation (RNAV) to improve safety and access to all airports capable of supporting instrument operations. At the same time, the GAWG identified incentives to encourage general aviation to move towards a performance based system.

It has been a relatively good year for general aviation navigation. After years of development, the FAA's Wide Area Augmentation System (WAAS) was approved for instrument operations on July 10, 2003. This NAVAID creates brand new opportunities for affordable navigation systems to emerge in general aviation aircraft. Vertical navigation is about to enter the world of general aviation. Issue identification was a major focus of the GAWG since LNAV/VNAV and LPV approaches (which can be flown using WAAS) are beginning to be developed at general aviation airports.

In addition to WAAS, general aviation pilots continued to purchase, install and utilize Global Positioning Systems (GPS) navigation receivers capable of non-precision instrument approaches and area navigation. Pilots utilizing GPS for instrument approaches rightfully expect to have improved access to general aviation airports over conventional ground based navigation aids.

GAWG strongly supports the WAAS and GPS initiatives by the FAA. However, it is important to recognize that procedures to implement the technical initiatives are imperative to success.

Building on the recommendations of the GAWG from 2002, the group has identified several challenges that need to be addressed by the FAA and industry in 2004 to ensure the success of the technical programs implemented by the FAA. The GAWG recommends that the FAA and industry aggressively pursue resolutions to these challenges. The issues identified require planning and support from many of the FAA's lines of businesses including airports, aviation system standards, air traffic, aircraft/avionics certification and flight standards.

1. **VNAV avionics certification.** There is one general aviation navigation system currently certified to fly approaches with vertical navigation. The cost of this system exceeds $75,000 installed. Other VNAV system certifications may be underway. This activity is not the sole responsibility of the FAA, but the lack of certified equipment tends to send a message to end users that the capability is not available for use.

2. **Lack of VNAV approaches that provide improved access over LNAV approaches.** In 2002, the industry recommended that the FAA implement LPV approaches in support of performance based operations, primarily to the benefit of general aviation. However, the FAA has only published ten (10) RNAV approaches with LPV minimums. The LNAV/VNAV approaches generally have higher approach minima than associated non-precision approaches, providing little access benefit during bad weather conditions. Without LPV-quality approaches, general aviation pilots will utilize non-precision approaches as their primary approach type, reducing one of the major potential benefits of WAAS—vertically-guided approaches to all IFR runway ends.

3. **Approaches using the Z and Y naming convention.** The FAA utilizes an approach naming convention that permits multiple RNAV approaches to the same runway. Unfortunately, only one of these RNAV approaches is available in the navigation system's databases. Depending on the aircraft type, the preferred approach may not be in the navigation database. Not only does this issue prevent pilots from accessing the best approach for their aircraft type, it essentially wastes government resources invested in publishing the second RNAV approach. The issue has been ongoing for several years. Several potential solutions have been identified; however the ultimate solution needs to derive from discussions between the FAA, Jeppesen and the pilot community, and should include publishing all approaches in electronic data bases.

4. **Where beneficial, institute changes to TERPS and TERPS implementation, including**
    a. Increased use of Category A & B-only approaches
    b. Use of multiple step-down fixes inside FAF on LNAV procedures, and reducing the minimum step down fix qualifier to 20 feet.
    c. Increased use of offset final approach courses on LNAV procedures.
    d. Ensuring VNAV approaches have DH of less than 300' AGL and visibilities 1 mile or less (primarily through use of LPV approaches).
    e. Steeper final approach angles on non-precision and VNAV approaches for Category A and possibly Category B aircraft.
    f. Shorter final approach legs for Category A and possibly Category B aircraft.

5. **Lack of survey data.** In 2002, the FAA's office of Aviation System Standards (AVN) published over 250 RNAV approaches at general aviation (non-part 139) airports. Unfortunately, only 25 percent of the approaches had minimums to support vertical guidance. One of the major reasons cited by AVN was the lack of quality survey data at these airports. The FAA (air traffic and airports) need to assemble a strategic plan to ensure that multiple survey vendors are available, the surveys are AIP eligible and airports have a basic outline of the work required to bring RNAV approaches with vertical guidance to their runway ends.

6. **Airport design standards bolstered.** The clearance zone requirements at airports desiring to have LPV, LNAV/VNAV or RNP approaches are substantially larger than those necessary for a conventional ground based VNAV approach. The new standards require nearly 3,000 feet of surface where no obstacles can exceed 50 feet prior to the runway threshold. Therefore, for a 5,000 foot runway to qualify for an RNAV (GPS) approach to each end with VNAV, it would need 6,000 feet of nearly obstacle free surfaces! (i.e., 3000 ft at each end). This may be difficult for airports to accomplish.

7. **Rate of Instrument Procedure Development.** The AVN is currently committed to develop less than 300 lines of minima per year. This includes LNAV, LNAV/VNAV, LPV, ILS, RNP, etc. Also AVN is maintaining over 14,000 instrument procedures, and the rate of development of new approaches may decrease as additional approaches are added. At this low rate of production, the benefits of WAAS and RNP will be minimal for many years, due to the large number of runways needing approaches.

The GAWG recommends that the FAA and industry immediately resolving these issues. The technical challenge has been met, but implementation is lagging. The GAWG believe that if beneficial procedures are implemented, then GA users ill transition towards performance based RNAV. If procedures are not implemented, this will slow the transition of the NAS, force the FAA to maintain ground based NAVAIDS longer and provide ATC services for a "dual NAS" longer. Removing obstacles that prohibit rapid equipage increases the benefit for FAA investments, improves safety, and transitions general aviation navigation into the 21st century.

<u>Vertical Flight Working Group</u>

No.	Subtask	Start	Completion Date	Commentary	Status
VF 1	Develop revisions to Advisory Circular AC 90FPP	Aug, 2002	Nov, 2003		Submitted to JSC – Nov, 2003
VF 2	Revise FAA Order 8260.42B	June 2003			Pending

Vertical Flight Working Group Report

Due to the unique operating characteristics of vertical flight aircraft and their preponderance of operations to non-runway environments, and considering the dominant focus of the TAOARC toward high altitude operations, the Vertical Flight Working Group (VFWG) determined to focus on terminal area operations that primarily affect rotorcraft operations. This partial disengagement from other TAOARC activities avoided the clouding of issues important to fixed-wing communities and allowed the VFWG to work on issues critical to this segment of the industry. The Vertical Flight Working Group met primarily by telephone conference call throughout 2003. The VFWG identified areas for improvement to terminal area operations by providing for better access to the IFR environment, specifically to and from non-runway facilities, i.e., heliports. Procedures that govern the development of instrument approaches and departures within the National Airspace System (NAS) do not reflect rotorcraft characteristics of high maneuverability and increasing sophistication. Therefore, the VFWG identified two documents for revision that would enhance future vertical flight terminal area operations: Advisory Circular AC-90FPP "Development and Submission of Special Instrument Procedures to the FAA" and FAA Order 8260.42A (Helicopter Global Positioning System (GPS) Nonprecision Approach Criteria).

The VFWG identified another deficiency within the terminal area of operations. Currently, the Obstacle Evaluation (OE) Program, overseen by the FAA's Airspace and Rules Division (ATA-400), is applied only to public airports. In the future, the vertical flight community foresees significantly increased utilization of heliports to alleviate capacity problems at airports and enhance the efficiency of intermodal transportation into metropolitan areas. Further, a significant segment of helicopter operations are conducted to and from hospitals, providing a critical lifesaving resource that serves the public good. However, the vast majority of heliports are private and served by "special" instrument approaches. The vertical flight community is faced with a situation whereby obstacles are constructed within the airspace provided for these instrument approaches. Although nothing in regulation forbids the OE Program to be extended to "special" instrument approaches, current policy refuses to consider it. The VFWG, therefore, places great importance in developing an Obstacle Evaluation Program for "special" instrument approaches to heliports.

References

Information related to the Industry Working Groups recommendations can be found at the TAOARC web site, http://ksn-team.faa.gov/taoarc:

Recommendations
The following table contains a list of the recommendations made by the TAOARC. Specific recommendations are provided on TAOARC recommendation forms following this table:

No.	Recommendation Title	Disposition
GEN-P2-001	Committee Work Plan	
RNP-P2-001	Operational and Qualifying Aircraft Criteria	
RNP-P2-002	SAAAR Criteria in 8260.51A	
RNP-P2-003	Baseline DME/DME RNAV	
RNP-P2-004	Approval of Database Supplier Processes	
RNP-P2-005	Development and Submission of Special Instrument Procedures	
RNP-P2-006	RNAV Notice of Proposed Rulemaking	
AWO-002	GBAS Failures and their implication on GLS operations and airworthiness approvals	

Note: These recommendations may include recommended rulemaking, advisory, or policy material. It may also include a proposal for tasking other groups, such as the AWOHWG.

Recommendation No. GEN-P2-001

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** Committee Work Plan

Recommendation:
To enable more effective committee activities in the development of recommendations, analyses, studies, criteria, etc and to balance the increasing number of issues and requested actions, a Work Plan should be developed to guide the Committee. The Work Plan should address the objectives, work structure, and methodology, as well as the tasks, actions, status and priorities. It will also be a basis for determining scheduling priorities and any necessary schedule adjustments to Committee activities. The Committee recommendations and Work Plan will be inputs to the FAA for any changes or additions to the implementation schedule for a Performance-based NAS.

Date:	Action:

Recommendation No. RNP-P2-001

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** Operational and Qualifying Aircraft Criteria

Recommendation:
As the FAA and Industry proceed with the implementation of Performance Based RNP Approaches, the relationship of performance-based procedure criteria to aircraft/systems performance requirements should be established by:

1) defining operational criteria, including performance requirements, to conduct the approach operation;
2) qualifying aircraft against that criteria, including operational mitigations as appropriate.
3) establishing aircraft capability criteria

To facilitate aircraft qualification, aircraft capabilities should be grouped together into categories of similar capability.
The operational criteria should be sufficient to evaluate new aircraft technologies, capabilities, or mitigations without re-consideration of the obstacle clearance criteria or flight inspection criteria.The FAA should use the criteria, technical recommendations and issues developed by the committee in the development of regulatory guidance such as AC's, Notices, HBAT, etc for RNP systems qualification and operational authorization.

Date:	Action:

Recommendation No. RNP-P2-002

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** SAAAR Criteria in 8260.51A

Recommendation

SAAAR criteria should allow for the conduct of instrument approach procedures considering:

1. Existing RNP certified aircraft (e.g. Airbus, Boeing), that provide RNP capability, alerting, displays and appropriate indications, flight planning, systems operational integrity, databases and vertical navigation will be the basis for the RNP SAAAR operations.
2. The procedures will have linear lateral obstacle surfaces at 2xRNP, and vertical obstacle identification surfaces that reflect those of AC120-29A and as further described in Attachment 1.
3. Qualification of new aircraft and systems will be based upon both existing RNP certified aircraft and the appropriate performance, functionality and capability elements from industry standard DO-236, AC120-29A and TSO-C145/C146. This is intended to enable participation and benefits to existing capability and to achieve the greatest level of participation by operationally acceptable aircraft and systems.

In addition, RNP-P2-002 Attachment 1 is a detailed summary of consensus recommendations in response to seven questions posed by the FAA in the paper titled "Data Needed For 8260.51A Completion". *Original FAA questions are printed in blue, italicized font in this paper*

Date:	Action:

Performance – A guiding principle

When possible, the group endeavored to use a performance based concept to determine criteria. Ensuring that aircraft performance correlates with procedure design assumptions has been a guiding principle.

Guideline & Minimum Baseline Assumptions

It was agreed that performance criteria should determine Minimum Baseline assumptions. However, it was recognized that in many/most cases identifying a Guideline assumption, more conservative than the Minimum Baseline assumption, would be necessary. It was felt that procedures should not be designed to some of the limiting (Minimum Baseline criteria) unless there was a valid requirement to do so. Guideline values are identified for some criteria. The Guideline values can be exceeded but may require FAA Flight Standards approval when so stipulated. Examples of where it would be appropriate to exceed Guideline values are when access to a runway is otherwise impossible, where a significant decrease in procedure track miles is attainable, when a "reasonable" decrease in minimums is achievable, or where proximity from terrain can be increased. Guideline values should not be arbitrarily or lightly disregarded. In order to prevent prolonged delay in procedure development the group assumed, and was assured, that the approval or disapproval process for exceeding Guidelines would take weeks, not months. Finally, because the Minimum Baseline design assumptions are performance derived they should not be exceeded in public criteria design.

FAA Question # 1. INITIAL AND INTERMEDIATE SEGMENT TURN RADIUS.

Turn radius calculations are based on assuming a standard rate of turn is flown at the following airspeeds (KIAS) by aircraft category: CAT A 150, CAT B 180, CAT C 240, CAT D/E 250. Is this method satisfactory? If not, we need an alternative method, or a set of standard radii referenced to aircraft category and segment altitude.

The minimum RF turn radius is a function of bank angle and ground speed.

Bank Angle – 25° as the Minimum Baseline limit. 22° Guideline criteria.
Bank angle guidance command limits are set by either the autopilot or flight director systems. Boeing and Honeywell indicated that their systems are limited to 30° bank. Rockwell-Collins indicated that their auto flight systems limit bank to 27°, and Airbus reported a 25° limit. 25° was the agreed consensus position for the Minimum Baseline

Ground Speed
Ground speed is a function of True Airspeed (TAS) and wind. True Airspeed is a function of altitude, temperature and Indicated Aircraft Speed (IAS). Each value was examined separately.

Altitude - RF turn design criteria should be based on the TAS for the highest altitude on any given RF leg.

The group agreed that 8260.51A should stipulate that the TAS for the highest altitude on any given RF turn segment should be used in determining the minimum turn radius for the entire procedure. This ensures that the most conservative value is chosen for any given RF turn, but provides maximum flexibility in tailoring RF turn radii for each unique procedure.

Temperature above ISA

TAS increases with temperature. To account for temperatures higher than ISA the following criteria was developed.

- Criteria will use ISA + 35°C as nominal temperature for TAS calculation
- Criteria will allow option for site specific determination of temperature based on location's meteorological history.

IAS

Guideline IAS Assumption - Procedure design will assume the following IAS';
CAT A 150, CAT B 180, CAT C 240, CAT D/E 250.

Minimum Baseline IAS – The group recognized that for some locations a lower Initial and Intermediate speed may be required to design a suitable procedure. The group agreed that when an RF turn is required in the Initial Segment that cannot be constructed using a 250 KIAS assumption, then the following maximum speed limits may be stipulated at the IAF:

- CAT A - 110 knots
- CAT B - 140 knots
- CAT C/D - 210 knots

The group agreed that when an RF turn is required in the Intermediate Segment which cannot be constructed using a 250 KIAS assumption, then the following maximum speed limits could be required at the (published and named) Intermediate Fix (IF):

- CAT A - 110 knots
- CAT B - 140 knots
- CAT C/D - 180 knots

It was agreed that there could only be one single annotated maximum KIAS per segment i.e. multiple speed limits within a segment are prohibited.

Finally, the group agreed that circumstances may require both a maximum IAF 210 KIAS and maximum IF 180 KIAS assignment. However, due to several complicating factors it was agreed that the two speed limit implementation for an approach would require Flight Standards Approval e.g. differing deceleration rates, differing points at which commanded deceleration is commenced, and increased chart annotations/procedure complexity because of two sequential less than Guideline RF turns.

Wind

Table 1 shows the consensus (tail)wind procedure design criteria. Altitudes from between 1,000 ft and 2,500 ft (inclusive) have both Guideline wind values, and a Minimum Baseline wind value which may be used at a given location after Flight Standards approval.

Altitude	8260.51A WG consensus *Assumption: Values indicate tailwind compnent*
SL	
500	25
1000	37.5/30*
1500	50/35*
2000	51/40*
2500	52/45*
3000	50
3500	55
4000	60
4500	65
5000	70
5500	75
6000	80
6500	85
7000	90
7500	95
8000	100
8500	105
9000	110
9500	115
10000	120
10,500	125
11,000	130

Table 1

NOTE: * Guideline/ Minimum Baseline tailwind.

It was agreed that 8260.51A design criteria should allow the option for a site-specific determination of wind based on that location's meteorological history (using NOAA or FOQA data).

RF Turns – Maximum number of degrees of traverse

The group acknowledged that performance criteria must accommodate RF turns up to 180°, but noted that RF turns could exceed 180°.

FAA Question 2. FINAL APPROACH SEGMENT TURN RADIUS.
*Turn radius calculations are based on assuming a **half**-standard rate of turn is flown at the following airspeeds (KIAS) by aircraft category: CAT A 90, CAT B 120, CAT C 140, CAT D 165. CAT E (specified by proponent). Is this method satisfactory? If not, we need an alternative method, or a set of standard radii referenced to aircraft category and FAF altitude.*

IAS

The Indicated Air Speeds (IAS) shown below were agreed to for RF turn radius criteria for the Final Segment.

CAT A 90, CAT B 120, CAT C 140, CAT D 165. CAT E (specified by proponent)

- Wind – *use same model as adopted for Question #1*
- Temperature – *use same criteria basis (+35°C ISA) as adopted for Question #1*

Criteria allow for site specific determination of wind and temperature

FAA Question 3. JOINING SEGMENTS OF DIFFERING WIDTHS

Many comments were received after publication of 8260.51 from both government (FAA and DoD) and non-federal procedure developers indicating the published method of joining segments of differing widths is too onerous. Request an alternative method more akin to standard TERPS tapering techniques.

It was decided that criteria should not account for FMS latency/ATD/Reaction & Escape time, as is currently the case in 8260.51. This removes questions which arise about how to join segments of varying RNP (width) when accounting for FMS latency/ATD/Reaction & Escape time.

To ensure that an FMS is correctly configured for the RNP at waypoint - *either*

- The FMS must feature "look ahead" capability or
- There must be a crew mitigation through a manual entry of RNP *prior to commencing procedure*

FAA Question 4. AUTHORIZED RNP LEVELS. *Please fill in the blanks of the following table:*

SEGMENT	PUBLIC RNP	SAAAR RNP
En Route	2.0	1.0
Initial	1.0	0.1
Intermediate	1.0	0.1
Final	0.3	0.1
Missed Approach	1.0	0.1

FAA Table

The FAA provided a table with nominal RNP values. The group reached consensus and reviewed and modified the table as shown below (Table2). It was agreed that "En route" did not apply to 8260.51A and it should be removed.

SEGMENT	PUBLIC RNP	SAAAR RNP
~~En Route~~	~~2.0~~	~~1.0~~
Initial	1.0	0.1**
Intermediate	1.0	0.1
Final	0.3	0.1
Missed Approach	1.0	0.1

Table 2

FAA concerns about how to accommodate for the transition from en route to the Initial Segment were resolved as indicated below.

Initial - Consensus**

The group decided that the need for operational flexibility required that an aircraft be able to transition to an RNP approach from non-RNP airspace, or from a non RNP leg e.g. "cleared direct to IAF". This requires that TERPS accommodate varying geometries for entry (See Fig 1).

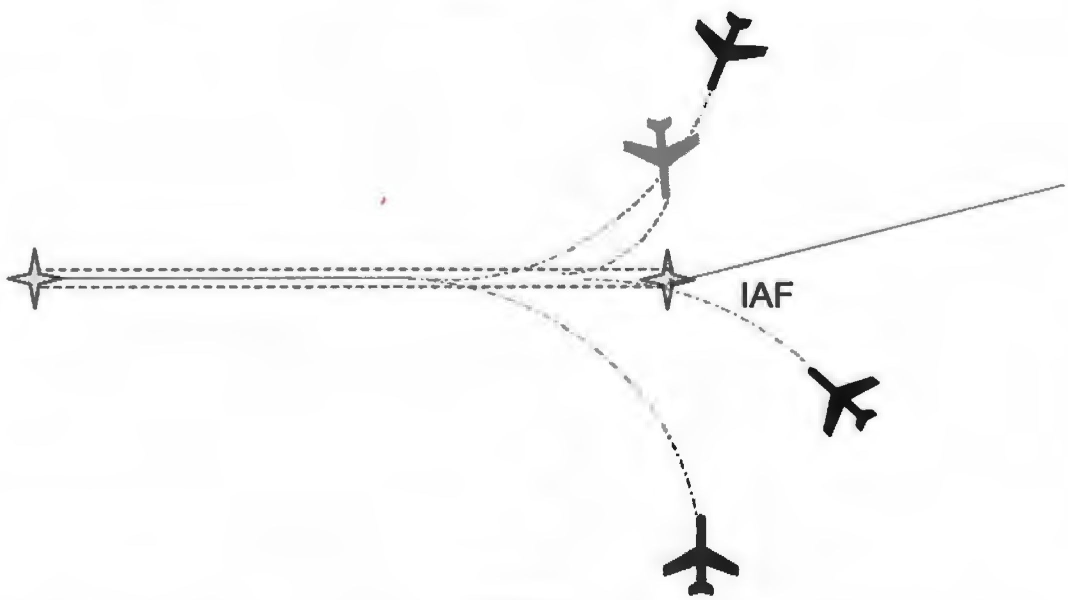


Figure 1

It was decided that there should be a TERPS obstacle protected area around the IAF (See Fig 2). This area would assure flight safety until the aircraft was established on the RNP course meeting RNP criteria.

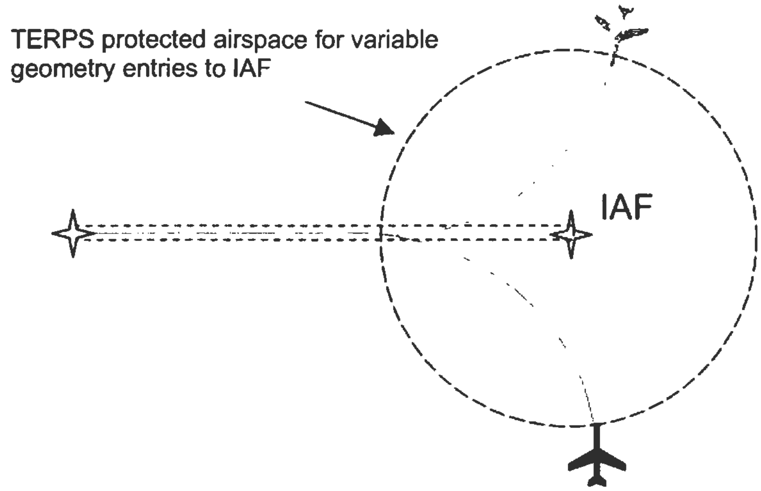


Figure 2.

FAA Question 5. RF TURNS ON FINAL APPROACH.

Our preliminary criteria requires a design that places the aircraft on centerline at an altitude nominally at 1000 feet feet above LTP elevation, at a distance from threshold, with a provision to roll out 500 feet above LTP if an operational imperative exists. Is this method satisfactory? If not, we need an alternative method, or a different minimum altitude/distance from LTP that the turn must terminate (what is the minimum straight-in distance required)?

The group agreed with the FAA position as stated above

- Guideline criteria – aircraft on centerline at 1,000 ft
- Minimum Baseline – aircraft on centerline at 500 ft "if an operational imperative exists" (Flight Standards Approval Required)

(Guideline criteria for operational imperative = Improves minimums by at least 100ft or ¼ mile)

FAA Question 6 MISSED APPROACH RNP LEVEL EQUAL TO FINAL SEGMENT. *In the draft criteria, the reduced RNP missed approach can extend throughout the missed approach to the missed approach holding point. Is this satisfactory? If not, what is the maximum distance from MAP that the level can apply? Are turns and/or speed restricted when the missed approach RNP is less than 1 NM? If so, how do you determine the restriction?*

Consensus was achieved on the following aspects for procedure missed approach design.

- Criteria assumes aircraft can maintain RNP capability during missed approach
- Criteria assumes RNP may extend up to the missed approach holding point
- Criteria will contain a straight segment (for missed approach) that extends to the Departure End of Runway. Turns may initiate at that point.
- Criteria guidelines will establish that small RNP values will not be arbitrarily selected during the design process

Missed Approach IAS
The following speeds were defined:

1. Guideline – 250 KIAS (for RF turn construction)

2. Minimum Baseline – 210 KIAS (requires flight standards approval)

3. Waiver – 180 KIAS when no other alternative available. Must be approved by waiver.

FAA Question 7.

Preliminary default VNAV criteria is based on FAA Order 8260.47 error budgets and criteria. In keeping with a performance-based philosophy, for approach operations where a reduced vertical error budget is required, the intent of the TERPS criteria is only to provide a means to define the operational requirement, and not a means to comply with it. Therefore, the proposal is to use the AC 120-29A nomenclature of RNP-0.3/125, where 2x0.3NM indicates the width of the obstacle clearance and 2x125' indicates the height of the obstacle clearance. However, since there is broad industry consensus that the procedure designer should account for the effects of deviation from standard atmosphere conditions, the proposed vertical criteria would be 2x125' + Dev ISA. The designator "125" could be scaled to reflect the operational requirement for the approach, down to values as small as 45' (in keeping with AC 120-29A vertical requirement for Category I approaches).

Vertical Error Budget (VEB)

The VEB formula, using the values supplied by Boeing will be used to determine the OCS. Additionally, it was recommended that the VEB be included as an Appendix to 8260.51A. The Appendix would serve to both record and explain the rationale for the OCS in 8260.51A and as a reference source when developing "special" i.e. non-public, procedures.

The group agreed to note that the assumptions used to derive the OCS from the VEB *"apply to procedure design only"* and do not necessarily address certification requirement/performance issues. Concern was raised on the following issues which will need to be addressed by a separate working group:

1) 4 sigma as an appropriate value to define Target Level of Safety (TLS)
2) Horizontal coupling error assumptions
3) Static Source Error being treated as Gaussian
4) Flight Technical Error (FTE) and assumptions about its relationship between long track error and vertical error.

Application of VEB to TERPS

The VEB OCS will apply to the Final Approach Segment out to 6 NM. When a FAF is located beyond 6 NM from runway threshold VEB procedure design elements apply provided *either:*

1. a hazard analysis is performed *or*
2. a flight standards waiver is granted

Normal TERPS criteria will apply to the Intermediate and Initial segments.

Cold Temperature Assumption in Procedure Design

To account for the effects of temperatures below ISA on obstacle clearance the following consensus position was developed.

1. Guideline criteria assumption of -30 ISA deviation
2. Criteria will allow option for site specific determination of temperature based on location's meteorological history.

Number of lines of Minima

Although not part of the FAA's 7 questions the group felt that it should develop guidelines concerning the number of lines of minima, and the associated RNP levels which may be displayed on aeronautical charts. The group is aware that this subject goes beyond the scope of this WG but felt that the Air Charting Forum (ACF) and others deserve a well thought out position with rationale from this 8260.51A WG before addressing RNP SAAAR Charting. The work on lines of minima and RNP levels for charting should be completed by 30 NOV and will be forwarded to the FAA.

Recommendation No. RNP-P2-003

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** Baseline for DME/DME RNAV

Recommendation

RNP-P2-003 Attachment 1 provides information and recommendations for minimum performance standard (baseline) DME/DME RNAV Systems for en route and terminal operations (RNAV routes, SIDs and STARs) with total system accuracy performance of 2.0 NM (95%). These recommendations should be used in the FAA performance and infrastructure assessment procedures and tools, and in any relevant airspace and procedure design criteria.

Date:	Action:

RNP-P2-003 Attachment 1: Proposed Changes following the July 25, '03 Telecon:

Primary Objective: Define minimum performance standard (baseline) DME/DME RNAV Systems for en route and terminal operations (RNAV routes, SIDs and STARs) with total system accuracy performance of 2.0 NM (95%).

Multi-Sensor RNAV Enablers

1. The FAA is responsible for evaluating DME/DME coverage and availability against minimum standard DME/DME RNAV system for each route and procedure. Operators without GPS that confirm they meet or exceed the minimum standard can operate on RNAV routes, SIDs and STARs where the FAA invokes this minimum standard.
2. Operators can get approval for these operations based on different RNAV and/or sensor performance, but the operator then takes responsibility for analysis of DME coverage and availability. The operator can still ask for FAA assistance, assuming FAA resource availability. However, by keeping this an operator responsibility, the operator can expect no procedure/operational NOTAM or procedure-designated service from the FAA based on this superior capability (NOTAMs would still be issued for DME facilities). Specific guidance for this approval process must be developed.
3. The baseline DME/DME minimum performance standard must factor the available infrastructure and accommodate most DMD/DME RNAV systems. For routes and procedures designed using this minimum standard, the FAA will assess if adequate DME/DME coverage is available on the routes and procedures using FAA tools and assets (e.g., flight inspection assets, computer modeling). This assessment of DME/DME coverage will also determine if an expanded service volume (ESV) is necessary for select DME facilities. Thus, there shall be no requirement to use VOR, LOC, NDB, IRU or AHRS during normal operation of the DME/DME RNAV system.
4. Additional requirements (not related to DME/DME) to operate on the routes or procedures include:
    a. Carriage of at least one RNAV system (e.g., FMS).
    b. Carriage of a current navigation database containing all navigation aids, waypoints, routes and procedures the RNAV system will use.
    c. A flight technical error contribution not exceed 1.0 NM (95%) (e.g., the guidance on flight technical error found in AC 20-130A).
    d. The availability of continuous radar monitoring along the entire route or procedure (e.g., if radar monitoring is lost and no longer available, the route or procedure shall no longer be available).
5. All DME facilities maintained by the FAA and used to define the availability of these RNAV routes or procedures shall comply with applicable ICAO facility maintenance and performance standards. To meet this requirement, the FAA could: 1) bring all available DME facilities into compliance; 2) decommission noncompliant facilities; or 3) require removal of noncompliant DME facilities from the aircraft's on-board navigation database.

6. The FAA cannot ensure that foreign DMEs (e.g., Canadian & Mexican DME facilities) meet ICAO standards on for use on these domestic RNAV routes and procedures. However, the FAA and operators could mitigate this by:
    a. Restricting development of routes/procedures to regions outside the DME reception range of foreign DME facilities until coordination with the foreign civil aviation authorities confirms compliance with the ICAO standards.
    b. Requiring exclusion of foreign DME facilities from the navigation database when the RNAV routes or procedures are within reception range of these foreign DME facilities.
    c. The operator demonstrating to the FAA that the RNAV system performs reasonableness checks to detect errors from the foreign DME facilities and excludes these facilities from the navigation position solution when appropriate (e.g., using the ARINC 424 coding to preclude tuning co-channel DME facilities when the DME facilities signals-in-space overlap).
7. The FAA also cannot ensure all U.S. Department of Defense (DOD) maintained DME facilities (e.g., TACAN facilities, including DOD-maintained VORTAC facilities) meet ICAO standards. Thus, the RNAV routes and procedures should not rely on use of these DOD facilities. However, the FAA and operators may mitigate this restriction by:
    a. Restricting development of routes/procedures to regions outside the DME reception range of DOD-maintained DME facilities until the FAA can assure the facilities comply with ICAO standards.
    b. Requiring exclusion of DOD-maintained DME facilities from the aircraft's navigation database when the RNAV routes or procedures are within reception range of these DOD DME facilities.xcluded from the navigation database.
    c. The operator demonstrating to the FAA that the RNAV system performs reasonableness checks to detect errors from the DOD DME facilities and excludes these facilities from the navigation position solution when appropriate (e.g., using the ARINC 424 coding to preclude tuning co-channel DME facilities when the DME facilities signals-in-space overlap).

Operational mitigations will/shall not require:

1. Pilot action during critical phases of flight.

2. Pilot monitoring the RNAV system's navigation updating source(s).

3. Time intensive programming or blackballing of *multiple* DME stations prior to executing a procedure.

Note: Blackballing single facilities NOTAM'd out-of-service and/or programming route/procedure-defined "critical" DME's is acceptable when this mitigation requires no pilot action during a critical phase of flight. A programming requirement also does not imply the pilots should complete manual entry of DME facilities that aren't in the navigation database.

Instead, this allows RNAV systems to tune a critical DME, as appropriate to a specific route or procedure. Also, the FAA shall not implement RNAV routes and procedures in regions requiring manual blackballing of a DME facility prior to flying the route or procedure on a permanent basis.

Note: The critical phase of flight is normally from the intermediate fix on an approach procedure, or below 2,500 ft AFE on a departure.

Minimum Performance Standard for each Route or Procedure:

The total system accuracy must be less than or equal to 2.0 NM (95%) throughout the route.

Note: The FAA assures that systems meeting the DME/DME RNAV minimum performance standard satisfy this requirement on all identified routes and procedures, and these RNAV systems do not require further evaluation. Systems seeking approval using different RNAV system characteristics or performance must demonstrate this performance for each published route or procedure.

Minimum Standard DME/DME RNAV System: The minimum standard DME/DME RNAV system shall:

1. Position update within 30 seconds of tuning DME navigation facilities.
2. Tune multiple DME facilities.
3. Provide continuous DME/DME position updating (given a third DME facility or a second pair has been available for at least the previous 30 seconds, there must be no interruption in DME/DME positioning when the RNAV system switches between DME stations/pairs.)
4. When needed to generate a DME/DME position, FMS must use, as a minimum, DMEs with a relative include angle between 30 degrees and 150 degrees. The FMS may use DME pairs outside these angles (for example, 20 degrees to 160 degrees).
5. When needed to generate a DME/DME position, as a minimum, the RNAV system must use an available and valid DME (excluding localizer DMEs) anywhere within the following region around the DME facility:
    - Greater than or equal to 3 NM from the facility; and
    - Less than 40 degrees above the horizon when viewed from the DME facility; and
    - For facilities with an ARINC 424 figure of merit (FOM) of 0, less than or equal to 40 NM from the facility and below 12000' above the facility;
    - For facilities with a FOM of 1, less than or equal to 70 NM from the facility and below 18000' above the facility;
    - For facilities with a FOM of 2, less than or equal to 130 NM from the facility;

- For facilities with a FOM of 3, less than or equal to 240 NM from the facility.

  Note: Many RNAV systems can use additional DME facilities (e.g., LOC DMEs, or DMEs outside this region). However, to gain credit for this additional capability the operator should refer to the requirements in item 2 of this paper, Multi-Sensor RNAV Enablers. For the purpose of this standard, a valid DME is a facility that broadcasts an accurate signal with a facility identifier, satisfies the minimum field strength requirements, and is protected from other interfering DME signals according to the co-channel and adjacent channel requirements. This requirement does not require an RNAV system to use the FOM value – an RNAV system using all facilities out to a distance of 240 NM or greater from the facilities meets this requirement.

6. Given any two DME facilities satisfying the criteria in items 4 and 5, and any combination of other valid DME facilities not meeting that criteria, the 95% position estimation accuracy must be better than or equal to 1.75 NM.

   Note: This performance requirement is met for any navigation system that uses two DME stations simultaneously, limits the DME inclusion angle to between 30 and 150 degrees, has small latency errors, and uses DME sensors that meet the accuracy requirements of TSO-C66c. Such a system just barely satisfies this requirement when the only available facilities are at the maximum range of 240 NM and an inclusion angle of 30 or 150 degrees. If the RNAV system uses DME facilities outside the range identified above, the DME signal-in-space error can be assumed to be 0.1 NM 95%.

7. The RNAV system must ensure co-channel DME facilities do not cause erroneous guidance. Examples of how this could be accomplished include reasonableness checking when initially tuning a DME facility or excluding a DME facility when there is a co-channel DME within line of sight

   Note: The DME assessment cannot use a DME facility when there is a co-channel DME facility within line of sight.

8. The RNAV system must ensure an erroneous VOR signal-in-space does not affect the position accuracy. Examples of how this could be accomplished include not using VOR signals since DME/DME will be available or weighting and/or monitoring the VOR signal with DME/DME to ensure it is no misleading position results (e.g., through reasonableness checks).

9. The RNAV system must not use DME facilities that are not operational (indicated by lack of Morse ident or the ident 'TEST'). Examples of how this may be accomplished by the FMS checking the ident or by manually inhibiting the use of facilities that are identified as not operational.

   Note: It may be possible for reasonableness checks to address the issue of the use of facilities under test. However, the operator would have to *demonstrate the sufficiency of the reasonableness checks and to gain credit for this capability the operator is referred to the requirements stipulated in Multi-Sensor RNAV Enablers,* ***Item 2 (top of this paper).***

Applicable References:

1. TSO-C115B, Airborne Area Navigation Equipment Using Multi-Sensor Inputs
2. AC 25-15, Approval of Flight Management Systems in Transport Category Airplanes
3. AC 20-130A, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors

Recommendation No. RNP-P2-004

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** Approval of Database Supplier Processes

Recommendation

As airspace operations, procedures, and aircraft move toward performance based operations and RNAV, where there is an increasing need for accurate, reliable, repeatable and predictable performance, industry and regulatory views are indicating a need for greater rigor in the processes associated with aeronautical data incorporated in navigation databases. The nature of database products where there is a known and managed data file structure and content but significant factors such as the dynamic nature of change, the manipulation of data as appropriate to different files/structures, and a means of data assurance should be managed through process assurance, not product certification.

The result of committee discussion resulted in the following recommendation:

- Guidance criteria should be developed that provides data suppliers with a letter of authorization (LOA) for the production of database products.
- The LOA from the FAA will follow a supplier application that provides evidence of procedures and processes for the production of databases, along with configuration management/control, and data quality management.
- The LOA will remain in effect until changes such as new data content, format, structure warrant changes in tools, production processes and procedures; at which time a revised LOA application and approval will be necessary.
- Such guidance should be harmonized internationally to ensure that a only a one time authorization will be necessary.
- Due to the potential significant cost impacts for this activity, any LOA criteria should be subject to a "field trial" and validation where voluntary participation by data supplier organization(s) is encouraged.

Date:	Action:

Recommendation No. RNP-P2-005

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** Development and Submission of Special Instrument Procedures

Recommendation

AC90-FPP should be developed and published to provide guidance and criteria in the development and submission of special instrument procedures, with consideration of:

- A process and criteria for designated private developers will be developed.
- Requests for the development of special instrument procedures can originate from within and outside of the FAA.
- The FAA will authorize individual qualified expert applicants based upon FAA/Industry agreed criteria
- The FAA will retain a role in quality management and assurance for such procedures
- Flight inspection will be performed by either the FAA or in the case of advanced procedures and aircraft, via an FAA/Operator/Industry agreed upon Flight Inspection Policy.

Date:	Action:

Recommendation No. RNP-P2-006

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** Foreign Terminal Instrument Procedures
Recommendation 8260.31 should be revised to facilitate the use, development and maintenance of FTIP. This should consider the roles and responsibilities of the FAA, certificate holders, and foreign agencies, as well as the need for additional coordination and authorization processes.	
Date:	Action:

Recommendation No. RNP-P2-007

TAOARC Recommendation

Date: 13 Jan 2004	**Title:** RNAV Noticed of Proposed Rulemaking

Recommendation

The recommended disposition of comments to the RNAV Notice of Proposed Rulemaking Docket No. FAA-2002-FRI14002 should be reflected in suggested rule changes. The effects of these rule changes should be disseminated into the apppropriate FAA documents such as operations specifications, FAA Orders providing inspector guidance and others as needed to assure consistency with the updated rule language. The guidance for complying with the referenced rules should be provided in a timely way.

Date:	Action:

Recommendation No. AWO-002

TAOARC Recommendation

Date: 1 November 2003	Title: GBAS Failures and their implication on GLS operations and airworthiness approvals

Recommendation:

The AWOHWG has completed its work on AHI 1008 - GBAS Failures and their implication on GLS operations and airworthiness approvals.

The Group has completed its assessment of the GBAS failures to be addressed during the certification of the airborne elements used to conduct GBAS Landing System (GLS) operation to Category I minima. Two GBAS failure modes need to be addressed:

The two GBAS failure modes to be addressed during the airworthiness demonstration of airborne systems to support Category I approach operations are:

1. Loss of VDB data (for greater than 3.5 seconds) – e.g. the ground station transmitter fails or the ground station stops sending data and shuts down due to another detected ground station failure.
2. Ground station provides data that biases the flight path to a value at or near the Alert Limit

The AWOHWG recommends that the above criteria be incorporated into Appendix 2 of AC 120-29A in the next update to that AC. The JAA/EASA will incorporate similar criteria in appropriate European criteria.

Date:	Action:

U.S. Department of Transportation

Federal Aviation Administration

Advisory Circular

AC 120-29A

August 12, 2002

CRITERIA FOR APPROVAL OF CATEGORY I AND CATEGORY II WEATHER MINIMA FOR APPROACH

Forward. This advisory circular (AC) provides an acceptable means, but not the only means, for obtaining and maintaining approval of operations in Category I and II Landing Weather Minima including the installation and approval of associated aircraft systems. It includes additional Category I and II criteria or revised Category I and II criteria for use in conjunction with RNAV, Required Navigation Performance (RNP), VNAV, xLS, satellite navigation systems (GLS), Head up Displays (HUD), and Category II during certain engine inoperative operations. This revision also updates and incorporates provisions of the former AC 120-29 through Change 3 into the revised AC 120-29A.

This revision incorporates changes resulting from the first steps toward international all weather operations (AWO) criteria harmonization taken by the Federal Aviation Administration (FAA), European Joint Aviation Authorities (JAA), and several other regulatory authorities. Subsequent revisions of this AC are planned as additional all weather operations harmonization items (AHI) are agreed and completed by FAA JAA, and other regulatory authorities.

/s/
Nicholas A. Sabatini
Associate Administrator for Regulation and Certification

TABLE OF CONTENTS

1. PURPOSE. This advisory circular (AC) provides an acceptable means, but not the only means, for obtaining and maintaining approval of Category I and II Weather Minima including the installation and approval of associated aircraft systems. This AC is applicable to Title 14 of the Code of Federal Regulations (14 CFR) parts 121, 135, and those part 125 operators not exempted under section 125.1 or not having received an applicable deviation authorization under section 125.3. Certain aspects of this AC are applicable to 14 CFR part 129 operators. Many of the principles, concepts, and procedures described also may apply to 14 CFR part 91 operations and are recommended for use by those operators when applicable.

a. This AC provides some guidance that may be applicable to operations conducted by civil helicopters and powered-lift aircraft. Supplementary guidance for those aircraft may be provided by other FAA or industry documents.

b. Mandatory terms used in this AC such as "shall" or "must" are used only in the sense of insuring applicability of these particular methods of compliance when the acceptable means of compliance described herein is used. This AC does not change, add, or delete regulatory requirements or authorize deviations from regulatory requirements.

c. Major changes introduced in this revision include new provisions for Required Navigation Performance (RNP), Vertical Navigation (VNAV), Flight Management System (FMS), Global Navigation Satellite System (GNSS), Head Up Display (HUD), Global Positioning System (GPS) or GNSS Landing System (GLS), revised obstacle assessment criteria related to RNP, and revised airborne equipment requirements for Category I and II.

d. With issuance of AC120-29A, the former AC 120-29, Criteria for Approving Category I and Category II Landing Minima for FAR 121 Operators, dated December 3, 1974, is canceled.

2. RELATED REFERENCES AND DEFINITIONS.

2.1. Related References.

a. Regulations. 14 CFR part 91, sections 91.175, and 91.189; 14 CFR part 121, sections 121.579, and 121.651; 14 CFR part 125, sections 125.379, and 125.381; 14 CFR part 129, section 129.11; and 14 CFR part 135, section 135.225; 14 CFR part 25, sections 25.1309, and 25.1329.

b. ACs. Current editions of: AC 120-28, Criteria for Approval of Category III Landing Weather Minimal; AC 20-129, Airworthiness Approval of Vertical Navigation (VNAV) Systems for Use In the U.S. NAS and Alaska; AC 20-130, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors; AC20-138, Airworthiness Approval of GPS Navigation Equipment for use as a Supplemental Navigation System; and AC 25-15, Approval of Flight Management Systems in Transport Category Airplanes.

c. Orders. FAA Orders 8400.8, Procedures for Approval of Facilities for FAR Part 121 and Part 135 CAT III Operations; 8400.10, Air Transportation Operations Inspector's Handbook; 8400.13, Procedures for the Approval of Category II Operations and Lower Than Standard Category I Operations on Type I Facilities; and 6750.24, Instrument Landing System (ILS) and Ancillary Electronic Component Configuration and Performance Requirements.

d. OpSpecs. Standard Operations Specifications Part A and C.

e. Foreign. Joint Aviation Authority (JAA) ACJ AWO 231, Flight Demonstration (Acceptable Means of Compliance) dated August, 1996.

2.2. Definitions. A comprehensive set of definitions pertinent to Category I and II is included in Appendix 1.

3. BACKGROUND.

3.1. Major Changes Addressed in this Revision. This advisory circular includes additional Category I and Category II criteria or revised Category II criteria for use of Head up Displays, use of Required Navigation Performance (RNP), satellite based navigation, and "engine inoperative" Category II approach procedures. This revision expands information regarding Category I approach procedures, and now includes material pertinent to types of approach procedures other than ILS, MLS, or GLS (e.g., also addresses approaches previously considered as non-precision approaches).

a. This AC also clarifies existing criteria to address frequently asked questions.

b. This revision incorporates changes resulting from the first steps toward international all weather operations (AWO) criteria harmonization taken by the FAA, European JAA, and several other regulatory authorities. Subsequent revisions of this AC are planned as additional all weather operations harmonization items (AHI(s)) are agreed and completed by FAA and JAA, or internationally.

3.2. Relationship of Operational Authorizations for Category I or Category II and Airborne System Demonstrations. Approach weather minima are approved through applicable operating rules, use of approved instrument procedures and issuance of Operations Specifications (Op-Specs)*. Airworthiness demonstration of aircraft equipment is usually accomplished in support of operational authorizations on a one-time basis at the time of Type Certification (TC) or Supplemental Type Certification (STC). This demonstration is based upon the airworthiness criteria in place at that time. Since operating rules continuously apply over time and may change after airworthiness demonstrations are conducted, or may be updated consistent with safety experience, additional Category I or Category II credit or constraints may apply to Operators or aircraft as necessary for safe operations. In general, criteria related to operational approval is contained in the main body of this AC and criteria related primarily to the airworthiness demonstration of systems or equipment is included in the appendices to this AC.

> ***NOTE: Operations Specifications are unique Federal Aviation Regulations applicable to a particular operator. OpSpecs are based on the regulations. However, they are specifically applicable to and tailored to a particular operator's aircraft, routes, and operating circumstances. Standard Operations Specifications are developed by FAA and provided to FAA field offices to aid in development and issuance of the particular and unique OpSpecs issued to each operator.**

3.3. Applicable Criteria. Except as described below, new airworthiness demonstrations or operational authorizations should use the criteria of AC 120-29A. Airworthiness demonstrations may use equivalent JAA criteria where agreed by FAA through the FAA/JAA criteria harmonization process. Operators electing to comply with these revised criteria may receive additional credit when using the revised criteria. Aircraft manufacturers or modifiers may elect to demonstrate their aircraft using the revised criteria to seek credit for additional operations. Aircraft demonstrated using earlier criteria may continue to be approved for Category I or Category II operations in accordance with (IAW) that earlier criteria. Operators seeking additional credit provided for in this AC must, however, use the criteria of this AC for that credit.

3.4. Category I, II, and III Terminology.

a. Since 1985, the FAA has referred to all approaches other than Category II or Category III as Category I, for purposes of regulatory authorization for part 121, 125, 135, and 129 operators (e.g., Operations Specifications). Thus for consistency and continuity, all Category I approach procedures and operational authorizations are now addressed in this AC. In addition to typical Category I Instrument Landing System (ILS), Microwave Landing System (MLS) and Global Navigation Satellite System (GNSS) Landing System (GLS) procedures (e.g., procedures historically considered as precision approach), information about approaches other than ILS, MLS, and GLS are now included (e.g., procedures historically considered as non-precision approach). The use of the term "non-precision" has been dropped within this AC to reduce confusion which exists with use of this term with current and future systems and authorizations, particularly with Vertical Navigation (VNAV) and Area Navigation (RNAV), and with other approaches that may incorporate the use of barometric VNAV to provide a stabilized descent path to a runway.

b. Accordingly, Category I, II, and III terminology used in this AC is based on and is consistent with current U.S. Standard Operations Specifications for part 121, 125, 135, and 129 Operators. Definition usage is also consistent with other ACs (e.g., AC120-28D). Definitions of instrument approach Categories in current use in the U.S. are listed in Appendix 1 of this AC (i.e., Category I, Category II, Category IIIa, IIIb, and IIIc). While there are slight variations of these definitions as used within ICAO and various countries internationally, the broad objectives and practical operational applications are similar. It is significant to note that for U.S. applications to part 121, 125, 135, and 129 operators, Category I is considered to include any instrument approach procedure having minima not less than 200 ft. Height Above Touchdown (HAT) and RVR not less than 1800ft. Accordingly, approaches such as Localizer (LOC); LOC BCRS; Localizer-Type Directional Aid (LDA); Simplified Directional Facility (SDF); Very High Frequency (VHF) Omni-directional Radio Range (VOR); Non-Directional Beacon (NDB); and RNAV are each considered to be Category I approaches. In other states, Category I may only apply to straight-in ILS or MLS instrument procedures. Also, in certain states, lowest authorized minima may be slightly different than as promulgated by the U.S. or ICAO criteria. In a few states, these approach categories relate more closely to aircraft configuration or ILS facilities used, rather than directly landing minima (e.g., Decision Altitude (Height) (DA(H)) and visibility or RVR).

3.5. Requirement for Evaluation Prior to Operations. Instrument approach procedures in the United States and its territories must be validated by an authorized FAA process. Special procedure requests should be made through the CMO to AFS-400.

4. OPERATIONAL CONCEPTS.

4.1. Classification and Applicability of Minima. Landing minima are generally classified by Category I, Category II, and Category III. Definitions for Category I, II, and III are as specified by ICAO and individual states. For the U.S. these definitions are as included in Appendix 1. Certificate Holding District Offices (CHDO) and Operators should be aware that slight differences exist in definition and use of Category I, II, and III terminology in international operations. Operators should ensure that any differences in definitions do not adversely affect intended operations (see Paragraph 3.4 above).

a. This AC addresses criteria for Category I and Category II instrument approach operations. AC 120-28 addresses takeoff in low visibility conditions and Category III landing operations.

b. Landing minima are generally addressed by parts 91.175, 121.649, 121.651, 121.652 and standard or special OpSpecs Part C. Application of these definitions of Category I, II, and III to landing is discussed in paragraph 4.3.1 below.

c. Although a wide variety of normal and non-normal situations are considered in the design and approval of systems and procedures for Category I and Category II, landing weather minima are primarily intended to apply to normal operations. For non-normal operations, flightcrews are expected to take the safest course of action appropriate for the situation, notwithstanding landing weather minima. When aircraft systems have been demonstrated to account for certain non-normal configurations and a procedure is specified (e.g., an approach with an engine inoperative non-normal procedure), the flightcrew may take account of this information in assessing the safest course of action. In addition, when inoperative aircraft systems have been accounted for in the Airplane Flight Manual (AFM) as an alternate configuration using criteria of this AC (e.g., an approach with an engine inoperative is specified as a demonstrated configuration) operational credit for that configuration (alternate minima credit) may be authorized.

d. Takeoff minimums are generally addressed by parts 91, 121, 135, and standard or special OpSpecs. Application of takeoff minima is discussed in paragraph 4.2 below.

4.2. Takeoff.

a. Takeoff Minima.

(1) Takeoff minima are addressed by sections 91.175(f), 121.649, 121.651, 135.225, and standard or special OpSpecs Part C. The authority for lower than standard takeoff minima is contained in sections 135.225(h)(3) and 121.651(a)(1).

(2) OpSpecs are applicable to part 121 and 135 Operators and certain other Operators (e.g., part 125 and part 129). Where minima lower than that provided in standard OpSpecs are necessary, applicable criteria for use of those minima are specified in AC 120-28D. When appropriate, principal operations inspectors (POI(s)) issue OpSpecs specifying the lower minima through paragraph C056 for part 121 Operators and OpSpecs paragraph C057 for part 135 Operators. OpSpecs contain specific guidance regarding pilots, aircraft, and airports when lower than standard takeoff minimums are used.

b. Takeoff RVR Equivalence and Assessment (See also 8.6.3). For takeoff procedures where minima are published only in terms of RVR, but visibility is being reported as a meteorological visibility, tables referenced in Standard OpSpecs may be used to establish equivalent RVR (see Appendix 7, OpSpec Paragraph). This table does not apply to minima published as meteorological visibility being reported as RVR

c. Pilot Assessment of equivalent RVR. For takeoff circumstances where Touchdown Zone RVR is inoperative or is determined by the pilot to be significantly in error (e.g., patchy fog obscuring a transmissometer but not the runway, snow on transmissometer causing erroneous readings), a pilot assessment may be made in lieu of RVR (see Appendix 7, OpSpec Paragraph C078).

(1) To be eligible to use this provision the operator must ensure that each pilot authorized to make this determination has completed approved training addressing pilot procedures to be used for visibility assessment in lieu of RVR, and the pilot can determine the necessary runway markings or runway lighting that must be available to provide an equivalent RVR to that specified to ensure adequate visual reference for the takeoff.

(2) When any pilot assessment of equivalent RVR is made, the pilot must be able to positively determine position on the airport and correct runway, and positively establish that the aircraft is at the correct position for initiation of takeoff. Typically this equivalent RVR assessment is applicable only at a runway threshold where runway identifying markings and number(s) are visible from the takeoff position (e.g., not applicable to intersection takeoffs).

(3) When such a pilot RVR assessment is made, the result of the assessment should typically be provided to any pertinent air traffic facility when practical, and may also be provided to the operator (e.g., dispatch) to facilitate other operations.

4.3. Landing.

4.3.1. Approach and Landing Concepts and Objectives. Landing minima are classified as Category I, Category II, and Category III. Definitions of these categories are provided in Standard OpSpecs Part A paragraph A002, and in Appendix 1. While generally consistent with ICAO definitions, the definitions used in Standard OpSpecs, where different from ICAO, apply and take precedence for U.S. operators, or for international operators conducting operations within the United States, or at U.S. facilities.

a. For U.S. Operators, any instrument approach with a DA(H) or Minimum Descent Altitude (Height) (MDA(H)) and visibility above that specified in OpSpecs for Category I, (see Appendix 7) is considered to be a Category I operation (e.g., an approach with either a DA(H) or an MDA(H) which is not lower than 200 ft. HAT and visibility not less than 1800 RVR is considered to be Category I, even though it may be based on a Navigational Aid (NAVAID) other than ILS).

b. Any instrument approach with a DA(H) or visibility less than that specified for Category I, but above that specified for Category II, is considered to be a Category II operation.

c. Any instrument approach with a DA(H) less than that specified for Category II (or with no DA(H) or with an Alert Height), or with a visibility less than that specified for Category II, IAW applicable OpSpecs is considered to be a Category III operation.

d. Category I operations may be conducted manually using raw data information, by reference to flight guidance displays (flight directors), or automatically using approved autopilot or autoland systems. However, air carrier operations, particularly with turbine powered aircraft, typically have minima restricted by OpSpecs if a flight director or autopilot is not used.

e. For Category I, basic airworthiness certification for IFR under provisions of 14 CFR part 25 typically is considered an acceptable means of demonstration of capability for operational acceptance of an aircraft and its associated systems. Specific criteria for airworthiness demonstration of certain specific systems or capabilities for Category I are included in Appendix 2 (e.g., FMS or RNP).

f. For Category I minima, it is expected that for non-normal operations (e.g., engine(s) inoperative, hydraulic or electrical system(s) failure) the pilot or operator should consider any necessary adjustment of operating minima, wind limit constraints, or other factors to ensure safe operation with the non-normal condition.

g. Category II operations may be conducted manually using flight guidance (e.g., flight director) displays. However, most Category II operations are conducted using an autopilot or autoland system, or with combinations of systems using both automatic and flight guidance (e.g., flight director) elements. Additional demonstration or operational assessment beyond that required for basic IFR flight under provisions of basic aircraft 14 CFR part 25 type certification typically is necessary for operational authorization of an aircraft for Category II (see Paragraph 5 and Appendix 3). Specific criteria for airworthiness demonstration of systems or capabilities for Category II are included in Appendix 3 (e.g., for flight director(s), autopilot(s), or HUD) for cases where an applicant seeks prior credit for such a prior airworthiness demonstration documented in the AFM).

h. For Category II minima, certain non-normal conditions are typically considered in the assessment and authorization process. Response to those non-normal conditions may be explicitly defined in the Category II authorization (e.g., engine failure, electrical component failure, or engine inoperative Category II). For failures other than those addressed by the Category II authorization, the pilot or operator may need to adjust the operating minima used, introduce wind limit constraints, or address other factors to ensure safe operation for the particular non-normal condition.

4.3.1.1. Operational Safety Evaluation. For any instrument approach using either Category I or Category II minima, the operator must adequately consider and provide for safe operations considering at least the following:

a. The possibility of a failure of any one of the pertinent navigation systems, flight guidance system, flight instrument system, or annunciation system elements used for the approach or missed approach (e.g., ILS receiver failure, Autopilot disconnect, etc.).

b. The possibility of a failure of a key aircraft component or related supporting system during the approach or missed approach (e.g., engine failure, electrical generator failure, single hydraulic component failure). Even though a particular failure may in itself be considered too remote based on exposure time (e.g., engine failure), it is nonetheless important to address these considerations since, in practical circumstances, a "go-around" may be due to a factor which relates to or leads to the failure, and thus is not an independent event (e.g., flocking bird ingestion). This is consistent with the long standing principle of safety of operation of multi-engine aircraft in air carrier operations which notes that after passing V1 on takeoff, until touchdown, the aircraft should typically be able to sustain a failure such as engine failure and still safely be able to continue flight and land.

c. The possibility of a balked landing or rejected landing at or below DA(H), or MDA(H), as applicable.

d. The possibility of loss or significant reduction of visual reference, that may result in or require a go-around

e. Suitable obstacle clearance following a missed approach, considering applicable aircraft configuration during approach and any configuration changes associated with a go-around (e.g., engine failure, flap retraction).

f. For special airports identified IAW section 121.445 (e.g., mountainous terrain), or other airports with critical obstacles that have not otherwise been accounted for, the ability to ensure suitable obstacle clearance following a rejected landing; applicable aircraft configuration(s) during approach and any configuration changes associated with a go-around and missed approach should be considered.

g. Unusual atmospheric or environmental conditions that could adversely affect the safety of the operation (e.g., extreme cold temperatures, known local atmospheric or weather phenomena that introduce undue risk, etc.).

When conducting a safety assessment of issues listed above, and uncertainty exists as to aircraft failure condition effects, procedural design intent or margins, aircraft characteristics or capabilities following failure, or other such issues, the operator should consult with an appropriate organization source able to provide reliable and comprehensive information. Typically this includes consultation with one or more of the following as applicable, and as necessary:

- Aircraft manufacturer,
- Avionics manufacturer;
- Procedure designer;
- Air Traffic Service provider, or regulatory authority.

NOTE: For definitions and discussion of differences among the terms "balked landing," "rejected landing," "go-around," and "missed approach," see Appendix 1.

4.3.1.2. Primary and Supplementary Means of Navigation and Required Navigation Performance (RNP). For the purpose of this AC, "Primary" and "Supplementary" means of navigation and Required Navigation Performance (RNP) are defined in Appendix 1. Application of these terms to instrument approach or takeoff is described below. In addition, it should be noted that the term "Primary Means of Navigation" may apply to either instrument approach initial, intermediate final approach, or missed approach courses of procedures flown to Category I or Category II minima. The term Supplemental Means of Navigation can typically apply to initial or intermediate segments or Missed approach segments, but typically does not apply to flying a final approach course of an instrument procedure. For definitions of Category I or Category II as used by the U.S. and ICAO, see Appendix 1.

a. Primary Means of Navigation. A "Primary Means" of navigation is a means of navigation that satisfies each of the necessary levels of accuracy and integrity for a particular area, route, procedure or operation. The failure of a "Primary Means" of navigation may result in, or require reversion to a "non-normal" means of navigation or alternate level of RNP.

(1) "Availability" as relates to a primary means of navigation is typically addressed in conjunction with the applicable operating rules for use of the system, in the context of the area, airspace, route, procedures, or operations for which system use is intended (e.g., use of multiple versus single sensors or systems, or NAVAID signal access, reliability, or continuity of service as might apply to a particular approach path).

(2) As applicable to instrument approach operations for an air carrier, particularly for a final approach segment or a missed approach segment, the following may be considered to satisfy requirements for a primary means of navigation.

(3) For sensor specific approaches (e.g., VOR, or NDB, or ILS) each particular airborne system using its respective associated NAVAID (e.g., ILS) may be considered as the "primary means of navigation" for completion of that respective specified approach procedure (e.g., ILS RWY 16R).

(4) When multiple components are required (e.g., ILS, with use of an NDB for the missed approach), the collective set of specified navigation components are considered to be the primary means of navigation for that procedure. Failure of any one of the required components may preclude use of the procedure, or may require reversion to a non-normal means of navigation for completion of the procedure (e.g., failure of the NDB missed approach NAVAID associated with an ILS approach).

(5) For RNAV based procedures where the only method of flying the procedure is by an RNAV or RNAV/RNP system (e.g., FMS), RNAV is considered to be the primary means of navigation for that approach procedure. Any associated NAVAID, or combinations of NAVAIDs, or airborne sensors necessary to achieve the necessary level of FMS performance may be considered as an input sensor(s) to the FMS, but the sensors or NAVAIDs taken alone are not necessarily considered to be the primary means of navigation.

(6) Where RNAV systems are used to overfly other types of instrument approach procedures (e.g., FMS RNAV systems over-flying VOR or NDB procedures), the RNAV system may be considered as a supplemental system if the aircraft can revert to use of the underlying procedure flown with "raw data," in the event of failure of the RNAV system (see b. below).

b. Supplementary Means of Navigation. A "Supplementary Means" of navigation is a means of navigation which satisfies one or more, but not necessarily all of the necessary levels of accuracy, integrity, and availability for a particular area, route, procedure, or operation. The failure of a "Supplementary Means" of navigation may result in, or require reversion to another alternate "normal" means of navigation for the intended route, procedure, or operation.

(1) As applicable to instrument approach operations for an air carrier, particularly for a final approach segment or a missed approach segment, the following may be considered to satisfy requirements as a supplementary means of navigation.

(2) When procedures have multiple methods to achieve compliance (e.g., a multi-sensor FMS over-flying a VOR approach, or an ILS approach with the choice of either an NDB or a VOR-based missed approach), those airborne systems which have another alternate normal means to accomplish the procedure, or a portion of the procedure, for one or more applicable segments, may be considered as supplementary for those applicable segments (e.g., if the FMS should fail, and the crew is monitoring the underlying VOR information, and the crew can transition to use of VOR-based navigation) the FMS may be considered as supplementary.

(3) Or, if, after an ILS approach, FMS RNAV capability is used to overfly a VOR/DME-based missed approach (with VOR/ DME NAVAID facilities operating), the FMS RNAV capability may be considered supplementary. Note, however, that if the specified approach/missed approach VOR/DME NAVAIDs are not operative, and the FMS RNAV operation is based on use of multi-sensor NAVAID capability, then the FMS use for that approach/missed approach would typically be considered a primary means of navigation.

c. Required Navigation Performance (RNP). Required Navigation Performance is a statement of the navigation performance necessary for operation within a defined airspace (Adapted from ICAO - IS&RP Annex 6). Required Navigation Performance is specified in terms of accuracy, integrity, and availability of navigation signals and equipment for a particular airspace, route, procedure, or operation.

4.3.1.3. Use of ICAO Standard NAVAIDs. U.S. Category I or Category II Operations are based on use of ICAO standard NAVAIDs, equivalent NAVAIDs, or other NAVAIDs acceptable to FAA and approved in OpSpecs. Authorization for use of NAVAIDs other than ICAO Standard NAVAIDs must be coordinated with AFS-400.

In the context of this AC, a Standard Landing Aid (SLA) is considered to be any navigation service or navigation aid provided by a State which meets internationally accepted performance standards (e.g., ICAO Standards and Recommended Practices (SARPs), or equivalent U.S. or other State standards - see Appendix 1).

4.3.1.4. Standard Instrument Approach Procedures (SIAPS).

a. Acceptable Instrument Approach Procedure Basis. Instrument approach procedures used by Operators IAW with this AC should be based on:

(1) U.S. Standard Instrument Approach Procedures;

(2) For non-U.S. airports, foreign instrument approach procedures acceptable to FAA promulgated by the state of the airport of landing (i.e., ICAO - State of the Aerodrome). The operator may propose use of such procedures for Principal Operations Inspector (POI), Aircrew Program Manager (APM), or Certificate Management Office (CMO) acceptance;

(3) Military instrument procedures acceptable to FAA for operations at military facilities. The operator may propose use of such procedures for POI, APM, or CMO acceptance;

(4) Special instrument approach procedures approved by the FAA;

(5) Special instrument approach procedures developed by the operator which are acceptable to FAA, or procedures developed by the operator using methods acceptable to FAA; or

(6) Special instrument approach procedures, acceptable to FAA, developed by other U.S. or non-U.S. Operators, or by the State of the Aerodrome (for foreign airports).

b. Considerations for use of procedures other than U.S. Standard procedures. For procedures other than those developed IAW FAA Order 8260.3, United States Standards for Terminal Instrument Procedures (TERPS), the operator must ensure consideration of at least the following factors related to use of those instrument procedures:

(1) Availability of suitable weather reporting and forecasts;

(2) Identification of any necessary alternate airports or alternate minima;

(3) Ability to discontinue an approach, if necessary, from any point to touchdown;

(4) Suitability of the airborne equipment to use the procedure (e.g., compatibility of the airborne equipment with the type/characteristics of the ILS, VOR, DME, NDB ground facilities used);

(5) Suitability of Ground Systems/Equipment (e.g., lighting, transmissometers, pilot control of lighting);

(6) Suitability of NAVAIDs (e.g., maintenance, monitoring);

(7) Suitability of Airport/Runway (e.g., obstructions, clear zones, markings);

(8) Availability of Aeronautical Information (e.g., timely NOTAM availability);

(9) Identification of any special Training or qualification related to the procedure; and

(10) Resolution of any issues identified from adverse "service experience" with the procedure.

c. Special Instrument Approach Procedures. Special instrument approach procedures should be coordinated with the Flight Standards Division of the FAA region having responsibility for the airport of the procedure. Special procedures should address any provisions associated with application of section 121.445 for special airport qualification. Special procedures are approved by AFS-400 and issued by the POI after coordination with pertinent FAA organizations.

d. Use of FAA/JAA Harmonized Instrument Approach Minima Tables. Information from FAA/JAA harmonized instrument approach minima tables are provided in Appendix 8. Unless otherwise authorized by AFS-400, procedures incorporating these minima are issued as special instrument procedures through OpSpecs, or through a Letter of Authorization (LOA). Minima based on values provided in Appendix 8 should not be below the lowest minima authorized through a Category I Standard OpSpec authorization, or below any applicable published foreign aerodrome minima when operating outside the United States (see Paragraph 6.2.18 and Appendix 8).

4.3.1.5. "Steep Approaches" and Approach Path Descent Angle Constraints. Approach path angles between 2.75 degrees and 3.77 degrees are considered standard for air carrier operations. Approach angles above 3.77 degrees are considered "steep angle" and, if authorized, may require additional assessment. Air carrier use of approach angles over 3.77 degrees requires coordination with AFS-400. Use of approach angles over 4.5 degrees should normally be based on an associated aircraft type AFM provision for "steep angle approaches," IAW AC 25-7A, Flight Test Guide for Certification of Transport Category Airplanes, or equivalent, and paragraph 6.8 of Appendix 2.

4.3.1.6. "Normal Maneuvering" Considerations. Part 91, section 91.175 requires that approach procedures should be based on use of "normal maneuvers" before and after passing DA(H) or MDA(H). Normal maneuvers typically do not involve use of bank angles greater than 30 degrees, pitch attitudes in excess of 25 degrees nose up or 10 degrees nose down, or sink rates in excess of 1100 ft. per minute below 500 ft. HAT while maneuvering to land within the touchdown zone, during go-around, or during a rejected landing. During a missed approach, pitch attitudes in excess of +30 degrees or bank angles greater than 30 degrees would typically be considered excessive.

4.3.1.7. Non-Normal Events or Configurations. Takeoff and landing weather minimums are intended for normal operations. When non-normal events occur, flightcrews are expected to take the safest course of action to ensure safe completion of the flight. Using emergency authority, crews may deviate from rules or polices, to the extent necessary for the circumstances, to minimize risk during landing.

Paragraph 6.1.8 addresses guidelines and procedures to be considered in conducting an instrument approach during a non-normal event.

4.3.1.8. Go-Around Safety.

a. General. A multiengine aircraft conducting a Category I or Category II instrument approach should be capable of safely executing a "one-engine-inoperative" go-around from any point in an approach prior to touchdown with the aircraft in a normal configuration, or specified non-normal configurations (e.g., engine out, if applicable). This is necessary to provide for go-around safety due to missed approaches or rejected landings due to a variety of circumstances such as:

- Unexpected environmental conditions (e.g., cross winds, turbulence)
- Aircraft related failures (e.g., gear unsafe)
- Air Traffic Service contingencies (e.g., RTO on a crossing runway)
- Loss of visual reference
- When a pilot finds the runway surface unsuitable (e.g., clutter, flocking birds)
- When the runway is blocked (airport vehicles or exiting aircraft ahead not clear), or due to a go-around or missed approach due to any other reason

(1) This objective may be achieved by the operator providing information to flightcrews on an appropriate lateral flight path to follow to enable the aircraft to safely operate to the runway, and out from the runway following a rejected landing. In the rare event that operation out of a runway may not be possible following a rejected landing, then provision of suitable information on a "commit point," or equivalent condition (e.g., limit weight, minimum speed, or suitable configuration) may instead be provided. The intent of providing information on safe go-around capability is to identify the best option or options for a safe lateral ground track and flight path to follow in the event that a missed approach, balked landing, rejected landing or go-around is necessary. It is not the intention of this provision to require or indicate the need for an analysis of each flight, or a dispatch assessment, or an individual

flight landing weight assessment or limitation. Operators may make the judgment as to whether a review on a "per-flight" or specific condition basis may or may not be needed.

(2) While coping with the go-around contingency situation is appropriate for any operation, it is particularly important for low visibility operations in which the pilot has minimum time to respond, and may have limited visual reference available to safely cope with the adverse condition (e.g., night and poor visibility). Further, "go-around" safety should be addressed regardless of when an engine failure may occur prior to landing. However, operators may elect to distinguish between procedures or expected crew response for engine failures occurring at various times during a flight as follows:

(a) Engine failure occurring enroute or prior to passing a final approach fix or point,

(b) Engine failure during a final approach segment, or

(c) Engine failure after passing DA(H) or after descending below MDA(H) but prior to touchdown, or during a go-around or missed approach.

(3) For an engine failure occurring prior to final approach, flight diversion planning should allow for the potential need for a missed approach or balked landing, and for the need to maintain subsequent suitable obstacle clearance (e.g., when making suitable diversion choices - sections 121.161, 121.191, or 121.193. The pilot should consider any adjustment to minima, procedures or missed approach path that may be appropriate to facilitate safe obstacle clearance (e.g., following a suitable operator-developed takeoff procedure, published takeoff procedure, or IFR Departure Procedure (DP)). This is particularly appropriate if U.S. TERPS or ICAO PANS-Ops-specified instrument procedural gradients cannot be met during any portion of a go-around or missed approach, or if following a suitable lateral path cannot be ensured (e.g., crosswinds with no course guidance available, cannot maintain VMC, or at night).

(4) For engine failure during approach, if there is any doubt of the ability to safely complete the landing or ensure a safe balked landing and missed approach capability, the pilot should consider the advisability of discontinuing the approach and diverting to a different airport or runway, to better ensure safe missed approach or balked landing obstacle clearance.

(5) For engine failure after passing DA(H) or descending below MDA(H), the pilot should be prepared to expeditiously follow or join any pre-established and applicable "T-procedure" or "IFR Departure Procedure," or equivalent, until becoming established on a published segment of the missed approach procedure, at or above a safe altitude.

(6) Accordingly, an operator should have reviewed the missed approach and rejected landing flight path to ensure that in the event of a go-around the aircraft is able to ensure safe obstacle clearance following a missed approach or go-around. This can be particularly important in mountainous areas where the landing runway may be in a direction not typically used for takeoff (e.g., an airport that is one way in, and the opposite direction out).

b. Go-Around Assessment Considerations.

(1) Operators may accomplish such assessments generically for a particular runway, procedure, aircraft type, and expected performance, and need not perform this assessment for each specific flight. Operators may use simplifying assumptions to account for the transition, reconfiguration, and acceleration distances following go-around (e.g., use expected landing weights, assume anticipated landing flap settings).

(2) The operational considerations should include:

(a) Go-around configuration transitions from approach to missed approach configuration including expected flap settings and flap retraction procedures.

(b) Expected speed changes.

(c) Appropriate engine failure and shutdown (feathering if applicable) provisions, if the approach was assumed to be initiated with all engines operative.

(d) Any lateral differences of the missed approach flight path from the corresponding takeoff flight path, and

(e) Suitable balked landing obstacle clearance, until reaching instrument approach missed approach or enroute procedurally protected airspace.

(f) Any performance or gradient loss during turning flight, if necessary to follow a flight path that is not over the runway or is not aligned with the runway after the balked landing transition.

(g) Any relevant related situations such as if the aircraft cannot dump fuel and may need to make an emergency return landing above maximum landing weight immediately after takeoff.

(h) Methods used for takeoff analysis, such as "Overspeed V2", "engine-out maximum angle climb," or other such techniques may be used if determined to be appropriate by the operator or aircraft manufacturer.

(i) Applicable flight guidance system operational procedures used. Information about any techniques required to achieve the specified performance should be available to the flightcrew (e.g., appropriate mode selection).

(j) Operators may make obstacle clearance assumptions similar to those applied to corresponding takeoff flight paths (e.g., Section 121.189) in the determination of net vertical flight path clearance or lateral track definition or lateral track obstacle clearance within an airport boundary or beyond an airport boundary, until the point at which cruise or other obstacle clearance requirements apply.

c. Go-Around Assessment Conditions.

(1) Assessments may assume the following initial conditions:

(a) A "balked landing" starts at the end of the Touchdown Zone (TDZ).

(b) An engine failure occurs at the initiation of the balked landing, from an all-engine configuration.

(c) Balked landing initiation speed $\geq V_{REF}$ or V_{GA} (as applicable).

(d) Balked Landing initiation height is equal to the specified elevation of the TDZ.

(e) Balked landing initiation configuration is normal landing flaps, gear down.

(f) At the initiation of the maneuver, all engines are at least in a spooled configuration.

(2) A TDZ typically is considered to be the first 3000 ft. of a designated landing runway. When appropriate for the purposes of this provision, Operators may propose to use a different designation for a touchdown zone. For example, alternate consideration of a TDZ may be appropriate for runways that:

(a) Are less than 6000 ft. in length and which do not have standard TDZ markings;

(b) Short runways requiring special aircraft performance information or procedures for landing;

(c) Runways for STOL aircraft; or

(d) Runway where markings or lighting dictate that a different TDZ designation would be more appropriate.

d. "One Way" Airports, "Commit Point," or Other Special Situations.

(1) Where obstacle clearance is determined by the operator to be critical such as for:

(a) "One-way in," "opposite way out" airports in mountainous terrain, or

(b) Runways at which a landing is to be planned or attempted, but at a weight which is significantly greater than that which would otherwise be allowed for a takeoff, or

(c) Where rejected landing obstacle clearance may not be readily ensured, a review should be completed by the operator to determine whether a contingency go-around path can be appropriately defined or whether a "commit point" or equivalent condition is necessary (e.g., limit weight, speed, or configuration).

(2) A "commit point" or equivalent condition however, should only be used where it is not otherwise possible to identify a safe go-around path. For a "commit point," the operator should either provide a representative weight, configuration or condition at which obstacle clearance can be ensured after initiation of a balked landing at the TDZ, or identify a path related waypoint, location, altitude, height, or fix, beyond which a go-around should not be attempted. For such determinations, the operator should consider at least the runway elevation, temperature, and appropriate aircraft configurations or configuration changes. If a "commit point" is used, the operator should provide any necessary advisory information to flightcrews to address any events which, while unlikely, could nonetheless occur beyond the designated "commit" point or condition (e.g., unforeseen significant wind shear, unacceptable winds, turbulence, or runway clutter, loss of visual reference, flare extending beyond the touchdown zone, or an obstruction on the runway).

e. TERPS/ICAO PANS-Ops Criteria Not Applicable to "Non-Normal" Operations. TERPS or ICAO PANS-Ops- based criteria do not typically address "special" instrument approach procedures, and they do not and are not intended to address non-normal operations (engine inoperative) or operations below published segments of instrument procedures (e.g., operations below DA(H) or MDA(H)). TERPS or ICAO PANS-Ops based criteria are intended only to address "standard procedures", normal operatioos (e.g., all-engine), and published segments of the resulting procedures. Thus, operator assessments of missed approach safety related to operations below published segments of instrument procedures, or operations with non-normal configurations or situations, need not apply provisions of TERPS or ICAO PANS-Ops. Compliance with TERPS or ICAO PANS-Ops based instrument procedure requirements alone may not necessarily ensure missed approach or rejected landing go-around safety. For example, it is recognized that certain types of aircraft (e.g., two-engine aircraft) may operate at weights that achieve gradients with an engine inoperative that may be less than TERPS or PANS-Ops gradients. Go-around from below DA(H) or MDA(H) (e.g., following loss of visual reference, or runway not suitable or available) does not necessarily provide for and does not need to apply TERPS or PANS-Ops criteria or provide for TERPS or PANS-Ops specified levels of obstacle clearance vertically or laterally. Methods related to TERPS or PANS-Ops criteria such as "Collision risk model (CRM)" also are not applicable to assessments other than for TERPS and PANS-Ops related procedure elements.

f. Flight Guidance System (FGS) Use. If not already assessed for the aircraft type during basic type certification, or STC, flight guidance systems (FGS) suitability for the intended procedure(s) should be considered. The operator may need to assess FGS mode use to ensure compatibility with intended flight path, mode transitions, and gradient determinations. This may be achieved by demonstrating (in simulation or flight) a safe go-around from 100 ft. above the TDZ (HAT) operationally for the specific procedure or, if applicable, for the most critical runway for that operator. For aircraft that have airworthiness demonstrations conducted IAW Appendix 2 or 3 or with AC 120-28D this provision is considered to be addressed.

g. Performance and Obstacle Data Availability and Use.

(1) Information or methods used by the operator for this assessment may be the best available information or methods from applicable aircraft manuals, terrain or obstruction charts, or supplementary information from aircraft or engine manufacturers. In the event that performance, obstacle, or flight path data are not otherwise available to support the necessary analysis from the above sources, the operator may develop, compote, demonstrate,

or determine such information to the extent necessary to provide for safe obstacle clearance during an engine-out missed approach or an engine-failure following a rejected landing. Data or methods used need not necessarily be from the applicable AFM or from the original aircraft manufacturer. Data or methods may be developed by the operator based on equivalence to other data or methods (e.g., takeoff data) or may be derived by using standard practices applicable to aircraft performance assessment or procedure construction, or may be derived by appropriate aircraft performance or engineering analysis, techniques, or methods.

(2) Information on terrain or obstructions for these assessments may be based on the best available information to the operator or to the agency or entity supporting the operator at the time the information is supplied (e.g., data available to a performance information contractor, or chart supplier). Best available information may be used, notwithstanding that certain information or data may not necessarily be "approved" by an authority, or may be data that is not necessarily recent (e.g., certain types of charting or obstruction information is not frequently updated). FAA Order 8260.19, paragraph 271 describes how the accuracy of the source data should be considered when constructing the procedure.

h. Related Information. Other paragraphs of this AC contain information related to this paragraph. Paragraph 5.14 describes typical factors to be considered when assessing go-around capability for a particular aircraft and flight guidance system. Paragraph 6 addresses procedures including those used for go-around or rejected landing, and Paragraph 7 addresses Training and Crew Qualification including relevant aspects of missed approach, go-around, or rejected landing.

4.3.2. ILS, GLS, or MLS (xLS) Instrument Approach Operations. ILS, GLS, or MLS (i.e., xLS) operations may be authorized to the lowest applicable DA(H) for the procedure used, and to the lowest visibility minima specified in the OpSpecs for the NAVAID, facilities, and lighting systems used (see Appendix 7, Standard OpSpecs Part C Paragraph C053 for Category I, and Standard OpSpecs Part C paragraph C059 for Category II).

a. ILS, GLS, or MLS (e.g., xLS) operations are typically authorized based on use of two or more navigation receivers or multi-mode receivers (MMRs) of a pertinent type (see 14 CFR, part 121, section 121.349, and part 125 section 125.203), each providing independent information to the appropriate flight guidance system elements and pilot displays.

b. Provisions of sections 121.349, and 125.203 applicable to ILS may also be considered as applicable to GLS or MLS.

c. Provisions of section 121.349 for use of a single navigation (e.g., ILS) receiver are typically limited to operations using minima at or above RVR4000, or for Minimum Equipment List (MEL) authorization for dispatch with a NAVAID receiver inoperative.

d. Precision Approach Radar (PAR) procedures are not considered xLS procedures(see paragraph 4.3.3).

4.3.3. Instrument Approaches other than ILS, GLS, or MLS (xLS). Instrument approach procedures other than ILS, GLS, or MLS (xLS) that may be authorized for air carriers include the procedure types shown in the following paragraphs.

a. Standard Instrument Procedures Other Than xLS. The following NAVAID specific instrument procedures are considered to be standard procedures for the purpose of air carrier operation specification approval. Typically these procedures do not inherently specify use of vertical guidance (i.e., most were traditionally considered as non-precision approaches).

(1) Some of these approach types may provide vertical guidance (e.g., a glideslope), however, the procedure may be offset from the runway, may not otherwise permit a straight in landing in the touchdown zone when flying the specified path, or may not have flight deck display of path information. Hence the approach is not considered to be an xLS approach.

(2) Approvable standard approach types other than xLS are considered to include:

- Localizer (LOC)
- Localizer Back Course (BC)
- SDF
- LDA
- VOR
- VOR/DME
- NDB
- Dual NDB
- NDB/DME
- TACAN, and
- RNAV (2D)* based on a procedurally specified NAVAID (e.g., typically when a particular VOR/DME is specified as a "Procedure tuned" facility to serve as a basis for a particular RNAV procedure - These RNAV procedures usually are those which meet U.S. TERPS Chapter 15 criteria for RNAV).

b. Standard Procedures Flown Using Vertical Navigation Path Guidance (VNAV). The procedures specified in paragraph a. above may also be flown in conjunction with use of FMS derived vertical guidance (e.g., FMS VNAV capability). In this instance, VNAV capability is considered to be based on a pre-specified and defined vertical path.

c. Standard Procedures Flown Using "Constant Vertical Descent Rate" Techniques. NAVAID specific procedures other than xLS may be flown using "Constant Vertical Descent Rate" Techniques as a "pilot procedural technique" to maintain a pre-determined vertical speed to achieve a corresponding assumed descent path (e.g., "open-loop" vertical speed descent profile). Operators may use these techniques, particularly when xLS or VNAV path guidance is not available or cannot otherwise be used. However, such "Constant Vertical Descent Rate" techniques are not considered to be "VNAV vertical guidance". This is true regardless of whether soch a procedure or technique is based on an altitude/distance cross check or not. While use of such techniques may be desirable for aircraft that are not using xLS or VNAV, they are not considered to be eligible for DA(H) use or credit.

d. "RNAV" Procedures (3D or 2D)* Based On RNP. Operators may use RNAV procedures based on RNP criteria that are found to be acceptable to FAA. Those RNAV procedures may use minima based on RNP criteria, or may use RNP for definition of some or all procedure segments (e.g., initial, intermediate, final, or missed approach segments).

e. Other "RNAV" Procedures (3D or 2D)*.

(1) When determined acceptable to FAA, Operators may also use RNAV Procedures (3D or 2D)* other than those based on criteria specified in U.S. TERPS Chapter 15 for RNAV (e.g., RNAV procedures as listed in paragraph a. above), or other than procedures based on RNP (RNAV procedures as listed in paragraph d. above), as follows:

- RNAV procedures identified as "GPS" instrument approach procedures, if those procedures are determined to be suitable for the aircraft and navigation system to be used (e.g., use of FMS with GNSS sensor inputs).
- International RNAV procedures, when appropriate for use at non-U.S. airports.

- RNAV procedures based on multi-sensor FMS using inertial systems and NAVAIDs other than specific "procedure-tuned" VOR or DME facilities. For example, RNAV Procedures (3D or 2D)* may be based on multi-sensor FMS systems which use DME-DME updating, or scanning DME updating, or VOR DME updating, or VOR VOR updating, from suitable and available NAVAIDs.
- RNAV procedures based on multi-sensor FMS using inertial systems and GNSS, or GNSS with Ground Based Augmentation System (GBAS), or Space Based Augmentation System (SBAS)).

(2) RNAV procedures may also be based on combinations of sensors if equivalent performance, availability, and integrity are established compared with any of the above methods.

***NOTE: For the purpose of this AC a "3D" approach procedure (3D) is considered to be one having both lateral and vertical path guidance (e.g., three dimensions - with x, y, and z path coordinates). These procedures may be identified as LNAV/VNAV. A "2D" procedure (2D) is considered to be one having only lateral path guidance (two dimensions - x and y path coordinates). These procedures may be identified as LNAV.**

f. Airport Surveillance Radar (ASR) Procedures. ASR or international equivalent procedures may be used.

g. Precision Approach Radar (PAR) Procedures. PAR or international equivalent procedures may be used.

h. Other Limited Use Special Procedures. Other special instrument approach procedures (e.g., LORAN, Transponder Landing System (TLS), airborne radar approach, Eastern European KRM). Special procedures include use of LORAN C, airborne radar, or any other landing system or non-ICAO NAVAID. Special procedures typically require unique approval of an operator's operational procedures, flightcrew qualification, and maintenance programs as well as proof of concept demonstration prior to operational authorization. Special Category I operations, by definition, require the use of airborne and/or ground based or satellite-based equipment over and above the minimum equipment necessary to operate in the U.S. national airspace. Special Category I operations usually also require special knowledge, skills, proficiency, and procedures. As a result, changes and amendments to the operator's overall Category I operations program are usually necessary to ensure safe conduct of these operations. There is additional criteria which must be incorporated into an operator's program for special Category I operations.

4.3.4. Applicability of a DA(H), MDA(H), or RA. Instrument approach and landing operations have limitations related to the minimum altitude (height) to which descent can be made without establishing visual reference (e.g., 14 CFR part 91, section 91.175). Minimum altitude or height to which descent can be made is typically related to assurance of clearance over terrain or obstacles, airborne instrumentation and equipment, NAVAIDs, and visual aids. Such a minimum altitude or height is usually specified as a DA(H), or MDA(H). A DA(H) may be intended for use as either a Decision Altitude (DA), or as a Decision Height (DH). A DH may be used directly, or it may be specified as a corresponding radio altitude (RA) value above underlying approach terrain. The type of instrument approach procedure determines whether a DA or DH is used, and whether a DH is specified directly, or is defined in terms of a corresponding radio altitude (RA) value above terrain. For a Category I procedure, a DA is typically used. For a Category II procedure, a DH with a corresponding radio altimeter (RA) height above approach terrain is usually used. When a RA value above approach terrain is specified, it typically corresponds to a particular desired DH value for the intended height above the TDZ (HAT).

Uses of DA(H), MDA(H), and RA are further described in paragraphs 4.3.4.1 through

a. DA, DH, RA, OCA, OCH, OCL. For xLS approaches (e.g., precision approaches), and certain RNAV approaches with VNAV, the minimum altitude or height for flight without having established the necessary visual reference during an approach is specified as a DA(H). For Category I within the U.S., the DA element of a DA(H) usually defines the applicable minima. For Category II, applicable minima are usually based on a DH, expressed in the published procedure as an RA value. In other countries, for Category I, either a DA or a DH may be used. For Category II outside the U.S., minima may be based either on a direct specification of DH, or on a corresponding RA value, as is done within the U.S. Other expressions of minima equivalent to a decision altitude (DA) or decision height (DH) may also be encountered outside of the U.S., such as when an obstacle clearance altitude (OCA), obstacle clearance height (OCH), or obstacle clearance limit (OCL) is specified, and is to be treated as a corresponding DA or DH

(1) In the United States and other countries that use U.S. TERPS criteria, the minimum instrument flight altitude for xLS approaches is considered to be the DA element of the DA(H) if minima are based on a barometric altimeter, or the (H) value of the DA(H) expressed as an RA minima, if minima are based on use of a radio altimeter. When a DH applies, it is usually specified as an RA value above the pertinent underlying approach terrain, considering a nominal approach vertical path. When a barometric altimeter specified DA is used to establish minima, the associated height value (H) is typically considered to be advisory. When a DH specified in terms of a radio altitude (RA) value is used, the corresponding published RA value is considered to be controlling, and any associated barometric altitude value shown in a procedure is typically considered to be advisory.

(2) For procedures with minima based on a DA, the DA is specified as a decision altitude referenced to mean sea level (MSL) using QNH altimeter settings. While the (H) element of the DA(H) is typically advisory for such procedures, in certain circumstances the (H) value may be the basis for minima, such as when a QFE referenced barometric altimeter setting is used.

(3) Obstacle Clearance Height (OCH) and Obstacle Clearance Limit (OCL) are used in some countries IAW various versions or revision levels of ICAO PANS-OPS. OCA, where used, is referenced to a barometric altitude (MSL). OCH and OCL are referenced to height above either the elevation of the airport, the elevation of the touchdown zone, or the elevation of the landing threshold.

b. Minimum Descent Altitude (MDA), Minimum Descent Height (MDH), HAT, Height Above Airport (HAA), Obstacle Clearance Altitude (OCA), OCH, OCL.

(1) For approaches other than xLS, the minimum height or altitude may be specified as a decision altitude DA or a DA(H) if suitable vertical guidance is authorized and provided (e.g., VNAV path), or specified as a minimum descent altitude MDA of an MDA(H) if vertical guidance is not provided. Minima may also be specified height above touchdown (HAT), height above airport (HAA), minimum descent height (MDH), obstacle clearance altitude (OCA), obstacle clearance height (OCH), or obstacle clearance limit (OCL). MDA, HAT, and HAA are typically used by certain countries that use various earlier versions of U.S. TERPS criteria. OCA, OCH, and OCL are used in countries having procedures established IAW ICAO PANS-OPS. Although ICAO PANS-OPS now does not use OCL, some procedures still use OCL criteria from previous versions of PANS-OPS. Some countries, in addition to OCA and OCH, provide MDA and MDH. MDA and OCA are barometric flight altitudes referenced to mean sea level (MSL). HAT, HAA, MDH, OCH, and OCL are radio or radar altitudes referenced to either the elevation of the airport, the elevation of the touchdown zone, or the elevation of the landing threshold.

(2) Accordingly, for international operations, the following equivalent minima formulations should be used by U.S. Operators:

(a) Use the altitude value of the MDA(H) where OCA may be specified for procedures other than xLS.

(b) Use the equivalent altitude value of the MDA(H) where HAT, OCH, or OCL are specified for "straight-in" approach procedures.

(c) Use the equivalent altitude value of the MDA(H) where HAA, OCH, or OCL may be specified circling approach maneuvers.

c. Lowest Permissible DA(H) or MDA(H). The lowest permissible DA(H) or MDA(H) for instrument flight (IMC) for any approach should not be lower than the most restrictive of the following, as applicable:

- Minimum height or altitude published or otherwise established for the instrument approach

- Minimum height or altitude authorized in OpSpecs for the approach
- Minimum height or altitude authorized for the flightcrew
- Minimum height or altitude authorized for the operator, aircraft, and airborne equipment
- Minimum height or altitude permitted by operative airborne equipment and NAVAIDs
- Minimum height or altitude for which required NAVAIDs can be relied upon*
- Minimum height or altitude which provides adequate obstacle clearance*, and
- Minimum altitude which provides compensation for extremely cold temperatures, if applicable**

*** Note: Item normally addressed by the published instrument approach procedure.**

**** Note: Applicable only when an operator has a procedure to correct altimeter errors for extremely cold temperatures (Typically T less than -22F/-30C).**

4.3.4.1. Application of a DA(H) for Category I. Procedures established based on use of NAVAID electronic vertical guidance (e.g., ILS, MLS, or GLS) use the barometrically based DA (of the specified DA(H)) for minima determination. Radio altitude above the approach terrain or touchdown zone, if provided, is advisory.

Procedures established based on use of other acceptable electronic vertical guidance (e.g., Baro VNAV meeting provisions of this AC, GNSS based geometric path VNAV) may use a barometrically based DA (of the specified DA(H)) for minima determination if an appropriate obstacle assessment has been completed for the region between the earliest point along the approach path at which the DA may be reached, to the runway threshold. Radio altitude, if provided, is advisory.

For Category I a decision height (DH) is not used.

DA(H) is applied to Category I instrument approach procedures as follows:

a. Category I ILS, MLS, or GLS (xLS) Approaches.

(1) For Category I approaches based on ILS, MLS, or GLS (e.g., xLS, or precision approaches), a DA(H) is typically specified. The DA(H) represents the minimum altitude in an approach to which descent may continue, or by which a missed approach must be initiated, if the required visual reference to continue the approach has not been established. The DA(H) "altitude" value is typically measured by a barometric altimeter, and is the determining factor for descent minima for an xLS approach procedure. The "height" value specified in parenthesis is typically a radio or radar altitude equivalent height above the TDZ (HAT) used only for advisory reference, and does not necessarily reflect actual height above underlying terrain. Where a Middle Marker (MM) beacon is installed, it may be used as advisory information, confirming a barometrically determined DA(H) that is coincident with the glide slope altitude at that point.

(2) For approaches which normally provide vertical guidance (e.g., xLS), but when vertical guidance capability cannot be used, such as due to an airborne system failure, see paragraph 4.3.4.2 below.

b. Category I Approaches with VNAV. For Category I approaches other than ILS, MLS, or GLS which use a published VNAV descent path to the runway threshold, a DA(H) may be specified instead of an MDA(H). See (a) above for DA(H) applicability.

c. Precision Approach Radar (PAR) procedures. For Category I minima, a DA(H) may be specified for PAR. See paragraph a. above for DA(H) applicability. Category II is not typically applicable to civil aircraft use of PAR (see 4.3.8.g).

4.3.4.2. Application of an MDA(H) for Category I. Procedures that are not based on use of vertical guidance (e.g., VOR, NDB, Back Course ILS) use the barometrically based MDA (of the specified MDA(H)) for minima determination. Radio altitude, if provided, is advisory.

a. Category I Approaches other than ILS, MLS, or GLS. For Category I approach other than ILS, MLS, or GLS (e.g., non-precision approaches), an MDA(H) is typically specified. The MDA(H) represents the minimum altitude in an approach to which descent may continue, until either the required visual reference is established and the aircraft is in a position to continue the descent to land using normal maneuvering, or until reaching the specified missed approach point. The MDA(H) "Altitude" value is typically measured by a barometric altimeter, and is the determining factor for descent minima for approaches other than ILS, MLS, or GLS (other than xLS) Category I instrument approach procedures. The "Height" value specified in parenthesis is typically a radio or radar altitude equivalent height above the touchdown zone (HAT), and is used only for advisory reference. This height value does not necessarily reflect actual height above underlying terrain. Where a VHF marker beacon (e.g., FM) is used, it may indicate a longitudinal position for a step-down fix, if identified in the procedure.

b. Circling Approaches. Many instrument procedures provide for circling approach minima. U.S. criteria require SIAP publication of circling maneuver minima if the inbound course does not meet straight-in alignment criteria, or when a specified descent gradient for a straight-in approach is steeper than a maximum value allowed by instrument procedure design criteria. Sufficient visual references for manually maneuvering the aircraft to a landing must be maintained throughout a circling maneuver. The pilot must keep the aircraft's position within the established maneuvering area while performing the circling maneuver. The circling MDA(H) or equivalent must be maintained until an aircraft is in a position from which a normal descent can be made to touchdown within the touchdown zone, using normal maneuvers and a safe descent path.

4.3.4.3. Application of a DA(H), or equivalent (i.e., Inner Marker), for Category II. Procedures using Category II minima typically use a radio altimeter and the associated DH (of the specified DA(H)) for minima determination. Barometric altitude is advisory.

a. Procedures that have "Radio Altitude Not Authorized (RA NA)" (for example, due to irregular underlying terrain) typically use the first indication of arrival at the "inner marker" as a means to establish DA(H). However, an operator may elect to use first indication of arrival at either the "inner marker" or the barometric altitude DA, which ever comes first, as the means for minima determination. In the first instance, both radio altitude and barometric altitude are advisory. In the second instance barometric altitude may be an acceptable means to establish DA(H), but only if it occurs before arriving at the "inner marker." When a procedure specifies "RA NA," a DA(H) greater than 100 ft. HAT is typically not used, since a marker beacon is not located in a position along the approach path corresponding to that minima.

b. While for Category II the use of barometric decision altitude (DA) is advisory, this does not preclude an operator or flightcrew from initiating a missed approach if the altitude equivalent to the barometric altitude minima (DA) is reached prior to arrival at the specified DH. A barometrically specified "DA" is not currently used for air carrier Category II minima. This applies regardless of whether radio altimeter or inner marker determines the DH.

c. For Category II a Decision Height of a published DA(H) (or an equivalent Inner Marker (IM) for irregular pre-threshold terrain) is used as the applicable descent minima. Any "altitude" value specified is considered to be advisory. The altitude value is available for cross-reference and backup. Use of the barometrically referenced DA element of a published DA(H) is not currently authorized for parts 121, 129, or 135 operations at U.S. facilities. If an operator elects to base discontinuance of an approach on the DA, if the DA is reached prior to the applicable DH, the DA element of a DA(H) may be considered applicable to Category II in other than an advisory capacity.

4.3.4.4. "Specified Visual Reference" Requirements for Category I or Category II.

a. Section 91.175 and Standard OpSpecs specify that for operation below the DA(H) or MDA(H) on an instrument approach, the required visual reference to continue the approach must be established. Unless otherwise authorized by the CMO (e.g., POI or APM for a particular type) the required visual reference may be considered to be those provisions as listed in section 91.175 items (c) and (d).

b. Circumstances in which the operator may request and the CMO may authorize use of alternative visual reference provisions might be situations such as certain Category I and II minima are based on use of autoland or HUD (see paragraph 10.5.3). In this instance provisions such as those shown in section 91.175 (c) (3) (i) for "red terminating bars" or "red side row bars" may not be necessary or appropriate. This is because these particular approach lighting visual references or configurations may not always be needed when operations are predicated on HUD or autoland use. They may not even be installed or applicable as a part of the approach lighting system for the runway or runways to be specially authorized. Conversely, for operations such as the ones noted above for autoland or HUD, it may be determined by the operator and CMO that continued descent below the DA(H) based solely on visual contact with a VGSI (which may in instances be otherwise permitted by 14 CFR), but without having sight of either the runway, runway lights, touchdown zone lights, centerline lights, or runway markings would not be appropriate. In this instance, the CMO may authorize the operator to define and use alternate visual references or visual reference combinations for Category I and II operations, rather than relying solely on the sighting of a VGSI as a basis for continued descent below a DA(H).

c. Refer to FAA Order 8400.13 for lower Category I operations. Changing the required visual reference requires the use of a Special Procedure and additional authorization.

4.3.5. Visibility and RVR Minima. Visibility minima are as specified in Standard or Special Instrument Approach Procedures approved for use by the operator, or as otherwise listed in standard OpSpecs applicable to that operator for Category I or II landing. Operating minimums may be expressed as meteorological visibility (VIS), runway visual range (RVR), or runway visibility values (RVV).

a. Meteorological Visibility (VIS). Meteorological visibility may be used as reported by the NWS, a source approved by the NWS, by FAA, or a source approved by the FAA.

(1) Outside of the U.S., the FAA may accept meteorological reporting sources for use by a particular operator. Outside the U.S. meteorological visibility determination may vary, and the operator should ensure that the meaning, definition, and significance of any meteorological visibility reported for use in determining minima is understood by that operator's pilots.

(2) For approval of use of weather sources other than the NWS (e.g., international), Operators should consult their respective CMO, CMU, or POI. FAA FSDOs, CMOs, or CMUs that need assistance in responding to operator inquiries regarding approval of weather sources that are not otherwise already addressed by current directives (e.g., FAA Order 8400.10) should consult AFS-400.

b. Runway Visual Range (RVR). RVR is considered to be an instrumentally derived value measured by transmissometers. RVR is calibrated by reference to runway lights and/or the contrast of objects.

(1) Controlling RVR means the reported values of one or more RVR reporting locations (TDZ, Mid, Rollout, or equivalent international locations) used to determine whether operating minima are or are not met, for the purpose of approach initiation, or in some cases, approach continuation.

(2) All U.S. Category I operating minimums below 1/2 statute mile (RVR2400) and all Category II and III operating minimums are based on RVR.

(3) Where RVR is used, the controlling RVR for Category I minima is touchdown RVR. All other readings are advisory.

(4) For Category II minima, controlling RVR is as specified by OpSpecs.

(5) RVR use has practical limitations that should be familiar to both the operator and pilot. For example, RVR is a value which typically only has meaning for the portions of the runway associated with the RVR report (TDZ, MID, or Rollout). RVR is a value that may vary with runway light step settings (1 through 5). Operators should ensure that pilots are familiar with runway light setting effects on reported RVR. RVR may not be representative of actual visibility along portions of the runway due to the location of the transmissometer baseline and limited length of the baseline, or due to variable conditions of fog, blowing snow, or other obscurations along the runway, or due to obscurations varying rapidly in time (e.g., patchy fog). Additionally, newer RVR systems may have localized performance sensitivity since they do not use a baseline along the runway (e.g., a scatter array may be used for visibility assessment). Thus, pilots and Operators should note that RVR is an instrumentally derived value that has operationally significant limitations and can be greater than or less than the actual visibility available to a pilot at typical flight deck eye height (ground level) at the runway. This is particularly true at night, if runway lights are not at settings standard for the prevailing conditions, or if unusual daylight conditions are experienced such as when a runway is aligned with a sunrise or sunset condition, in shallow or patchy fog.

(6) Outside of the U.S. some RVR reports may not necessarily be instrumentally derived by transmissometers or scatter meters, and may alternately be made by pilots or other weather observers. Accordingly, Operators should ensure that the meaning, definition, significance, and variability of any non-instrumentally derived value of RVR reported to the pilot for use in determining minima is understood by that operator, and that operator's pilots.

c. Runway Visibility Values (RVV). RVV minima are now used infrequently, are being phased out, and should be used only where minima cannot otherwise be specified as a meteorological visibility (VIS) or runway visual range (RVR).

4.3.6. Visibility Assessment and RVR Equivalence for Landing.

a. For instrument procedures where minima are expressed in terms of meteorological visibility, but reported visibility available to the flightcrew is specified as an RVR, the tables referenced in standard OpSpecs may be used to establish equivalent meteorological visibility minima. (see Appendix 7, OpSpecs paragraph C051).

b. Conversely, for instrument procedures outside of the United States where minima available to the flightcrew on instrument procedures are expressed only in terms of RVR, but reported visibility available to the flightcrew by ATS or other approved source is specified only as a meteorological visibility and RVR is not reported, the "Visibility-RVR Equivalence" table referenced in standard OpSpecs may be used to establish an equivalent RVR value (see Appendix 7, OpSpec paragraph C051). Use of this provision, however, specifically requires FAA authorization in addition to issuance of paragraph C051, and should be limited by the POI or CMO to only those Operators and locations outside of the U.S. that have a need to use the "visibility-RVR" equivalence table for this type of determination.

4.3.7. General Requirements for Category I Operations and Minima.

4.3.7.1. Category I Definition, Background, Classification, and General Criteria.

a. Category I Definition. Within the United States, a Category I instrument approach is considered to be any instrument approach or approach and landing with a decision altitude (height) not lower than 60m (200 ft) and with either a visibility not less than 1/2 statute mile (800m), or a runway visual range not less than 550m (1800 ft).

b. Background. Originally the term Category I applied only to the difference between basic turbojet ILS minima and use of a 200 foot DH with a commensurate low RVR. Subsequently, the definition and common use of the Category I classification evolved several additional times, and variations in its use developed internationally. For U.S. air carriers, the current Category I definition has been in use since FAA's standard OpSpecs were revised in the 1980s. Air carriers since that time have been issued these revised OpSpecs, in both domestic and international operations.

(1) This latest adjusted U.S. Category I definition was necessary because previous criteria for instrument approaches relating to "precision" and "non-precision" approach classification was inadequate to address modern air carrier operations. Provisions were not made for numerous levels of navigation system performance capability that are possible and needed by operators. Systems or methods such as FMS, RNAV, VNAV, electronic map displays, multi-sensor filtering, GPS, inertial systems, RNP, and various GPS augmentation schemes such as GBAS or SBAS now make possible significant improvements in instrument approach capability and cannot be suitably addressed by former criteria or classifications. Combinations of the above approach capability also cannot be adequately classified, represented, or used. Former classifications and criteria failed to appropriately consider the linear nature of modern RNAV systems, certain rare-normal and non-normal conditions, and often did not properly relate to necessary supporting airport systems (e.g., lighting, markings) or meteorological reporting capabilities (e.g., RVR). Previous criteria did not recognize that some procedures or systems formerly considered as "non-precision" (RNAV) may actually have superior performance to systems considered as "precision" systems (e.g., FMS can have better performance than ILS at and beyond distances several miles from the runway). With former criteria and classifications, it was not easy to appropriately classify these systems or derive appropriate benefits.

(2) An important consequence of the U.S. definition for Category I is that, for an air carrier, any instrument approach with minima not less than a DA(H) or MDA(H) of 200 HAT, and visibility not less than RVR 1800, is considered to be Category I. This means that VOR, NDB, RNAV, LOC, Back Course LOC and other such approaches, other than ILS or MLS, are also treated as Category I. This is true even though those approach types may have been considered "non-precision."

(3) This use of Category I is important to consistently apply to certification and authorization criteria for modern systems and procedures. It is also necessary to ensure that Operators or authorities can implement safety and efficiency advances in a timely and effective way, provide effective and uniform training, and provide necessary facilities, meteorological services, and air traffic services.

c. Instrument Approach Classification.

(1) Accordingly, this AC is based on and uses the definition of Category I as provided in 4.3.7.1. a. The AC treats classification of instrument approach procedures as being grouped into any one of three broad classes:

(a) "xLS,"

(b) "RNAV," and

(c) "Instrument procedures other that xLS, or RNAV" (e.g., traditional or classic procedures such as VOR, NDB, LOC, and ASR).

(2) Procedures identified as "xLS" may apply to ILS, MLS or GLS.

(3) Procedures identified as RNAV include procedures based on use of

- FMS
- RNAV systems using traditional VOR/DME sensors systems, or
- GNSS (GPS) or augmented GNSS systems (e.g., includes SBAS/WAAS)

(4) RNAV procedures are addressed as either three-dimensional (3-D) if suitable LNAV and VNAV is used, or two-dimensional (2-D) if only lateral navigation is used. It is recognized that various levels of performance are possible either laterally or vertically. Hence, provision is made to address Required Navigation Performance (RNP). RNAV procedures are also considered to include those which may use RNAV methods, techniques or systems to fly traditional sensor specific VOR, NDB, or Localizer based approaches (e.g., use of FMS to fly a VOR, NDB or Back Course Localizer approach in LNAV and VNAV, based on an electronic map display rather than using a "raw data" readout of course deviation). The remaining instrument procedure group titled "Instrument approaches other than xLS, or RNAV" address traditional or classic procedures such as VOR, VOR/DME, NDB, LOC, BC

LOC, and ASR. This group is considered to include any other remaining types of instrument approach procedures that are not already covered by or addressed by the groups xLS or RNAV.

(5) The AC and associated classification schema do not use former terminology of "precision" or "non-precision" as applies to xLS or RNAV instrument approaches. However, it does not preclude continued use of the term by Operators as apply to classic procedures, particularly when training materials or manuals may take a very long time to eventually be amended in the normal course of longer term revision. Since the terms "precision" and "non-precision" are not necessary to implement or conduct operations and can be confusing and ambiguous, their use is discouraged in favor of use of the common generic term "instrument approach" or use of "xLS", "RNAV", or "approaches other than xLS or RNAV" for many important applications (e.g., Inappropriately classifying as "non-precision" operations of aircraft using RNAV systems to fly multi-sensor based and highly accurate levels of RNP and accurate VNAV paths, to a low DA(H)).

d. General Criteria For Category I. The following general requirements apply to the operational authorization of Category I instrument approach procedures:

(1) The airborne system(s) should meet the requirements of the applicable paragraphs of 5.2 for the type of Category I procedures to be flown;

(2) Appropriate NAVAIDs and airport/lighting facilities for the procedures to be flown should be available, consistent with paragraph 8;

(3) Flightcrew qualification consistent with provisions of paragraph 7 for Category I has been completed;

(4) An acceptable airworthiness (maintenance) program for the airborne system is provided IAW paragraph 9; and

(5) An operational authorization has been completed IAW paragraph 10 for a U.S. operator or paragraph 11 for a Non-U.S. operator.

e. Minimum authorized DA(H). For simplicity of description, where a minimum authorized DA(H) is cited in this paragraph as applicable to Category I minima, it is stated in terms of a height above touchdown zone elevation (e.g., HAT value), even though operational minima for Category I are specified as a DA, based on MSL altitudes.

4.3.7.2. "xLS" Procedures - Minima not less than 200 feet DA(H). Instrument approach operations that may be authorized Category I minima not less than 200 ft. DA(H) include at least the following:

a. ILS.

b. GLS (GBAS/LAAS).

c. MLS.

d. Special Procedures - Special procedures having individual FAA approval for each operator or location that are capable of supporting a DA(H) down to at least 200 ft. HAT may be authorized (e.g., PAR, GLS SCAT I). Such special procedures typically require associated conditions or limitations for special flightcrew training, for navigation facility use coordination, site-specific suitability review, or operator or other agency monitoring (e.g., as for DOD provision of PAR capability).

4.3.7.3. "3D" RNAV Procedures - Minima not less than 200 feet DA(H). Instrument approach operations that may be authorized Category I minima not less than 200 ft. DA(H) include:

a. 3D RNAV procedures based on suitable levels of RNP and VNAV capability (e.g., RNP.15/125 ft. or lower)

b. 3D RNAV procedures based on acceptable full capability GNSS/SBAS(WAAS) augmentation

4.3.7.4. "3D" RNAV Procedures - Minima not less than 250 feet DA(H). Instrument approach operations that may be authorized Category I minima not less than 250 ft. DA(H) include:

a. NAVAID specific procedures flown using RNAV lateral and vertical guidance (e.g., "VOR Rwy 16R" flown using acceptable FMS LNAV and VNAV) such as a VOR, VOR/DME, NDB, Localizer, or Localizer Back Course approach flown using RNAV, when the procedural identified NAVAID(s) are referenced in the FMS position determination, or when the procedure is flown with the crew monitoring the specified facility(s) by instrument display cross reference (e.g., RDMI raw data display, or equivalent);

b. RNAV (FMS LNAV/VNAV) Procedures overlaying a NAVAID-specific procedure, when FMS position updating is referenced to "data base procedural tuning" of the specified facility(s) (e.g., "RNAV or VOR Rwy 16R" flown using acceptable LNAV and VNAV, with FMS using the appropriate procedurally identified NAVAID(s) along with any other applicable sensors for position determination);

c. RNAV (FMS LNAV/VNAV) Procedures overlaying a NAVAID-specific procedure, when FMS position updating is not based on the "data base procedural tuning" of the specified facility(s), but instead is based on the FMS's selection of optimum NAVAIDs or sensors (e.g., "RNAV or VOR Rwy 16R" flown using an FMS which is using optimally identified sensors or NAVAID(s) combinations for position determination); These procedures may be flown with or without the underlying NAVAID operational;

d. RNAV (FMS LNAV/VNAV) Procedures not based on a specific ground based NAVAID, when suitable FMS position updating is used (e.g., a "GPS Approach" flown using a suitably capable FMS and appropriate updating capability); or

e. RNAV RNP based procedures with levels of RNP or vertical navigation capability other than as qualify paragraph under 4.3.7.2.

4.3.7.5. "2D" RNAV Procedures (e.g., VOR/DME-based RNAV, or GPS-based RNAV) - Minima not less than 250 ft. MDA(H). Instrument approach operations in this group may be authorized **Category I** minima of not less than **250 ft. MDA(H).**

a. This group includes at least the following:

- 2D RNAV based on sensor inputs from GPS
- 2D RNAV based on sensor inputs from DME/DME
- 2D RNAV based on sensor inputs from VOR/DME
- 2D RNAV based on sensor inputs from combinations of LOC and VOR or DME

b. RNAV (2D - LNAV only) Procedures overlaying a NAVAID-specific procedure (e.g., FMS/RNAV, used to fly an underlying VOR or NDB approach, but flown as a 2D RNAV procedure - without procedural tuning of the specified NAVAID facility);

c. RNAV (FMS LNAV/VNAV) Procedures not based on a specific ground based NAVAID, when suitable FMS position updating is used (e.g., a "GPS Approach" flown using a suitably capable FMS and appropriate updating capability); or

d. Other FAA authorized RNAV-based approach procedures (e.g., Loran, Airborne radar).

4.3.7.6. Procedures Other than xLS or RNAV (e.g., VOR, NDB, LOC, Back Course LOC, or ASR Procedures) - Minima not less than 250 ft. MDA(H). Instrument approach operations in this group may be authorized Category I minima of not less than 250 ft. MDA(H).

a. This group includes ICAO or U.S. NAVAID-specific procedures other than those based on xLS or RNAV, including at least the following:

- VOR
- VOR/DME
- NDB
- NDB/DME
- LOC
- LOC Back Course
- LDA, and
- SDF

b. NAVAID-specific procedures as listed in item (1) above, but when flown with vertical guidance (e.g., using VNAV)

c. NAVAID-specific procedures as listed in item (1) above, but when flown with an "open loop" vertical speed based descent profile, and

d. Radar Surveillance Approach Procedures including ASR.

4.3.7.7. Other Special Procedures or Authorizations. Other special procedures or authorizations may be issued as follows:

a. Lower than Standard Category I minima authorizations may be issued, as addressed in FAA Order 8400.13 (e.g., Authorization for HUD or Autoland RVR 1800 minima, when using limited facilities for approach lighting and runway lighting).

b. Special Obstacle Assessment Procedures may be issued for a particular runway, operator, or a group of Operators (e.g., KDTW RW21R). Special Authorization to use a 200 ft. HAT DA(H) based on an obstacle assessment of the runway touchdown zone region and operator use of flight director or autoflight guidance systems.

c. Airborne Radar Approach authorizations may be issued to qualified applicants, for use with qualified airborne systems.

d. Special Limited Use (Non-ICAO) Procedures (e.g., TLS, KRM).

4.3.7.8. Previously Approved Category I Operations or Use of Previous or New Category I Criteria. Operators approved IAW criteria of earlier versions of AC 120-29 (e.g., AC 120-29 Change 3) for Category I, or operating IAW approved OpSpecs for instrument approaches other than ILS, MLS, or GLS may continue to operate IAW their previously approved program, consistent with current standard operations specifications or any special provisions approved for that operator in that Operator's approved operations specifications.

a. Approval criteria used for a particular aircraft are typically listed in an AFM. If not shown in an AFM, the applicable FAA Aircraft Evaluation Group (AEG) may be consulted through the POI or CMO, to determine eligibility.

b. Aircraft qualified using other than FAA criteria will be as designated in approved OpSpecs or as designated by the applicable AEG (e.g., through the FAA Flight Standardization Board Report for the aircraft type) or AFS-400

c. Aircraft demonstrated to meet airworthiness provisions of previous versions of AC 120-29 through Change 3, or criteria previous to AC 120-29, may remain eligible for previously approved operational authorizations. Additional airworthiness demonstration under provisions of this AC are not necessary for these aircraft unless additional credit based on meeting the criteria in the appendices of this AC is specifically sought.

d. Operators seeking credit provided for only by this version of AC 120-29A and which were not available in previous versions of AC 120-29 must meet operational criteria as described in the main body of this AC.

e. New airworthiness approvals addressing Category I, intended for use by an air carrier, may use criteria earlier than this AC only on a case by case basis as determined by FAA. Examples of cases where criteria prior to this AC may be acceptable include providing information from a service bulletin based on a previous version of AC 120-29 to ensure compliance status of an "in-service" aircraft. Another situation would be for continuing the production and delivery of an aircraft or autoflight system type which had a type certification basis using a preceding version of this AC, or when seeking certification of a new derivative aircraft which has an autoflight system the same as or very similar to one previously approved based on an earlier version of AC 120-29.

4.3.8. Requirements for Category II.

4.3.8.1. General Category II Requirements. The following requirements apply to the operational authorization of Category II instrument approach procedures:

a. The airborne system should meet the requirements of the applicable paragraph of 5.2 for the type of Category II procedures to be flown,

b. Appropriate NAVAIDs and airport/lighting facilities for the procedures to be flown, consistent with Paragraph 8, should be available,

c. Flightcrew qualification consistent with provisions of Paragraph 7 for Category II has been completed,

d. An acceptable airworthiness program for the airborne system is provided IAW Paragraph 9, and

e. An operational authorization has been completed per Paragraph 10 for a U.S. operator or Paragraph 11 for a Non-U.S. operator.

4.3.8.2. Specification of a Category II DA(H). To simplify description of Category II operations and minima, the lowest authorized DA(H) for Category II is cited in this paragraph as an equivalent DH related to wheel height above touchdown zone elevation (e.g., HAT value of 100 ft.). This is done even though operational minima for Category II are typically specified as an equivalent DH value based on radio altitude height above the underlying approach terrain.

a. DH for a Category II procedure may be set and procedurally identified by the following nominal conditions:

(1) The aircraft's navigation reference point tracks the center line of the glide path and FAS,

(2) Standard wheel to navigation reference point height and distance assumptions are used,

(3) A 100 foot or 150 foot wheel height HAT is assumed for the landing aircraft at DH, depending on minima to be specified, and

(4) A determination is made of the actual radio altitude above underlying terrain that occurs when an aircraft with nominal wheel to navigation reference height reaches the point on approach where its wheel height first reaches 100 ft. HAT.

b. Alternately a Category II DH may be set based on specifying use of a 100 foot DH above underlying terrain, regardless of circumstance in which the 100 foot above terrain point is reached. In this instance, the first point or time in which any aircraft, with any arbitrary wheel to navigation reference height, pitch attitude, configuration, lateral displacement, or speed, first reaches the point at which 100 ft. radio altitude is indicated above underlying terrain, the aircraft is considered to have reached DH.

c. While a DA is conceptually not precluded for use with Category II, DAs are not currently operationally used for Category II, except as a backup for inner marker-based minima when irregular terrain precludes reliable radio altimeter use to determine minima.

4.3.8.3. Eligibility for Category II Minima not less than 100 ft. DA(H). Instrument approach operations that may be authorized Category II minima not less than 100 ft. DA(H) include:

a. ILS,

b. GLS (GBAS/LAAS), and

c. MLS.

4.3.8.4. Use of Inner Marker. Use of Inner Marker may be authorized in lieu of a DA(H). An Inner Marker is typically used at runways designated by the applicable procedure, such as where radar altimeter use is limited due to irregular underlying terrain (e.g., RA NA).

4.3.8.5. Barometric Altimeter DAs not currently used for 14 CFR Parts 121 or 135 Category II. Barometric altimeter-specified DAs are not currently used as a basis for minima for air carrier Category II, except for those Operators electing to discontinue an approach upon reaching either the DA or DH, which ever is reached first, when visual reference is not established, or upon reaching either the DA or IM, which ever is reached first, when using an IM as the basis for Category II minima.

4.3.8.6. Category II on U.S. Type I ILS. Category II on FAA Type I ILS (limited to FAA-specified locations) for certain qualified flight guidance systems. Instrument approach operations may be authorized Category II minima not less than 100 ft. DA(H). Criteria for special authorizations for air carriers to conduct Category II operations on certain FAA Type I ILS facilities is contained in FAA Order 8400.13

4.3.8.7. Category II using RVR 300 "Meter" Minima. Category II using RVR300m minima (at designated international locations) may be authorized when meeting special provisions of Standard OpSpecs paragraph C059a Table 1. (see Appendix 7). This provision permits an operator to be authorized use of Non-U.S. State minima of RVR300m with a DA(H) of 100 ft. HAT at certain international runways qualifying for a minima less than that specified by ICAO for Category II. A flight guidance system meeting provisions of Appendix 7, Paragraph C059, paragraph c, is required. Corresponding flightcrew procedures must be used. Following successful operational experience using this provision, FAA may determine that the above authorization may be also acceptable using an auto-coupled approach to 100 ft. HAT or other flight guidance system (e.g., HUD) without necessarily meeting other provisions for Category III. Following successful operational experience using this provision, FAA may determine that the above authorization may also be approved for use at certain U.S. facilities having appropriate Category II procedures with a minimum RVR of 1000 and a DA(H) of 100 ft. HAT. For use of this provision internationally, where such operations are authorized by the State of the Aerodrome (e.g., certain European airports), FAA considers the operation to be the equivalent of a limited U.S. Category III operation (1000RVR), even though the State may locally classify or consider it to be Category II.

4.3.8.8. Precision Approach Radar (PAR). Precision Approach Radar Minima may be authorized to minima of not less than 200 ft. HAT, or the published PAR minima, whichever is higher. PAR authorizations are limited to those Operators and crews specifically qualified to use PAR. Request for PAR operations with minima below 200 ft. HAT are approved only on a case by case basis, considering any special crew qualification required, the aircraft type and its characteristics (e.g., aircraft size, aircraft geometry, and PAR radar signature), and the specific facilities to be used.

4.3.8.9. Previously Approved Category II Operations or Use of Previous or New Category II Criteria. Operators approved IAW earlier versions of AC 120-29 (e.g., AC 120-29 Change 3) for Category II may continue to operate IAW their previously approved program, consistent with current standard OpSpecs or any special provisions approved for that operator in that Operator's approved OpSpecs.

a. Approval criteria used for a particular aircraft are typically listed in an AFM. If not shown in an AFM, the applicable FAA Aircraft Evaluation Group (AEG) may be consulted through the POI or CMO, to determine eligibility.

b. Aircraft qualified using other than FAA criteria will be as designated in approved OpSpecs or as designated by the applicable AEG (e.g., through the FAA Flight Standardization Board Report for the aircraft type) or AFS-400.

c. Aircraft demonstrated to meet airworthiness provisions of previous versions of AC 120-29 through Change 3, or criteria previous to AC 120-29, may remain eligible for previously approved operational authorizations. Additional airworthiness demonstration under provisions of this AC are not necessary for these aircraft unless additional credit based on meeting appendices of this AC is specifically sought.

d. Operators seeking credit provided for only by this version of AC 120-29A, and that were not available in previous versions of AC 120-29 must meet operational criteria as described in the main body of this AC.

e. New airworthiness approvals addressing Category II, intended for use by an air carrier, may use criteria prior to this AC only on a case by case basis as determined by FAA. Examples of cases where criteria prior to this AC may be acceptable include providing information from a service bulletin based on a previous version of AC 120-29 to ensure compliance status of an "in-service" aircraft. Another situation would be for continuing the production and delivery of an aircraft or autoflight system type which had a type certification basis using a preceding version of this AC, or when seeking certification of a new derivative aircraft which has an autoflight system the same as or very similar to one previously approved based on an earlier version of AC 120-29.

4.3.9. Runway Field Length Requirements and Runway Clutter. For Category I or II, landing distance requirements are as specified by 14 CFR 121.185, 121.187, 121.195 or 121.197.

a. The following typical means of complying with the above provisions of part 121 are considered to be acceptable. Examples are provided for turbine aircraft. Aircraft other than turbine powered aircraft, or aircraft operating under 14 CFR parts other than part 121, may apply equivalent provisions in a similar manner.

b. Part 121 turbine aircraft operations must meet provisions of section 121.195(b). Normally these landing distances (e.g., that already include the specified 60% factor) are factored into the AFM data provided for landing distance. They do not have to be added additionally or separately to the AFM data.

c. If it is determined during dispatch, in weather forecasts or reports, that the landing runway may be wet (e.g., may is considered to include "chance," "occasional," "temporary," or a probability equal to or greater than 10%), the effective runway length must be at least 115% (i.e., IAW section 121.195(d)) of the distance determined under section 121.195(b).

d. Unless otherwise authorized by FAA, wet is considered to be any condition "not clear and dry" on any part of the useable area of the runway (useable area does not include edges, sides, melting of ice or snow banks at edges or sides, area beyond the advertised plowed and sanded surface, overruns, etc.).

> **NOTE 1: FAA may authorize a wet grooved runway with good braking friction characteristics, or equivalent, to be considered a dry runway for purposes of dispatch determination. A wet runway is considered to be a runway that is other than clear and dry, and has no standing water.**

NOTE 2: Aircraft for which a special demonstration has been made for stopping distance on a wet runway for compliance with section 121.195(d) may use information from this determination for low visibility landing distance assessment (see AC 121.195-1A).

e. If any useable part of the expected landing runway or runways are slippery (e.g., wet and not-grooved or porous friction coarse (PFC), snow, slush, ice, or standing water) the provisions of section 121.195(d) apply. In addition, operators should consider the possible need for extra stopping distance beyond that required by section 121.195(d) if braking action is reported or expected to be worse than "good." The amount of additional stopping distance, if any is determined by the operator to be appropriate, may be related to any estimated reduction in stopping capability for the assumed conditions.

f. Information on autobrake distance provided by the manufacturer may be used as the basis for Category I or Category II field length determinations. If AFM autobrake data is used as the basis for determining acceptable landing distance, the operator should ensure that appropriate factors for use of autobrakes are considered, and if appropriate, accounted for (e.g., brake configuration, autobrake setting(s), runway surface friction, and runway slope). If a dispatch process applies, dispatch should consider, and provide any necessary information to the flightcrew regarding any pertinent "autobrake settings" on which dispatch may be based. If autobrakes are to be used, it is not necessary to additionally factor autobrake stopping distance data by the 115% specified in section 121.195(d) beyond the stopping distance otherwise protected by section 121.195(d). However, if expected stopping distance based on using an autobrake system, or any particular setting(s) of an autobrake system, is greater than that protected by section 121.195(d), then the operator should take that fact into consideration and provide appropriate stopping distance information or stopping procedures to the flightcrew.

g. When an operator needs to provide for an instrument approach and low visibility landing following an emergency return after takeoff, or when using a takeoff alternate, the operator should consider the expected landing configuration, braking method, and initial braking speeds in assessing landing field length requirements (e.g., consider landing weight, engine out flap settings, engine inoperative speeds as applicable, potential for partial brakes, or partial antiskid, or inoperative reverse thrust).

h. When determining alternate airport field length provisions (e.g., section 121.187 or 121.197 as applicable) it is recommended that the operator consider the weights, flap settings and approach speeds that may be applicable to use of that alternate airport with an engine inoperative. For credit for use of an alternate airport based on "Engine Inoperative Category II" capability, the operator must consider such representative speeds, as applicable to the engine inoperative configuration, in assessment of the required landing distance.

i. The following field length factors and considerations are considered acceptable:

(1) Category I Field Lengths.

(a) For minima or conditions expected to be at or above RVR 3000, the runway field-length requirement for Category I is as specified by section 121.195 for either a dry or wet runway. For minima or conditions expected to be below RVR 3000, the field length requirement should be based on conditions for a wet runway (section 121.195(d)).

(b) Field length requirements are determined based on applicable weather reports and forecasts considered at the time of dispatch or release (i.e., section 121.195 reference to "takeoff"). Once an aircraft is enroute, it is recommended that field length requirements be reassessed if conditions significantly change from the conditions on which the departure was based.

(2) Category II Field Lengths. The Runway Field-Length Requirement for Category II is as specified by section 121.195(d) for a wet runway.

(a) When auto brake systems are used for Category II, information must be available to the flightcrew to assist in making the proper selection of a suitable auto brake setting consistent with the field length available for landing and the runway condition, including braking action.

(b) Category II operations should not normally be conducted with braking action less than "fair" unless the operator has a method to ensure that timely updates of field conditions are provided to the flightcrew, and, if applicable, also provided to the dispatcher, and that the flightcrew considers that sufficient runway length is available for the landing in the conditions reported.

(3) Runway Field Length Airborne Considerations. Runway field length requirements are typically considered to be dispatch or release (pre-departure) requirements rather than "in-flight" assessment requirements. In the event of unforecast adverse weather enroute, or if braking system or other failures affecting stopping performance occur enroute, the crew should consider any adverse landing distance consequences that may result from a decision to make a landing on a particular runway (e.g., braking action reports, clutter).

4.3.10. NAVAIDs or Landing System Sensors and Aircraft Position Determination.

a. Various landing system sensors (NAVAIDs) or combinations of sensors may be used to provide the necessary position fixing capability to support authorization of Category I or II landing weather minima. While certain navigation sensors (NAVAIDs) are installed and classified primarily based on landing operations, the sensors described in this paragraph may also be used for takeoff, missed approach, or other operations (e.g., RNAV position determination). Regardless of the sensors, NAVAIDs, or combination of NAVAIDs used, the NAVAIDs and sensors must provide coverage for the intended flight path and anticipated displacements from that flight path for normal operations, rare normal operations (e.g., winds and wind gradients), and for specified non-normal operations where applicable (e.g., "VNAV out" flight path, "engine-out go-around" flight path). In addition, Category I or II authorizations should be consistent with the provisions or characteristics for specific sensors listed below in paragraph 4.3.10.1 through paragraph 4.3.10.3 unless otherwise accepted or approved by FAA.

b. For NAVAID-specific procedures (e.g., ILS), use of ICAO recognized NAVAIDs are eligible for authorization as either a Standard Instrument Approach Procedure or as a Special Instrument Approach Procedure. NAVAID types that are not recognized by or in ICAO criteria (e.g., in Annex 6, Annex 10, ICAO Doc 9365/AN910 Manual of All Weather Operations) are eligible only for authorization as Special Instrument Approach Procedures.

4.3.10.1. Instrument Landing System (ILS). The ILS provides a reference signal aligned with the runway centerline and deviation signals when the airplane is displaced left or right of the extended runway centerline. The linear coverage area for this signal is approximately 3 degrees either side of the extended runway centerline from a point emanating at the far end of the runway. The ILS also provides a vertical flight path (nominally 3 degree descent angle) to a point in the landing zone of the runway. The vertical coverage is approximately 0.7 degrees on either side of the vertical reference path. ILS characteristics should be considered as defined in ICAO Annex 10, unless otherwise specified by FAA. U.S. ILS systems are classified by Type as defined in FAA Order 6750.24 (II/D/2, etc.).

4.3.10.2. Microwave Landing System (MLS). The MLS provides a reference signal aligned with the runway centerline and deviation signals when the airplane is left or right of the extended centerline. The linear coverage area is approximately 40 degrees either side of the extended runway centerline emanating from a point at the far end of the runway. The MLS provides a vertical flight path to the runway similar to ILS. MLS characteristics should be considered as defined in ICAO Annex 10, unless otherwise specified by FAA. U.S. MLS systems are classified by Type, similar to ILS.

4.3.10.3. Global Navigation Satellite System (GNSS) Landing System (GLS). GLS is a landing systems based upon the Global Navigation Satellite System (GNSS). For lowest Category I minima and Category II operations the landing system typically includes a local area differential augmentation system in the vicinity of the runway for which lowest Category I or Category II procedures are specified. The local area system may serve one or more runways, or nearby airports, depending on its classification for each particular runway. The classification of a GLS service may be different for different runway ends (e.g., III/E/3 for Runways 14L and 14R, but I/D/1 for RW 22L). Desired path, centerline, and deviation signals as applicable, are computed by airborne avionics. The coverage area for GLS is typically within a 30 mile radius of a ground facility, but extended service volumes are possible. GLS provides for both vertical and lateral flight path specification to the touchdown zone of the runway(s) served, and a lateral path for rollout or takeoff guidance. GLS characteristics should be considered as defined in ICAO Annex 10, unless otherwise specified by FAA (e.g., FAA-accepted references to RTCA SC-159 MASPS). U.S. GLS systems should typically be classified by "Type" of system for each runway end served, similar to ILS (e.g., GLS II D 2), or by an equivalent schema. Authorization for use of GLS is for each specific air carrier, aircraft type, and GLS system type until pertinent GLS international standards accepted by FAA are promulgated.

4.3.10.4. Satellite Systems. Navigation Satellite systems currently consist of the U.S. Global Position System (GPS) and the Russian Federation Global Navigation Satellite System (GLONASS). These systems may be considered part of a GNSS.

a. Various forms of augmentation exist or are in development including Space Based Augmentation Systems (SBAS), Ground Based Augmentation Systems (GBAS), and Aircraft Based Augmentation Systems (ABAS).

b. These augmentation systems may also be classified as wide area (e.g., EGNOS, WAAS, MSAS) or local area augmentation systems (e.g., LAAS).

c. GNSS may be combined with certain augmentation systems (e.g., LAAS) to provide a GNSS based Landing System (GLS).

4.3.10.4.1. GPS/GLONASS and Reference Datum Information. Satellite position fixing systems authorized for use by U.S. Operators include GPS and FAA-authorized augmentation systems for use with GPS (e.g., WAAS or LAAS). These systems may be used in the U.S., in U.S. territories, in other States that authorize GPS use, and in international airspace.

a. When using GPS or navigation systems that base position fixing on GPS, it is the responsibility of the operator to ensure that in airspace outside of the U.S. that an appropriate Reference Datum (e.g., WGS-84) is used for definition of waypoint or critical path point coordinates. Information on states using WGS-84 or various other databases are typically available from commercial charting sources, and may be available on the worldwide web.

b. An example of one worldwide web data source for "Datum" information that is acceptable for use is:

http://www.jeppesen.com/qref.html

c. GLONASS, or other satellite position fixing systems than GPS, may be used only as approved by the CHDO/POI following coordination with AFS-400.

4.3.10.4.2. Local Area Systems. Ground Based Augmentation Systems (GBAS) are considered to include the FAA's Local Area Augmentation System (LAAS) and non-federally provided systems (e.g., SCAT I).

a. Initial GLS augmentation authorizations have been limited to use of a DA(H) not lower than 200 ft. HAT. This value may be reduced as more capable airborne or ground based LAAS equipment is implemented or upgraded, amended criteria are issued, increasing numbers of GLS operational authorizations are issued for a wider variety of operating conditions, and satisfactory operating experience is gained.

b. Procedures based on any form of GBAS augmentation with performance that is equivalent to or better than a U.S. Type I ILS may be identified as "GLS" (GPS Landing System) procedures.

4.3.10.4.3. Wide Area Systems.

a. Space Based Augmentation Systems (SBAS) include the FAA's wide area augmentation system (WAAS) and other internationally accepted wide area augmentation systems (e.g., EGNOS, MSAS).

b. Credit for use of SBAS augmentation alone would currently be limited to use of DA (H) not lower than 200 ft. HAT. Procedures based on any form of SBAS augmentation alone or SBAS augmentation in multi-sensor systems such as FMS should be identified as "RNAV" or "RNAV RNP" procedures, as applicable.

4.3.10.5. LOC/LDA/SDF/Back Course. Localizer, Localizer Type Directional Aid (LDA), Simplified Directional Facility (SDF), and Back Course (BC) ILS procedures are authorized for air carrier use and may be authorized to Category I minima not less than 250 ft. HAT.

4.3.10.6. VOR Authorized Procedures. VOR based procedures, when based on VOR alone, when based on multiple VORs, or when specified in conjunction with use of DME, may be authorized to use Category I minima not less than 250 ft. HAT.

a. VOR or VOR/DME based procedures may be flown using any of the following flight instrument displays suitable for the procedure to be accomplished, and for course or intended flight path to be achieved, including:

- EHSI or ND Map Display
- EHSI or ND Raw data display (e.g., EHSI lateral deviation display or VOR needle(s))
- Electromechanical HSI
- RMI, RDMI, or equivalent, or
- raw data lateral deviation display (e.g., cross pointer display)

b. VOR procedures, when flown as a procedure without vertical guidance (e.g., without VNAV), should use an MDA(H).

c. Qualifying VOR procedures, when flown with approved vertical guidance (e.g., with VNAV), may use either an MDA(H) or a DA(H), as determined to be suitable by the operator for the procedure or group of procedures to be flown.

d. The aircraft navigation system or flight instrument system display(s) used should be determined to be acceptable by the POI, for the procedures to be flown, considering that operator's routes, procedures, crew qualification, training, and recency of experience policies or programs.

e. Use of a Single VOR Airborne System.

(1) Under certain conditions, the use of a Single Airborne VOR system may be acceptable. The objective is for the pilot to have multiple ways of navigating, when operating with a single airborne VOR system such that, in the event of failure of a single element of the airborne navigation or display system, or the NAVAID, the approach can be safely discontinued at any point during the approach to touchdown, or at any time during a missed approach.

(2) Additionally, following initiation of the missed approach or rejected landing, a transition can be made to use some other NAVAID or NAVAIDs, other than the failed system or facility, to complete a safe missed approach and subsequent flight and an approach to an alternate.

NOTE: A period of dead reckoning may be permissible between the time the failure occurs and the time alternate navigation means are established for continuing the missed approach and flight to alternate. During this period of dead reckoning the aircraft should not be unduly exposed to loss of obstacle clearance due to proximity to terrain or significant obstacles. Suitable navigation performance should be achievable to safely complete the missed approach, fly to the alternate, and complete a subsequent approach using a different navigation system or NAVAID, without loss of knowledge of position, loss of appropriate obstacle clearance, or loss of terrain clearance.

f. Use of RNAV for VOR, VORTAC, or TACAN Fix Substitution. VOR, NDB and TACAN fixes may be authorized for substitution use with "xLS" procedures.

(1) RNAV waypoints or along track fixes may otherwise be substituted for any VOR, TACAN, DME, NDB, Compass Locator, marker beacon, or other fix on any segment of a VOR, VOR/DME, ILS or MLS, LOC, LOC BCRS, or NDB procedure where a corresponding VOR azimuth (radial) or TACAN fix is procedurally specified or can be determined by the FMS to the necessary degree of accuracy and reliability.

(2) The substitution of RNAV capability based on FMS or GPS must be determined to be acceptable for that operator by the CMO or POI.

g. Inoperative or Unsuitable VOR, VORTAC, TACAN, or DME NAVAID. If VOR, VORTAC, TACAN, or DME updating is used in support of area navigation system (e.g., FMS) position determination, Operators and flightcrews should be aware of when and how to disable use of an unsuitable NAVAID or NAVAID element within the navigation system. This is especially true when the unsuitable NAVAID is likely to cause a significant map shift (e.g., movement of a ground NAVAID to a new geographic location without making a corresponding update to that NAVAID's recorded position in an aircraft's navigation system database, thus leading to introduction of a sudden navigation system map display position error).

4.3.10.7. DME. DME based procedures, when used in conjunction with VOR, NDB, LOC, LDA, SDF, or BC are authorized for air carrier use, and may be authorized to Category I minima not less than 250 ft. HAT.

a. When used in conjunction with ILS or MLS, DME along track fixes may be authorized for use with Category I, II, or III procedures, as applicable to the specified procedure.

b. Except for Category II or Category III procedures that are specifically identified by FAA as requiring use of an Inner Marker, DME along track fixes may otherwise be substituted for any marker beacon, VOR, NDB, or Compass Locator on any segment of an ILS or MLS procedure where the corresponding DME value is procedurally specified or can be determined.

c. Use of **RNAV for DME Fix Substitution.** Suitable RNAV systems including FMS or GPS may be used to substitute for DME when equivalent DME fix information can be established by the flightcrew. For this substitution to be authorized, suitable chart information and flight deck navigation system display information (e.g., electronic navigation map displays) must be available to establish the equivalent DME fix capability required for the areas, airspace, routes, or procedures to be used by the operator. Such substitution may be applicable to normal inflight use, to continuation of flight after failure, or to dispatch with inoperative DME capability if consistent with the applicable MMEL for the aircraft type. The substitution of RNAV capability based on FMS or GPS must be determined to be acceptable for that operator by the CMO or POI.

d. Inoperative or Unsuitable DME NAVAID. If DME updating is used in support of area navigation system (FMS) position determination, Operators and flightcrews should be aware of when and how to disable use of an unsuitable NAVAID or NAVAID element within the navigation system. This is especially true when the unsuitable NAVAID is likely to cause a significant map shift (e.g., movement of a ground NAVAID to a new geographic location without making a corresponding update to that NAVAIDs recorded position in an aircraft's navigation system database, thus leading to introduction of a sudden navigation system map display position error).

4.3.10.8. NDB Authorized Procedures. NDB based procedures, when based on NDB alone, when based on multiple NDBs, or when specified in conjunction with use of DME are authorized for air carrier use, and may be authorized to minima not less than 300 ft. HAT.

a. NDB or NDB/DME based procedures may be flown using an appropriate EHSI or ND Map Display, EHSI or ND Raw data display, Electromechanical HSI, RMI, RDMI, or ADF display for course guidance, as determined acceptable to the POI considering the crew qualification, training, and recency of experience applicable to that operator.

b. NDB procedures, when flown as a procedure without vertical guidance (e.g., without VNAV), use an MDA(H).

c. NDB procedures, when flown as a procedure with approved vertical guidance (e.g., with VNAV), may use a DA(H).

d. Use of a Single NDB/ADF Airborne System. Other than following an in-flight failure of one of several installed airborne systems NDB/ADF receivers, instrument procedures based on NDB/ADF may be flown using a single airborne NDB/ADF receiver in lieu of two airborne NDB/ADF receivers (reference section 121.349) under the following conditions:

(1) The operator is authorized to conduct procedures using a single airborne NDB/ADF receiver;

NOTE: Authorization for use of a single NDB/ADF may be for a specific procedure, a group of procedures, for an operator's particular fleet of aircraft (e.g., B727 fleet), for all of an operator's aircraft, or for a geographic region (e.g., within the United States and U.S. territories), as applicable to the operator's route structure, and fleet.

(2) Instrument procedures requiring simultaneous use of more than one NDB/ADF NAVAID facility are not authorized, unless approved for that operator and each specific procedure;

(3) In the event of failure of the airborne NDB/ADF receiver, or other essential element of the airborne NDB/ADF navigation or display system, or the NDB/ADF NAVAID, the approach can be safely discontinued at any point during the approach to touchdown, or at any time during a missed approach, and

(4) Following initiation of the missed approach or rejected landing, a transition can be made to use some other NAVAID or NAVAIDs, other than the failed system or facility, to complete a safe missed approach and subsequent flight to an alternate.

NOTE: A period of dead-reckoning may be permissible between the time the NDB/ADF airborne system or NDB/ADF NAVAID failure occurs and the time alternate navigation means are established for continuing the missed approach and flight to alternate. During this period of dead-reckoning the aircraft should not be unduly exposed to loss of obstacle clearance due to proximity to terrain or significant obstacles. Suitable navigation performance should be achievable to safely complete the missed approach, fly to the alternate, and complete a subsequent approach using a different navigation system or NAVAID, without loss of knowledge of position, loss of appropriate obstacle clearance, or loss of terrain clearance.

e. Use of RNAV for NDB Fix Substitution.

(1) Suitable RNAV systems including FMS and GPS may be used to substitute for NDB or ADF when equivalent NDB fix information can be established by the flightcrew. RNAV (FMS) fixes may be authorized for use as an NDB substitute with Category I, II, or III procedures, as applicable. RNAV fixes based on FMS may also be substituted for bearing or cross track fixes. RNAV waypoint or along track fixes may be substituted for any NDB, Compass Locator or other NDB based fix on any segment of a VOR, ILS or MLS, LOC, LOC BC, or NDB procedure where the corresponding NDB bearing is procedurally specified or can be determined by the FMS to the necessary degree of accuracy and reliability.

(2) For substitution to be authorized, suitable chart information and flight deck navigation system display information (e.g., electronic navigation map displays) must be available to establish the equivalent NDB fix

capability required for the areas, airspace, routes, or procedures to be used by the operator. Such substitution may be applicable to normal inflight use, to continuation of flight after failure, or to dispatch with inoperative ADF capability if consistent with the applicable MMEL for the aircraft type. The substitution of RNAV capability based on FMS or GPS must be determined to be acceptable for that operator by the CMO or POI.

f. Inoperative or Unsuitable NDB NAVAID. If NDB updating is used in support of area navigation system (FMS) position determination, Operators and flightcrews should be aware of when and how to disable use of an unsuitable NAVAID or NAVAID element within the navigation system. This is especially true when the unsuitable NAVAID is likely to cause a significant map shift (e.g., movement of a ground NAVAID to a new geographic location without making a corresponding update to that NAVAID's recorded position in an aircraft's navigation system database, thus leading to introduction of a sudden navigation system map display position error).

4.3.10.9. Radar Systems (e.g., PAR, ASR). Various other systems are in limited use (e.g., PAR, ASR). These systems are considered for air carrier operations only as described below.

a. Air carrier approach operations using ASR or PAR may only be approved if OpSpecs contain authority for their use.

b. For use of ASR, dedicated training is not specifically required unless the POI determines that the Operators general training and qualification program is not satisfactory for routine use of ASR procedures, and that specific ASR training is needed.

c. For use of PAR, dedicated PAR training is appropriate unless the POI determines that the Operators training and qualification program is otherwise able to ensure adequate crew preparation so that dedicated PAR/ASR training or demonstration is not needed (also see 4.3.8.8).

4.3.10.10. Other Systems, Procedures, and Special Systems.

a. Marker Beacons. 75 MHz marker beacons are used in the NAS or internationally as part of ILS, and for other limited or special applications (e.g., step-down fixes, departure turn points for instrument departure heading assignments). Use of marker beacons does not require dedicated crew training or qualification beyond that for conduct of ILS approaches.

b. Airborne Radar Approach. Operational authorization of use of any "airborne radar approach" procedure (e.g., use of ground mapping radar or equivalent) for purposes of conducting an instrument approach requires coordination with AFS-400, and may require proof of concept demonstration acceptable to FAA.

c. KRM, RMS, SRE or other unique systems or procedures which are not necessarily used IAW ICAO criteria (e.g., as used in certain parts of Europe) may only be approved for use by an air carrier if the aircraft is suitably equipped to receive and use the specified system and the system can meet the performance, integrity, and availability standards equivalent to those established for currently approved types of U.S. operations (e.g., ILS, LDA, ASR, RNAV using FMS). Minima authorized should not be less than any corresponding minima that would be applicable to an equivalent U.S. procedure. If not otherwise an ICAO standard NAVAID, operational authorization of use of such systems should include coordination with the state of the aerodrome and with AFS-400, and may require acceptable review of use or demonstration of use to FAA (e.g., to a POI, APM, or CMO).

d. Transponder Landing System. Transponder Landing System or other such "multi-lateration" systems may only be approved for an air carrier if the system can meet the performance, integrity, and availability standards equivalent to those established for currently approved types of operations (ILS, FMS, etc.), to corresponding minima. Operational authorization of use of any of these systems requires successful completion of a proof of concept demonstration acceptable to FAA.

e. Enhanced Vision Systems are intended to provide the flightcrew with a visual presentation of a view of the approach to a runway that may otherwise be obscured by weather or darkness. Air carrier approach operations using these systems may only be approved if the system can meet the performance, integrity, and availability standards equivalent to those established for currently approved types of operations (e.g., ILS, FMS, etc.), to corresponding minima. Operational authorization for use of enhanced vision systems requires successful completion of a proof of concept demonstration acceptable to FAA.

4.3.10.11. Circling Approaches. When instrument approach design criteria or operational factors do not permit a "straight-in" approach to the landing runway, circling procedures may be used. U.S. criteria require SIAP publication of circling maneuver minima if the inbound course is offset more than 30 degrees from the runway centerline, or when a specified descent gradient for a straight-in approach is steeper than a maximum value allowed by instrument procedure design criteria.

a. Use of circling minima, however, does not preclude a pilot making a straight in landing if the requirements of section 91.175 can be continuously met below MDA(H), to touchdown, for adequate visual reference and for normal landing maneuvering. Typically, circling approaches are based only on an MDA(H). Use of a DA(H) for circling is addressed because certain procedures using a DA(H) may apply to "sidestep" maneuvers, or may be used with very high values of DA(H), such as in mountainous areas that otherwise may require a circling maneuver to position to land after reaching minimums.

b. The circling maneuver can be initiated from any instrument approach procedure where circling is authorized, and may be continued below MDA(H) or beyond the missed approach point (MAP) only when the specified visual reference exists, and when in a position for a normal descent to landing. Electronic course or glidepath information, or FMS flight path presentations are only considered supplementary information to visually accomplishing the circling maneuver. The pilot must keep the aircraft's position within the established maneuvering area for the approach speed and category specified for the procedure while performing the circling maneuver. An altitude at or above the circling MDA(H) must be maintained until an aircraft (using normal maneuvers) is in a position from which a normal descent can be made to touchdown within the touchdown zone. A missed approach must be executed when external visual references are lost or sufficient visual cues to manually maneuver the aircraft cannot be maintained.

c. It is important to note that the published missed approach procedure may not provide obstacle clearance when below DA(H) or MDA(H), or when past the published missed approach point (MAP). If it is necessary to conduct a missed approach from below the DA(H) or MDA(H) or from past the published MAP (e.g., as a result of a balked landing, rejected landing, loss of visual reference, not in a safe position to land, blocked runway, or other similar reason for a go-around), reference to the associated IFR departure procedure for the applicable runway(s) usually provide help to the pilot in determining a safe course of action to climb back to procedurally protected airspace (adequate obstacle clearance) as specified by the published missed approach procedure.

d. When a missed approach from a circling maneuver is executed from below DA(H) or MDA(H) such as when visual reference is lost after passing DA(H) or MDA(H), or when initiating the missed approach from beyond the missed approach point such as when not able to maneuver to be able to accomplish a normal landing in the touchdown zone, the direction of the initial missed approach turn should typically be in a direction toward an appropriate runway, to ensure obstacle clearance. This is to keep the aircraft within the maneuvering area, until climb above the DA(H) or MDA(H), and intercept of a published segment of the missed approach procedure can be accomplished. Pilots should be aware of the applicable radius of protected airspace for the respective approach category used for the circling maneuver, and attempt to maneuver the aircraft within that protected airspace radius from the airport.

e. Operators may be authorized to perform circling approaches as published, or may choose not to train flightcrews to accomplish circling maneuvers and accept corresponding high minima limitations regarding circling approaches. If an operator chooses not to train for circling approaches, a 1000 ft HAT DA(H) or MDA(H) and 2 mile visibility limit, or greater, is typically included in OpSpecs to limit use of circling minima for that operator or aircraft type.

f. It is recommended that unless special circumstances exist, wide body (long wingspan) aircraft or aircraft needing to accomplish circling maneuvers at speeds in excess of 165 KTS ground speed should not typically be authorized circling minima below 1000 ft. HAT and 3 miles meteorological visibility.

4.4. RNAV/Flight Management Systems (FMS). An FMS provides a means to navigate along a flight path based upon earth referenced waypoints. These waypoints can define a flight path that originates or terminates at a runway or at other relevant fixes located in terminal or en route airspace. This type of system may be approved for low visibility approach and missed approach operations IAW criteria in pertinent appendices of this AC and standard OpSpecs.

a. FMS systems eligible for use must meet criteria of AC 25-15, AC 20-129 and AC 20-130, or subsequent criteria, or equivalent criteria. Equivalent systems are considered to be those systems previously shown to meet AC 90-45 which predated the above references, but would have otherwise been capable of meeting essential elements of the later criteria (e.g., B757, B767), or other aircraft that have subsequently been determined to be capable of meeting essential elements of the above criteria even though they were not specifically certificated using that criteria (e.g., certain non-U.S. manufactured aircraft such as the A320).

b. For RNP operations, additional information is provided below and in paragraph 4.5 and Appendix 5.

4.4.1. FMS Use for xLS Procedures

a. ILS, MLS, or GLS approaches or procedures are typically flown with FMS only to the extent that the FMS:

- Serves as a means to display the ILS, MLS, or GLS procedure (e.g., as on a navigation map display);
- May be used to tune appropriate ILS, MLS, or GLS NAVAIDs or radio frequencies;
- May be used to define and display and fly various LNAV or VNAV segments to intercept the final approach path or segment, or glideslope; or
- May be used to define, display and fly various LNAV or VNAV segments for a missed approach path.

b. Use of FMS to fly ILS, MLS, or GLS approaches when ILS, MLS, or GLS navigation aids are out of service (e.g., localizer or glideslope inoperative, or GNSS GBAS facility inoperative) may be authorized only in conjunction with RNP criteria (See paragraph 4.4.4 below).

4.4.2. FMS Use for Procedures Other Than xLS or RNAV. FMS may be used to conduct VOR, VOR/DME, NDB, NDB/DME, LOC, and LOC Back Course approaches when suitable navigation position updating which provides required accuracy and integrity is used by the FMS (e.g., DME-DME-IRS, or scanning DME, or VOR/DME, or GNSS position updating, or Localizer (LOC) updating, etc.).

4.4.3. FMS Use for RNAV. FMS may be used as a 2D or 3D RNAV system, to conduct RNAV instrument approaches.

a. RNAV procedures may be authorized based on one or more "procedure specified" NAVAID(s) (e.g., the FMS data base identifies a specific VOR/DME "Procedure tuned ("P" tuned)" NAVAID, or a combination of specific DME facilities to use as a basis for the procedure).

b. GPS approaches are considered to be RVAV approaches when flown by an FMS. GPS approaches may only be flown by those FMS systems which are capable of suitable GPS position updating and have appropriate navigation data base information to properly load and display the procedure to the flightcrew. Not all GPS approaches may necessarily be suitable for use with FMS because of procedure design, vertical path definition, an inability to "call up" or "load" the procedure from a data base, because the FMS may not be able to appropriately recognize "GPS" as a type of approach classification, or because the airplane AFM may not suitably provide for GPS procedure use. Operators intending to fly "GPS approaches" using FMS should treat such procedures as

RNAV procedures, and ensure that the FMS can properly fly each procedure or each type of procedure to be used (e.g., LNAV/VNAV or LNAV only).

c. RNAV procedures may also be authorized based on use of a "NAVAID rich environment" in which specific "procedure identified" NAVAIDs may not be identified, but rather the FMS is permitted to select optimum NAVAID's from those available. When such RNAV and NAVAID updating procedures are used, the NAVAID service provider, authority, or operator must ensure that the normally selected NAVAID(s) and the alternately selected NAVAID(s) suitably support the procedure to an acceptable level of accuracy and availability (e.g., at ranges, at altitudes, and along the expected flight paths relevant to achieving appropriate system approach performance). For an FMS which uses DME-DME or VOR-DME-based NAVAID sensors in conjunction with IRS, in a NAVAID rich environment, this can typically be accomplished by analysis, or by in-flight assessment (usually during line operations) to show suitable NAVAID reception for normal facilities to be used and for the first alternate facilities anticipated to be used for a particular system and procedure if the normal facility(s) become unavailable. For equivalent RNAV procedure assessments for RNP-qualified aircraft, see paragraph 4.4.3.3 below.

d. RNAV procedures that do not use "procedure tuned facilities" may be authorized for use with multi-sensor FMS based on use of "DME-DME" updating, "VOR/DME" updating, "scanning DME" updating, or "GNSS (GPS)" updating. These methods may be used individually, or may be used in combination, or may be used in conjunction with inertial position filtering.

> **NOTE: For purposes of this paragraph, any 14 CFR part 97 procedure with a specified DME limitation must be reviewed and resolved by the POI prior to the operator's use of that procedure.**

4.4.3.1. Use of a Single RNAV Airborne System. Other than following an in-flight failure of one of several installed airborne RNAV systems (e.g., failure of one FMS), instrument procedures based on RNAV may be flown using a single airborne RNAV system in lieu of two RNAV systems (reference section 121.349) under the following conditions:

a. The operator is authorized to conduct procedures using a single RNAV (FMS) system,

> **NOTE: Authorization for use of a single RNAV may be for a specific procedure, a group of procedures, for an operator's particular fleet of aircraft (e.g., B737 fleet), for all of an operator's aircraft, or for a geographic region (e.g., within the United States and U.S. territories), as applicable to the operator's route structure, and fleet.**

b. Instrument procedures requiring simultaneous use of more than one RNAV system are not authorized, unless approved for that operator and each specific procedure,

c. In the event of failure of the airborne RNAV system, or other essential element of the airborne RNAV navigation or display system, or associated NAVAID(s), the approach can be safely discontinued at any point during the approach to touchdown, or at any time during a missed approach, and

d. Following initiation of the missed approach or rejected landing, a transition can be made to use some other NAVAID or NAVAIDs, other than the failed RNAV system or facility(s) used by that system, to complete a safe missed approach and subsequent flight to an alternate.

> **NOTE: A period of dead-reckoning may be permissible between the time the RNAV system is used and reversion to another system, or following NAVAID failure, to the time alternate navigation means are established for continuing the missed approach and flight to alternate. During this period of dead-reckoning the aircraft should not be unduly exposed to loss of obstacle clearance due to proximity to terrain or significant obstacles. Suitable navigation performance should be achievable to safely complete the missed approach, fly to the alternate, and complete a subsequent approach using a different navigation system or**

NAVAID(s), without loss of knowledge of position, loss of appropriate obstacle clearance, or loss of terrain clearance.

4.4.4. FMS Use for RNAV with RNP. RNP operations may be based on capability as specified in a FAA approved AFM. RNP operations may also be based on "Fleet Qualification" of and individual aircraft, a group of aircraft, or an aircraft type using criteria acceptable to FAA (e.g., RTCA DO-236 Appendix D for RNP Fleet Qualification).

a. Approach or departure RNP operations for an air carrier typically require dual FMS capability for RNP.

b. See paragraph 4.4.2 above for operations and limitations that may apply for a single FMS with RNP capability. In addition, procedures for departure or approach for air traffic separation that are based on use of RNP may require use of dual RNP-capable systems, when so designated.

c. FAA may authorize other approach types for use by FMS on a case by case basis for each operator or aircraft type.

4.4.4.1. Standard RNP Qualification. FMS may be used as a 2D or 3D RNAV RNP system, as appropriate, to conduct RNAV instrument approaches based on aircraft qualification for RNP. Operations should be consistent with the approved AFM and apply appropriate RNP obstacle clearance criteria. Appendix 5 provides obstacle clearance criteria for RNP that can be used for RNAV approaches using RNP-based minima. FAA Order 8260.47, or other criteria acceptable to FAA, may be used to specify vertical obstacle clearance criteria for use of VNAV.

4.4.4.2. "Fleet Qualification" For Use of RNP. Some FMSs do not incorporate provisions for RNP as part of their type design approval. Aircraft with such FMSs may be candidates for fleet qualification for one or more RNP levels when certain provisions are met for autoflight systems, displays, annunciations, and FMSs. These aircraft may use corresponding RNP procedures and criteria (e.g., see Appendix 5 for RNP-based obstacle criteria). Criteria of Appendix 5 applicable to RNP-based RNAV approaches may be used for these FMS systems when approved by the FAA. RNP vertical criteria or vertical criteria of FAA Order 8260.47, or other criteria acceptable to FAA, may be used to specify vertical obstacle clearance requirements for use of VNAV.

a. Examples of aircraft and systems which may typically "fleet qualify" under this provision would be aircraft having IRS and dual FMS incorporating GPS updating, or dual FMS using DME-DME or scanning DME updating when the aircraft is operated in an area with a significant number of DME facilities. A significant number of DME or other NAVAID facilities are considered to be a number which provide for adequate signal coverage in the event of failure of any single facility, and with more than one facility or facility pair providing acceptable position update geometry and accuracy, considering the updating requirements for the FMS and any other relevant sensors used (e.g., IRS, IRU, ADIRU). Typically, aircraft having FMS and sensor systems such as these are considered to meet either /E or /F flight plan classification.

b. The following capabilities for aircraft and systems (e.g., for aircraft systems described, named or described differently but providing equivalent capability) should be considered for fleet qualification for RNP 0.3 or greater.

(1) Suitable autopilot or Flight Director use*,

(2) Suitable alerting; e.g., an "IRS Only" annunciation message, should suitable NAV updating not be available, and

(3) Suitable navigation display; e.g., A 10 mile (or lower) EFIS Map Scale, showing the designated flight path (such as an FMS designated green or magenta flight path line), with a suitable aircraft position symbol allowing a pilot to suitably monitor availability of a correct flight path, and aircraft path displacements (FTE)**,

(4) Suitable navigation check procedures; e.g., if not otherwise ensured by system performance or flight deck annunciation, a "reasonableness check" for acceptable position fixing error to be completed not later than passing a Final Approach Fix (FAF), and

(5) Suitable navigation system status assessment, e.g., a NAVAID or sensor updating capability suitability cross check, performed not later than passing a Final Approach Fix (FAF)***.

c. Additional criteria may be necessary depending on the specific fleet, and desired operations, routes, or procedures. Additional information may be found in DO 236, Appendix D.

***NOTE: Credit may be limited by Flight Technical Error (FTE) capability that can be achieved.**

****NOTE: The objective is to assure that the pilot has that information, in a suitable form, necessary to conduct the operation (e.g., appropriate to the airspace/type of operation). Credit for systems other than EFIS "map displays" (e.g., systems using only an HSI or lateral deviation scale display) for RNP may be permitted, but credit is limited to use of "simple procedures." Procedures considered to be unacceptable (i.e., not simple) are those procedures involving:**

- **multiple short flight path segments,**
- **frequent or large angle turns**
- **critical obstacles adjacent to turns**
- **adjacent aircraft flight paths with turns**
- **adjacent significant or mountainous terrain**
- **use of multiple or complex VNAV gradients**
- **procedures requiring a high level of pilot "situation awareness" to detect and correct the consequence of flight path definition or waypoint difficulties (e.g., an FMS "Legs Page" waypoint "Bypass")**
- **procedures unduly sensitive to pilot setup errors or mistakes made in programming a navigation system that could readily be detected when using a map display**
- **procedures that require unusual levels of attention, FTE monitoring, or**
- **other criticality that are aided by use of a map display**

*****NOTE: May be a limiting factor for the level of RNP to be authorized, considering the pilot or operator's ability to assess position fixing errors as relate to sensors or NAVAIDs intended to be used.**

4.4.4.3. Assessment Credit for RNP-qualified aircraft flying "non-RNP" based RNAV Procedures. RNAV procedure assessment credit may be based on an RNP (AFM qualified) aircraft flying non-RNP based RNAV procedures to demonstrate that acceptable system performance is achieved and that a NAVAID rich environment (e.g., DME-DME IRS or RNAV-DME IRS updating) is capable of appropriately supporting an RNAV procedure for that aircraft and system type. For such assessments, it is acceptable for an operator to show that the demonstrated ANP (EPE) remains below an acceptable value throughout an approach, and any applicable parts of a missed approach, for the normal and first alternate FMS NAVAID facility selections expected to be used (see paragraph 4.4.3).

4.4.4.4. Assessment of Expected Levels of ANP for RNP-qualified aircraft flying "RNP" Procedures. When RNP qualified aircraft ("AFM Qualified" or "Fleet Qualified") fly "RNP" based RNAV procedures, suitable levels of positioning accuracy (e.g., anticipated, projected, or achievable) should be available appropriate to the level(s) of RNP intended and the procedures used.

a. If the procedure specifies ground-based facilities to be used for the procedure, this assessment may be considered to have already been done. Otherwise, an assessment must be accomplished (e.g., by that operator, by another operator, by a designee, by an authority, or by a service provider).

b. An accuracy assessment of navigation services may apply to an airspace, areas, routes, procedures or operations planned or otherwise intended (e.g., contingency alternates). The assessment may be accomplished by any one or more of a variety of technically qualified people or organizations, including the operator, a pilot, a fleet manager or other qualified representative of the operator (e.g., dispatcher), an authority, airspace planners, procedure developers, air traffic services, charting agencies, through ICAO global or regional agreement, by technically qualified supporting contractors to any of the above entities, or by a relevant aircraft or avionics manufacturer.

c. When determining the suitability of the airplane/system to achieve the expected level(s) of accuracy, the person or organization accomplishing the assessment should refer to appropriate airplane and system material. The expected levels of accuracy should be applicable to the system or systems to be used (e.g., airborne system as well as supporting NAVAIDs or space-based system elements external to the aircraft), should be suitable to support the level(s) of RNP to be used for the time period(s) to be used, and should be compatible with the airspace or procedures to be used (e.g., consider geographic or geometric effects such as "terrain masking," if applicable).

d. Acceptable source material for determining anticipated, expected, projected, or achievable ANP may include any one or more of the following:

- Information from an applicable aircraft AFM
- Information from an applicable aircraft operating manual
- Applicable operational navigation documents (e.g., Systems Requirements and Objective (SR&O) documents) available from the aircraft or avionics manufacturer that apply to a navigation system
- Appropriate authority or air traffic service provider assessments or airspace studies
- Appropriate published instrument procedure provisions
- Authority, ATS provider, or ICAO-specified NAVAID locations, standard NAVAID characteristics, NAVAID performance and service volume charts or plans
- Published GNSS satellite constellation characteristics or GNSS augmentation method characteristics found acceptable to FAA and the State of the Aerodrome or ICAO
- NOTAM information
- AIP or AIM, or equivalent, information
- Appropriate studies or assessments conducted by an operator found acceptable to FAA, or
- Any other source material able to help assess projected accuracy that is found acceptable to FAA

e. The primary and secondary NAVAIDs identified during this process should be determined to be operating prior to use (e.g., the operator or pilot should ensure that the pertinent NAVAIDs are not "out of service").

4.4.5. FMS VNAV. FMS procedures typically use vertical navigation capability (VNAV) based on a barometric pressure-based VNAV path (e.g., Barometric (Baro) VNAV). FMS systems may also use a VNAV path based on a geometrically defined VNAV path which is fixed in space by "earth centered earth fixed (ECEF) coordinates" (e.g., fixed relative to earth reference and does not vary with barometric pressure - analogous to an ILS Glide Slope, except does not compensate for earth curvature). In this AC these paths are referred to as "ECEF Geometric VNAV Paths."

a. ECEF Geometric VNAV Paths (if and when used) typically are only used for final approach segment path definition. ECEF Geometric VNAV Paths, if used in either an FMS or instrument procedure, must be clearly distinguished from Baro VNAV paths, and must have clearly defined and compatible transitions from Baro VNAV paths to the ECEF Geometric VNAV Path. Baro VNAV paths may be used for all applications including final approach paths.

b. Baro VNAV paths may be defined as follows:

(1) Baro VNAV paths with constraints for "at," "at or above," "at or below," or the proceeding with corresponding speed constraints.

(2) Baro VNAV geometrically-based path defined as an approximate straight line segment from one defined WP pressure altitude to another WP pressure altitude (following earth curvature), or

(3) Baro VNAV geometrically-based path defined as two approximate straight line segments from one defined WP pressure altitude to another WP pressure altitude (following earth curvature), but using a reduced gradient for the final part of the path preceding the "to" WP to accommodate a speed constraint at the "to" WP, or

(4) Baro VNAV Performance-based climb or descent paths may be used.

(5) When used for a final approach segment, Baro VNAV paths may be based on a defined descent path angle rather than a segment between two sequential WP barometric altitudes, and

(6) For credit within this AC for use in a final approach segment (e.g., DA(H) credit) a Baro VNAV path should:

(a) Meet provisions of AC 20-129, as amended, for VNAV, or equivalent (e.g., equivalent means aircraft such as the B757 or A320 which meet AC 90-45A or other earlier international standard as a certification basis, but have systems which operationally have been determined to meet objectives of AC 20-129. Such aircraft system designs preceded issuance of AC 20-129, and were the basis for its subsequent development), and

(b) Be capable of providing vertical tracking performance within ± 125 ft vertically (two sigma) (e.g., meeting or meeting the equivalent of RNP 0.3/125 ft. for the vertical performance component), excluding temperature correction for deviation from ISA, (see 4.2.5-1),

or,

(c) Alternately, FMS systems may provide for additionally more accurate vertical tracking performance within ± 45 ft vertically (two sigma) or + 15 ft. vertically (e.g., meeting or meeting the equivalent of RNP x.xx/45 ft. or RNP x.xx/15 ft. for the vertical performance component), excluding temperature correction for deviation from ISA, (see 4.2.5-1), and

(d) Provide a VNAV path vertical displacement scale display showing a displacement range within at least ± 550 ft. or less (with a scale of ± 400 ft. recommended), unless meeting the more stringent requirement of paragraph 5.9.2 Figure 5.9.2-1 for final approach segment displays.

c. It is also recommended that the FMS systems have digital readout capability available to the pilot showing vertical displacement (e.g., FMS progress page or equivalent).

d. For "Go-Around," when using a VNAV path for a final approach segment and a corresponding DA(H) is authorized for use, momentary descent below the DA(H) is considered acceptable while the aircraft transitions from the descent approach path to a missed approach.

4.4.6. FMS Use for International Procedures. For international operations (e.g., for instrument procedures outside the United States), equivalent criteria to the criteria specified above (e.g., ICAO PANS-OPS) may be used. In addition, operators may use criteria of this AC, and related U.S. criteria referenced by this AC, internationally when approved by FAA, and when found acceptable by the country in which the Aerodrome is located for the procedure being used. For international operations it may be important to apply provisions of this AC regarding use of an appropriate waypoint or NAVAID reference datum (e.g., WGS-84 see paragraph 6.2.17), or provisions for extreme cold temperature correction (see paragraph 8.13).

4.4.7. FMS RNAV Use for Substitution for VOR, DME, NDB, or Marker Beacon NAVAIDs or Fixes. Where suitable NAVAID updating of an FMS or GNSS navigation system is available, FMS or GNSS-based RNAV may be used to substitute for inoperative or unavailable VOR, DME, NDB, or Marker Beacon NAVAIDs or fixes for approach procedures, missed approach procedures, or departure procedures. For such substitution, except as provided in item 4 below where an authority has already specified an acceptable substitution, the operator should ensure that the navigation system used and updating method available, taken with the available remaining NAVAID(s) or sensors are suitable for the route or procedure segment to be flown.

a. FMS RNAV substitution for VOR, DME, NDB, or Marker Beacon NAVAIDs or fixes may be applied if:

(1) The operator can ensure the necessary accuracy of the aircraft's RNAV system to substitute for the desired fix, NAVAID, or waypoint, and

(2) If the aircraft's navigation system is able to suitably depict the substitute WP, facility, or fix, and

(3) The aircraft can suitably fly any applicable leg, route, or procedure segment that otherwise would be based on the inoperative NAVAID or unavailable fix, or

(4) If the responsible authority (e.g., FAA or JAA) has otherwise established or provided for, and the operator uses, an acceptable RNAV substitution (e.g., IAW AIM GPS substitution provisions for NDB or DME, or FAA's enroute NAVAID RNAV substitution policy, or IAW an acceptable RNAV substitution method promulgated via NOTAM).

b. Also see provisions for various specific NAVAID types within paragraph 4.3.10, such as 4.3.10.7 for inoperative DME substitution.

4.4.8. Inhibiting RNAV System Use of Inoperative or Unsuitable VOR, DME, VORTAC, TACAN, or NDB NAVAIDs. If VOR, DME, VORTAC, TACAN, or NDB updating is used in support of area navigation system (FMS) position determination, Operators and flightcrews should be aware of when and how to disable RNAV system use of an unsuitable NAVAID or NAVAID element within the navigation system. This is especially true when the unsuitable NAVAID is likely to cause a significant map shift (e.g., movement of a ground NAVAID to a new geographic location without making a corresponding update to that NAVAID's recorded position in an aircraft's navigation system database, thus leading to introduction of a sudden navigation system map display position error).

4.5. Required Navigation Performance (RNP). RNP is a navigation performance standard for a particular area, airspace, route, procedure, or operation. A definition of RNP is specified in Appendix 1.

a. The specification of RNP has two major aspects, the airspace (e.g., area, route, route segment, leg, procedure, or particular operation) and the airborne system. The airspace requirement is to specify airspace, routes, procedures, or operations within which the aircraft must be located with a high degree of assurance. The airborne systems requirement is to provide a level of performance that is reliable, repeatable, and predictable. The airborne system specification of navigation performance is as defined in RTCA DO-236, or equivalent (e.g., as agreed in an FAA-approved certification plan), except as otherwise found acceptable to FAA.

b. Application of an appropriate airborne specification for RNP serves as a basis to ensure that airborne system performance will match or exceed the level necessary for the area, route, route segment, leg, procedure, or operation. RNP criteria have currently been developed and applied for area navigation standards for use with lateral types and levels of RNP (e.g., types such as addressing 95% lateral performance only, or addressing lateral performance using RNP x 2 containment areas, or various levels of RNP such as RNP .3, RNP .5, RNP 1). Extension of the RNP concept to other types or levels of RNP (e.g., levels such as RNP .15/45 ft.) represent more stringent lateral and vertical performance standards that may in the future be applied to approaches or 3D terminal arrival and departure VNAV paths. Other future applications of RNP may provide for along track performance (e.g., "Required Time of Arrival (RTA)") and are anticipated to evolve as general navigation requirements and operational concepts evolve.

Hence this AC currently addresses only initial RNP applications, and recognizes that RNP criteria will continuously evolve to address other future operational requirements as necessary to define and manage evolutionary changes in the International Airspace System (INAS). Accordingly, different aircraft may meet RNP requirements in different ways regarding sensors used or criteria met (e.g., FANS 1, FANS A, RTCA DO-236, Fleet qualification). Regardless of RNP application, however, it must be possible to determine that each specific aircraft meets the level of RNP required for the airspace application, and that a suitable identifiable standard has been applied.

c. RNP addresses the aircraft and navigation service (non-aircraft) accuracy, integrity, continuity, and availability requirements for normal and rare fault-free performance and for performance with failures. RNP specifies the nominal and limit lateral, and if applicable, vertical flight path displacements permissible for a particular procedure. RNP can be related to obstacle clearance or aircraft separation requirements to ensure a consistent set of operational procedures and design requirements.

d. The following elements of RNP, and error components, are thus considered applicable to systems and operations, as defined and described below in Figure 4.5-1.

e. A **desired flight path** is the path that the pilot, or pilot and air traffic service, expect the aircraft to fly. A desired flight path may be identified by the pilot, by ATS, by an airspace planner or by a procedure developer. It is typically specified in the form of a route or procedure, or is as otherwise identified by ATS in a pre-specified flight plan or clearance, or is as defined by an ATS clearance issued in "real time" (e.g., an assigned track, radial, bearing, course, arc, or heading). The desired flight path may be a simple straight segment, may be a path defined by multiple waypoints connected by straight segments, or may be a complex path defined by continuous straight and curved segments. The path may be defined in two dimensions (2D) consisting of lateral and longitudinal elements, three dimensions (3D) including vertical path elements, or may be defined in four dimensions (4D) including a longitudinal position as a function of time elements, or "time of arrival" constraints at waypoints.

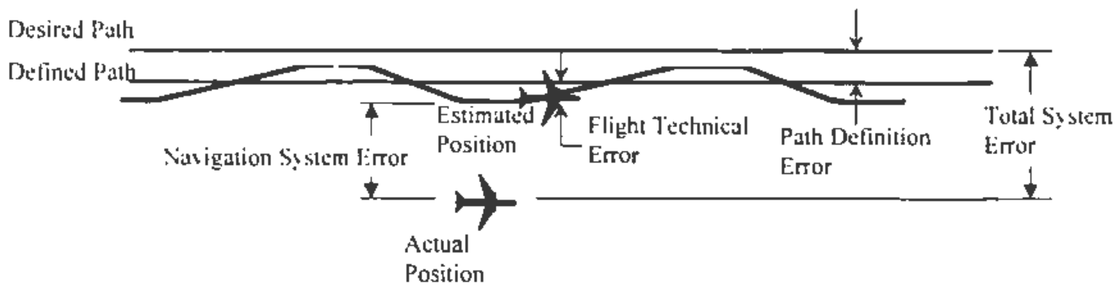
f. In order for an aircraft to follow the desired flight path it is necessary that the navigation system (airborne or on the ground) generate a **defined flight path.** The defined flight path is the path as determined by the path definition function of an aircraft's navigation system (Note: It may also be defined by a system external to the aircraft, and intrinsically provided, or otherwise communicated to the aircraft). While the defined flight path is typically intended to be the same as the desired flight path, the defined flight path is often only a close approximation to the desired flight path due to unavoidable path definition error factors. Factors such as non-spherical earth shape or curvature, determination of geometric altitude versus true altitude or pressure altitude, changing magnetic variation or outdated NAVAID declination, differences in "great circle" route calculations, survey errors, database resolution limitations, or other such factors can result in the defined path being slightly different than the desired path. This difference between the desired path and the defined path is called the **path definition error.**

g. The aircraft elements of the navigation system estimate the aircraft's position and compare that position with the defined flight path. A deviation indication is produced which represents the calculated displacement of the airplane from the defined flight path. This deviation is typically displayed on a primary flight display, or navigation displays, for flightcrew awareness, and is provided as an input to an autopilot and/or flight director system for command guidance or automatic control. The resulting difference (i.e., non-zero deviation) between the estimated aircraft position from the desired flight path is called the **path steering error.** This error includes display errors and flight technical error.

h. The error in the estimation of the aircraft's position is referred to as position estimation error, or **navigation system error**. The navigation system error may result in a displacement from the desired flight path.

i. The accuracy with which the aircraft is controlled as measured by the indicated aircraft position with respect to the indicated command or defined flight path position is called **flight technical error (FTE).** FTE does not include human performance conceptual errors (e.g., entry of an incorrect waypoint or waypoint position, selection of an incorrect procedure, selection of an incorrect NAVAID frequency, or failure to select a proper flight guidance mode). FTE can be influenced by factors such as flightcrew response to guidance (e.g., response to Flight Director information), or external environment conditions such as a wind gradient or turbulence.

j. The sum of the path definition error, navigation system error, and the path steering error (i.e., flight technical error plus any display error) is the **total system error** (TSE), which is the difference between the desired flight path and the actual flight path. Figure 4.5-1 below shows the error terms considered in the cross-track dimension of the total system error.



Navigation Lateral Error Components Related to RNP
Figure 4.5-1.

k. Particular levels of RNP can be satisfied using various NAVAIDs such as ILS and MLS, or by the use of a combination of navigation sensors (DME/DME, VOR/DME, IRU/IRS, GNSS, etc.) using a navigation computer (e.g., FMS). When a computed path (e.g., series of waypoints) is used as the basis for an approach operation, the desired flight path must typically be defined by a series of three dimensional earth-based coordinates for the applicable waypoints or path definition points.

l. Approach or missed approach operations can be approved by demonstration of the capability to meet the required navigation performance (e.g., accuracy, integrity, availability) for a specific approach procedure, for a set of particular procedure types, or for a set of RNP levels.

m. The transition from typical en route or terminal RNP levels to an approach RNP level is accomplished by transitioning to the required RNP level for the approach IAW the approved instrument procedure or by a point no later than the final approach fix, if an aircraft is radar-vectored to final.

n. Associated with the RNP level is a containment limit that is specified as "two times the level of RNP (2xRNP)." The system performance integrity provided by this RNP containment limit is intended to support its application as a basic element for either aircraft separation or obstacle or terrain clearance assessment. However, other considerations such as an obstacle rich environment, potential weather factors, high traffic density, limited communication or surveillance environment, or other such factors may also be appropriate to consider in determining if any additional airspace buffers may be appropriate beyond the RNP containment limit. Similarly, operations at less than 2xRNP, may be found to be appropriate, such as if an ATS communication and surveillance environment otherwise safely permits ATS management of the airspace by other means than RNP containment (e.g., where ATS radar monitoring and radar vector separation on adjacent Standard Terminal Arrival Route (STAR) transitions may be used to ensure safe separation, in lieu of use of RNP containment).

4.5.1. RNP Levels or Types. The expression "RNP Level" is used to describe a specific value or level of required navigation performance. The term "RNP Level" may be interchangeably described as "RNP Type" in some industry and FAA references. However in this AC, the term "RNP Level" is meant to apply only to a lateral RNP element (e.g., RNP .5) or to specific paired lateral and vertical elements (e.g., RNP .3/125 ft.). The term "RNP Type" is generally reserved for future uses, in which future vertical and longitudinal elements or other conditions of RNP may additionally apply.

a. Table 4.5.1-1 provides RNP Levels that could support initial, intermediate, final and missed approach segments. These RNP levels have not yet been established as international standards.

Table 4.5.1-1.
RNP LEVELS FOR APPROACH

RNP Level	Applicability/Operation (Approach segment)	Normal Performance (95%)	Containment Limit (*)
RNP 1	Initial/Intermediate approach	+/-1 nm	+/-2 nm
RNP 0.5	Initial/Intermediate/Final approach [Supports limited Category I minima]	+/-0.5 nm	+/-1 nm
RNP 0.3	Initial/Intermediate/Final approach [Supports limited Category I minima]	+/-0.3 nm	+/-0.6 nm
RNP 0.3/125 ft.	Initial/Intermediate/Final approach with specified baro vertical guidance [Supports limited Category I minima]	+/-0.3 nm +/-125 ft	+/-0.6 nm +/-250 ft
RNP 0.03/45 ft.	Final approach with specified vertical guidance[Supports Category I minima]	+/-0.03 nm (**) +/-45 ft	+/-0.06 nm +/-90 ft
RNP 0.01/15 ft.	Final approach with specified vertical guidance [Supports Category I/II minima]	+/-0.01 nm (***) +/-15 ft	+/-0.02nm +/-30 ft
RNP 0.003/15 ft.	Final approach with specified vertical guidance [Supports Category I/II/III minima]	+/-0.003 nm +/-15 ft (****)	+/-0.006 nm +/-30 ft (*)

(*) NOTE: For barometric VNAV, the obstacle assessment methodology described in Appendix 5 may be used to addresses vertical containment limits which consider multiple factors such as altimeter error, temperature, and "along track" fix error. Each of these factors should be considered, as necessary, in determining Required Obstacle Clearance (ROC). Nominal vertical values shown in this Table associated with various levels of RNP are intended to be used in conjunction with and considering factors described in Appendix 5, as applicable to the vertical path specified and the type or types of sensor systems used. For other forms of VNAV (e.g., when using an ECEF coordinate specified geometric path), assurance of vertical containment may be met by any FAA approved method, including the method specified by Appendix 5. Examples of acceptable methods other than that based on Appendix 5 would be methods where containment is considered as a "designed-in capability" of a system or aircraft (e.g., as for GBAS or SBAS), or a specific system/infrastructure/operational assessment method, acceptable to FAA, with potential corresponding operational or procedural requirements.

(**) NOTE: Performance consistent with Category I operation based on ILS performance requirements at 200 feet

(***) NOTE: Performance consistent with Category II operation based on ILS performance requirements at 100 feet

(****) NOTE: Consistent with landing and rollout performance (refer to AC 120-28D). Vertical accuracy does not apply below 100 feet HAT due to the transition to a flare maneuver consistent with reduction in sink rate and landing dispersion requirements.

b. RNP is a required navigation performance level described by the specification of a numeric value indicating the required navigation accuracy for a specific operation, typically specified laterally in nautical miles (e.g., RNP 1 is a Required Navigation Performance of +/-1 nautical mile (95% Probability)).

c. RNP containment is specified as RNP (X) x 2.

d. RNP Levels are defined for lateral performance, or lateral and vertical performance, if applicable. Standard values for RNP for general use are as specified in RTCA's Minimum Airspace Performance Standards (MASPS) for RNP (RTCA DO-236) as amended, this AC, related ACs, or as otherwise specified by FAA through published instrument procedures, the Aeronautical Information Manual (AIM), or by NOTAM. ICAO specified types or levels of RNP as promulgated in ICAO Manuals or ICAO Regional Supplements for International Airspace may also be considered as acceptable RNP levels for Approach operations.

e. RNP Levels typically used for various approach and missed approach segments supporting Category I procedures may be based on use of multi-sensor RNAV (e.g., FMS with IRS, VOR, DME, or GNSS inputs), or on other aircraft navigation systems having FMS-like capabilities (e.g., GPS based navigation systems). RNP Levels applicable to Category I may also take advantage of, or also be based on, sensor inputs received from specific landing systems (e.g., ILS, MLS, or GLS).

f. RNP Levels typically used for various approach and missed approach segments supporting Category II procedures may be based on the same capability specified above for Category I, except that for any portions of a final approach segment below 200 ft. HAT for Category II, use of specific landing system sensors (e.g., ILS, MLS, or GLS) may be determined to be necessary to achieve the desired level of RNP. Similarly, for portions of any FAS below 200 ft. HAT, use of a multi-sensor RNAV system should have suitable integrity and availability capability (e.g., may require use of multiple FMS with IRS, and suitable ILS, GNSS, or GBAS inputs to achieve the necessary RNP capability).

4.5.2. Other RNP Levels or Types. Other RNP Levels or Types may include types specified by a particular Authority for specific applications (e.g., RNP 5 within certain geographic areas; RNP .15 for a particular air carrier "Special approach procedure")

4.6. Flight Path Definition. Certain flight segments and waypoints are necessary to effectively implement approach and missed approach operations using landing systems where the required flight path is not inherent in the signal structure of the navigation aid (e.g., integrated multi-sensor area navigation systems and other RNAV systems such as satellite systems). The concepts and criteria described below may be applied to other types of navigation systems when using area navigation and RNP concepts.

a. In general, an operator must have an acceptable method to ensure that any waypoints or path points which are considered critical to an instrument procedure (if any) are correctly defined, and are loaded into each applicable aircraft's database, initially, and at each change cycle.

b. RNP-based area navigation systems may use any leg types available and suitable for RNP path definition as specified by acceptable FAA or industry criteria (e.g., RTCA DO-236; ARINC 424) for a particular type of navigation system), or leg types as otherwise approved by FAA for use with RNP. Leg types may be specified to define a suitable path in space in conjunction with established waypoints, new waypoints, or path definition points.

c. Levels of RNP may be procedurally specified, may be specified in a data base for automatic call up for an entire procedure when a procedure is loaded, may be specified in a data base for automatic call up for each leg or segment of a procedure, may be entered by the flightcrew into the navigation system for a procedure or leg, or may be based on navigation system default settings if those default RNP settings are found to be acceptable to FAA (e.g., when using standard FMS RNP default values and standard instrument procedures with a compatible RNP level specified). When possible, it is recommended that RNP levels be specified by the instrument procedure, and automatically set for each applicable leg, to minimize flightcrew input workload and potential for FMS or navigation system input error.

d. Levels of RNP may be specified for individual path segments, for an entire procedure, or for portions of a procedure (e.g., Intermediate segment, FAS, IMAS, or an entire missed approach path).

e. The following criteria and considerations are appropriate to specify the landing and rollout flight path. A graphic depiction of the points, heights, angles or other considerations described below is shown in Figure 4.6-1.

f. The approach segment connects with the rollout segments. An approach flight path is considered to terminate at the beginning of the rollout segment.

4.6.1. Landing and Rollout Flight Path. The following criteria specifies certain reference points and other criteria necessary to effectively implement landing and rollout operations using a landing system where the required flight path (e.g., FAS and RWS) is not inherent in the signal structure of the navigation aid (e.g., for satellite based sensor systems).

4.6.2. Runway Datum Point (RDP). The RDP is used in conjunction with the FPAP and the vector normal to the WGS-84 ellipsoid at the RDP to define the geodesic plane of a final instrument approach flight path to touchdown and rollout (e.g., FAS). It is a point typically at the designated center of the landing runway. An RDP is defined by a specified latitude, longitude, ellipsoidal height, and orthometric height. The RDP is a reference point used to connect the approach flight path with the runway. The RDP may or may not be coincident with, and need not necessarily be coincident with the designated runway threshold.

4.6.3. Flight Path Alignment Point (FPAP). The FPAP is a point, usually at or near the stop end of a runway, used in conjunction with the RDP and a vector normal to the WGS-84 ellipsoid at the RDP, to define the geodesic plane of a final approach and landing flight path (e.g., FAS and RWS). The FPAP typically may be the RDP for the reciprocal runway.

4.6.4. Flight Path Control Point (FPCP). The Flight Path Control Point (FPCP) is a calculated point located above the RDP in a direction normal to the WGS-84 ellipsoid. The FPCP is used to establish the vertical descent path and descent angle of the final approach flight path (e.g., FAS) to the landing runway.

4.6.5. Datum Crossing Height (DCH). The height of the Flight Path Control Point (FPCP) above the Runway Datum Point (RDP). Note that the FPCP may be specified in units of feet or meters, but is typically specified in units of feet.

> **NOTE: A standard datum crossing height should typically be 50 ft. For sloped runway touchdown zones, a DCH in the range of 50 to 55 ft above the designated datum point is acceptable. Other values are accepted on a case by case basis considering the airport need for a different value, and the type of aircraft and operations to be used (e.g., STOL). Typically a DCH is coincident with the runway threshold (TCH). (Also see Sections 5.12.3 and 5.12.4).**

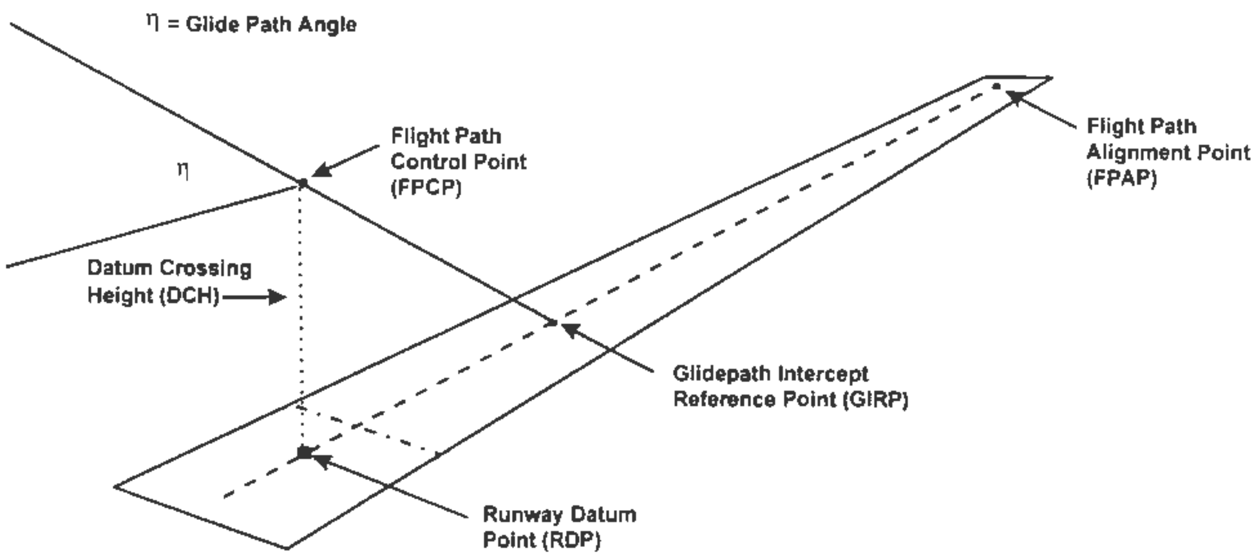
4.6.6. Glide Path Angle (GPA). The glide path angle is an angle, defined at the FPCP, that establishes the descent gradient for the final approach flight path (e.g., FAS) of an instrument approach procedure. It is measured in the geodesic plane of the approach (defined by the RDP, FPAP, and a vector normal to the WGS-84 ellipsoid at the RDP). The vertical and horizontal references for the GPA are a vector normal to the WGS-84 ellipsoid at the RDP and a plane perpendicular to that vector at the FPCP, respectively.

4.6.7. Glide Path Intercept Reference Point (GIRP).

a. The GIRP is the point at which the extension of the final approach path (e.g., FAS) intercepts the runway.

Points, Heights, Angles Or Other Considerations For Definition of An Approach And Landing Flight Path

Figure 4.6-1



b. The locations established for, and the values assigned to, the **RDP, FPCP, DCH** and **GPA** will be selected based upon the operation need to establish the required **GIRP**. Operational considerations include:

(1) Path of wheels over threshold(s),

(2) Need for coincidence with other aids and systems - visual and non-visual,

(3) Runway characteristics (upslope and downslope, crown, etc.),

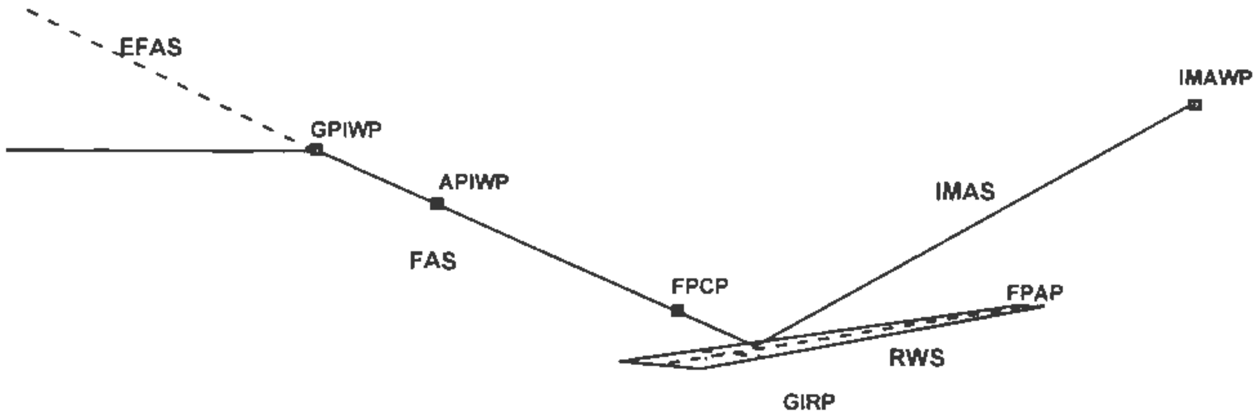
(4) Actual threshold, displaced threshold or multiple threshold characteristics,

(5) Actual clearway or stopway characteristics.

4.6.8. Approach and Missed Approach Segments. Figure 4.6-2 below shows the applicable reference points, path points, waypoints and leg types typically used to construct instrument approach procedures applicable to air carrier operations.

Waypoint and Segment Placement

Figure 4.6-2



4.6.9. Procedure Design Related Waypoint Definitions and Use. The following procedure design-related waypoint definitions and uses are provided:

a. Glide Path Intercept Waypoint (GPIWP) - The point at which the established glide slope intercept altitude (MSL) meets the Final Approach Segment (FAS), on a standard day, using a standard altimeter setting (1013.2 HPa or 29.92 in).

b. Approach Intercept Waypoint (APIWP) - A variable waypoint used when necessary to link a barometric LNAV/VNAV flight path with a Final Approach Segment (FAS) that is fixed in space (e.g., a xLS final segment). The APIWP permits LNAV and barometric VNAV segments, which may vary vertically in location on an approach as a function of barometric pressure setting or temperature variation from standard, to join or be connected to a FAS which is otherwise fixed in vertical location with respect to a runway.

c. Initial Missed Approach Waypoint (IMAWP) - (Used only for MAP) A Waypoint generally aligned with the runway centerline, beyond the touchdown zone, used to establish a suitable initial climb segment beyond the touchdown zone. The IMAWP intends to provide a safe path and altitude, if applicable, in the vicinity of the runway, to be used to establish a safe initial go-around path following a low altitude go-around or rejected landing.

d. Procedure Design Related Segment Definitions. The following procedure design related segment definitions are provided:

Final Approach Segment (FAS)	The segment of an approach extending from the Glidepath Intercept Waypoint (GPIWP) or Approach Intercept Waypoint (APIWP), whichever occurs later, to the Glidepath Intercept Reference Point (GIRP). For the purpose of procedure construction, The Final Approach segment is defined as beginning at the FAF and ending at the Flight Path Control Point (FPCP) or point at which the missed approach segment starts (e.g., point of lowest nominal DA(H)).
Extended Final Approach	That segment of an approach, co-linear with the Final Approach Segment, but

Segment (EFAS)	which extends beyond the Glidepath Intercept Waypoint (GPIWP) or Approach Intercept Waypoint (APIWP).
Runway Segment (RWS)	That segment of an approach from the glidepath intercept reference point (GIRP) to Flight Path Alignment Point (FPAP).
Initial Missed Approach Segment (IMAS)	That segment of an approach from the Glide Path Intercept Waypoint (GIRP) to the Initial Missed Approach Waypoint (IMAWP).
Missed Approach Segment (MAS)	That segment of an instrument approach procedure from a point on the FAS corresponding to the position where the lowest DA(H) occurs under nominal conditions, to the designated IMAWP, or missed approach holding WP, as specified for the procedure.

5. AIRBORNE SYSTEM REQUIREMENTS.

5.1. General. The following accuracy, integrity and availability criteria are specified for aircraft systems intended for Category I or II. Aircraft related systems are addressed by 5.1.1. Non-aircraft systems (e.g., NAVAIDs) are addressed in 5.1.2. Specification of flight path is addressed in 5.1.3, such as is applicable to defining an RNAV, LNAV, or VNAV path to be followed by an aircraft. Specific airborne equipment requirements for Category I or II authorizations are addressed in 5.2 and 5.3.

5.1.1. Airborne Systems.

a. Airworthiness criteria for aircraft systems intended to meet requirements of this AC are specified in paragraph 5.1.3 through 5.19 below, or Appendix 2 or 3 for demonstration of airborne systems for eligibility for Category I or II minima respectively.

b. For aircraft which completed an airworthiness demonstration applicable to Category I or II using earlier versions of this AC, or previous applicable ACs, new operational authorizations may be requested or may be continued only as provided for in standard OpSpecs.

5.1.2. Non-Airborne Systems (e.g., NAVAIDs or equivalent GNSS capability). Unless otherwise specified by FAA, NAVAID/landing system characteristics to be used should have been addressed using an acceptable means of facility or capability classification (e.g., For a U.S. ILS facility, and example of a typical classification would be "II/E/2").

a. The classification should be specified in a manner suitable to address:

(1) Intended NAVAID performance level (or an equivalent capability for GNSS),

(2) Signal or capability coverage with respect to the intended flight path(s) and runway, and

(3) NAVAID or capability "availability and integrity" (e.g., considering standby capability and power, as applicable).

b. This classification schema should at least be provided for any xLS capability (e.g., ILS, MLS, or GLS). Typically this is done by use of FAA or ICAO criteria such as specified by FAA Order 6750.24 as amended, or ICAO Annex 10 Criteria, as suited to the applicable NAVAID facility or capability. NAVAID facility or capability operational use is then predicated on suitable facility or capability classification respectively for ILS, MLS, or GLS (e.g., for ILS, III/E/2).

c. NAVAID classifications or equivalent capability classification schema should be consistent among ILS, MLS or GLS to the maximum extent possible.

d. At non-U.S. facilities, consideration of equivalence to U.S. classification may be necessary for operational authorizations.

e. For GLS, classification schema are evolving and are expected to continue to do so as new GNSS elements or augmentation methods become operational. Nonetheless, an appropriate classification method equivalent to that used for ILS, or as otherwise specified by FAA or ICAO, should be used (e.g., addressing "Performance Level"/"Coverage"/"Integrity" such as "PL2/T/1").

f. NAVAID facility or capability classification schema or associated airborne system documentation referring to that classification schema for ILS, MLS, or GLS should not be defined or expressed in operational authorization terms (e.g., Category I, II, or III xLS). This is necessary to recognize that operational authorization criteria for Category I, II, or III may change in time, and because authorizations may not be unique to a particular NAVAID classification or capability, and further, may depend on and be a function of evolving airborne system elements, procedures, or other factors.

5.1.3. Flight Path Specification.

5.1.3.1. Lateral.

a. Category I. The following levels of lateral performance shown in Table 5.1.3-1 are acceptable for Category I and corresponding minima may be applied. Any one or more methods listed below may be demonstrated, but the method(s) used should be identified as the basis for the demonstration.

Table 5.1.3.1-1.
CATEGORY I - LATERAL PERFORMANCE/MINIMA

1)	ILS/MLS/GLS (any one xLS)	[Minima equivalent to ILS at 200 ft. HAT] [Lateral tracking performance from 1000 ft. HAT to 200 ft. HAT should be stable without large deviations (i.e., within ±50 microamps deviation) from the indicated course or path, or equivalent; using at least 3 different representative facilities for a minimum of 9 total approaches. System performance should be acceptable without undue oscillation.]
2)	"ILS Equivalent" (e.g., SCAT I/ MASPS;WAAS/MOPS)	[Minima equivalent to ILS at 200 ft. HAT]
3)	RNP RNP ≤ .03 .03 <RNP< .3 RNP ≥ .3	 [Minima equivalent to ILS at 200 ft. HAT] [Minima typically not lower than a DA(H) of 250 ft. HAT] [Minima restricted to not lower than a DA(H) of 250 ft. HAT]
4)	FMS (LNAV/VNAV or LNAV)	[Minima restricted to not lower than a DA(H) of 250 ft. HAT]
5)	RNAV	[Minima as specified by Standard OpSpecs/SIAP]
6)	LOC, LOC BCRS, VOR, VOR/DME, NDB, ASR, PAR	[Minima as specified by Standard OpSpecs/SIAP]

b. Category II. The following levels of lateral performance shown in Table 5.1.1-2 are acceptable for Category II. Any one or more methods may be demonstrated, but the method used should be identified as the basis for the demonstration.

Table 5.1.3.1-2.
CATEGORY II - LATERAL PERFORMANCE/MINIMA

1)	ILS/MLS/GLS (any one xLS)	[Minima equivalent to ILS at 100 ft. HAT] See Category I Criteria to 300 ft. HAT, and in addition, [Lateral tracking performance from 300 ft. HAT to 100 ft. HAT within ±25microamps deviation from the indicated course or path, or equivalent, (for 95% of the time/per approach) using at least 3 representative facilities and for a minimum of 20 total approaches. System performance should be acceptable without undue oscillation.]* * NOTE: Or using JAA ACJ AWO 231 Method
2)	RNP RNP ≤ .01	 [Minima equivalent to ILS at 100 ft. HAT]

c. Lateral Performance below or beyond DA(H). For either Category I or II procedures with a DA(H) below 250 ft. HAT*, when guidance is provided (e.g., for autoland, or HUD flare/rollout), the lateral performance should at least be equivalent to that attainable using an ILS Type I/E/1 localizer (or RNP .003) from 200 ft. HAT, or 100 ft. HAT as applicable, to the end of rollout.

***NOTE: This provision does not apply to systems intended for Category III - see AC120-28D for Category III requirements.**

d. From 200 ft. HAT or 100 ft. HAT, as applicable, until returning to an established missed approach segment of the approach procedure, if guidance is provided, performance should be at least equivalent to that attainable using an ILS Type I/E/1 localizer front and back course, or RNP.3 as applicable.

5.1.3.2. Vertical.

a. Category I. The following levels of vertical performance are acceptable for Category I and corresponding minima may be applied. Any one or more methods listed below may be demonstrated, but the method(s) used should be identified as the basis for the demonstration.

Table 5.1.3.2-1.
CATEGORY I - VERTICAL PERFORMANCE/MINIMA

1)	ILS MLS GLS Glide Slope Glide Path (any one xLS Glide Slope)	[Minima equivalent to ILS at 200 ft. HAT] [Vertical tracking performance from 700 ft. HAT to 200 ft. HAT should be stable without large deviations (i.e., within ±75 microamps deviation) from the indicated path, or equivalent, using at least 3 different representative facilities and for a minimum of 9 total approaches. System performance should be acceptable without undue oscillation.]
2)	"ILS Glide Slope Equivalent" (e.g., SCAT I/ MASPS; WAAS/MOPS)	[Minima equivalent to ILS at 200 ft. HAT]
3)	RNP RNP ≤ .03 and ECEF** VNAV .03 <RNP< .3 and BARO VNAV RNP ≥ .3 with or without BARO VNAV	 [Minima equivalent to ILS at 200 ft. HAT] [Minima typically not lower than a DA(H) of 250 ft. HAT] [Minima restricted to not lower than a DA(H) of 250 ft. HAT]
4)	FMS BARO VNAV	[Minima restricted to not lower than a DA(H) of 250 ft. HAT]
5)	RNAV	[Vertical performance not applicable*]
6)	LOC, LOC BCRS,VOR, VOR/DME, NDB, ASR, PAR	[Vertical performance not applicable*; except PAR minima equivalent to ILS]

***Note: A procedure addressing a stabilized approach from the Final Approach Fix to MDA(H) is recommended for these procedures (except this note does not apply to PAR).**

****Note: ECEF VNAV - VNAV referenced to "Earth Center Earth Fixed Coordinates," or geometric height above the "earth reference surface" based VNAV.**

b. Category II. The following levels of vertical performance are acceptable for Category II. Any one or more methods may be demonstrated, but the method used should be identified as the basis for the demonstration.

Table 5.1.3.2-2
CATEGORY II - VERTICAL PERFORMANCE/MINIMA

1)	ILS/MLS/GLS (any one xLS Glide Slope/Glide Path)	[Minima equivalent to ILS at 100 ft. HAT] See Category I Criteria to 300 ft. HAT, and in addition, [Vertical tracking performance from 300 ft. HAT to 100 ft. HAT within ±35** microamps deviation from the indicated course or path, or ±12 ft. which ever is greater, or equivalent, (for 95% of the time per approach) using at least 3 different representative facilities and for a minimum of 20 total approaches. System performance should be acceptable without undue oscillation.]* * NOTE: Or using JAA ACJ AWO 231 Method ** NOTE: When this provision is applied to path tracking in conjunction with Category III, momentary excursions up to ± 75 microamps during test demonstrations may be acceptable if flight guidance system touchdown and landing performance is otherwise shown to be satisfactory.
2)	RNP RNP ≤ .01 with ECEF** VNAV	[Minima equivalent to ILS at 100 ft. HAT]

c. Category I or Category II.

(1) Vertical (VNAV) performance at altitude constraints prior to a Final Approach Fix (FAF) or Final Approach Point (FAP), or at an FAF or FAP. For procedures with VNAV segment(s) prior to an FAF or FAP, at an FAF or FAP (e.g., intercepting an FAS from an en route segment, STAR, Profile Descent, initial approach or intermediate approach segment), vertical performance should normally be based on use of a vertical "Fly by" path rather than a "Fly over" path. The small vertical displacement which may occur at a vertical constraint as a result of using a vertical "Fly by" waypoint rather than vertical "Fly over" waypoint is considered operationally acceptable, and desirable, to ensure asymptotic capture of a new (next) vertical segment. This momentary deviation below the published minimum procedure altitude is acceptable provided the deviation is limited to no more than 100 ft. and is a result of a normal VNAV capture. This applies to both "level off" or "altitude acquire" segments following a climb or descent, or vertical climb or descent segment initiation, or joining of climb or descent paths with different gradients.

NOTE: A "Fly By" vertical waypoint is a WP for which an aircraft may initiate a vertical rate change and depart the specified vertical path to the active WP prior to reaching that WP, in order to asymptotically capture the next vertical path. A "Fly Over" vertical waypoint is a WP for which an aircraft must stay on the defined vertical path until passing the active WP and may not initiate the necessary vertical rate change to capture the next vertical path until after passing the active WP. Hence, after passing the active WP, as the next WP becomes active, and if there is a vertical path change, the aircraft must re-adjust vertical rate to re-capture the vertical path after having already overshot the first opportunity for an asymptotic capture of that new path.

(2) Vertical (VNAV) performance at waypoint altitude constraints near the point at which DA(H) or MDA(H) may occur. For procedures with waypoints at or near the point at which DA(H) may occur, vertical (VNAV) performance should not preclude continuous descent of the aircraft to the runway, following the established VNAV path to the runway (e.g., VNAV should not initiate inappropriate capture of a missed approach segment and automatic level off (at MDA(H)) or initiation of MAP climb, without pilot confirmation that a missed approach or go-around is intended (e.g., TOGA initiation).

(3) Vertical (VNAV) performance below or beyond DA(H) or MDA(H). For procedures with a DA(H) below 200 ft. HAT* (e.g., for autoland, or HUD flare/rollout), the glide path/glide slope vertical performance should at least be equivalent to that attainable using an ILS glide slope at a facility classified as Type I E/1, between 200 ft. HAT and 50 ft. HAT.

***NOTE: This provision does not apply to systems intended for Category III - see AC120-28D for Category III requirements.**

5.1.3.3. Longitudinal. Longitudinal (along track) requirements for Category I or II operations are as specified below.

a. Category I. The following longitudinal (along track) requirements are acceptable for Category I. Any one or more methods listed below may be demonstrated, but the method(s) used should be identified as the basis for the demonstration.

Table 5.1.3.3-1.
CATEGORY I - LONGITUDINAL PERFORMANCE/MINIMA

1)	ILS/MLS/GLS (any one xLS, or any combination provided by MMR)	
	Use of VHF OM/MM Marker Beacons	[Minima equivalent to ILS at 200 ft. HAT]
	Use of VOR/TACAN Fixes (other than for MM)	[Minima equivalent to ILS at 200 ft. HAT]
	Use of LOM/LMM NDBs	[Minima equivalent to ILS at 200 ft. HAT]
	Use of suitable DME Distance Information	[Minima equivalent to ILS at 200 ft. HAT]
	Use of FMS RNAV Fixes (other than for MM)	[Minima equivalent to ILS at 200 ft. HAT]
	Use of Distance to "Runway Threshold WP"	[Minima equivalent to ILS at 200 ft. HAT]
	Other methods (e.g., Radar fixes, Fan Markers)	[Restricted minima may apply - DA(H)$\geq$250 ft. HAT]
	No specific method of assuring along track position	[Restricted minima may apply - DA(H)$\geq$250 ft. HAT]
2)	"ILS Equivalent" (e.g., SCATI/MASPS;WAAS/MOPS)	[Same as for ILS/MLS/GLS described above
3)	RNP*	
	RNP $\leq$ .03	[Minima equivalent to ILS at 200 ft. HAT]
	.03 $<$RNP$<$ .3	[Minima typically not lower than a DA(H) of 250 ft. HAT]
	RNP $\geq$ .3	[Minima restricted to not lower than a DA(H) of 250 ft. HAT]
		*Note: RNP Systems/Procedures that do not provide for display of distance to a "Runway Threshold WP" may have minima additionally restricted.
4)	FMS (LNAV/VNAV or LNAV)	[Minima restricted to not lower than a DA(H) of 250 ft. HAT]
5)	RNAV (Op-Specs Part C; Para C063)	[Minima as specified by Standard Op-Specs/SIAP]
6)	LOC, LOC BCRS,VOR, VOR/DME, NDB, ASR, PAR	[Minima as specified by Standard Op-Specs/SIAP]

b. Category II. The following levels of longitudinal (along track) performance are acceptable for Category II. Any one or more methods may be demonstrated, but the method used should be identified as the basis for the demonstration.

Table 5.1.3.3-2
CAT II - LONGITUDINAL PERFORMANCE/MINIMA

1)	ILS/MLS/GLS (any one xLS, or any combination provided by MMR)	Same as for Category I, except that an IM or suitable distance readout to a "Runway Threshold WP" is also required.
2)	RNP RNP $\leq$ .01	 [Same as for ILS/MLS/GLS above.]

5.1.3.4. Typical Wind and Wind Gradient Disturbance Environment. The lateral and vertical performance described in paragraph of 5.1.3 above should typically be expected to be achievable in conditions at least as described below. Performance may be estimated, assessed analytically, demonstrated in simulation, or demonstrated in flight. Relevant associated information on demonstrated winds encountered or estimated wind gradient capability may be included in the AFM, as desired by the applicant.

a. Systems intended for use with procedures for either Category I or Category II should be capable of coping with at least the following wind, wind gradient, and turbulence conditions:

- Reported Surface Headwind Component - 25 kts
- Reported Surface Tailwind Component - 10 kts
- Reported Surface Crosswind Component - 15 kts

b. Wind Gradients/Shear - at least 4 kts per 100 ft. from 500 ft. HAT to the surface;

c. Recommended Capability - Ability to cope with 8 kts per 100 ft. for 500 ft., moderate turbulence, knife edge shears of at least 15kts over 100 ft., 20 kts lateral directional vector shears of 90 degrees over 100 ft., and ability to cope with a 20 kt logarithmic shears between 200 ft. and the surface.

5.2. Airborne Equipment for Category I. The following equipment (along with any additional equipment specified by 14 CFR for IFR flight) is the recommended aircraft equipment for an authorization for Category I.

a. For ILS, GLS, or MLS approach capability:

- Two navigation receivers, or equivalent type of device, of each type intended for use,

  NOTE 1: The navigation receivers specified above may be provided as two or more integrated multi-sensor units (e.g., MMR),

  NOTE 2: For GLS, at least one data link receiver capable of receiving GBAS uplinked corrections for GNSS position fix correction data may be considered acceptable, when used with dual navigation receiver capability (e.g., dual GPSSU sensors) receiving GPS SV ranging information. Dual data link receivers capable of receiving GBAS uplinked corrections for GNSS are recommended.

  NOTE 3: Installation of only one navigation receiver may be authorized by FAA for special circumstances, considering the particular facilities and routes to be used, such as if suitable minima restrictions and requirements for alternate navigation capability are applied (e.g., one GLS receiver if two ILS receivers are installed).
- Suitable navigation displays, attitude, vertical speed, and airspeed displays for each pilot (see paragraph 5.9 for details)
- Suitable failure annunciation visible to each pilot
- One or more Marker Beacon systems (unless an approved RNAV substitute is available, or if not necessary for the route of flight, including alternates)
- One or more DMEs (unless an approved RNAV substitute is available, or if not necessary for the route of flight, including alternates)
- One or more ADFs (unless an approved RNAV substitute system is available, or unless ADF is not required for the intended route of flight, including alternates). Note that two ADFs may be required IAW paragraph 121.549 for certain international operations, and for certain obstacle or terrain critical departure, approach, or missed approach procedures
- For aircraft intended for approval of landing minima below RVR 3000, at least one flight director or one autopilot

- It is recommended that the following capability be available:
  - Radar Altimeter
  - Standby power for at least one pilot's ILS/GLS navigation receiver and displays
  - Rain removal capability

b. For approaches other than ILS, GLS, or MLS (e.g., RNAV, VOR, VOR/DME, NDB).

- 2 navigation receivers and associated displays of the type of the approach system to be used (unless otherwise authorized by FAA for the facilities and route to be used), or
- 2 FMS systems (unless use of 1 is authorized by FAA for the facilities and route to be used) which are capable of using the necessary NAVAIDs or equivalent (e.g., space vehicles (SVs)), or which can be monitored by using raw data NAVAID data (e.g., on an associated ND display or RDMI).
- Suitable navigation displays, attitude, vertical speed, and airspeed displays for each pilot (see paragraph 5.9 for details)
- Suitable failure annunciation visible to each pilot
- For ASR or PAR, at least 2 communication radios capable of receiving communications of ASR or PAR information.
- It is recommended that the following capability be available:
  - Radar Altimeter
  - Standby power for at least one pilot's VOR or RNAV navigation receiver and displays
  - Rain removal capability

c. For aircraft types and systems approved previously to issuance of this AC using earlier AC120-29A or equivalent criteria, the aircraft must have a system which meets that earlier criteria. While such systems may continue to be produced and installed for retrofit in aircraft, or may continue to be installed in new production aircraft or variants, or future derivatives of those types or variants, any additional credit permitted by this AC for Category I capability may be limited to those aircraft and systems meeting revised provisions of this AC, including those provisions shown in Appendix 2.

d. For requirements related to equipment inoperative dispatch pertaining to Category I approach capability see paragraph 5.22 below. For situations involving in-flight failure of equipment pertaining to Category I approach capability see paragraph 5.23 below.

5.3. Airborne Equipment for Category II. The following equipment (along with any applicable equipment otherwise specified above for Category I) is the minimum aircraft equipment considered necessary for an authorization for Category II.

a. Two independent navigation receivers, or equivalent, of each type intended for use,

NOTE 1: The navigation receivers specified above may be provided as two or more integrated multi-sensor units (e.g., MMR),

NOTE 2: For GLS, at least one data link receiver capable of receiving GBAS uplinked corrections for GNSS position fix correction data may be considered to be acceptable, when used with dual navigation receiver capability (e.g., dual GPSSU sensors) receiving GPS SV ranging information. Dual data link receivers capable of receiving GBAS uplinked corrections for GNSS are recommended.

b. A suitable Automatic Flight Control System, or manual flight guidance system, or both (e.g., flight director) as follows:

- A system or systems designed to meet criteria of Appendix 3, or

- For aircraft types and systems approved previously to issuance of this AC using earlier AC 120-29A or equivalent criteria, the aircraft must have a system which meets that earlier criteria. While such systems may continue to be produced and installed for retrofit in aircraft, or may continue to be installed in new production aircraft or variants, or future derivatives of those types or variants, any additional credit permitted by this AC for Category II capability may be limited to those aircraft and systems meeting revised provisions of this AC, including those provisions shown in Appendix 3.

- At least 1 autopilot (AFGS) and at least dual flight director systems with an independent display for each pilot is recommended. Dual systems which provide the same information to both pilots, with the second system in "hot standby status" may be acceptable only if suitable comparison monitoring between the systems is available, and timely transfer to standby can be completed, and suitable annunciation to the flightcrew is provided.

c. A radar altimeter display for each pilot. (Note: At least 2 independent radar altimeters with a display for each pilot are recommended.)

d. Rain removal equipment is required for each pilot (e.g., windshield wiper, bleed air). (Note: hydrophobic coating is recommended for each applicable forward windshield, in lieu of rain repellent, due to environmental considerations.)

e. Flight instruments and annunciations which can reliably depict relevant aspects of the aircraft position relative to the approach path, attitude, altitude and speed, and aid in detecting and alerting the pilots in a timely manner to failures, abnormal lateral or vertical displacements during an approach, or excessive lateral deviation (see paragraph 5.9 for details).

f. Unless otherwise approved by FAA based on demonstration of acceptable pilot workload, an autothrottle system should be provided.

g. For requirements related to equipment inoperative dispatch pertaining to Category II approach capability see paragraph 5.22 below. For situations involving in-flight failure of equipment pertaining to Category II approach capability see paragraph 5.23 below.

5.3.1. Standard Category II Minima. Standard Category II minima are a DA(H) of 100 ft. HAT and RVR not less than 1200 ft. (350m).

5.3.2. Special Category II Authorizations. Special Category II minima may be authorized for certain qualifying ILS/GLS facilities (e.g., Type I ILS). Minima at these facilities may be restricted as follows depending on NAVAID, airport facility, and obstacle assessments by FAA. Order 8400.13 addresses certain standard provisions applicable to these authorizations. Other provisions may apply when proposed by the applicant, and approved by FAA. Any authorizations issued should be consistent with one or more of the following DA(H) and RVR paired provisions:

- DA(H) 150 ft. HAT RVR 1800
- DA(H) 150 ft. HAT RVR 1600
- DA(H) 100 ft. HAT RVR 1800
- DA(H) 100 ft. HAT RVR 1600
- DA(H) 100 ft. HAT RVR 1200

5.4. Automatic Flight Control Systems and Automatic Landing Systems. Automatic Flight Control Systems, Autoland Systems, or Manual Flight Guidance systems (e.g., HUD) are considered acceptable for use and are recommended for Category I or II ILS, MLS, or GLS procedures which do not have NOTAM restrictions on localizer or glide slope or equivalent signals (e.g., Glide Slope unusable below 500 ft. HAT, or Localizer unusable inside threshold).

5.5. Flight Director Systems. Characteristics of Flight Director Systems (head down or head up) used for aircraft authorized for Category I or II should be compatible with the characteristics of any autopilot or autoland system used. Flight control systems that provide both autopilot control and flight director information may display, or may not display, flight director commands as appropriate for the system design and operator requirements. Regardless of whether Flight Director commands are provided, situational information displays of navigation displacement must also be provided to both flight crewmembers. To ensure that unacceptable deviations and failures can be detected, the displays must be appropriately scaled and readily understandable in the modes or configurations applicable.

5.6. Head up Display Systems. Head up Display systems used as the basis for a suitable Category I or II authorizations must provide guidance for one or both pilots as appropriate for the system design. If information is provided to only the flying pilot, then appropriate monitoring capability must be established for the non-flying pilot. Monitoring tasks must be identified, and the non-flying pilot must be able to assume control of the aircraft in the event of system failure or incapacitation of the pilot using the HUD (e.g., for a safe go-around or completion of rollout). Head up Display Systems acceptable for Category I or II must meet provisions of Appendix 2 or 3 respectively, or acceptable earlier criteria specified by the FAA and referenced in an AFM.

5.7. Enhanced/Synthetic Vision Systems. Enhanced/Synthetic Vision Systems based on millimeter wave radar or other such sensors may be used to ensure the integrity of other flight guidance or control systems in use during Category I or II operations. They must be demonstrated to be acceptable to FAA in a proof of concept evaluation and they must otherwise meet the requirements of Appendix 2 or 3 of this AC as applicable. Use of Enhanced/Synthetic Vision Systems for purposes other than establishing the accuracy or integrity of flight guidance system performance must be demonstrated to be acceptable through proof of concept testing prior to identification of specific airworthiness and operation criteria.

5.8. Hybrid Systems. Hybrid systems (e.g., a fail passive autoland system used in combination with a monitored HUD flight guidance system) may be acceptable for Category I or II if the system provides the equivalent performance and safety to a non-hybrid system as specified for the minima sought (e.g., Category I or II).

a. Hybrid systems with automatic landing capability should be based on the concept of use of the automatic landing system as the primary means of control, with the manual flight guidance system serving as a backup mode or reversionary mode.

b. Any transition between hybrid system elements (e.g., control transition from autoland use to manual control HUD use, or for response to failures) must be acceptable for use by properly qualified flightcrews (e.g., qualified IAW part 121, an approved Advanced Qualification Program (AQP), or equivalent JAA criteria, as applicable, and standard industry practices). Transitions should not require extraordinary skill, training, or proficiency.

c. For any system which requires a pilot to initiate manual control at or shortly after touchdown, the transition from automatic control prior to touchdown to manual control using the remaining element of the hybrid system (e.g., HUD) after touchdown must be shown to be safe and reliable.

5.9. Instruments, Systems, and Displays. The following identifies Flight Instrument, Systems, and Display presentations requirements for Category I and Category II operations:

5.9.1. Instruments, Systems, and Displays for Category I.

a. Attitude indicators, EADIs or primary flight displays must be provided for each required pilot (pilot flying (PF) and pilot not flying (PNF)), or equivalent electro-mechanical instruments depicting attitude, barometric altitude, airspeed, and vertical speed.

b. HSIs, EHSIs, NDs, or other equivalent navigation displays, with pertinent, reliable and readily understandable lateral situation information for both normal and non-normal conditions related to Category I landing and missed approach procedures, must be provided for each required pilot.

c. Instrument and panel layouts must follow accepted principles of flight deck design (e.g., basic-T format, conventions for airspeed altitude scales).

d. The location and placement of situation information navigation displays must be appropriate for each required flight crewmember, and must be appropriately scaled and readily understandable in presentations or mode of display used.

e. Suitable redundant lateral, and where applicable, vertical path displacement information from the final approach course and specified glide path must be provided.

(1) For any operation intended for use with a DA(H) below 250 ft. HAT, lateral and vertical displacement information must be provided on the PFD, EADI, ADI, or equivalent to each pilot independently.

(2) For RNP operations with minima below 250 ft. HAT, the lateral and vertical displacement full-scale indication on the PFD, EADI, or attitude indicator should be as shown in Figure 5.9.2-1 and 5.9.2-2, unless otherwise approved by the FAA. It is recommended that these displacement indications be provided for any RNP approach operations.

(3) Different display sensitivities may be necessary for steep or shallow angle approaches.

(4) The 0.7 degree taper prior to the 100 ft. HAT for vertical display sensitivity is acceptable for most glide path angles. A taper of ¼ the glide path angle is an acceptable alternative, and would be preferred for steep or shallow glide path angles.

(5) The display sensitivities that are selected should be validated by simulator or flight evaluation.

f. Decision Altitude (Height) or Minimum Descent Altitude (Height) advisory indications that are readily understandable and appropriately distinctive plus marker beacon indications (middle marker, and outer marker), or equivalent, should be provided at each required pilot station.

> **NOTE: Unless otherwise approved by FAA, advisory indications should be expressed as either "RH" or "RA" for radar/radio height or altitude, and as "BARO" for barometric altitude. Flightdeck depiction of radio and barometric height or altitude advisories should not typically use the operational designations of "DH" or "MDA."**

g. Appropriate system status and failure annunciations suited to the guidance systems used, navigation sensors used, and any related aircraft systems (e.g., autopilot, flight director, electrical system) should be provided.

h. Automatic audio call-outs as described in paragraph 5.11 are recommended.

i. A suitable rain removal method is recommended for each pilot for Category I operations. Suitable methods typically include windshield wipers, bleed air windshield rain removal, or hydrophobic coatings.

5.9.2. Instruments, Systems, and Displays for Category II.

a. Attitude indicators, EADIs or primary flight displays must be provided for each required pilot (PF and PNF), or equivalent electro-mechanical instruments depicting attitude, barometric altitude, airspeed, and vertical speed plus suitable standby attitude information available to each required pilot.

b. HSIs, EHSIs, NDs or other equivalent navigation displays with pertinent, reliable, and readily understandable lateral situation information for both normal and non-normal conditions related to Category II landing and missed approach procedures, must be provided for each required pilot.

c. Instrument and panel layouts must follow accepted principles of flight deck design (e.g., basic-T format, conventions for airspeed altitude scales).

d. The location and placement of situation information/navigation displays must be appropriate for each required flight crewmember, and must be appropriately scaled and readily understandable in presentations or mode of display used.

e. Suitable redundant lateral and vertical path displacement information from the final approach course and specified glide path must be provided.

(1) Lateral and vertical displacement information must be provided on the PFD, EADI, ADI or equivalent to each pilot independently.

(2) Lateral displacement expanded scale information must be provided to confirm that the aircraft position with respect to intended flight path and the landing runway on each PFD, EADI, ADI or equivalent (e.g., for ILS, a full scale sensitivity of 1 Dot (0.0775 ddm)), or the following criteria applicable to RNP.

(3) For RNP operations, the lateral and vertical displacement full-scale indication on the PFD, EADI, or attitude indicator should be as shown in Figure 5.9.2-1 and 5.9.2-2, unless otherwise approved by FAA. It is recommended that these displacement indications be provided for any RNP approach operations. Figure 5.9.2-1 and 5.9.2-2 shows that for the point on the approach path where the RNP portion of the path meets the angular portion of display limits, the display limit distance from nominal path (zero deviation) to full scale high or to full scale low display deviation is $\pm$ 250 ft. (vertical displacement), and $\pm$ 1 x RNP (lateral displacement). At the point on the approach path where the vertical angular display limit converges to a constant value (i.e., nominal path is at 100 ft. HAT), the full-scale displacement is $\pm$24' (vertical displacement). At that point on the approach path where the lateral angular display limit converges to a constant value (i.e., runway threshold), the full scale displacement is $\pm$175 ft. (lateral displacement).

f. An autopilot or flight director system suitable for the minima to be authorized.

g. Unless otherwise approved by the FAA for Category II operations based on autopilot use alone, flight director(s), or command guidance information, should be provided for each pilot, suitable for the minima to be authorized - at least dual independent system capability must be installed for Category II operations for aircraft which are certificated with more than one required pilot.

> **NOTE: For Head Up Display (HUD) operations, availability of the information in items a, b, and e above on a HUD does not necessarily substitute for availability of this information on pertinent head-down displays (HDDs). Configurations found acceptable to FAA include use of a compatible HUD and HDDs at the Crewmember 1 (CM1/Captain) flight deck station, and suitable and comparable HDDs at the Crewmember 2 (CM2 /FO) flight deck station, each with adequate flight path display and failure annunciation. Use of other HUD/HDD configurations for CM1 and CM2 must be evaluated by FAA, and be determined to provide acceptable and equivalent or better capability.**

h. Unless otherwise approved by FAA based on demonstration of acceptable pilot workload, an autothrottle system should be provided.

i. Decision Altitude (Height) advisory indications that are readily understandable and appropriately distinctive plus a display of radio altitude and marker beacon indications (inner marker, middle marker, and outer marker), or equivalent, should be provided at each required pilot station.

NOTE: Unless otherwise approved by FAA, advisory indications should be expressed as either "RH" or "RA" for radar/radio height or altitude, and as "BARO" for barometric altitude. Flight deck depiction of radio and barometric height or altitude advisories should not typically use the operational designations of "DH" or "MDA."

j. Appropriate system status and failure annunciations suited to the guidance systems used, navigation sensors used, and any related aircraft systems (e.g., autopilot, flight director, electrical system) should be provided.

k. Automatic audio call-outs as described in paragraph 5.11 are recommended.

l. A suitable rain removal method is required for each pilot for Category II operations.

m. A demonstration of the suitability of any indications for non-normal configurations for which credit is sought (e.g., electrical configurations, hydraulic power).

Figure 5.9.2-1

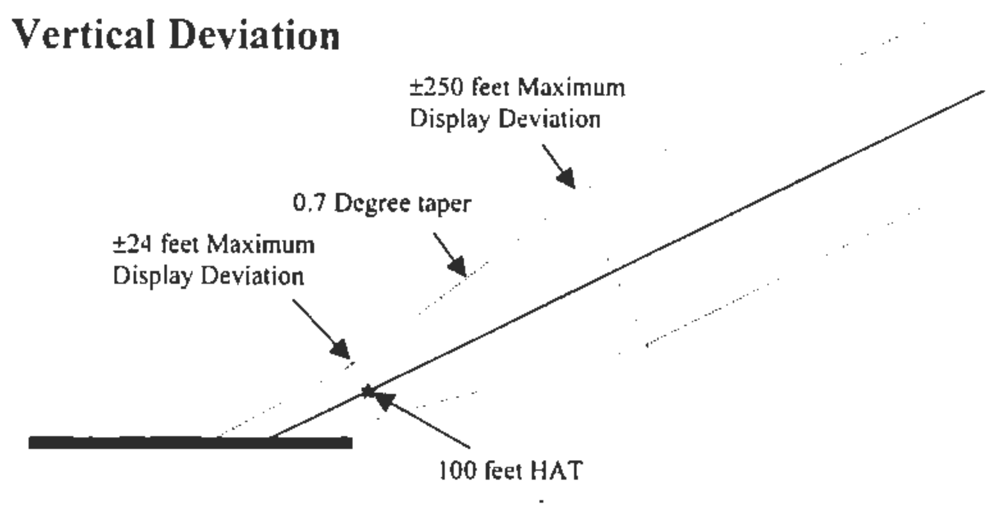
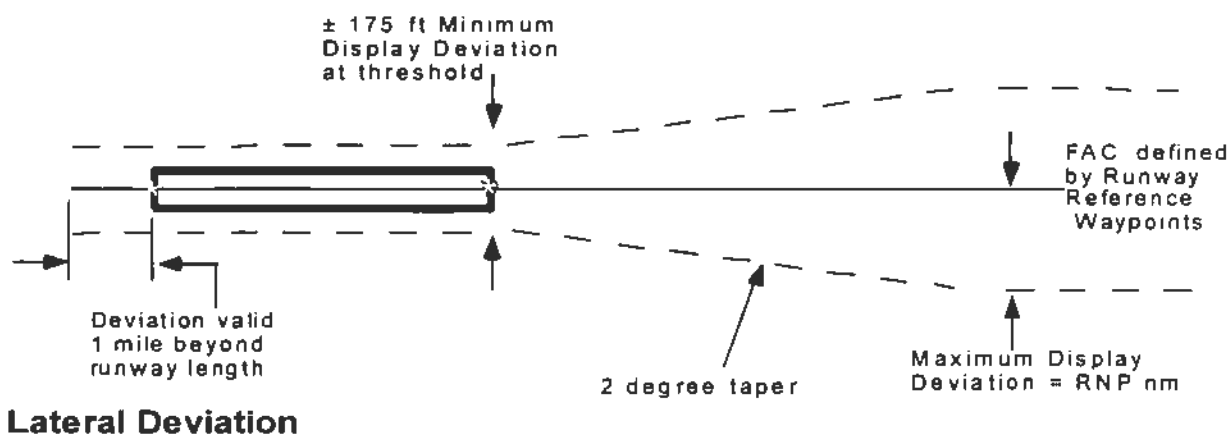


Figure 5.9.2-2



5.10. Annunciations. Annunciations must be clear, unambiguous, and appropriately related to the flight control mode in use. The mode annunciation labels should not be identified by landing minima classification. For example, APPROACH, LAND 2, LAND 3, Single Land, Dual Land, are acceptable mode annunciation labels, whereas, "Category II," "Category III," etc., should not be used. Aircraft previously demonstrated for Category I or II which do not meet this criteria may require additional operational constraints to ensure the correct use of minima suited to the aircraft configuration.

5.11. Auto Aural Alerts.

a. Automatic Aural Alerts (automatic call-outs, voice callouts, etc.) of radar altitude, or call-outs approaching landing minimums, or call-outs denoting landing minimums are recommended and should be consistent with the design philosophy of the aircraft in question. However, any automatic call-outs used should not be of a volume or frequency that interferes with necessary flightcrew communications or normal crew coordination procedures. Recommended automatic call-outs include a suitable alert or tone as follows:

(1) At 500 ft. (radar altitude), approaching minimums and at minimums, and

(2) Altitude call-outs during flare, such as at "50" ft., "30" ft. and "10" ft., or altitudes appropriate to aircraft flare characteristics.

b. Low altitude radio altitude call-outs, if used, should appropriately address the situation of higher than normal sink rate during flare, or an extended flare which may be progressing beyond the touchdown zone. Other alerts may be used when approved by the Administrator, if those alerts are consistent with that Operators approved procedures and minima, and do not impair crew communication.

5.12. Navigation Sensors.

a. Navigation sensors as noted in paragraph 4.3.7.1 through 4.3.7.4 and in 5.12.1 or 5.12.2 below may be used to support Category I or Category II Instrument Approach Procedures.

b. Navigation systems, procedures, sensors, or NAVAID signals cited in paragraphs 4.3.7.1 through 4.3.7.4 or in 5.12.1 or 5.12.2 may also use and take suitable credit for various forms of inertial or air data system capability when combined with capability of the sensors cited in the above provisions to improve accuracy, integrity, or availability performance (e.g., position or velocity complementary filtering, or Kalman filtering may be used, and appropriate credit taken for performance improvement).

5.12.1. Navigation Sensors for (xLS) - ILS, GLS, or MLS. For ILS, GLS, or MLS, various navigation sensors individually may be acceptable to support Category I or II operations. ILS localizer and glideslope signals are the primary means currently used for the determination of deviation from the desired path for lowest Category I or II operations. Criteria for acceptable ILS and MLS localizer and glide-slope receivers are included in Appendix 2 or 3 or in earlier acceptable criteria used by FAA for previous demonstrations of systems for Category I or II.

a. Other navigation information based upon GNSS, or SBAS/GBAS, may be used individually or in combination to satisfy the necessary accuracy, integrity, and availability for Category I or II. Navigation sensors other than ILS must meet equivalent ILS performance or appropriate RTCA or EUROCAE criteria for lowest Category I minima credit, unless otherwise authorized.

b. Appropriate marker beacon information, or equivalent, must be displayed to each pilot for the outer, middle and inner markers. The FAA may authorize appropriate substitutes for marker beacons for Category I or II based upon the use of suitable GNSS or SBAS/GBAS capabilities, or DME.

c. ADF capability, or equivalent capability, should be available as suitable for the planned route of flight or planned alternates (e.g., 14 CFR sections 91.205 (d)(2) and 121.349). For example, at least 1 ADF should be available for ILS procedures, unless the operator does not use ILS procedures with an NDB facility identified as an approach transition or missed approach NAVAID, or if the operator has available and uses an approved RNAV capability providing equivalent or better performance to that provided by ADF NDB. RNP-qualified aircraft may be considered to be eligible for ADF NDB waypoint substitution any time the area navigation system (e.g., FMS) is able to provide RNP.3 or better capability, for each applicable equivalent procedure segment, or for use of an equivalent NDB waypoint. Any other RNAV capability substitution for use of ADF/NDB for instrument procedures should be as determined to be acceptable for that operator by the CMO (e.g., GNSS system substitution IAW AIM provisions).

Note: PAR may also be considered to be acceptable for Category I (also see 4.3.4.1.c and 4.3.8.8).

5.12.2. Navigation Sensors for Approaches other than ILS, GLS, or MLS. For approaches other than ILS, GLS, or MLS, the following sensors are considered to be acceptable for providing course guidance for Category I Operations (Note: Category II operations are not authorized exclusively using these sensors.):

- LOC
- LDA
- SDF
- BCRS
- RNAV (e.g., FMS)
- GPS
- VOR
- VOR/DME
- TACAN
- NDB
- NDB/DME
- Dual NDB
- ASR
- KRM (RMS)

5.12.3. Aircraft Navigation Reference Points, Wheel to Eye Height, and Wheel to Navigation Reference Point Height. To ensure suitable wheel height and clearance over the threshold of runways when following an electronic path (e.g., glideslope or VNAV) and when using visual references (e.g., VGSI/PAPI) aircraft manuals should specify and Operators should be aware of the height of the pilots eye reference point and the height of the navigation reference point (e.g., glideslope antenna) above the wheel path during landing. This is usually specific to each aircraft type. This information should be available to the operator and pilot, along with any guidance on the minimum acceptable runway threshold crossing height criteria for procedures, if applicable, and any constraints or recommendations for proper VGSI/PAPI use.

5.12.4. Threshold Crossing Height (TCH).

a. Typically, procedures are designated with vertical path runway threshold crossing height in the range of 50 to 55 ft. The maximum TCH for instrument approaches is usually limited to 60 ft. Unless otherwise accepted by FAA, aircraft should be able to use these standard facilities and any other facilities with a vertical path (glideslope or VNAV path) having a threshold crossing height specified as not less than 48 ft.

b. For operations on facilities where a threshold crossing height (glideslope or VNAV) is less than 48 ft., the operator and CHDO should consider the advisability of those operations on a case by case basis. Considerations should include any obstructions in the pre-threshold area, the amount the glideslope or VNAV path is below standard values, aircraft type and aircraft characteristics as proposed for the operation, whether the runway under-run area is a full load-bearing surface, placement of lighting aids (threshold lights/approach lights), availability, and suitability of VGSI/PAPI, weather minima to be used, and any other relevant factors.

5.13. Supporting Systems and Capabilities.

5.13.1. Flight Deck Visibility. Forward and side flight deck visibility for each pilot should be provided as follows.

a. The aircraft should have a suitable visual reference cockpit cutoff angle over the nose for the intended operations, at the intended approach speeds, and for the intended aircraft configurations, as applicable (e.g., flap settings);

b. The aircraft's flight deck forward and side windows should provide suitable visibility for taxi and ground operations in low visibility; and

c. Placement of any devices or structure in the pilot's visual field which could significantly affect the pilot's view for low visibility operations must be acceptable (e.g., HUD drive electronics, sun visor function or mountings).

5.13.2. Rain and Ice Removal.

a. Suitable windshield rain removal, ice protection, or defog capability should be provided as specified below:

(1) Installation of rain removal capability is recommended for Category I and required for Category II (e.g., windshield wipers, windshield bleed air).

(2) Installation of use of windshield hydrophobic coatings, or use of equivalent rain repellent systems which meet pertinent environmental standards are recommended.

(3) Installation of suitable windshield anti-ice or de-ice capability is recommended for Category I and required for Category II for aircraft intended to operate in known icing conditions during approach and landing.

(4) Installation of at least suitable forward windshield defog capability is recommended for aircraft subject to obscuration of the pilot's view during humid conditions.

b. Aircraft subject to obscuration of the windshield due to rain, ice, or fogging of the pilot's view which do not have protection, or which do not have adequate protection may require operational limitations on the conditions in which low visibility operations are conducted.

5.13.3. Miscellaneous Systems. Other supporting systems including instruments, radar altimeters, air data computers, inertial reference units, instrument switching, or capabilities such as flight deck night lighting, landing lights and taxi lights, position, turnoff, and recognition lights, flight data recorders, cockpit voice recorders, or other low visibility related aircraft systems must meet any appropriate criteria as specified in Appendix 2 or 3, in basic airworthiness requirements applicable to U.S. certificated aircraft or equivalent, or acceptable earlier criteria authorized by FAA for aircraft previously demonstrated to be acceptable for Category I or Category II operation (See paragraphs 5.20 and 5.21 for GPWS, TAWS and FDR provisions).

5.14. Go-Around Capability.

a. For aircraft authorized for instrument approaches, and particularly for aircraft intended for operation to Category II minima, evaluation of go-around capability should be based on both normal and any specified non-normal operations, down to the lowest minima expected. Assessment should account for factors related to aircraft geometric limitations (e.g., fuselage attitude and potential for tail strike) during the transition to go around, limited visual cues, autoflight system mode switching if applicable, and any other pertinent factors identified by FAA. For aircraft in which a go-around from a very low altitude may result in an inadvertent touchdown, the safety of such a procedure should be established considering its effect on related systems, such as operation of autospoilers, automatic braking systems, autopilot/flight director mode switching, autothrottle operation and mode switching, reverse thrust initiation and other systems associated with, or affected by, a low altitude go-around.

b. If an automatic or flight director go-around capability is provided, it should be demonstrated that a go-around can be safely initiated and completed from any altitude to touchdown. If an automatic go-around mode can be engaged at or after touchdown, it should be shown to be safe. The ability to initiate an automatic or flight director go-around at or after touchdown is not required or appropriate. Inadvertent selection of go-around after touchdown (either an automatic or flight director go-around capability) should have no adverse effect on the ability of the aircraft to safely rollout and stop.

c. Regardless of the flight guidance system used, availability of appropriate information to safely go-around should be available to the flightcrew, and the aircraft should have the capability to go-around. The go-around must be able to be initiated at any time during the approach to touchdown. Although flight guidance system go-around capability is not required, if such go-around capability is supported by a flight guidance system, that capability should be able to be selected at any time during the approach to touchdown. If a go-around mode of a flight guidance system is activated at a low altitude where the aircraft inadvertently touches the ground, the flightcrew should have access to adequate information to accomplish a safe go around, and the aircraft or flight guidance system should not exhibit any unsafe characteristic as a result of an inadvertent touchdown.

d. The following factors should typically be considered when evaluating the safety of a go-around from any point in the approach before touchdown:

(1) Go-around capability should address normal operating conditions, and may include specified non-normal conditions (e.g., engine out) down to the lowest expected operating minimum.

(2) Factors related to any geometric limitations (such as tail strike) or configuration changes (such as flap retraction, or allowing for any necessary acceleration segment) of the aircraft during the transition to a go-around should be considered.

(3) Factors such as the autopilot, flight director, or autothrottle mode switching or automatic disconnect, minimizing altitude loss during transition to a go-around, and addressing any adverse consequences that might result from autopilot, flight director, or autothrottle malfunction should be considered.

(4) If a go-around could result in an inadvertent touchdown, the safety of such an event should be considered. The aircraft design and/or procedures used should accommodate relevant factors. Examples of relevant factors to consider include operation and acceleration characteristics of engines, failure of an engine, the operation of autothrottle, autobrakes, auto-spoilers, autopilot/flight director mode switching, and other systems (e.g., ground sensing logic) which could be adversely affected by an inadvertent touchdown.

(5) If the occurrence of any failure condition in the aircraft or its associated equipment could preclude a safe go-around from low altitude, then such failure conditions should be identified. In such a case, a minimum height may be specified from which a safe go-around was demonstrated if the failure occurs. If the failure occurs below the specified height, pilots should be made aware of appropriate procedures to be used, and the effects or consequences of any attempt to go-around.

e. If necessary, information should be provided to the flightcrew concerning appropriate procedures for low altitude go-around. If the ability to conduct approach and landing operations with an engine inoperative using low minima are intended (e.g., minima below an MDA(H) or DA(H) of approximately 250 ft. HAT), or if procedures for an engine failure during a low altitude go-around require special consideration or are significantly different than for any other go-around, then flightcrew procedures to safely conduct such an engine-out go-around should be addressed. If necessary, suitable information to safely conduct such a low altitude go-around should be provided to the flightcrew (e.g., flap configurations and flap retraction procedures, appropriate acceleration to a suitable go-around speed, appropriate use of auto-feather capability).

5.15. Excessive Deviation Alerting. Some method is recommended for being able to detect excessive deviation of the aircraft laterally and vertically during approach, and laterally during rollout, as applicable. The method used should not require excessive workload or undue attention. This provision does not require a specified deviation warning method or annunciation, but may be addressed by parameters displayed on the ADI, EADI, or PFD. When a dedicated deviation warning is provided, its use must not cause excessive nuisance alerts.

5.16. Rollout Deceleration Systems or Procedures for Category I or II.

5.16.1. Stopping Means. A means to determine that an aircraft can be reliably stopped within the available length of the runway, considering ambient conditions, is recommended for any operation.

5.16.2. Antiskid Systems. Unless otherwise specified by FAA, aircraft authorized for Category I or Category II do not have specific antiskid system installation or use requirements beyond those specified in the applicable AFM, applicable FAA MMEL and MEL, and applicable field length operating rules.

5.17. Engine Inoperative Category II Capability. The following criteria are applicable to aircraft systems intended to qualify for "engine inoperative Category II" authorizations. Aircraft demonstrated to meet the provisions of Appendix 2 with an "engine inoperative" and have an appropriate reference to engine inoperative Category II capability in the FAA approved AFM are typically considered to meet the provisions listed below. Other aircraft which have an AFM showing only all-engine Category II capability may be operationally demonstrated for engine inoperative Category II capability IAW paragraph 5.19.1 through 5.19.3 and paragraph 10.5.

a. The AFM or equivalent reference (e.g., Operators manual) must suitably describe demonstrated approach and missed approach performance for the engine inoperative configuration, and the aircraft must meet pertinent criteria otherwise required for all-engine Category II or equivalent criteria. Suitable performance information should also be available to the pilot and, if applicable, the aircraft dispatcher, to ensure safe landing capability in the anticipated configuration and with anticipated speeds, and to establish safe go-around capability from DA(H) and, if applicable, for a balked landing from the TDZ (e.g., equivalent to an obstacle clearance takeoff procedure). When assessing engine out Category II capability, the following exceptions to all-engine Category II criteria may be used:

(1) The effects of a second engine failure when conducting Category II operations with an engine inoperative need not be considered,

(2) Crew intervention to re-trim the aircraft to address thrust asymmetry following engine loss may be permitted,

(3) Alternate electrical and hydraulic system redundancy provisions may be acceptable, as soited to the type design (e.g., bus isolation and electrical generator remaining capability must be suitable for the engine out configuration),

(4) Requirements to show acceptable approach performance may be limited to demonstration of acceptable performance during engine-out flight demonstrations (e.g., a safe approach to minima), and

(5) Approach or Landing system "status" should accurately reflect the aircraft configuration and capability.

b. Suitable information about flight guidance system capability must be available to the flightcrew in flight, particularly at the time of a "continuation to destination" or "diversion to alternate" decision. This is to determine that the aircraft can have an appropriate Category II approach capability when the approach is initiated (e.g., Non-normal checklist specification of expected configuration during approach, autopilot or flight director status annunciation of expected mode capability).

c. The operator should consider system performance in appropriate weather conditions (e.g., winds, turbulence or wind gradients) to make a determination as to whether any weather related restrictions or limitations are appropriate.

5.18. Special Airports with Irregular Pre-Threshold Terrain. Not withstanding the fact that most aircraft systems that have completed airworthiness demonstrations consider irregular terrain in the pre-threshold area, special operational evaluations are nonetheless appropriate for certain airports having difficult pre-threshold terrain conditions. These special evaluations consider each particular aircraft type, the particular flight control system, and may include consideration of particular system elements such as the type of radar altimeters installed or other equipment. The need for such a special evaluation of a part 97 instrument approach procedure is identified by FAA order 8400.8, Procedures for Approval of Facilities for FAR Part 121 & Part 135 CAT III Operations. Criteria for the evaluation of irregular Pre-threshold terrain airports is contained in FAA Appendix 8 of AC 120-28D. Criteria for approval of Operators or procedures regarding operations at runways with irregular Pre-threshold terrain are addressed in paragraphs 6.2.5 and 10.7.

5.19. Airborne System Evaluation and Approval. Category I and Category II airborne systems may be IAW the applicable airworthiness criteria contained in Appendix 2 or 3 during type certification or STC approval, or they may be evaluated in conjunction with a FAA-approved program with an air carrier. To be acceptable for Category I or II landing minima, the airborne equipment should meet the criteria in Appendix 2 or 3 of this AC and be able to conduct Category I or II operations IAW the operational concepts discussed in Paragraph 4 above. However, if a determination of compliance with Appendix 2 or 3 has not been made, airborne equipment which is shown to meet the operational demonstration criteria in the applicable subparagraphs below may also be acceptable for Category I (e.g., RNP Operations) or Category II landing minima if it is demonstrated that this equipment permits safe Category I or II operations, as applicable, IAW the operational concepts discussed in Paragraph 4 above.

5.19.1. "Operator Use Suitability" Demonstrations - Applicability. The following criteria in paragraphs 5.19.2 through 5.19.3 (also see paragraph 10.5) apply to applicants desiring airborne equipment approval for those systems which do not have a statement in the approved airplane flight manual which indicates that the equipment meets the relevant performance standards of this AC, previous editions of this AC, or equivalent criteria (e.g., either for Category I such as applicable to FTE demonstrations for RNP, or for Category II). The criteria of paragraphs 5.19.2 and 5.19.3 are not intended to apply to those aircraft types or variants which already include a statement in the approved airplane flight manual indicating that the airborne flight guidance system was evaluated IAW criteria of this AC.

5.19.2. Airborne Equipment Operational Validation. The applicant should provide an acceptable test and evaluation plan which establishes satisfactory performance of the flight guidance system for either the Category I or Category II operations intended, as applicable. To be acceptable, the applicant should conduct an appropriate number of approaches and missed approaches, or other applicable operations, for representative instrument procedures to be flown. For such assessments under this provision, an applicant may be considered to be an operator, a group of Operators, or an aircraft manufacturer or avionics manufacturer in conjunction with one or more Operators. An aircraft manufacturer or avionics manufacturer seeking to demonstrate alternate levels of FTE without involvement of an operator would normally be expected to do so as part of a TC or STC process, IAW criteria of an Appendix of this AC.

5.19.2.1. Category II Assessments. For Category II, the applicant should typically be expected to perform at least 300 successful approaches to appropriate Category II DA(H) minima, in each aircraft type intended. The 300 approaches may be allocated to several variants within a type if the flight guidance systems used by each variant are the same or similar. If a related or similar aircraft type is configured with the same or a similar flight guidance system and is already approved for Category II, or for special case consideration such as consideration of an engine inoperative Category II approach, the number of approaches for a particular type or variant may be reduced by an appropriate amount depending on the degree of system similarity, flight guidance performance similarity, or aircraft similarity, as determined appropriate by the CMO, AEG, or AFS-400. Approaches may be accomplished in line operations, during training flights, or during specific demonstration flights, or in any combination. Not less than ninety percent of the total demonstrated approaches conducted should be successful. No unsafe approaches or missed approaches should occur. (See 5.19.3.3 for a definition of a successful approach). Approaches should be accomplished IAW the following criteria:

a. A minimum of three facilities/runways should be used during the demonstrations, unless Category II operations will be conducted only at fewer than 3 facilities by that operator. At least 10 percent of the total number of approaches should be conducted on each of at least three of the facilities selected. The number of approaches conducted on additional facilities may be at the applicant's discretion.

b. At least some approaches should be accomplished using facilities approved for Category II or Category III Procedures. However, at the applicant's option, demonstration may be made using facilities used only for Category I Procedures.

c. No more than 15 approaches per day should be conducted on a single facility.

d. No more than 60 percent of the approaches should be conducted in any single aircraft, unless the operator has 3 or fewer aircraft to be evaluated, and performance of the other aircraft may be considered to be equivalent.

e. Where an applicant has different variants of a type aircraft which utilize the same or similar flight guidance system, the applicant should ensure that each of the variants can meet the necessary performance criteria.

f. If flight director performance is to be assessed, a representative number of pilots should be used to conduct the necessary approaches. No single pilot should perform more than 20 percent of the approaches, unless a small total number of pilots assigned to the aircraft type requires the use of a greater percentage.

g. An acceptable sample of the approaches conducted should be observed by an FAA Aviation Safety Inspector or other suitably qualified evaluator(s) (e.g., a check airman representatives of the operator, an APD or equivalent, or representatives from the aircraft or avionics manufacturer), as determined acceptable by FAA.

5.19.2.2. Flight Technical Error (FTE) Assessments. Flight Technical Error (FTE) assessments for approach or missed approach, or other defined operations, may be made by an aircraft manufacturer, an avionics manufacturer, or an operator to establish alternate levels of expected FTE to be used for navigation system or procedure authorization. Alternate levels of FTE may then be applied to instrument procedure development or authorization, in lieu of standard assumed FTE values, when the assumptions or conditions of the alternate FTE levels can be met or satisfied.

a. FTE levels may be established by analysis (e.g., of existing data), by simulation (e.g., in a suitable flight training simulator), through flight verification (e.g., data collected from flight demonstration(s) with an appropriately configured aircraft), or in any combination of these methods. Regardless of the method(s) used, sufficient assessment should take place to ensure that any resulting FTE information or values are valid for the navigation conditions or procedures to which they are to be applied. The assessment should key to types of procedures to be flown, appropriately consider normal, non-normal and rare normal operations, should address pilot capability or system variability to the extent necessary, and should have sufficient repeatability to have confidence in the FTE level(s) that result.

b. Any FTE assessment related exceptions to industry criteria found in sources such as RTCA DO-236 for RNP should be clearly identified, if necessary (e.g., navigation systems for which 22nm constant radius turns are not intended to be applicable).

5.19.3. Data Collection and Analysis for an Airborne System Evaluation.

5.19.3.1. FTE Data Collection and Analysis. For an FTE assessment demonstration, sufficient data should be collected to establish the suitability of the levels of FTE sought. The data collection and consequent analysis should match and at least consider the types of procedures to be flown (e.g., representative leg types and leg geometry), aircraft configurations to be used (e.g., map display, flight director, autopilot), representative environmental conditions, pertinent normal or non-normal conditions, and representative pilot qualification and experience. Data collection may be from a dedicated FTE assessment, or from data collected during line operations, if appropriate conditions are experienced (e.g., weather) and assumptions satisfied (e.g., pilot sample variability). FTE data collection and analysis may separately address flight on stabilized portions of straight segments, and flight during curved segments or during leg to leg captures. Use of statistical methods for analysis of data is acceptable, but is not necessarily required (e.g., for treatment of certain rare normal or non-normal conditions). The analysis methods or techniques to be used by the applicant and any demonstration program to be used should be determined to be acceptable to FAA prior to commencement of the FTE assessment program.

5.19.3.2. Data Collection for a Category II Demonstration. For a Category II system suitability demonstration, each applicant or designated representative should provide the information listed below, as necessary and as requested by the CHDO. This information should be related to performance of the airborne flight guidance system and display system regardless of whether an attempted approach demonstration is successful, unsuccessful, or discontinued. The information, along with recommendations and any clarifying information regarding unsuccessful or discontinued approaches should be provided to the FAA CHDO:

a. Specify the total number of approaches attempted, the number of successful approaches, and the number of and reasons for unsuccessful or discontinued approaches, if known.

b. If an approach is discontinued, specify the height above the runway at which the approach was discontinued.

c. Specify the acceptability of lateral position, vertical position, track, vertical path/vertical speed, speed error, and pitch trim acceptability at 200 ft. HAT, 100 ft. HAT or at DA(H), and note if the approach was in any way inconsistent with continuing an approach to a normal landing within the touchdown zone.

d. Specify the NAVAIDs and runway facilities used and the reported weather and wind conditions in which the assessment was conducted.

e. Evaluate the tracking performance stability, and suitability of the flight director or autopilot, as applicable, for the intended operation.

f. If not otherwise based on data recording, the evaluator(s) should note and record the lateral and vertical position of the airplane relative to the localizer and glide slope at least at the 200 ft. HAT, 100 ft. HAT or at DA(H), and the estimated runway touchdown point achieved consistent with following the flight guidance system, as applicable to the system used.

g. If unable to initiate an approach due to a deficiency in the airborne equipment, note the reason for the deficiency and any recommendation for addressing the deficiency.

h. Provide any other relevant associated recommendations or circumstances.

> **NOTE: Unsuccessful approaches attributed solely to Air Traffic Service (ATS) circumstances may be excluded from the data (e.g., flights vectored too close to a final fix or at large angles preventing adequate localizer and glide slope capture; termination of an approach at the request of an Air Traffic Facility or due to an amended air traffic clearance; evidence of inappropriate ILS critical area protection). Also, unsuccessful approaches may be excluded from consideration due to faulty NAVAID or non-aircraft sensor signals. Airborne system failures attributed to maintenance failures or maintenance factors should be documented for subsequent joint resolution by FAA and the operator.**

5.19.3.3. Definition of a Successful Approach for a Category II Demonstration. For the purpose for the airborne system suitability demonstration for Category II, a successful approach is one in which, at least at the 100 ft. HAT point or DA(H), through touchdown, meets the following criteria:

a. The airplane is continuously in a position to complete a normal landing using normal maneuvering. Typically this is considered to require that below 200 ft. HAT the flight deck is positioned within and is tracking to remain within, the lateral confines of the extended runway.

b. The deviation from glide slope does not exceed ± 75 microamps (1/2 scale) as displayed on the ILS, MLS, GLS, or equivalent system indicator at least down to the DA(H). Below the DA(H) a normal approach path is followed and a normal flare occurs, with a landing safely within the touchdown zone at normal sink rates and attitudes.

c. The indicated airspeed, track, vertical speed, alignment, and heading are satisfactory. Indicated air speed does not exceed ± 5 knots of planned approach airspeed but may not be less than computed threshold or reference speed.

d. No unusual maneuvers or excessive attitude changes or attitude rates occur.

e. The airplane is generally in trim so as to preclude any excessive control forces.

5.20. Ground Proximity Warning System (GPWS) or Terrain Awareness Warning System (TAWS) Interface. Airborne equipment used for approach should have appropriate interfaces with or compatibility with GPWS and TAWS. This is to ensure nuisance free operation at routine airports. Special procedures may be used for non-normal procedures or at airports with unusually difficult underlying terrain, or other such factors.

5.21. Flight Data Recorder (FDR) Interface. Airborne equipment used for approach should have appropriate interfaces with or compatibility with flight data recorders, and if applicable cockpit voice recorders (e.g., alerting audio audibility on CVR).

5.22. Takeoff, or Dispatch, with Inoperative Navigation Receivers, Instruments, or Displays for Category I or II. Notwithstanding the airborne equipment installation provisions of paragraphs 5.2 and 5.3 above, and IAW any other FAA applicable MMEL and MEL provisions (e.g., as specified by the FAA FOEB or FSB for the type), a pilot may depart or an operator may dispatch an aircraft for Category I or Category II using the following guidelines (e.g., the operator may address MEL provisions stating "As required by the CFR," or equivalent provisions, as shown below):

5.22.1. Inoperative System Departure or Dispatch for Category I. For departure, or dispatch for Category I, if applicable, two navigation receivers are typically required, with each suitable for the route of flight and expected approaches to be conducted (e.g., dual ILS, if flying a route based on expected use of ILS for landing).

a. If the flight is based on use of a planned approach procedure that specifically requires dual navigation capability (e.g., /E required, or dual NDB required, or dual VOR required) then two pertinent systems are required for takeoff or dispatch.

b. If an approach procedure planned for use is not precluded from being conducted using one navigation source (e.g., one NDB, one FMS, one ILS), a minimum of one navigation receiver, or equivalent, of each type required for the intended flight is required. That navigation receiver's indication, or equivalent, should be able to be displayed at or be visible to each required pilot station, for each type of facility(s) intended for landing. Use of this provision requires considering subsequent failure of the one system intended for use (e.g., the ILS) and the need to be able to safely use any alternate remaining navigation system(s) (e.g., VOR or RNAV) while enroute, during approach, or during missed approach. In any instance, after the first failure in flight, there must still be another suitable navigation capability available to the aircraft to safely land. The other navigation capability required above may be based on use of a different NAVAID type, use of acceptable RNAV capability, or use of an alternate airport with the same or a different type of instrument procedure.

c. Instruments, or displays, or display elements may be inoperative if, considering the remaining instruments or displays, each pilot can accomplish that pilot's respective assigned crew duties for flying and monitoring the flight (e.g., failure of an ILS raw data display on the F/O's ADI or PFD may be permissible if that information or equivalent is available by other acceptable means - such as by using the F/O's HSI LOC or ND LOC indication in lieu of the ADI LOC indication). When considering inoperative component(s), subsequent failure of any single additional instrument, or display, or display component must not put the aircraft or crew in an unsafe situation for which the pilots cannot safely compensate (e.g., it is determined to be acceptable in the above example that after a subsequent failure the F/O will be able to acceptably monitor the Captain's corresponding instruments, or standby instruments).

5.22.2. Inoperative System Departure or Dispatch For Category II. For departure, or dispatch, for Category II, a minimum of two LOC or GLS navigation receivers of each type to be used are normally required for Category II. The receiver's indications to be used should be able to be independently displayed at or be visible to each respective pilot station, for each type of facility(s) intended for landing (e.g., ILS, MLS, or GLS). For ILS glide slope, only one receiver need be operative for departure or dispatch, if that receiver is a self monitored receiver with reliable failure indication, if the receiver information can be displayed at each pilots station, and if any other systems required for the Category II minima do not depend on having dual glideslope capability available (e.g., autoland, alerting and warning or monitoring systems).

a. Use of the "departure or dispatch with a single glideslope receiver" provision requires considering subsequent failure of the one GS system intended for use while enroute or on approach, and the need to be able to safely use alternate remaining navigation system(s) to safely land, after failure of the glideslope receiver in flight.

b. Instruments and displays provisions are the same as for Category I, except that at least one operative radar altimeter must be provided, and that one radar altimeter must at least be able to be displayed at each pilot station, or be easily visible to each pilot station.

NOTE: For Category II minima, if minima are intended to be based on use of an Inner Marker in lieu of a radar altimeter(s), and if the operator is not otherwise precluded from using the Inner Marker as a means to establish Category II minima, the radar altimeter need not be operative for takeoff or dispatch for purposes of establishing landing minima (e.g., for DA(H)). This provision does not address other MMEL/MEL provisions that may otherwise independently apply to radar altimeter availability, however, such as for appropriate GPWS function.

c. In addition to instruments and displays for Category II, there must be acceptable ice and rain removal protection available for the expected conditions during approach (e.g., windshield anti-ice for icing conditions, windshield wipers or equivalent for rain).

5.22.3. Inoperative System Departure or Dispatch for Either Category I or Category II.

a. For departure or dispatch for either Category I or II, for EFIS aircraft that have capability to switch entire display formats to different flight deck display locations, these systems typically may be dispatched with an inoperative display or with displays in alternate locations. For an alternate location, each pilot must be able to acceptably perform respective PF or PNF duties for approach and missed approach. Following failure of an additional display or display in an alternate position, the aircraft must still be able to be safely flown and landed using available instrument approach NAVAID capability and remaining displays.

b. Operators should ensure that planned operations consider any pertinent AFM or FCOM provisions for flight guidance system use that may relate to inoperative components (e.g., altimeter source, navigation source, or instrument source switching, and available flight director or autopilot modes, as applicable).

5.23. Continuation of Flight after Navigation System Failure Enroute, or During Approach for Category I or II. Notwithstanding the airborne equipment installation provisions of paragraphs 5.2 and 5.3 above, MMEL and MEL provisions of paragraphs 5.22 above, and any other FAA applicable FSB provisions for the type aircraft, a pilot may continue enroute or initiate an approach to Category I or Category II minima using the following guidelines of 5.23.1 through 5.23.3.

5.23.1. Continuation of a Flight After Failures For Category I.

a. The operator should establish a policy addressing typical failure conditions for which initiation or continuation of an approach in low visibility conditions is considered acceptable (e.g., failure of a single flight director, FCC, or instrument, for which switching to an alternate or common source still provides adequate information). Operators should also describe typical conditions for which the operator would expect that a pilot would divert to a different airport with better weather conditions, if possible (e.g., for complex engine or hydraulic failures where flight guidance or go-aroond performance may be significantly degraded).

b. Unless dual capability is specifically required for a particular procedure (e.g., /E reqoired, dual NDB required), for initiation or continuation of approach, a minimum of at least one navigation receiver or sensor of each type required for the intended approach procedure is required. If an approach is initiated with only one receiver or sensor, the pilot should, to the extent possible, consider the potential consequence of subsequent failure of that system or sensor.

5.23.2. Continuation of a Flight after Failures For Category II. For continuation enroute or initiation of an approach, a minimum of one LOC or GLS navigation receiver of each type to be used is normally required for initiation or continuation of Category II approach. The receiver's displacement indications, if applicable, should, however, be able to be independently displayed at or be visible to each respective pilot station, for each type of facility(s) intended for landing (e.g., ILS, MLS, or GLS). For ILS glide slope, only one receiver need be operative for approach if the receiver information can be displayed at each pilot's station, and if any other systems required for the Category II minima do not depend on having dual glideslope capability available (e.g., autoland, alerting and warning or monitoring systems).

a. Instruments and displays provisions are the same as for Category I, except that at least one operative radar altimeter must be provided, and that one radar altimeter must at least be able to be displayed at each pilot station, or be easily visible to each pilot station.

> **NOTE: For Category II minima, if minima are intended to be based on use of an Inner Marker in lieu of a radar altimeter(s), and if the aircraft and crew are not otherwise precluded from using the Inner Marker as a means to establish Category II minima, the radar altimeter need not be operative for approach, for purposes of establishing landing minima (e.g., for DA(H)).**

b. In addition to suitable instruments and displays, there must be acceptable ice and rain removal protection available for the expected conditions during approach (e.g., windshield anti-ice for icing conditions, windshield wipers or equivalent for rain).

5.23.3. Continuation of a Flight after Failures for either Category I or Category II. If a flight is to be continued to destination and the originally planned instrument approach procedure(s) (IAP) used after a failure enroute, or if an approach is to be continued, the pilot should consider the consequence to and alternatives available for the flight if remaining navigation receiver or sensor capability should subsequently fail.

a. For EFIS aircraft that have capability to switch entire display formats to different flight deck display locations following a failure, these systems typically may be switched to an operative display, or display in an alternate location. For a failed display or an alternate location, each pilot must be able to acceptably perform respective PF or PNF duties for approach and missed approach. Following failure of an additional display or display in an alternate position, the aircraft must still be able to be safely flown and landed using available instrument approach NAVAID capability and remaining displays.

b. Pilots should ensure that planned operations consider any pertinent AFM or FCOM provisions for flight guidance system use that may relate to inoperative components (e.g., altimeter source, navigation source, or instrument source switching, and available flight director or autopilot modes, as applicable).

c. A pilot exercising emergency authority may deviate from the above or any other provisions of this AC to the extent necessary to ensure safe flight and landing.

6. PROCEDURES.

6.1. Operational Procedures. Appropriate operational procedures based on the approved operator program should be addressed. Operational procedures should consider the pilot qualification and training program, airplane flight manual (AFM), crew coordination, monitoring, appropriate takeoff and landing minima including specification of either a DA(H) or MDA(H), as applicable, for landing, crew call-outs, and assurance of appropriate aircraft configurations. Suitable operational procedures must be implemented by the operator and be used by flightcrews prior to conducting low visibility Category I or II landing operations.

6.1.1. AFM Provisions. The operator's procedures for low visibility takeoff or Category I or II landing should be consistent with AFM provisions specified during airworthiness demonstrations. Adjustments of AFM procedures consistent with operator requirements are permitted when approved by the POI. Operators should ensure that no adjustments to procedures are made which invalidate the applicability of the original airworthiness demonstration.

6.1.2. Crew Coordination. Appropriate procedures for crew coordination should be established so that each flight crewmember can carry out their assigned responsibilities. Briefings prior to the applicable takeoff or approach should be specified to ensure appropriate and necessary crew communications. Responsibilities and assignment of tasks should be clearly understood by crewmembers. Tasks should be accomplished consistent with the operator's specified provisions for the aircraft type or variant and each crewmember position unless otherwise approved by the POI (duties of each pilot, monitored approach, etc.).

6.1.3. Monitoring. Operators should establish appropriate monitoring procedures for each type of low visibility approach, landing, and missed approach. Procedures should ensure that adequate crew attention can be devoted to control of aircraft flight path, displacements from intended path, mode annunciations, failure annunciations and warnings, and adherence to minima requirements associated with DA(H) or MDA(H).

a. In the event that a "monitored approach" is used, (e.g., where the first officer is responsible for control of the aircraft flight path by monitoring of the automatic flight system) appropriate procedures should be established for transfer of control to the pilot who will be making the decision for continuation of the landing at or prior to DA(H) or MDA(H).

b. Monitoring procedures should not require a transfer of responsibility or transfer of control at a time that could interfere with safe landing of the aircraft. Procedures for calling out failure conditions should be pre-established, and responsibility for alerting other flight crewmembers to a failure condition should be clearly identified.

6.1.4. Use of the DA(H) and MDA(H). Decision Altitude (Height) is used for Category I and II operations. Decision Altitude (Height) is used when vertical path guidance is available (e.g., ILS, GLS, MLS, VNAV). Decision Altitude (DA) is used for barometrically determined altitude minima (MSL), typically associated with Category I procedures where vertical guidance is available. If specifically authorized by FAA (rare uses) a DA may in some circumstances be used for Category II.

a. Decision Height (DH) is used for Category II operations, except where use of an Inner Marker is authorized in lieu of a DH, or where a DA is authorized (rare use).

b. When DAs or DHs are specified, procedures for setting various reference bugs in the cockpit should be clearly identified, responsibilities for DA or DH call-outs should be clearly defined, and visual reference requirements necessary at DA or DH should be clearly specified, so that flightcrews are aware of the necessary visual references that must be established by and maintained after passing DA or DH.

c. MDA(H) is typically used for procedures that do not have vertical path guidance (e.g., VOR, NDB, 2D-RNAV, Circling). U.S. Operators are authorized to use MDA. MDH may be used internationally by non-US Operators, and U.S. Operators may need to be aware of its existence and use when operating to international locations even though U.S. Operators are not typically authorized to use MDH. Any request for use of MDH must be coordinated with AFS-400. Also the "height element (H)", used with MDA(H), provides an advisory value for RA relative to the airport or TDZ elevation, and may be used for situation awareness, even if not used to actually define minima. Caution should be noted however, since irregular terrain in the vicinity of the airport may result in observed RA values that are significantly different than expected height (H) derived from the published procedure when not over or near the airport surface.

d. Procedures should be specified for call-out of the DA, DH, or MDA(H).

e. Procedures should be specified for conversion of the DA or DH to an MDA(H) in the event that the aircraft reverts from or loses vertical path guidance. However, any adjustments to approach minima or procedures made on final approach should be completed at a safe altitude (e.g., above 1000 ft. HAT).

f. Any use of QFE procedures for DA or DH for Operators that are not already so authorized (applicable to either Category I or II, whether inside the United States or outside the United States) must be specifically approved by the CHDO, after coordination with AFS-400.

g. For Category II, the operator should ensure that at each runway intended for Category II operations, the radar altimeter systems used to define DH provides consistent, reliable, and appropriate readings for determination of DH. In the event of irregular terrain underlying the approach path an alternate method should be used. DH may be based on other means (e.g., inner marker) when specifically approved by FAA.

6.1.5. Callouts. Altitude/Height callouts should be developed, implemented, and used for Category I and Category II operations. When more than one Category of operation is used (e.g., Category I or II) callouts should be compatible, consistent, and preferably common to as many Categories of Operation as practicable.

a. Callouts may be accomplished by the flightcrew or may be automatic (e.g., using synthetic voice call-outs or a tone system). Typical call-outs acceptable for Category I or Category II include the following:

- "1000 ft." above the touchdown zone,
- "500 ft." above the touchdown zone,
- "approaching minimums,"
- "at minimums," as applicable,
- any pertinent visual reference(s) observed, and resulting crew action, as applicable (e.g., "runway in sight,... landing"),
- key altitudes during flare, (e.g., 50, 30, 10) or AFGS mode transitions (e.g., flare, rollout), and
- as appropriate, auto spoiler, reverse thrust deployment and autobrake disconnect.

b. Combinations of these calls may also be used as appropriate. In any event, the calls made by the flightcrew should not conflict with the automatic systems or auto call-outs of the aircraft, and conversely the configuration selected for the aircraft should not conflict with expected call-outs to be made by the flightcrew. Compatibility between the automatic call-outs and the crew call-outs must be ensured. The number of call-outs made automatically, manually or in combination should not be so frequent as to interfere with necessary crew communication for abnormal events.

c. Also, call-outs should be specified to address any non-normal configurations, mode switches, failed modes, or other failures that could affect safe flight, continuation of the landing, or the accomplishment of a safe missed approach. Any use of crew initiated call-outs at altitudes below 100 ft. during flare should ensure that the call-outs do not require undue concentration of the non-flying pilot on reading of the radar altimeter rather than monitoring the overall configuration of the aircraft, mode switching, and annunciations. Automatic altitude call-outs or tones are recommended for altitude awareness, at least at and after passing DA(H) or MDA(H).

6.1.6. Configurations.

a. Operational procedures should accommodate any authorized aircraft configurations that might be required for Category I or Category II approaches or missed approaches. Examples of operational procedures that an operator may need to accommodate include:

(1) Alternate flap settings,

(2) Use of alternate AFGS modes or configurations (e.g., with or without autopilot(s) or flight director(s), autoland, HUD),

(3) Inoperative equipment provisions related to engine(s) inoperative, or the minimum equipment list, such as a non-availability of certain, inoperative instruments (e.g., PFD, radar altimeter), air data computers, hydraulic systems or instrument switching system components,

(4) Availability and use of various electrical system components (e.g., generator(s) inoperative), alternate electrical power sources (e.g., APU) if required as a standby source, and

(5) If applicable, describing the relationship of approach minima to any decision or commit points for critical aircraft configurations that are identified by the operator (e.g., two engines inoperative procedures for three or four engine aircraft, or abnormal flight control configuration procedures)

b. Procedures required to accommodate various aircraft configurations should be readily available to the flightcrew to preclude the inadvertent use of an incorrect procedure or configuration. Acceptable configurations for that operator and aircraft type should be clearly identified so that the crews can easily determine whether the aircraft is or is not in a configuration to initiate a low visibility approach using a pertinent Category I or Category II procedure.

c. Configuration provisions must be consistent with, but are not limited to, those provided in the OpSpecs for that operator.

6.1.7. Compatibility between Category I, Category II, and Category III Procedures.

a. The operator should ensure that to the extent possible, flightcrew and operational procedures for Category I and Category II are consistent with the procedures for that operator for Category III, particularly to minimize confusion about which procedure should be used in variable weather.

b. The operator should to the extent practical, minimize the number of procedures that the crew needs to be familiar with for low visibility operations so that, regardless of the landing category necessary for an approach, the correct procedures can be used consistently and reliably.

6.1.8. Procedure Considerations During Non-Normal Operations. When procedures or configurations have been specified for non-normal situations, flightcrews are expected to apply those procedures and use good judgment in making the determination of any appropriate adjustments to safely use an instrument approach procedure. This may include identifying any necessary adjustments to DA(H), MDA(H), approach path, missed approach path, or required visibility believed to be necessary (e.g., assessing the climb gradient that can be achieved, identifying a safe engine out lateral and vertical flight path, requesting an appropriate length of final approach). Guidelines for non-normal configurations, situations, or procedures may be provided by the aircraft flight manual or by the operator. Crews are expected to be familiar with these guidelines and apply them to the extent practical.

a. Specific guidelines for initiation for a Category II approach with an inoperative engine are provided in paragraph 5.17.

b. When procedures or configurations have not been specified for a non-normal situation or configuration, flightcrews are expected to use good judgment and select the safest course of action in making the determination of appropriate configurations or margins for an approach. The decisions to initiate, continue, or to discontinue an approach, divert to an alternate, and any adjustments to minima should be made considering relevant factors such as:

- Seriousness of the emergency
- Failure status of the aircraft
- Potential for unknown damage or further failures
- Navigation system status
- Runway, visual aid, and NAVAID status
- Procedure flight path and minima to be used
- Proximity to high terrain, obstacles, or adjacent approaching aircraft
- Potential altitude loss, flight path required, or cleanup altitude needed to change configuration and accelerate for a missed approach
- Obstacle clearance during transition to a missed approach (including the possible need to reject the landing from below DA(H) or MDA(H)
- Fuel on board
- Distance and suitability of alternate airports
- Likelihood of changing weather, NAVAID, or runway conditions,

c. It is not the intent of this AC to comprehensively define guidelines for each circumstance that might be possible (e.g., serious in-flight fire, minimum fuel). It should be noted, however, that flightcrews have both the authority and responsibility to consider relevant factors, such as those identified above, when deciding the safest course of action. If doubt exists on a course of action (e.g., initiating or continuing an approach with conditions potentially below minima), it is the flightcrews responsibility to exercise any necessary emergency authority to ensure safe flight.

6.2. Category I or Category II Instrument Approach Procedures.

6.2.1. Acceptable Procedures for Category I. Procedures acceptable for a Category I authorization for a U.S. Operator in the Unites States, or internationally, under provisions of part 121, 125, or 135, or for a Foreign Operator under provisions of part 129 at U.S. Airports, are those listed in paragraphs 4.3.1.4, 4.3.2, and 4.3.3, and any others found acceptable to FAA and listed in Standard OpSpecs, Part C.

6.2.2. Acceptable Procedures for Category II. Procedures acceptable for a Category II authorization for a U.S. Operator in the United States, or internationally, under provisions of part 121,125, or 135, or for a Foreign Operator under provisions of part 129 at U.S. Airports, are those listed in Paragraphs 4.3.1.4 and 4.3.2 above, and any others found acceptable to FAA and listed in Standard OpSpecs, Part C.

6.2.3. Standard Obstacle Clearance for Approach and Missed Approach. Standard approach and missed approach criteria for obstacle clearance for normal operations are as specified in FAA Order 8260.3, United States

Standard for Terminal Instrument Procedures, or as referenced in FAA Air Traffic criteria for terminal procedures (FAA Order 7100.11, Flight Management System Procedures Program), or for non-U.S. airports, ICAO PANS-OPS.

a. Standard VNAV criteria may be applied as specified in FAA Order 8260.40, Flight Management System (FMS) Instrument Procedures Development.

b. Standard RNP criteria may be applied as specified in Appendix 5 of this AC or pertinent paragraphs of AC 120-28D.

c. For non-normal operations (e.g., engine inoperative), criteria equivalent to that specified in 14 CFR for takeoff (e.g., section 121.189) may be applied for those portions of an approach or missed approach not otherwise addressed by procedure design for normal operations (e.g., engine out missed approach gradients, or engine inoperative flap retraction and acceleration segments, or a rejected landing climb back to procedurally protected airspace after loss of visual reference at an airport with significant nearby obstacles or mountainous terrain)

d. Regardless of criteria used, the operator should ensure appropriate consistency between obstacle clearance criteria used for takeoff, en route operations, terminal procedures, instrument approach procedures, engine inoperative procedures, and drift down procedures, as applicable.

6.2.4. Special Obstacle Criteria. Obstacle criteria for RNP is as identified in Appendix 5.

a. Obstacle clearance criteria for Category II procedures is identified in Appendix 6.

b. Obstacle clearance criteria to facilitate implementation of VNAV paths for approaches other than xLS are contained in FAA Order 8400.10

c. Other obstacle clearance criteria may be requested for use by an applicant and authorized by FAA, for specific applications (e.g., international operations, operations at military facilities, disaster relief). When other criteria are used, related compensating factors are typically considered, to ensure equivalent safe terrain or obstacle clearance.

6.2.5. Irregular Pre-threshold Terrain Airports. Irregular pre-threshold terrain airports identified by a 14 CFR part 97 procedure, or by FAA Order 8400.8, must be evaluated IAW FAA approved procedures prior to incorporation in OpSpecs for use by air carriers operating to Category II minima. (See the FAA worldwide web site for Category II/II Status L, for Restricted (irregular pre-threshold terrain) airports:

http://www.faa.gov/avr/afs/afs410/afs410.htm).

Acceptable procedures for evaluation of use of these airports may be found in AC 120-28D, Appendix 8. For aircraft not using autoland, this evaluation consists primarily of ensuring availability of an appropriate method for identification of DA(H) (e.g., assessing acceptable radar altimeter indications approaching and at DA(H), or substituting use of "Inner Marker" in lieu of Radio Altimeter). Assessing acceptable radar altimeter indications is done by ensuring sufficient Radio Altimeter display readout stability and continuity to be able to be easily read the Radar Altimeter when approaching DA(H) and at DA(H), while over-flying the irregular underlying terrain. This assessment may typically be done during operations using minima no lower than Category I, or may be based on operations at that runway by that operator with an equivalent radio altimeter installation (e.g., previously in a B757, for new B767 operations), or may be based on other U.S. Operators who have completed an assessment using the same aircraft type and radio altimeter system combination, or equivalent.

6.2.6. Airport Surface Depiction for Category I or II Operations.

a. Unless otherwise authorized for a particular airport or series of airports, a suitable airport surface depiction should be available to flightcrews for each regular, provisional, or alternate airport or any airport the operator could reasonably expect operations (e.g., section 121.161 ETOPS diversion airports, designated emergency airports), to ensure appropriate identification of visual landmarks or lighting to safely accomplish taxiing from the gate to the runway and from the runway to the gate. Airport depiction should be on an appropriate scale with suitable detailed information on gate locations, parking locations, holding locations, critical areas, obstacle free zones, taxi way identifications, runway identifications, and any applicable taxiway markings for designated holding spots or holding areas. Standard depictions provided by commercial charting services may be acceptable if they provide sufficient detail to identify suitable routes of taxi to and from the runway and gate positions for departure or arrival.

b. Electronic presentations of airport diagrams are considered an acceptable substitute for paper (hard copy) depictions if acceptable operational provision is made for failure of the electronic device providing the airport depiction, if each necessary flight crewmember can have access to the depiction when needed, and if equivalent scaling, orientation, chart detail, and information content is provided.

6.2.7. Continuing Category I or Category II Approaches in Deteriorating Weather Conditions. The following procedures are considered acceptable in the event that weather conditions are reported to drop below the applicable Category I or II minima after an aircraft has passed the final approach point or final approach fix, as applicable (reference section 121.651).

a. Operations based on a DA(H) may continue to the DA(H) and then land, if the specified visual reference is subsequently established by the pilot no later than the DA(H).

b. Operations based on an MDA(H) may continue to the MDA(H), and then to the point of intercept of the VNAV path to the runway, to the VDP, or equivalent, or to the MAP, as applicable, then land, if the specified visual reference is established by the pilot no later than point at which descent below the MDA(H) commences.

NOTE: For wind constraint applicability on final approach see paragraph 6.2.11.

6.2.8. "Approach Ban" Applicability. Sections 121.651, 125.381, and 135.225 generally require that weather conditions be at or above takeoff minima prior to takeoff, and above landing minima prior to initiating the final segment of an instrument approach. However the applicability of these rules can be different for certain Domestic and International Operations (e.g., pilots authority to initiate "Look-See" Approaches at non-U.S. airports when weather is reported below minima). This paragraph explains and clarifies applicability of weather reporting for takeoff minima, and applicability of the "approach ban" provision related to sections 121.651, 125.381, or 135.225 at U.S. and non-U.S. airports.

a. Accordingly, an instrument approach should not be continued beyond the applicable outer marker, final approach fix, or equivalent position in the final approach segment unless the reported visibility or controlling RVR is above the specified minimum. If no outer marker, final approach fix, or equivalent fix is available, or if such a fix is not used as the point of application of an approach ban when weather is reported below minima, the aircraft should in no case descend below an altitude of 1,000 ft. above the TDZE for the runway of intended landing, unless weather is reported to be at or above minima. Equivalent positions to the outer marker are considered to be, but are not limited to: DME, VOR, non-directional beacon, or other such fixes authorized in the standard instrument approach procedure (SIAP), which are located at a position similar to an outer marker, outer compass locator, or final approach fix. A corresponding surveillance radar fix may also be used as a point of application of an approach ban, in lieu of an outer marker, final approach fix, or such equivalent fix.

b. If, after passing the applicable approach ban fix or point (e.g., outer marker, equivalent fix, or an altitude 1,000 ft. above the TDZ Elevation), and the reported visibility or controlling RVR falls below the specified minimum, the approach may be continued to DA(H) or MDA(H). If suitable visual reference can be established prior to descending below DA(H) or MDA(H), a landing may be completed.

c. Controlling RVR means the reported values of one or more RVR reporting locations (touchdown, midpoint, rollout, or equivalent international locations) used to determine whether operating minima are or are not met. Where RVR is used, the controlling RVR is the touchdown RVR, unless otherwise specified by FAA (e.g., through operations specifications).

d. Differences in application of the approach ban between U.S. airports and non-U.S. airports stems from the recognition that there may be differences in non-U.S. and U.S. methods to determine and report weather conditions On a worldwide basis, differences exist in types and characteristics of meteorological devices used, measurement techniques and policies, or processes for categorizing, reporting, or disseminating weather (e.g., different methods of determining and reporting RVR or meteorological visibility).

e. An approach ban is applicable at U.S. airports. It may also apply at airports in countries outside the United States where that state or airport authority specifically precludes "look-see" authorization when weather is below minima. Operators should be familiar with such policies of states outside the United States, or for non-US airports, and appropriately apply those states or airports policies.

f. 14 CFR and FAA policies require that for airports within the United States and its territories (e.g., Puerto Rico) or at U.S. military airports (e.g., airports at which U.S. military forces manage the facility or have a designated U.S. base or facility) it is necessary to have reported weather at a value at or above landing minima prior to initiating an approach (section 121.651).

g. The latest weather report from the most reliable source is considered to be the applicable controlling weather report as follows:

(1) Report from a co-located Air traffic Facility (e.g., Tower Local Control, Approach control), or

(2) ATIS Report, or

(3) Airline or FSS report from NWS or an approved source

6.2.9. Approach Operations at Non-U.S. Airports, when Weather is Reported "Below Minima." This paragraph describes the regulatory basis for executing an instrument approach procedure (IAP) at a non-U.S. airport when it is previously known that the weather at that airport may be, or is below the charted weather minima or approach ban weather criteria for that IAP.

a. When an aircraft approaches an airport, a decision typically must be made whether or not to initiate the approach and whether it is permissible to proceed beyond the FAF or FAP on an IAP, based on specified "approach minima."

b. These criteria are not necessarily the same as the charted criteria at the bottom of the approach plate, since in ICAO compliant publications, some States set approach minimums for an IAP by specifying an "approach ban" at weather minima different than that specified on the approach plate or OpSpecs for continuing below or beyond DA(H) or MDA(H).

c. The approach initiation minimums for an IAP may or may not be the same as the landing minimums shown on the IAP.

d. The following criteria are considered to apply as noted below (reference 14 CFR sections 91.703, 121.11, 135.3, 135.225, 125.23, 125.381).

(1) Operations Specifications: Always apply, domestic and international.

(2) State of the Aerodrome criteria if promulgated as rules or regulations: Typically always apply in the national airspace of that state, as an agreed sovereign right.

(3) 14 CFR parts 121, 125, or 135 always apply to domestic operations, and always apply internationally unless the State of the Aerodrome specifically prohibit use of a particular part or provision of 14 CFR, or promulgates a rule contradicting a regulation, and the FAA agrees to apply the overriding provision of the State of the Aerodrome rather than the regulation. Typically State of the Aerodrome provisions may be more restrictive than the regulation, but may not provide relief from a U.S. regulation that applies to international operation.

(a) Section 121.651, 125.381 and 135.225 address approach minimums. A weather report for that airport is required prior to commencing an IAP. This is required worldwide.

(b) Reported visibility is required to be at least as good as the "visibility minimums prescribed for that approach" prior to commencing an IAP. This visibility requirement applies to airports in the United States, its territories, and U.S. military airports (whether in the United States or outside the United States), and to any airport in a foreign country where the country's operating rules require that the prescribed visibility be available prior to commencing the approach.

(c) Parts 121, 135, and 125 allow the crew to continue an IAP to DA(H) or MDA(H) if a below minimums weather report is received while already on the final segment of the approach.

(d) Part 121 allows an ILS Category I Procedure to be conducted with below minimums weather if both the ILS and a PAR are used simultaneously by the pilot. This does not apply to an operator not authorized for use of PAR, since that operator may not train for PAR approaches.

(e) Accordingly, there is no requirement for an above minimums weather report to commence an IAP in a foreign State (e.g., using a weather source other than the NWS or a source approved by the NWS) unless FAA has specifically precluded use of the look-see provision for a particular State or States. (Note: The State of the Aerodrome or Airport may additionally preclude such below minima operations, and U.S. Operators are expected to abide by such provisions, unless otherwise approved by FAA (e.g., through an emergency authorization in time of conflict or natural disaster).

(4) ICAO Standards apply over the high seas (international airspace), and in the airspace of a State which adheres to the ICAO Convention, subject to modification by that State, or ICAO filed "Difference." ICAO Standards and Recommended Practices (e.g., ICAO Annex 2, Annex 6, and PANS-OPS) do not address "approach minimums," or any particular weather criteria applying to the decision whether to initiate or continue an IAP. (Also see "ICAO Manual of All Weather Operations" DOC 9365 AN/910.)

(5) Part 91 always applies to domestic operations unless superseded by part 121, 125, or 135 provisions. Internationally certain provisions of part 91 apply when not otherwise superseded by part 121, ICAO, or State of the Aerodrome rules. Section 91.175 does not specifically address minimums related to initiation of an approach, or any weather criteria for initiating an IAP. All references are to landing minimums and the required visual references to continue below DA(H) or MDA(H). For operators conducting operations under part 91 (e.g., training, ferry, aircraft functional flight test), the approach ban provisions of part 121, 125, or 135 may thus not necessarily apply if the particular operation is considered to be conducted under part 91 by the CMO. Also, for flight test and POC demonstration purposes, waivers to provisions of section 91.175 may be requested from FAA (e.g., such as to authorize limited use of reduced weather minima for test or evaluation purposes).

6.2.10. IFR Approaches or Low Visibility Takeoffs in Class G Airspace. An operator may be authorized to conduct IFR approaches to Category I or Category II minima, or low visibility takeoffs, in Class G airspace, if the requirements of the applicable OpSpecs are met.

a. Nonscheduled Operations. For nonscheduled operations, the CHDO must ensure that the operator's Category I or II operations program provides the policy, and direction and guidance necessary to safely conduct these operations. The CHDO must also ensure that the certificate holder's manuals cover the specific procedures which must be used, and the facilities and services which must be available and operational for the safe conduct of instrument approach operations in Class G airspace (e.g., weather reporting, advisory frequencies, and NAVAID critical area protection, as applicable).

b. Scheduled Operations. In addition to meeting the requirements for nonscheduled operations, the CHDO must ensure that the facilities and services necessary for the safe conduct of instrument approach procedures in Class G airspace are available during the times of scheduled operations, and are specified in the OpSpecs.

c. Method of Approval. The authorizations to conduct instrument approach procedures in Class G airspace are addressed by issuing Special Non-14 CFR part 97 OpSpecs.

6.2.11. Wind Constraint Applicability. When wind constraints apply to Category I or Category II procedures (e.g., an OpSpec 15 knot crosswind component limit) the limit is considered to apply to the point of touchdown. If a report of a crosswind component value greater than the limit is received while on approach, an aircraft may continue an approach, but a subsequent wind report indicating winds are within limits or a pilot determination that actual winds are within limits must be made prior to touchdown.

a. The flightcrew should use the most recent, reliable and appropriate information. Acceptable methods for a wind determination may include ATS reports, reports of other aircraft with reliable means of wind determination (e.g., IRS), pilot use of on-board IRS or FMS wind readout capability, data link of recent winds, or pilot confirmation of an acceptable visual indication of winds on the surface by a wind sock, wind indicator or equivalent wind indicating device.

b. When an Airplane Flight Manual or other manufacturer's reference (e.g., FCOM) references "Maximum wind component speeds when landing weather minima are predicated on autoland operations," or an equivalent statement, an operator or flightcrew may consider those wind values to apply to "steady state" wind components.

c. It is considered acceptable for the flightcrew to land when gust values are reported to exceed the steady state wind limit if the flightcrew considers the gust exceedance to be:

- insignificant in magnitude
- variable in direction
- occasional, or
- the wind report is not applicable (e.g., obviously outdated, measured at a location considered too far from the runway or touchdown zone, or gusts considered not pertinent during the period of touchdown or rollout.)

6.2.12. Crosswind Component Determination at Airports with Significant Magnetic Variation (Polar Regions). Operators, flightcrews, and dispatchers (if applicable) of air carriers operating in polar regions or having ETOPS or EROPS alternates in these polar regions should be familiar with appropriate methods to determine wind components and particularly tailwind and crosswind components at airports with significant magnetic variation, or with runways oriented to true north. Due to METAR, TAF, and ATS Tower reported winds and runways potentially having different magnetic or true north reference, caution must be exercised where significant magnetic variation values exist, to correctly determine applicable crosswind and tailwind component limits.

6.2.13. Unusual or Extreme Temperatures or Pressures.

6.2.13.1. General Cold Temperature Considerations. Appropriate "cold temperature" altitude adjustments for instrument procedure minimum segment altitudes (e.g., initial or intermediate segments) should be made when altitude errors resulting from unusually cold airport surface temperatures are considered significant, and are needed to ensure terrain or obstacle clearance. Instrument procedure designers, airspace planners, Authorities, Air Traffic Service (ATS), Operators or pilots may make appropriate corrections, as necessary. Altitude errors typically may be considered significant in mountainous regions when surface temperatures are below -22F/-30C, when significant terrain or obstacle clearance is a factor, and when temperature considerations have not otherwise been addressed by instrument procedure design. Flightcrews should not additionally make corrections if instrument procedures already address temperature related terrain or obstacle clearance to the degree necessary, or if ATS has addressed cold temperature considerations in their assigned clearance altitudes. Use of any altitude corrections made by flightcrews should be consistent with ATS cold temperature altitude correction policies when such policies are promulgated, and when safe clearance is ensured by those ATS policies. (Also see paragraphs 4.3.1.1 item g, 4.3.4. item c., 7.1.3. items d, and 8, 8.13, and 8.14 for related information).

6.2.13.2. Temperatures Below Those Used in Procedure Design. In some countries, cold temperature errors are considered during procedure design, and are addressed in published instrument procedures, MEAs, and Air Traffic Service (ATS) minimum clearance altitudes such as MVAs when necessary. If temperatures are significantly below the reference temperature considered during procedure design, it may be appropriate for pilots or Operators to apply altitude corrections to the specified (published or charted) procedure minimum altitudes while in flight. This may be done using an appropriate altitude correction table as provided in Table 6.2.13-1 below, or through an equivalent table or method, to ensure terrain or obstacle clearance.

6.2.13.3. Segments which may need to be Corrected for Temperature. Altitude corrections are particularly important on initial or intermediate approach segments in areas of mountainous terrain when there is a significant difference between true altitude and indicated altitude due to unusually cold surface temperatures. Additionally, the size of any temperature-induced altitude or height error decreases in magnitude as the height above the airport surface decreases. Corrections may also be appropriate for MEAs, MVAs, "driftdown" flight paths in mountainous terrain, or missed approach or takeoff flight paths, when extreme cold temperature effects are not otherwise considered. When a U.S. Air Traffic Facility, or international ATS facility already considers cold temperature effects in clearances, additional corrections by flightcrews should not normally be made (e.g., for a radar vector altitude clearance).

6.2.13.4. Uncorrected Procedures. In certain states, cold temperature correction may need to be applied any time temperature is below ISA (e.g., Canada, Northern Europe, when using ICAO criteria). When flying to such states, it is important for the operator and pilots to be aware of that state's cold temperature instrument procedure correction policy, and to operate consistent with that policy. This may be accomplished by an operator applying that state's policy, or by the operator using the operator's own policy, if that policy provides for safe clearance and is suitable for use within that state (e.g., the operator's altitude correction policy for cold temperature is compatible with that state's ATS procedures or requirements).

6.2.13.5. VNAV Path and Visual Guidance (VGSI) Temperature Considerations. Pilots and Operators should be aware that temperature-related effects on VNAV path formulation can occur when operating well below or above ISA. For example, in extreme cold temperatures, VNAV descent gradients may be more shallow than usual and visual aids (e.g., VGSI, VASI, PAPI) may not necessarily show "on path" indications when visual reference is first acquired, even though the aircraft is correctly flying the FMS-indicated VNAV path. In such cases, pilots should be alert for the need to adjust and ensure a safe flight path. Similarly, pilots and operators should be aware that unusually shallow VNAV gradients could be lower than "step down" crossing altitudes if temperature considerations have not been addressed. For temperatures well above ISA, VNAV descent angles may be correspondingly steeper than nominal. While obstacle clearance would not be an issue, aircraft descent gradient capability could be a factor if operating near descent gradient limits for the aircraft (e.g., with unusual tailwind conditions at altitude, or with reduced flap settings with an engine inoperative).

6.2.13.6. Unusual Cold Temperature Operations within the Unites States. Within the United States, cold temperature factors and related altitude additives should be considered by procedure designers when necessary (e.g., during procedure design) or are considered by airspace planners to the extent necessary (e.g., when establishing MVAs in cold climates and mountainous areas). However, since assessments for cold temperature correction may vary for particular procedures or situations, if an operator has questions as to the suitability of a particular procedure in extreme cold conditions. Operators may consult the appropriate FAA procedure design office through their respective POI or CMO to determine what additional precautions or adjustments may be appropriate in extreme cold temperature conditions, if any.

6.2.13.7. Unusual Cold Temperature Operations Outside of the Unites States.

a. It is particularly important to note these temperature effects when operating outside of the Unites States. Not all states necessarily address temperature compensation within instrument procedure development or in airspace procedure planning. If a flightcrew or operator is in doubt regarding safe obstacle clearance, additional margin should be provided (e.g., requested from ATS, if applicable). Operators may elect to coordinate with authorities or ATS facilities in countries outside of the Unites States which have unusually cold temperatures to determine which procedure-specified altitudes include extreme cold temperature considerations, if any, and which do not. If a pilot is in doubt as to safe altitude clearance, corrections should be considered and applied, and ATS should be advised of the use of corrected altitudes, if applicable.

b. Where temperature constraints are placed on instrument approach procedures, operators and pilots should be familiar with and properly apply those constraints. Pilots and operators should also be familiar with any temperature correction table(s) provided by the "State of the Aerodrome" (ICAO) or aircraft manufacturer. For FMS, pilots should be familiar with any temperature correction methods that apply to proper FMS use, if provided.

6.2.13.8. Use of Standard Cold Temperature Correction Table (Table 6.2.13-1). Extreme cold temperature corrections may be made within the United States, or by U.S. operators when flying internationally, IAW the standard temperature correction table shown in Table 6.2.13-1, or through an equivalent table. International operators flying to the Unites States (e.g., part 129) may use methods acceptable to the authority of the State of the operator, or methods equivalent to those found acceptable for U.S. operators by FAA.

a. Table 6.2.13-1 provides altitude correction values in feet, related to reported airport surface temperature, to be added to various published instrument procedure-related altitudes. The amount of altitude correction to be applied depends on the height of the published segment above the airport.

b. For example, using Table 6.2.13-1, an altitude correction of 280 ft. would apply for (see highlighted values in Table 6.2.13-1):

(1) a reported airport surface temperature of -30C, and

(2) a published instrument procedure segment altitude of 1500 ft. above the airport elevation,

6.2.13.9. Use of Other Cold Temperature Correction Tables. In the event that different cold temperature altitude correction table(s) or methods are provided by a "State of the Aerodrome," an aircraft manufacturer, ICAO, another authority for that State, or by the operator (e.g., simplified table(s) or methods), pilots or operators may use that alternate table or method in lieu of Table 6.2.13-1. The alternate table(s) or methods should, however, ensure suitable terrain and obstacle clearance, and its use must be compatible with any applicable ATS procedure or clearance.

6.2.13.10. Altimeter Settings. Pilots and operators should be familiar with the proper altimeter settings to use and should take necessary precautions to switch altimeter settings at appropriate times or locations, considering possible multiple sources for altimeter settings including ATS-issued altimeter settings, company or airport reported settings, or settings broadcast over ATIS, or automated settings received by radio based on AWOS, or ASOS.

6.2.13.11. Altimeter Settings (Not Recent). Pilots and Operators should also take necessary precautions when using altimeter settings that may not be recent, or settings from remote locations, or rapidly varying settings, particular at times when pressure is reported or is expected to be rapidly decreasing.

6.2.13.12. Precautions for Unusually High or Low Temperatures or High or Low Pressures. Aircraft performance or procedure adjustments may need to be considered for unusually high or low temperatures or high or low pressures (e.g., temperatures or pressures above or below available AFM data). In such situations, operators may need to request suitable additional information or AFM provisions from the manufacturer, if temperatures or pressures exceed available AFM information or limitations. Data may be provided by the aircraft manufacturer or other approved source (e.g., if the aircraft manufacturer no longer exists or does not support the aircraft type) for such unusual temperatures or surface pressures. In addition to acquiring the necessary data and revised limitations, these situations can also be an important additional consideration for go-around or missed approach assessment.

Table 6.2.13-1

Cold Temperature Altitude Corrections

Note: Values are to be added to published altitudes.

Arpt Temp (°C)	Height Above Altimeter Source (feet)													
	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
0	20	20	30	30	40	40	50	50	60	90	120	170	230	290
-10	20	30	40	50	60	70	80	90	100	150	200	290	390	490
-20	30	50	60	70	90	100	120	130	140	210	280	430	570	710
-30	40	60	80	100	120	130	150	170	190	280	380	570	760	950
-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
-50	60	90	120	150	180	210	240	270	300	450	600	890	1190	1500

6.2.14. Metric Altitudes. When used, the operator should address appropriate flightcrew and dispatch procedures for identification of and appropriate setting and use of altimeters, altitude alert systems, and altitude reference bugs for metric altitude use. This should include emphasis on distinguishing appropriate use of metric versus non-metric units for altimeter settings, change over points, and callouts as used by that operator, and as applicable to the metric altitude routes and procedures used.

6.2.15. International "Approach Procedure Title" Requirements for or Limitations on NAVAID Use. The operator should address appropriate flightcrew and dispatch procedures (if applicable) for identification of and appropriate use of international approach procedures which may or may not have all necessary NAVAIDs listed in the "procedure title" (e.g., NDB ILS Runway 16). For some of these procedures, NAVAIDs may be required which are not necessarily shown in the procedure title. For these procedures the operator should ensure that appropriate airborne equipment is operating for dispatch (if applicable), and crews should verify that appropriate navigation equipment is operating to safely conduct the approach and missed approach. Where substitutions are approved for U.S. Operators (e.g., FMS based RNAV for NDB, VOR, or DME, or GPS for NDB) the operator should ensure flightcrews are familiar with substitutions allowable for that region, state, or procedure.

6.2.16. "U.S. TERPS" or "ICAO PANS-OPS" Obstacle Clearance Procedural Protection Limitations. The operator should be aware that U.S. Standards for Terminal Instrument Procedures (TERPS) and ICAO PANS-OPS-based instrument procedures principally address normal operations, including flight above DA(H) or MDA(H), and above any specified or assumed climb gradients. Operations in non-normal configurations or at unusual speeds (e.g., operations with an engine inoperative, particularly for twin engine aircraft, or in unusual flap or flight control configurations) do not necessarily ensure compliance with climb gradients assumed for TERPS or PANS-OPS-based standard procedures. Accordingly, operators, flightcrews, and dispatchers (if applicable) should consider any necessary aircraft type specific or weight/altitude/temperature (WAT) specific procedures (e.g., similar to takeoff procedures) that may be necessary to ensure safe obstacle clearance, for at least the following situations:

a. Engine failure prior to initiation of or during approach or missed approach,

b. Balked landing or go-around from below DA(H) or MDA(H) (e.g., as for inadvertent loss of visual reference)

c. Any special precautions that may be needed if a crew follows a published missed approach procedure or ATS instruction for a turn from below DA(H) or MDA(H), and before climbing to a safe altitude protected by the procedure or MVA.

d. Any necessary consideration of an associated "IFR departure procedure" as an aid to ensure safe obstacle clearance, if initiating a go-around from below DA(H), MDA(H), or during a circling approach.

e. Any special limitations that may be necessary for safe operations into section 121.445 designated airports.(e.g., Reno, NV [KRNO]).

6.2.17. Navigation Reference Datum Compatibility (e.g.,WGS-84/Other Datum). Outside the Unites States, it is important for operators using FMS, GPS, and RNAV to be aware of, and where necessary, take precautions to address potential differences in the Navigation Data Base (NDB) "reference datum" used by their aircraft's navigation system, and the datum used locally by States for aeronautical data (e.g., NAVAID locations, runway waypoint locations) and specification of instrument procedures.

a. This is important to preclude significant navigation errors. If not appropriately addressed, the actual position of the aircraft may significantly differ from the indicated position. Aircraft may experience incorrect FMS position updating, may fly to an incorrect geographic location for a waypoint, NAVAID, or runway, may violate obstacle clearance during approach or missed approach, or may complete an instrument procedure displaced from the airport or runway intended. Significant map shifts can occur if FMS position estimates are based on use of a NAVAID using a different reference datum than the aircraft's NDB presumes. Similarly, GPS stand alone systems, while accurately flying to locations specified in a WGS-84 coordinate frame, may not necessarily fly the path over the ground intended by the procedure if the specification of that path uses a datum significantly different than WGS-84. This also can be important when flying with a navigation data base using WGS-84 as the basis for a procedure, but the aircraft is not using GPS or GPS updating, and is depending on local NAVAID updating with those NAVAIDs referenced to a different datum (e.g., as for a GPS inoperative MEL dispatch case with FMS).

b. For Category I or II procedures, the issue of use of an appropriate Navigation "Reference Datum" principally applies to flying procedures as follows:

- RNAV approach or missed approach procedures
- RNAV Initial or intermediate segments ILS or MLS procedures, or
- RNAV missed approach segments ILS or MLS procedures

c. The final approach segment of ILS or MLS typically is not adversely affected by a difference in reference datum.

d. GLS or RNP procedures, while depending on specification of an appropriate reference datum for final approach, are protected through other criteria to ensure consistent navigation.

e. Information about the Navigation Reference Datum used in a particular location outside of the United States is typically available on the Internet. An example of a web site containing this information is:

http://www.jeppesen.com/wgs84.html

f. Accordingly, when outside United States airspace and when WGS-84 is not used as the reference datum locally for NAVAID's or procedures, or a reference datum equivalent to WGS-84 is not used, and RNAV segments are flown as part of an instrument approach or missed approach procedure for:

- FMS-equipped aircraft
- FMS-equipped aircraft using GPS updating, or
- GPS "stand alone" equipped aircraft

Operators should take suitable precautions, as described below:

(1) Aircraft Equipped With FMS Having GPS Updating Capability, or Equipped With "GPS Stand Alone" Navigation Systems.

(a) For aircraft having FMS capability with GPS updating, or a "GPS Stand Alone" navigation systems, for each approach outside the United States where the local datum is not WGS-84, or WGS-84 equivalent, or where the operator is uncertain as to whether the local datum is significantly different than WGS-84, the operator should take one or more of the following precautions, as necessary:

i. Verify that the datum is WGS-84, or equivalent,

ii. Conduct an assessment of the difference in the datum used, to determine that any difference is not significant for the procedures to be flown,

iii. Develop and use special RNAV procedure segments or aeronautical data referenced to WGS-84 or equivalent, as necessary,

iv. Manually inhibit GPS updating of the FMS while flying the approach, or segments of the approach affected by the difference in reference datum,

v. Only use FMS or GPS Stand Alone systems to fly pertinent RNAV segments of the approach where it is possible to use other NAVAID raw data to confirm correct aircraft position along the flight path,

vi. Conduct simulation verification, or in-flight verification or confirmation of suitable navigation performance,

vii. Preclude FMS or GPS use on segments of the approach affected by the difference in reference datum, or

viii. Use any other method proposed by the operator, and found acceptable to FAA, to ensure that a difference in the NDB Reference Datum from the local datum does not cause loss of navigation integrity.

(b) For GLS or RNP procedures or procedure segments, since the reference datum is consistent with WGS-84 by procedure design, Operators of aircraft using GPS updating of FMS need not apply the special precautions listed above, unless otherwise advised (e.g., by NOTAM or equivalent).

(2) FMS Aircraft That Do Not Have GPS Updating Capability.

(a) While possible, FMS-equipped aircraft that do not have GPS updating capability may be less likely to experience this particular datum reference difference issue. This is because navigation databases, local NAVAIDs, and local instrument procedures typically address and resolve datum issues consistently on a local basis, and in a consistent manner within the locally used coordinate frame of reference. However, even though the datum difference issue may be less likely, it nonetheless may occur. Operators should apply precautions, as necessary, if there is significant doubt as to Navigation Data Base datum differences.

(b) The precautions listed above in item (1) should not be interpreted to discourage GPS installation and use. GPS updating of FMS can significantly increase both navigation accuracy and integrity, and reduce the risk of other types of navigation errors, including map shifts, yielding a significant safety increase.

6.2.18. Alternative Use of FAA/JAA Harmonized Minima. This AC provides for use of optional "FAA/JAA harmonized operating minima" when authorized by OpSpecs or an LOA, in lieu of otherwise published minima based on U.S. TERPS or ICAO PANS-OPS. Use of these minima is limited to use within the United States, within any JAA (European) State that authorizes use of these minima or equivalent, or in other States that accept or apply FAA or JAA criteria. These minima have been determined to be acceptable for use by U.S. Operators or JAA supervised Operators within the United States who have implemented applicable provisions and criteria of Appendix 8, or its equivalent.

a. Minima based on values provided in Appendix 8 should not be below the lowest minima authorized through a Category I Standard OpSpecs authorization, or below any applicable published foreign aerodrome minima when operating outside the United States.

b. These minima provide for a single table for Aerodrome Operating Minima regardless of approach type, and are intended for use by aircraft and procedures which are based on a stabilised descent path to the runway (e.g., using an xLS glide slope, VNAV, or other specifically approved method for maintaining a constant vertical descent path or rate during final approach). Use of minima in this table for other procedures not using a glide slope or constant VNAV descent path to minima is considered only on a case-by-case basis by the FAA.

c. The harmonized minima are intended to cover all categories of straight-in approach procedures including xLS (e.g., ILS GLS, MLS) and approaches other than xLS (e.g., RNAV, LOC, BCRS, VOR, NDB). Any procedure based on U.S. TERPS or ICAO PANS-OPS, or special procedures otherwise approved by FAA are eligible to use these harmonized minima.

d. Approaches with glide slope angles or VNAV descent paths in excess of 3.77 degrees, or special procedures at certain airports that require specific knowledge or training, are not typically eligible for use of these special approach minima.

e. The FAA/JAA Harmonized Approach minima which may alternately be approved through OpSpecs for use by U.S. Operators, or JAA supervised Operators, or equivalent authority/operators determined acceptable by FAA (e.g., Canada), are as listed in Appendix 8.

6.2.19. Assessment of Threshold Crossing Height (TCH), Approach Descent Gradient, and Runway Slope.

a. Operators should assess instrument procedures to be used at regular, alternate, and provisional airports, and at planned diversion contingency airports to ensure satisfactory Threshold Crossing Height (TCH) for the type of aircraft to be flown (see 5.12.3 and 5.12.4). Typically, TCHs of less than 48 ft. should not be used by wide body air carrier aircraft without special review by the operator.

b. Operators should assess instrument procedures to be used at regular, alternate, and provisional airports, and at planned diversion contingency airports to ensure that final approach descent gradients specified are appropriate for the type of aircraft to be flown, and for conditions expected to be encountered (e.g., engine-out flap settings and speeds, anti-ice operating). For facility, obstacle, or terrain constraints, certain airports served by air carrier aircraft have unusually steep gradients (Stephenville, Newfoundland. - CYJT) or unusually shallow gradients (Kodiak, Alaska - PADQ) that may have operational consequence for certain aircraft types.

c. Under extreme cold temperature conditions certain VNAV paths may be more shallow than normal, and under extreme high temperatures these VNAV paths may be steeper than normal (see paragraph 6.2.13). In either case the paths may not closely align with fixed visual aids such as VGSI/PAPI.

d. Certain runways have unusual general slope, or complex varying slope that should be assessed by the operator for pilot awareness, or for operational consequence (e.g., operator specifies that the aircraft must touchdown by a certain point on the runway, or the last portion of the runway is not visible during flare in the TDZ due to changing slope).

7. TRAINING AND CREW QUALIFICATION.

a. Training and crew qualification programs pertinent to Category I, Category II, or lower than standard takeoff minima should include appropriate ground training (e.g., knowledge assurance) and flight training (e.g., skill or maneuver experience in simulation or an aircraft) to ensure safe aircraft operation for instrument procedures and low visibility operations in normal, rare normal (e.g., winds, turbulence, restricted visibility), and specified non-normal conditions (e.g., engine or various systems inoperative). Although training is not required for part 125, Operators are encouraged to prepare a training and qualification program for all flight crewmembers IAW this paragraph.

b. This is typically accomplished through appropriately addressing initial qualification, recurrent qualification, upgrade qualification, differences qualification, recency of experience, and re-qualification. The Operator's program should provide appropriate training and qualification for each pilot in command (PIC), second in command (SIC) and any other pilot or flight crewmember expected to have knowledge of or perform duties related to Category I or Category II landing operations (e.g., Flight engineer, augmented flight crewmember).

c. Each PIC, and each other pilot or dispatcher, if applicable, having duties related to flight planning or use of Category I or Category II instrument procedures is expected to have comprehensive knowledge of areas described in paragraph 7.1 below. Each pilot expected to perform instrument procedures in normal or specified non-normal operations or perform duties associated with those procedures, should have successfully demonstrated the necessary skills in accomplishing those designated maneuvers or procedures as shown in paragraphs 7.2 through 7.4 below. Demonstration of skill in performing instrument procedures typically is accomplished through simulator training, checking, or during line operating experience or evaluations. Pilots other than a PIC or SIC may only be expected to perform those relevant duties, procedures or maneuvers related to instrument procedures that are applicable to their own crew position or assigned duties (e.g., international relief officers).

7.1. General Knowledge (Ground) Training for All Weather Operations (AWO).

a. Appropriate ground training should be conducted suitable for the "All weather Operations," instrument procedures, aircraft type(s) or variants, crew positions, airborne systems, NAVAIDs, and ground systems used.

b. Topics should be addressed to include at least those listed in paragraphs 7.1.1 through 7.1.3, and be addressed or tailored to suit application to initial qualification, recurrent qualification, re-qualification, upgrade, or differences qualification, as applicable.

c. Topics should be addressed for each PIC and any other pilots having assigned duties (e.g., SIC) as a PF or PNF during conduct of IAP. When duties are specifically assigned to a PF or PNF (e.g., monitored approach, Category II), only those duties applicable to the assigned crew position need be addressed for that crew position. When instrument approach-related duties are specifically assigned to other than the PIC or SIC, such as a flight engineer or relief pilot duties applicable to the assigned crew position should be addressed. When flight crewmembers other than a PIC or SIC are not assigned duties associated with an IAP but are expected to be present on the flight deck during an instrument approach, it is recommended, but not required, that they also receive suitable academic training.

d. Acceptable methods to address ground training topics include classroom instruction, self guided slide/tape presentation, or computer-based instruction, or self-instruction using appropriate reference materials.

e. If the method of satisfying ground training requirements is exclusively through self guided learning or review from appropriate reference materials (e.g., flightcrew operating manual, Aeronautical Information Manual, and commercially available instrument procedure charts), the operator should use some clearly identified method (e.g., periodic written examination) to verify that each pilot has acquired or has retained the necessary knowledge.

7.1.1. Ground Systems and NAVAIDs for Category I or Category II.

a. Ground systems and NAVAIDs are considered to include characteristics of the airport, electronic navigation aids, lighting, marking, and other systems (e.g., RVR) and any other relevant information necessary for safe Category I or Category II landing or low visibility takeoff operations.

b. The training and qualification program should appropriately address the operational characteristics, capabilities and limitations of at least each of the following:

(1) NAVAIDs. The navigation systems or NAVAIDs to be used, such as the instrument landing system (ILS) with its associated critical area protection criteria, GPS Landing System (GLS), or Microwave Landing System (MLS) characteristics, as applicable, marker beacons, VOR, DME, NDB, DME, compass locators or other relevant systems should be addressed to the extent necessary for safe operations. If area navigation systems, or other non-ground based NAVAID systems (e.g., GNSS, LORAN) are used, any characteristics or constraints regarding that method of navigation or associated supporting elements (e.g., GBAS, WAAS), must be addressed.

(2) Visual Aids. Visual aids include approach lighting system, TDZ, centerline lighting, runway edge lighting, taxiway lighting, standby power for lighting and any other lighting systems that might be relevant to a Category I or Category II environment, such as pilot control of lighting aids, or coding of the center line lighting for distance remaining, and lighting for displaced thresholds, land and hold short lighting, or other relevant configurations should be addressed.

(3) Runways and Taxiways. The runway and taxi way characteristics concerning width, safety areas, obstacle free zones, markings, hold lines, signs, holding spots, runway slope, suitability of TCH, unusual friction, grooving, or PFC characteristics, critical area protection areas, or taxi way position markings, runway distance remaining markings and runway distance remaining signs should be addressed.

(4) Meteorological Information. METARs, TAFs, visibility reporting, Transmissometers systems, including RVR locations, readout increments, sensitivity to lighting levels set for the runway edge lights, variation in the significance of reported values during international operations, controlling and advisory status of readouts, and requirements when transmissometers become inoperative; appropriate use of Temperatures in C or F, conversion of temperatures between C and F; appropriate use of pressure information including altimeter settings in units of HPa or inches, QNE, QNH, QFE (if applicable); appropriate use of Transition Level and Transition Altitude; appropriate interpretation and use of reported wind and gust information, in true or magnetic direction, as applicable to the source and circumstance.

(5) NOTAMs and other Aeronautical Information. Facility status, proper interpretation of outage reports for lighting components, standby power, or other factors and proper application of NOTAMs regarding the initiation of Category I or Category II approaches or initiation of a low visibility takeoff.

(6) Flight Planning and Flight Procedures Related to Inoperative or Unsuitable NAVAIDs. When NAVAID position updating is used in support of area navigation position determination (e.g., VOR, VOR-DME, DME-DME, GNSS updating), Operators and flightcrews should be aware of when and how to disable use of an unsuitable NAVAID or updating method within the airborne navigation system. This is especially true for NAVAID failure conditions that are probable to cause a significant map (position) shift (e.g., movement of a NAVAID to a new location without corresponding update of the NAVAID position in a database, significant numbers of space vehicle outages, or areas of interference).

7.1.2. The Airborne System.

a. The training and qualification program should address the characteristics, capabilities, and limitations of each appropriate airborne system element applicable to Category I or Category II landing including the following:

(1) **Flight guidance system.** The flight guidance system, including appropriate modes to be used for different circumstances or procedures (e.g., APPROACH, HDG, V/S, LNAV/VNAV), and any associated landing system or landing and roll out system, or go-around capability, if applicable (e.g., autopilot, autoland);

(2) **Flight director system.** The flight director system, including appropriate modes to be used for different circumstances or procedures (e.g., APPROACH, HDG, V/S, LNAV/VNAV), and including any associated landing or landing and roll out capability, or go-around capability, if applicable (e.g., HGS);

(3) **Automatic throttle.** The automatic throttle control system, if applicable. Mixed mode autoflight/autothrottle operation should be addressed (e.g., manual flight, but with autothrottles on, or vice versa), if pertinent to the aircraft type.

(4) **Displays.** Situation information displays, as applicable, including any applicable limits for acceptable approach performance to continue an approach, flare, rollout, or go-around (e.g., typically 1/2 dot or less lateral or vertical displacement below 500 ft. HAT down to DA(H), and

(5) **Status, Alerting and Warning Displays.** Other associated instrumentation and displays, as applicable, including any monitoring displays, status displays, mode annunciation displays, failure or warning annunciations, and associated system status displays that may be relevant.

(6) **Means for determining DA(H) or MDA(H).** The means for determining DA(H) or MDA(H) as follows:

(a) DA(H) as applicable to the particular Category I ILS, GLS, or MLS procedure (e.g., as an applicable DA, or Marker Beacon substitute for a DA when authorized);

(b) DA(H) as applicable to the particular Category I RNAV or RNAV RNP procedure with VNAV (e.g., as an applicable DA);

(c) MDA(H) as applicable to the particular Category I procedure other than ILS, GLS, or MLS (e.g., as an applicable MDA, and any associated missed approach point); and

(d) DA(H) as applicable to the particular Category II ILS, GLS, or MLS procedure (e.g., as an applicable DH, or Marker Beacon substitute for a DH, when authorized).

(7) **Other Flight Deck Systems.** Other flight deck systems operations or use, as may be related to low visibility operations (e.g., autobrakes, autospoilers), and any associated limitations, characteristics, or constraints (e.g., touchdown pitch up or pitch down tendency of certain autospoiler or autobrake settings or non-normal conditions, time delays, auto-deactivation features with go-around).

(8) **Other aircraft characteristics.** Any system or aircraft characteristics that may be relevant to Category I or Category II operations, such as cockpit visibility cutoff angles and the effect on cockpit visibility of proper eye height, seat position or instrument lighting intensities related to transition through areas of varying brightness visual conditions change. Crews should be aware of the effects on flight deck visibility related to use of different flap settings, and approach speeds. Minimum usable TCH and minimum or maximum final approach descent gradients should be addressed, if applicable.

(9) **Lighting.** Proper use of various landing, taxi, turnoff, wing, logo, or strobe lights for approach visibility, taxi, or collision avoidance conspicuity.

(10) **Rain Removal and De-fog.** Proper procedures for use of rain removal/defog (e.g., windshield wipers). If windshield defog, anti-ice, or de-icing systems affect forward visibility, crews should be aware of those effects and be familiar with proper settings for use of that equipment related to low visibility landing.

(11) Course and Frequency Selection. For automatic or manual systems which require crew input for parameters such as inbound course or automatic or manually tuned navigation frequencies, the crew should be aware of the importance and significance of any incorrect selections or settings, if not obvious, to ensure appropriate system performance.

(12) Environmental Limits. Description of the limits to which acceptable system performance has been demonstrated for headwind, tailwind, crosswind, and wind shear as applicable, and recognition of unacceptable performance in the case of adverse weather (e.g., windshear, turbulence).

(13) Non-normal or Failure Conditions. Recognition and response to pertinent non-normal or failure conditions, and related non-normal procedure and checklist use for flight guidance, instrument, and supporting systems (electrical, hydraulic, and flight control systems).

(14) Go-Around. Proper airborne system use for go-around, including consideration of height loss during transition to a go-around, performance assurance for obstacle clearance, management of any necessary mode changes, and assurance of appropriate vertical and lateral flight path tracking.

b. As applicable, the operator may consult the CHDO/POI to ensure that information presented by the operator about any training or qualification items or issues referenced above, or any additional issues pertinent to the type aircraft or system used, are consistent with the pertinent FAA Flight Standardization Board (FSB) Report for the applicable aircraft type.

7.1.3. Flight Procedures, Operations Specifications, and Other Information.

a. Regulations and OpSpecs. Pilots, and dispatchers if applicable, should be familiar with FAA regulations pertinent to their operation (e.g., sections 91.175, 121.651, 125.381 and 135.225) and OpSpecs applicable to Category I or Category II landing, or lower than standard takeoff minima, as applicable.

b. Crew Duties. Pilots should be familiar with appropriate crew duties, monitoring assignments, transfer of control during normal operations using a "monitored approach" appropriate automatic or crew initiated call-outs to be used, proper use of standard IAPs, special IAPs, applicable minima for normal configurations or for alternate or failure configurations and reversion to higher minima in the event of failures.

c. Visibility and RVR. Pilots, and dispatchers if applicable, should be familiar with proper application of meteorological visibility, METARs, TAFs, RVR, RVV (if applicable), including their respective use and limitations, the determination of controlling RVR and advisory RVR, required transmissometers, appropriate light settings for correct RVR readouts and proper determination of RVR values reported at foreign facilities. Pilots should be familiar with any authorized methods for pilot assessment and reporting of visibility at non-U.S. facilities.

d. Procedures and Charts.

(1) Pilots, and dispatchers if applicable, should be familiar with the proper use of instrument procedures and charts including application of DA(H) and MDA(H), and when to use DA, DH, or an equivalent (e.g., OCA (H)), or MDA as applicable, including proper use and setting of barometric or radar altimeter bugs, use of the inner marker where authorized or required due to irregular underlying terrain and appropriate altimeter setting procedures for the barometric altimeter consistent with the Operators practice of using either QNH or QFE, and if applicable.

(2) Pilots should be aware of when to make suitable cold weather temperature corrections for altimeter systems and procedures, if necessary.

e. Visual references. Pilots should be familiar with the availability and limitations of visual references encountered, both on approach before and after DA(H), if a DA or DH is applicable. Pilots should be familiar with the expected visual references likely to be encountered. Pilots should be familiar with procedures for an unexpected deterioration of conditions to less than the minimum visibility specified for the procedure during an approach, flare or roll out including the proper response to a loss of visual reference or a reduction of visual reference below the specified values when using a DA(H) or MDA(H) and prior to the time that the aircraft touches down. The operator should provide some means of demonstrating the expected visual references where the weather is at acceptable minimum conditions and the expected sequence of visual queues during an approach in which the visibility is at or above the specified landing minimums. This may be done using simulation, video presentation of simulated landings or actual landings, slides showing expected visual references, computer based reproductions of expected visual references or other means acceptable to the FAA.

f. Visual Transition. Procedures should be addressed for transitioning from non-visual to visual flight for both the PIC, SIC, as well as the pilot flying and pilot not flying, during the approach. For systems that include electronic monitoring displays, as described in item e above, procedures for transitioning from those monitoring displays to external visual references should be addressed.

g. Unacceptable Displacements. Pilots should be familiar with the recognition of the limits of acceptable aircraft position and flight path tracking during approach, flare and, if applicable, roll out. This should be addressed using appropriate displays or annunciations for the aircraft type.

h. Environmental Effects. Environmental effects should be addressed. Environmental effects include appropriate constraints for head winds, tail winds, cross winds, and the effect of vertical and horizontal wind shear on automatic systems, flight directors, or other system (e.g., HGS) performance. For systems such as head up displays which have a limited field of view or synthetic reference systems (e.g., EVS or SVS) pilots should be familiar with the display limitations of these systems and expected crew actions in the event that the aircraft reaches or exceeds a display limit capability. Extreme temperature or pressure effects should be considered, if necessary.

i. Operator Policies. Pilots, and dispatchers if applicable, should be familiar with the Operators policies and procedures concerning any constraints applicable to Category I or Category II landings, or low visibility takeoff including constraints for operations on contaminated or cluttered runways. Procedures to be used when obscuring of appropriate lighting or markings occurs, and limits should be noted for operations on slippery or icy runways regarding both directional control and stopping performance. Pilots, and dispatchers if applicable, should be familiar with appropriate constraints related to use of braking friction reports. Pilots, and dispatchers if applicable, should be familiar with the method of providing braking friction reports applicable to each airport having instrument landing operations.

j. Response to Aircraft or System Failures. Pilots should be familiar with the recognition and proper reaction to significant aircraft system failures experienced prior to and after reaching the final approach fix and experienced prior to and after reaching DA(H), as applicable. Expected crew response to failures prior to touchdown should be addressed, particularly for Category II operations.

k. Ground or Navigation System Faults. Pilots are expected to appropriately recognize and react to ground or navigation system faults, failures, or abnormalities at any point during the approach, before and after passing DA(H) and in the event an abnormality or failure which occurs after touchdown. Pilots should be familiar with appropriate go-around techniques, systems to be used either automatically or manually, consequences of failures on go-around systems which may be used, the expected height loss during a manual or automatic go around considering various initiation altitudes, and appropriate consideration for obstacle clearance in the event that a missed approach must be initiated below DA(H).

l. Navigation Anomalies or Discrepancies. Pilots, and dispatchers if applicable, should be familiar with the need to report navigation system anomalies or discrepancies, or failures of approach lights, runway lights, touchdown zone lights, center line lights or any other discrepancies which could be pertinent to subsequent Category I or Category II operations.

m. International Procedures. Pilots, and dispatchers if applicable, should be familiar with any applicable international procedures including application of OCA, OCH, the applicable State AIP, or regional supplements (if not otherwise addressed by the operator in the FCOM or equivalent), pertinent excerpts from ICAO references (e.g., Manual for All Weather Operations - ICAO DOC 9365AN 910). Regulatory requirements and responsibilities at non-U.S. international airports (e.g., approach ban and "look see" provisions).

n. Performance and Obstacle Clearance. Pilots, and dispatchers if applicable, should be familiar with any applicable aircraft performance or weight limit information to ensure safe obstacle clearance for "all engine," or "engine inoperative" missed approach, or rejected landing. Applicable performance information should consider applicable flap settings to be used, go-around procedures, acceleration segments if applicable, transition at any time following an engine failure between the specified "all-engine lateral flight path" (or radar vectors) and any specified "engine-inoperative lateral flight path," using acceptable flap retraction and cleanup height procedures.

o. Flight Plans and Equipment Classification. Pilots, and dispatchers if applicable, should be familiar with use of appropriate flight plan equipment classifications (e.g., Required System Performance (RSP)) affecting eligibility for various takeoff or landing procedures (e.g., flight plan /F, /E designations), and proper alternate airport identification and use, including any takeoff, en route ETOPS, or destination alternates, as applicable.

p. EVS, SVS, or ILM. When a synthetic reference system such as a "synthetic vision system" (SVS) or "enhanced vision system" (EVS) or "Independent Landing Monitor" (ILM) system is used, pilots should be familiar with the interpretation of the displays to ensure proper identification of the runway and proper positioning of the aircraft relative to continuation of the approach to a landing. Pilots should be briefed on the limitations of these systems for use in various weather conditions and specific information may need to be provided on a site-specific basis to ensure that misidentification of taxiways or other adjacent runways does not occur when using such systems.

7.2. Maneuver or Procedure (Flight) Training for All Weather Operations (AWO).

a. Aircraft or Flight Simulator Use. Maneuver/Procedure (Flight) training and evaluation should be provided, and should use appropriate simulation capability. If simulation capability is not available, training or evaluation may be accomplished partially with training devices, or partially or completely in an aircraft. However, when training or evaluation is done using training devices, or with simulators with limited capability (e.g., not Level C or D), or with an aircraft, additional factors or techniques (e.g., use of CBT) may need to be considered by the operator to ensure effective training.

b. Addressing Applicable Regulations. Maneuver or procedure training should generally address applicable part 121 Appendix E or F provisions, an approved AQP Program as applicable, approach and landing events specified in part 61, relevant FAA Order 8400.10 airman certification takeoff and landing provisions, FAA Order 8700.1 for part 125 competency or instrument checks, or FAA ATPC Practical Test Standards (PTS) as applicable, as described or credited below.

c. Types Of Procedures and Conditions to be Addressed. Maneuvers and procedures trained should be keyed to the types of instrument procedures used by the operator, the environment in which they are flown, and any special considerations that may apply to their safe application. Operating policies, procedures, and documentation representative of that applicable to the particular operator should be used. Maneuver and Procedure Training and any necessary evaluation should ensure that instrument procedures can be safely flown considering at least the following factors, as applicable to the specific operator:

(1) Types of instrument procedures used (standard and special, if applicable);

(2) That operator's manuals, charts, and checklists;

(3) Aircraft type(s) and variants flown;

(4) Flight guidance system(s) used;

(5) NAVAID(s) and visual aids used;

(6) Flightcrew procedures used (e.g., PF/PNF duties, monitored approach, callouts);

(7) Airport characteristics typically experienced (e.g., Visual aids, transition level, air traffic procedures, meteorological procedures, signs and markings, unusual airport features (elevations, slope) as applicable);

(8) Runway characteristics typically experienced (e.g., representative field lengths, grooving, marking);

(9) Nearby critical terrain or obstruction environment, if applicable;

(10) Relevant environmental conditions (e.g., wind, turbulence, shear, visibility and ceiling conditions, slippery runways, rain or snow effects on visibility);

(11) Lowest Category I or Category II straight-in, or Category I circling minima as applicable; and

(12) Other relevant AWO characteristics (e.g., special instrument procedures).

d. Use of Part 121.Appendix H Level C or D Simulators.

(1) When simulation (e.g., part 121, Appendix H level C or D) is the primary method used for flight training or evaluation for takeoff, approach and landing procedures, appropriate normal, non-normal, and environmental conditions (relevant wind, turbulence, visibility, and ceiling conditions) should be simulated. In this instance, training and evaluation need only be conducted using applicable landing minima and relevant and representative procedures and conditions (e.g., a representative mix of day, night, dusk, variable/patchy conditions, representative temperatures, landing runway altitudes, precipitation conditions, turbulence, and icing conditions). Multiple requirements for maneuvers may be combined at the discretion of the POI/APM/CMO/CMU, subject to the constraints below (e.g., to preclude the need to repeat various Category I/II/III, approach scenarios for normal approaches, approaches with an engine(s) out, missed approach, landing, rejected landing, and various go-around events). The training benefit of realistic simulation is acknowledged, and credit for use of a representative sample of conditions to be flown, directly using pertinent minima, is considered to be acceptable. Accordingly, when level C or D simulation is used, only a sample of procedural types, environmental conditions, successful crew performance, and other factors listed in c. above need be assessed. However, when such credit for combining events is permitted, the operator and CMO/CMU/POI/APM should nonetheless ensure that the program used leads to flightcrews reliably performing the necessary low visibility procedures under both normal and anticipated non-normal conditions in line service. Acceptable numbers and types of training or demonstration instrument approach procedure events for various types of training or checking or qualification programs are listed in paragraphs 7.2.1 through 7.2.7 below.

(2) In instances where Level C or D simulation is typically used IAW this provision, but the level of simulation capability is temporarily degraded to Level A or B, the operator with CMO concurrence may nonetheless apply provisions of this paragraph on a temporarily basis, until the simulation capability can be returned to level C or D status.

e. Use of Simulators other than Part 121 Appendix H Level C or D, use of Training Devices, or use of an Aircraft. When part 121, Appendix H level C or D simulation (or equivalent) is not used for All Weather Operations (AWO) Qualification (e.g., when an aircraft is used, or a training device(s) level 2 through 7, or visual simulator, or non-visual simulator, or Level A or B simulator, or a simulator qualified for Level C or D but used as an FBS is used) certain restrictions and additional provisions may apply to training or qualification, as follows:

(1) The POI or CMO/CMU may require that during training or evaluations the flightcrew demonstrate satisfactory lateral and vertical flight path tracking performance, to an appropriate tolerance, and to ensure flight path stability after passing DA(H). This is to address the possible lack of visual reference or external environmental disturbances that may exist in real operations but that may be minimal or absent during training or testing in limited capability simulators or simulation devices (e.g., due to lack of visual reference, turbulence or other disturbances being faithfully represented).

(2) The POI or CMO/CMU may require that additional procedures or combinations of procedures be demonstrated, or that limitations apply to credits allowed by this AC in terms of credit for combining maneuvers or

types of procedures trained, maneuvers demonstrated, or other events evaluated (e.g., for combinations of various Category I, II, or III procedures for ILS, VOR, VOR DME, NDB, Back Course Localizer, or engine inoperative missed approach or landing procedures).

(3) The POI or CMO/CMU may require additional training or checking event items beyond those identified in this AC below, or those addressed only generically in part 121 Appendix E or F, or in part 61 if applicable (e.g., providing for HUD or autoland qualification where part 121 or 91 only make general reference to items like other special characteristics as necessary).

(4) When using an aircraft for training or testing, the POI or CMO/CMU may require that provision be made for use of a view limiting device for any necessary competency demonstrations. This is particularly applicable to any evaluation of a pilot that has not previously qualified to fly a similar class of aircraft (e.g., large turbojet aircraft), or for a pilot that does not have significant instrument experience beyond that necessary to satisfy minimums for issuance of an FAA commercial pilot's license with instrument rating.

(5) For use of Level A or B Simulation in lieu of Level C or D Simulation that is temporarily not available, see paragraph 7.2 d. above.

f. Flight Training Maneuvers for Category I or II Landings. Maneuvers may be addressed individually as a respective Category I or Category II maneuver, or an appropriate sample of Category I and Category II maneuvers may be trained and evaluated, if crews are to be both Category I and II qualified. When flightcrews are authorized to use minima for Category III, as well as Category II, samples of maneuvers selected to be performed for training and evaluation may be from appropriate combinations of Category I, II, and III procedures. When found acceptable to the CHDO/POI, each maneuver need not be repeated for each Category of landing weather minima to be authorized. Flight training for Category I or Category II landing should address at least the following maneuvers:

(1) **Normal landings.** Normal landings at the lowest applicable Category I or Category II minima, using representative autoflight configurations or combinations of configurations authorized for use (e.g., flight director, autopilot, autothrottles);

(2) **Missed approach.** A missed approach from the lowest applicable DA(H) and MDA(H), (may be combined with other maneuvers);

(3) **Balked landing.** A balked landing or missed approach from a low altitude that could result in a touchdown during go-around (balked landing or rejected landing - may be combined with other maneuvers);

(4) **System or NAVAID Failures.** Appropriate aircraft and ground system NAVAID failures (may be combined with other maneuvers);

(5) **Engine Failures.** Engine failure prior to or during approach (if specific flight characteristics of the aircraft or operational authorizations require this maneuver);

(6) **Low Visibility Rollout.** Manual roll out with low visibility at applicable minima (may be combined);

(7) **Realistic Environmental Conditions.** Landings (in simulation) with environmental conditions at a representative sample of limiting values authorized for applicable Category I or II minima for that operator (e.g., regarding wind magnitude, headwind and crosswind components, turbulence, and runway surface friction characteristics (wet, snow, slippery) may be combined); and

(8) **Non-normal configuration approaches and landings.** Representative non-normal configuration approaches and landings in instrument conditions should be demonstrated. For these approaches, the simulated weather minima may be above, or well above, the lowest Category I or Category II minima authorized. Minima should be at levels that might typically be experienced in line operations, for a landing with the non-normal condition used. During these approaches, representative autoflight, instrument, and aircraft system configurations or

combinations of configurations should be demonstrated (e.g., flight director, autopilot, autothrottles, raw data, inoperative electrical or hydraulic components).

(9) **Basic Airmanship Skills.** In accomplishing items (1) through (8) above, each pilot should demonstrate competence, or be judged to have the necessary competence in "basic airmanship skills" to adequately address:

(a) **Manual Control.** Manual control, or reversion to manual control of the aircraft, if necessary, (for FBW aircraft, normal law or configuration is acceptable)

(b) **Automation.** Proper use of automation,

(c). **Situation Awareness.** Appropriate planning and situation awareness, including terrain awareness,

(d) **Detection and coping with adverse environmental factors.** Ability to detect and cope with adverse environmental conditions (e.g., applicable crosswinds, turbulence, windshear, convective weather, or adverse airport conditions (e.g., slippery runways)),

(e) **Detection and coping with adverse NAVAID factors.** Detection Ability to detect and cope with adverse ground system, space system, or NAVAID failures or anomalies), and

(f) **Crew coordination and CRM.** Proper crew coordination, and crew resource management.

(g) **Flight Training Maneuvers for Takeoffs.** For low visibility takeoff (RVR less than 2400 RVR), the following maneuvers and procedures should be addressed (may be combined):

i. Normal takeoff,

ii. Rejected takeoff from a point prior to V1 (including an engine failure),

iii. Continued takeoff following failures including engine failure, and any critical failures for the aircraft type which could lead to lateral asymmetry during the takeoff, or

iv. Limiting conditions. The conditions under which these normal and rejected takeoffs should be demonstrated include appropriate limiting cross winds, winds, gusts, and runway surface friction levels authorized. A demonstration should be done at weights or on runways that represent a critical field length.

h. Demonstration of Appropriate PF or PNF Duties By Each Pilot. During each of the specified maneuvers or procedures, flight crewmembers are expected to perform their respective assignments or duties (e.g., Captain, First Officer, PIC, SIC, Pilot-Flying (PF), Pilot-Not-Flying (PNF)), as applicable. However, PICs and SICs should typically be able to perform either PF or PNF duties, unless otherwise limited by the Operators policies or aircraft characteristics (e.g., if F/Os are precluded by operator policy or system installation (HUD) from serving as PF during certain adverse weather takeoffs or landings). In situations where flight crewmembers are being qualified other than as part of the complete flightcrew (e.g., when two pilots in command are being qualified) or when a pilot other than the PIC is also to be authorized to serve as the PF for low visibility operations, each flight crewmember should individually demonstrate the required maneuvers or procedures, or an acceptable sample of procedures. Relevant procedures are those involving manual control of the aircraft, rather than procedures such as autoland, which may not involve significant differences in PF or PNF skills.

7.2.1. Initial Qualification. Prior to maneuver or flight training, Initial General Knowledge (Ground) Training for "All Weather Operations (AWO)" should be addressed. Coverage of those subjects specified in 7.1 should typically be completed for each pilot having assigned AWO responsibilities.

a. Maneuver or Procedure (Flight) Training addressing suitable for that operator's Initial Qualification for "All Weather Operations (AWO)" should be conducted. While the number of procedure types covered, number of simulator periods, number of training flights, if any, or other factors may vary, coverage should at least address the expected initial assignment of the flight crewmember receiving the initial training. AWO training may be combined with the initial aircraft type qualification training program or it may be done separately as AWO qualification. Regardless, the operator is expected to provide sufficient initial training to assess knowledge and skills of each new flight crewmember, address any individual area of weakness, ensure each flight crewmember can perform to applicable AQP, PTS, or other relevant standards, and ensure that each crewmember can competently perform the maneuvers or procedures specified in 7.2 above.

b. If weaknesses are identified, the Operator is to provide sufficient remedial training to ensure that any new flight crewmember can perform to applicable FAA Commercial Pilot, Instrument, Multiengine, or ATPC standards, for the applicable aircraft type or variant, and can acceptably use that operator's policies, manuals, and procedures, before releasing that flight crewmember to IOE or to serve in line operations.

c. When Category I or II minima are based on manual operations using systems like head up displays or flight directors, a number of repetitions of the maneuvers specified in 7.2 above may be necessary to ensure that each of the required maneuvers can be properly and reliably performed.

d. Operators should also ensure that flight crewmembers receiving initial training have appropriate basic airmanship skills related to AWO (e.g., crosswind takeoff and landing skills, ability to fly to an adequate level using raw data, ability to assess and safely cope with adverse runway friction, make adverse weather avoidance judgments), or are provided relevant remedial training.

e. Guidance for acceptable programs related to a particular aircraft type can be found in FAA FSB reports for specific aircraft types. Operators should adhere to FSB guidelines when published, unless otherwise authorized by AFS 400. Sufficient assessment should take place to ensure that the operator has determined that above objectives have been met for each flight crewmember, and that the resulting evaluation or assessment can be documented.

7.2.2. Recurrent Qualification.

a. Recurrent General Knowledge (Ground) Training for All Weather Operations (AWO). Recurrent General Knowledge (Ground) Training for All Weather Operations (AWO) should provide any remedial review of topics specified in 7.1 to ensure continued familiarity with those topics. Emphasis should be place on any program modifications, changes to aircraft equipment or procedures, and review of any occurrences or incidents that may be pertinent. Also, emphasis may be placed on re-familiarization with topics such as mode annunciations for failure conditions or other information which the pilots may not routinely see during normal line operations. Topics to be addressed for each PIC, SIC, or other flight crewmember, or dispatcher if applicable, are those topics necessary for the performance of the assigned duties for each respective flight crewmember or dispatcher in the current assignment.

b. Recurrent Maneuver or Procedure (Flight) Training for All Weather Operations (AWO). Recurrent Maneuver or Procedure (Flight) Training for Category I or II landings and low visibility takeoffs, as applicable, should be provided to ensure competency in each of the maneuvers or procedures listed in 7.2 above.

c. Recurrent Maneuver or Procedure (Flight) Training should be conducted using an approved simulator with an appropriate visual system. In the event that simulation is not available, recurrent flight training may be accomplished in the aircraft, as approved by the CHDO/principal operations inspector considering factors identified in paragraph 7.2 e.

d. Recurrent flight training should include at least assess a "sample" of the applicable Category I or Category II procedures to be used by the Operator. The assessment should emphasize any rare or critical procedures used by that operator which have not otherwise been flown routinely or may not have been flown recently by a flight crewmember, but which may otherwise need to be reviewed. Emphasis may be placed on any critical non-normal procedures (e.g., engine inoperative, system failure cases), and any special emphasis procedures or items found to require attention due to in-service feedback by the operator (e.g., excessively high descent rates near the surface, proper VNAV use). At least some procedures should be sampled at or near limiting adverse weather conditions (e.g., at minimum RVR or limiting wind components or with windshear, or to runways with minimum operationally used field lengths, or at critical terrain airports or at airports having operator-unique special airport procedures). Repetition of maneuvers frequently accomplished successfully in line operations (e.g., normal ILS, normal autoland) may be de-emphasized by limited sampling and limited assessments of those conditions and procedures.

e. Recurrent flight training maneuvers may be accomplished individually or may be integrated with other maneuvers required during proficiency training or during proficiency checking. If minima are authorized using several methods of flight guidance and control such as FMS, autopilot, flight director, or head up display, then the training program should ensure an appropriate level of proficiency using each authorized mode or system. Where Category I or II minima are based on manual control using flight guidance such as provided by a head up flight guidance system, appropriate emphasis should be placed on failure conditions which a pilot does not normally experience in line operations.

f. When takeoff minima are below RVR2400 are approved, recurrent flight training must include at least one rejected takeoff at the lowest approved takeoff minimum used, with an engine failure near but prior to V1.

g. Numbers of maneuvers or procedures to be performed during recurrent training or checking should be sufficient to ensure appropriate flight crewmember performance, but not less than the following:

(1) An engine inoperative approach to a landing and a go around.

(2) Appropriate aircraft or ground system NAVAID failures.

(3) Approaches and landing(s) with environmental conditions at a representative sample of limiting values authorized for applicable Category I or II minima for that operator (e.g., wind components, turbulence, windshear or limiting runways or adverse runway surface friction).

(4) Any special emphasis procedures or items identified by the operator or CHDO/POI.

(5) A low visibility takeoff with critical performance or a suitable failure condition.

7.2.3. Qualification in Conjunction with Advanced Qualification Programs (AQP). Appropriate re-qualification or recurrent qualification programs may be adjusted as necessary when incorporated in AQP or other single visit training programs. With such programs, however, each of the areas of knowledge specified by paragraph 7.1 and each of the areas of competency specified in paragraph 7.2 must be ensured.

7.2.4. Re-qualification.

a. Credit for previous Category I or II qualification in a different aircraft type or variant, or previous qualification in the same type or variant at an earlier time may be considered in determining the type of program, length of program, required maneuvers to be completed or the repetition of maneuvers for re-qualification for Category I or II operations. Any re-qualification program should ensure that the pilots have the necessary knowledge of the topics specified in paragraph 7.1, and are able to perform their assigned duties for Category I or II or low visibility takeoff considering the maneuvers or procedures identified in paragraph 7.2.

b. For programs which credit previous Category I or II qualification in a different type aircraft, the transition program should ensure that any subtle differences between aircraft types which could lead to pilot misunderstanding of appropriate characteristics or procedures in the new type must be suitably addressed.

7.2.5. Upgrade Qualification.

a. Credit for previous Category I or II qualification in a different crew position in the same type or variant at an earlier time may be considered in determining the type of program, length of program, required maneuvers to be completed or the repetition of maneuvers for upgrade qualification for an aircraft type authorized for Category I or II operations. Any upgrade program should ensure that the pilot has the necessary knowledge of the topics specified in paragraph 7.1, and are able to perform the new or additional assigned duties for the new crew position for Category I or Category II or low visibility takeoff considering the maneuvers or procedures identified in paragraph 7.2.

b. Credit may also be permitted, as determined appropriate by the CMO, for prior pilot experience with a similar flight deck and flight guidance system (e.g., A330 and A340; B757 and B767). (Also see FAA AC120-53).

7.2.6. Differences Qualification - Addressing Cockpit or Aircraft System Differences. For Category I and II programs using aircraft which have several variants, training programs should ensure that pilots are aware of any differences that exist and appropriately understand the consequences of those differences. Guidelines for addressing differences can be found in AC 120-53 and FSB reports applicable to a particular type.

7.2.7. Recency of Experience. Recency of experience requirements specified by section 121.439 or IAW AC 120-53 normally provides an assurance of the necessary level of experience for Category I or II landing or low visibility takeoff operations. In the event that special circumstances exist where flight crewmembers may not have exposure to particular aspects of the flight guidance system used for long periods of time beyond that permitted by section 121.439 or AC 120-53, then the operator should ensure that the necessary recency of experience is addressed prior to pilots conducting Category I or II landings, or low visibility takeoff operations below RVR 2400.

a. For FMS/RNAV or RNP approaches or automatic landing systems, pilots should specifically be exposed to use of these systems and procedures during training or checking if the crew has not otherwise conducted frequent relevant similar line operations with those systems since the previous training cycle or event.

b. For manual flight guidance landing or takeoff systems (e.g., HUD) a pilot flying should typically be afforded an opportunity to use such systems or procedures in the aircraft or in simulation once each 90 days. If the pilot has not otherwise had an opportunity to conduct line approaches or landings using the manual flight guidance system within the previous 90 days, a simulator refresher, recurrent training or checking event, line operational use in weather conditions better than basic VFR, flight with a check airman, or other similar method acceptable to the POI may be used to re-establish recency of experience with that system.

7.3. Checking or Evaluations.

7.3.1. Checking For Category I Qualification. Testing, checking or evaluation for Category I is basic to qualification for IFR operations, and should be accomplished in conjunction with basic aircraft type or variant qualification for each crew position. Testing or evaluation, if necessary and as necessary, should be keyed to assuring that each pilot has the necessary knowledge and skill appropriate to the type of qualification being completed (e.g., Initial, transition, upgrade, differences, or re-qualification programs) IAW applicable regulations (e.g., SFAR 58 Approved AQP program, part 121 appendix F, part 61, and applicable FAA ATPC Type Rating Practical Test Standards). (Also see initial, transition, upgrade, or differences paragraphs above.)

7.3.2. Checking For Category II Qualification. Specific testing or evaluation should be completed for Category II qualification. Flight crewmembers should demonstrate proper use of Category II-related aircraft systems and correct procedures including any provisions otherwise specified by an applicable FSB report. If not otherwise addressed by Category I or Category III qualification, pilots should demonstrate proficiency in performing duties related to conduct of Category II approaches including at least the following conditions individually, or in any combination:

a. A normal approach to a landing and to a go-around at or near Category II minima;

b. Approaches with related aircraft system, navigation system, or flight guidance failures.

c. An engine-inoperative approach (if authorized for engine-inoperative Category II capability);

d. For initial qualification which includes use of an automatic landing system, at least one automatic landing, and if applicable, one automatic go-around from a low approach (at or after DA(H) but before touchdown). The approach or go-around may be conducted in either normal or non-normal conditions, as determined appropriate by the operator and CHDO;

e. For continuing qualification which includes use of an automatic landing system, at least one automatic landing or low altitude automatic go-around (if applicable), with a relevant non-normal condition;

f. For manual flight guidance and control systems (e.g., HUD) one landing at the lowest applicable minima and one go-around from low altitude below DA(H), and at least one response to a failure condition during the approach or missed approach; and

g. Recognition and proper response to other representative non-normal conditions or adverse weather situations (e.g., Outage NOTAM, NAVAID failure, variable or below minima weather, ILS critical area protection anomaly).

7.3.3. Combined Checking for Simultaneous Category I/II or I/II/III Qualification. When qualification programs simultaneously address Category I and Category II, or Category I, II, and Category III, testing events may be appropriately combined, and the FAA or operator need not repetitively test each type of approach at each landing Category.

7.3.4. Checking for Low Visibility Takeoff Qualification.

a. For new low visibility takeoff authorizations, and unless otherwise qualified for low visibility takeoff IAW FAA AC 120-28D, before using any takeoff minima below RVR 1200, pilots should have successfully demonstrated in simulation at least one takeoff at the lowest applicable minima with an engine failure at or after V1, and one rejected takeoff with an engine failure or other appropriate failure prior to V1.

b. If an acceptable simulator is not available, the demonstration may be conducted in the type of aircraft to be authorized for use of takeoff minima below RVR 1200. Representative failure speeds and conditions may be used that do not risk or adversely affect the aircraft or its systems (e.g., tires and brake energy). Use of a view limiting device for the pilot being evaluated is not necessary.

7.4. Experience with Line Landings. For Category II, unless otherwise specified by an applicable FSB report for the aircraft type, when a qualification program has been completed using a simulator program other than Level C or D, at least the following experience should be required before initiating Category II operations:

a. For automatic systems at least one line landing using the auto flight system approved for Category II minima should be accomplished in weather conditions at or better than Category II.

b. For manual systems such as head up flight guidance system for Category II, the pilot in command must have completed at least ten line landings using the approved flight guidance system and procedures, in the configuration specified for Category II, at suitable runways and using suitable landing NAVAIDs.

7.5. Crew Records. The operator should ensure that records suitably identify initial and continued eligibility of pilots for Category I or II operations. Records should note the appropriate completion of training and any necessary checking for both ground qualification, flight qualification, initial qualification, recurrent qualification, differences qualification, upgrade qualification, or re-qualification, or recency of experience for takeoffs or landings, or other tracked events (e.g., AQP), as applicable.

7.6. Multiple Aircraft Type or Variant Qualification.

a. In the event that flight crewmembers are multiply qualified as either captain or first officer, or for performing the duties of the PIC or SIC (e.g., International relief officers), or for flight crewmembers dual qualified between several aircraft types or variants, appropriate training and qualification must be completed to ensure that each flight crewmember can perform the assigned duties for each crew position and each aircraft type or variant.

b. For programs involving dual qualification, principal inspectors should approve the particular operator's program considering the degree of differences involved in the Category I or II aircraft systems, the assigned duties for each crew position and criteria such as described in AC 120-53 related to differences. If a pilot serving as second in command is not expressly restricted from performing the duties of the pilot in command during Category I or II approaches or low visibility takeoffs below 2400 RVR, then that pilot must satisfactorily complete the requirements for a pilot-in-command regarding those low visibility related maneuvers specified in paragraph 7.2.

7.7. Aircraft Interchange. When aircraft interchange is involved between Operators, flight crewmembers must receive sufficient ground and flight training or qualification assessment to ensure familiarity and competency with respect to the particular aircraft system or systems of the interchange aircraft. Guidelines for differences should be consistent with those specified in AC 120-53 and any applicable FAA FSB reports.

7.8. Training Regarding Use of Foreign Airports for Category I or Category II Operations. Operators authorized to conduct Category I or II operations or low visibility takeoffs below RVR1200 at foreign airports, which require procedures or limitations different than those applicable within the United States, should ensure that flight crewmembers, and dispatchers if applicable, are familiar with any meteorological reporting, airport, visual aid, NAVAID, or ATS clearance or procedure differences appropriate to operations at those foreign airports.

7.9. Initial Operating Experience (IOE)/Supervised Line Flying (SLF). Any Initial Operating Experience (IOE) or Supervised Line Flying (SLF) conducted by the operator should be consistent with and ensure compliance with applicable provisions of the AWO program of the operator.

7.10. Line Checks, Route Checks, LOE, LOS, or LOFT. Any "Line Checks," "Route Checks," LOS, LOE, or LOFT (or other equivalent AQP events) conducted by the operator should be consistent with, and ensure compliance with applicable provisions of the AWO program of the operator.

7.11. Special Qualification Requirements for Particular Category I or Category II Operations. Certain authorizations may require additional Category I or II training or qualification such as specified in paragraph 7.11.1 through 7.11.5 below. Additionally, special qualification may be required for particular instrument procedures, particular types of procedures, or particular airports as determined appropriate by the operator or CMO.

7.11.1. HUD or Autoland. Use of Certain RVR 1800 Authorizations based on HUD or Autoland. Use of lower than standard Category I minima based on use of HGS guidance or Autoland may be authorized. Such authorizations may be requested from the CHDO, and are approved on a case by case basis by AFS-400.

7.11.2. Use of Lowest Category I Minima at Certain Obstacle Limited or Restricted ILS Facilities. Operators may receive an authorization to use the lowest Category I minima at runways otherwise restricted to use higher minima due to near-in obstacles (e.g., KDTW RW21R). Such authorizations may be requested from the CHDO, and are approved on a case by case basis by AFS-400.

7.11.3. Simultaneous Operations Using PRM Radar. For pilot procedures regarding Simultaneous Operations using PRM Radar, see the Aeronautical Information Manual. When these procedures are used by an operator, flightcrews should be suitably briefed on their appropriate use, and how and when to decline their use.

7.11.4. Simultaneous Operations with Converging Approaches and Coordinated Missed Approaches. Simultaneous Operations with Converging Approaches should be addressed if used by the operator. Pilots should be familiar with how to determine if such operations are in effect, how to program the procedure in the FMS, if applicable, how to determine if their aircraft can comply with an applicable missed approach clearance for that particular landing, how to determine if there are any special SIAP or airport procedures to be used, what to do in a contingency, and circumstances in which it may be appropriate to decline such a clearance.

7.11.5. Simultaneous Runway Operations. Simultaneous Operations with land and hold short (LAHSO) ATS clearances should be addressed if used by the operator. Pilots should be familiar with how to determine if such operations are in effect, if their aircraft can comply with a LAHSO clearance for that particular landing, how to determine if there are any special airport markings or lighting to be used, what to do in a contingency if the other aircraft does not respond as expected or cannot stop in the allocated distance, if a failure occurs on either aircraft, or if either or both aircraft must reject the landing, and circumstances in which it may be appropriate to decline such a clearance.

7.11.6. Special Qualification Airports. The operator may identify certain airports as requiring special flightcrew qualification regarding instrument procedures, in conjunction with section 121.445, or in addition to section 121.445 (e.g., due to unusual terrain, obstructions, or weather).

7.11.7. Special Qualification Instrument Procedures or Types of Instrument Procedures. The operator may identify certain instrument procedures or types of procedures as requiring special flightcrew qualification (e.g., due to use of particular flight guidance systems or procedures, or requirements for FTE management, or procedure complexity)

7.12. Special Qualification Requirements for Category II Operations at Certain U.S. Type I ILS Facilities. Qualification Requirements for Category II Operations at Certain U.S. Type I ILS Facilities requires that flightcrews, and dispatchers if applicable, be familiar with any operational aspects of the applicable OpSpecs for these special operations, the DA(H) and RVR minima to be used, required visibility reports necessary to be used, controlling visibility or RVR to be applied, lighting aids required, and any precautions necessary that may be unique to the airport or Type I ILS facility used.

7.13. Simultaneous Training and Qualification for Category I and II. Training and qualification may be completed individually for Category I and II or may be combined. When combined Category I and Category II training is completed, pilots must clearly be aware of responsibilities for each Category of approach used, including differences in methods for determination of minima, controlling visibility or RVR, use of correct procedures and callouts for each Category, requirements for airborne equipment for initiation of approach with normal configurations, and response to typical failure cases appropriate for each Category of approach.

7.14. Simultaneous Training and Qualification for Category I, II, and III. See AC 120-28D for provisions addressing Category III.

a. Training and qualification may be completed individually for Category I or II, or may be combined for Category I, II, and III.

b. When combined Category I/II/III training is completed, pilots must clearly be aware of responsibilities for each Category of approach used, including differences in methods for determination of minima, controlling visibility or RVR, use of correct procedures and callouts for each Category, requirements for airborne equipment for initiation of approach with normal configurations, and response to typical failure cases appropriate for each Category of approach.

7.15. Credit for "High Limit Captains" (Reference Sections 121.652, 125.379, 135.225). When authorized by the POI, credit for high landing weather minimum limits and required turbojet experience may be authorized consistent with provisions of exemptions authorized for Category I or II qualification credit. Among other provisions of the FAA exemptions, crews eligible for this credit must meet applicable provisions of paragraph 7.1 and 7.2 above.

7.16. Particular Approach System/Procedure Qualification.

7.16.1. **Autoland Qualification.** Unless otherwise specified by FAA in OpSpecs, autoland qualification for Category I or II may be completed through use of Level A, B, C, or D simulation, or by observation of an autoland during IOE. When using simulation, at least one normal autoland and one autoland with a failure or non-normal condition requiring pilot intervention or takeover should be completed.

7.16.2. Head Up Display Qualification.

a. Category I or II, or Category I and II.

(1) An acceptable list of flight training events for Category I, or Category II, or Category I and II qualification is shown below.

(2) For qualification, the PF (usually the Captain) and PNF (usually the F/O) should each accomplish their respective duties. It is desirable but not required that the PNF receive at least some exposure to use of the HUD as PF, in order to be familiar with its operation, its characteristics, and its limitations.

Takeoffs:

- Two Takeoffs (RVR at lowest authorized minima - e.g., RVR 300)
- One with an engine failure leading to continuation
- One with any failure leading to an RTO
- One windshear event during takeoff

Landings:

- Five for the lowest Category I or Category II qualification as applicable (three with, two without failures)
- Five Missed Approaches/balked landings due to a failure
- One Circling approach (non ILS/GLS/MLS)

b. Simultaneous Category I/II/III qualification (also see AC120-28D).

(1) An acceptable list of flight training events for Simultaneous Category I/II/III qualification is shown below.

(2) The PF / PNF should each accomplish respective duties as in paragraph a. above. In addition, it is appropriate that the PNF receive at least limited exposure to use of the HUD as PF. The number of events for the PNF, however, may be determined by the operator considering the experience and familiarity of the PNF with HUD operations.

Landings:

- Two Category I (one with, one without failure)
- One Category II (with or without a failure)
- Five Category III (three with, two without failures)
- Five Missed Approaches/balked landings due to a failure
- One Circling approach (non ILS/GLS/MLS), if applicable for that operator

7.16.3. RNAV Approach Qualification.

a. Requirements to conduct RNAV approaches (e.g., for /E or /F qualified airplanes, or RNP qualified aircraft) that already routinely use LNAV/VNAV autoflight modes, are as follows:

(1) The flightcrew must know how to properly use the applicable navigation system(s) for the particular types of approaches to be flown. This is typically addressed in training as a flight crewmember initially qualifies to fly a particular type or variant.

(2) The flightcrew should have, know, or be able to do each of the items below.

(a) Have access to the appropriate instrument chart(s) (e.g., SID, STAR, or approach plates) for the applicable procedures,

(b) Know how to properly load the procedure(s) and any associated transitions, string related waypoints, address discontinuities, enter associated data (e.g., path constraints, altitude constraints, speed constraints, winds, anti-ice initiation altitudes), and

(c) Know how to properly fly the procedure(s) (e.g., operate the aircraft to properly stay on the designated LNAV and VNAV path, and meet constraints, regardless of autoflight mode(s) selected for use, or unexpected mode changes or reversions).

(3) The flightcrew must know how to properly apply applicable flight information (e.g., NOTAMs), if any, for the navigation system and route of flight (e.g., to properly deselect relevant NAVAIDs that are out of service, or could otherwise cause a problem such as a map shift, if they could adversely and significantly degrade navigation system performance).

(4) The flightcrew must know how to apply or accomplish any routine or special flight deck procedures specified by the operator for the approach type used or for the particular approach to be flown, including:

(a) Tuning or setting associated radios, altimeters, radar altimeters,

(b) Setting reference bugs and MCP altitudes, speeds, or headings,

(c) Selecting or arming appropriate AFDS modes,

(d) Performing any necessary navigation performance/map validity verification checks, using some acceptable method to the operator, to ensure suitable navigation performance. Examples of acceptable verification methods typically include:

i. A crosscheck of FMS position with raw data prior to passing a FAF or FAP,

ii. A crew assuring that the FMS is using an acceptable updating mode during the descent check (e.g., DD IRS (3)), and no map shift is evident prior to passing the FAF or FAP,

iii. Periodically monitoring raw data navigation information for consistency with RNAV position information that is displayed on the PFD or ND, or

iv. Comparison of RNAV position or other parameters (e.g., radio altitude at a known waypoint or position) with other independent sources of acceptable position information (e.g., Crosscheck an LNAV path with a path depicted by radar or TAWS, if applicable) which ensures the validity of the navigation system position estimate (e.g., cross checking VNAV with radio altitude, if applicable).

v. Know how to verify navigation data base loads for currency, and verify waypoint and critical waypoint validity, if applicable. Know how to verify appropriate levels of RNP, ANP, EPE, as applicable. Know how to verify suitable sensor performance if applicable (e.g., Acceptable IRS drift rate performance, DME-DME, VOR-DME or GPS updating).

(e) Configuring the aircraft at appropriate times, or in conjunction with ATS clearances (speed intervention adjustments), and addressing or otherwise appropriately responding to related aircraft or system status annunciations, advisories, alerts, cautions, or warnings.

(5) The flightcrew must be familiar with any unique issues particular to a specific approach or family of approach procedures (e.g., proper use of RNP (if applicable) for each particular approach or missed approach segment, or any special flight guidance procedures or actions necessary to accomplish the procedure(s) such as with the flight director, autopilot, autothrottle, or FMS).

(6) The operator must have the pertinent OpSpecs paragraph and the flightcrew must be aware of any operationally significant OpSpec provisions that relate to the procedures to be flown.

b. The above provisions may be addressed through initial or revised FCOM material, briefing bulletins, demonstrations, having crews accomplish typical procedures during scheduled PC/PT or AQP events, or as briefing emphasis items during IOE.

c. Each operator should ensure that effective methods are used to implement applicable RNAV or RNAV/RNP procedures to ensure that in line operations each pilot can perform assigned duties reliably, and expeditiously for each procedure to be flown, both in normal circumstances, and for probable non-normal circumstances (e.g., engine failure and other representative QRH, or equivalent, non-normals).

d. The best method or method(s) to be used by a particular operator to ensure competency in flying RNAV or RNAV/RNP procedures may vary significantly from operator to operator. Methods, level, and extent of training and checking, and recency may depend on the type of procedures used by the operator, the aircraft/FMS types and any autoflight systems used, level of familiarity or experience of crews with the FMS, autoflight, and the RNAV or RNAV/RNP procedures used, the complexity and criticality of procedures to be flown, and the environment in which the procedures are flown.

e. The CHDO (assigned POI/APM) may determine any credit allowed for an operator, or additional constraints determined necessary for that operator based on the above factors, and considering any provisions described in the applicable FSB report for the type.

7.16.4. Category I or II Operations with an Engine Inoperative.

a. Category I.

(1) For a Category I approach with inoperative engine(s), appropriate training should be completed to ensure that pilots, and dispatchers if applicable, can properly identify and select the nearest adequate or suitable airport (2 engine aircraft), or a safe airport (3 or more engine aircraft) pertinent to OpSpecs and Federal Aviation Regulations, to safely conduct an engine(s) inoperative landing. The flightcrews, and dispatchers if applicable, should have and demonstrate knowledge of factors influencing selection of a suitable airport for landing and safe completion of the approach considering factors such as the following:

(a) Engine (or engines) inoperative aircraft configuration (e.g., degree of thrust asymmetry, appropriate flap settings, adjusted reference speeds, remaining reverse thrust capability and use),

(b) Other potentially affected aircraft systems (e.g., electrical or hydraulic),

(c) Weather Conditions (winds, turbulence, ceiling and visibility, RVR, icing, windshear, crosswind or tailwind components, recency and accuracy of weather information),

(d) Use of appropriate minima for the configuration and possible need for adjustment of approach and landing minima to suit the particular circumstances,

(e) Special minima considerations that might be appropriate (e.g., engine-out missed approach obstacle or terrain assurance and balked landing obstacle avoidance considerations, consideration of subsequent engine failure (aircraft with more than 2 engines)),

(f) Selection of most favorable NAVAIDs, runway, or runway conditions (e.g., regarding braking friction, clutter),

(g) Availability of emergency services,

(h) Airport and procedure familiarity,

(i) Nearby terrain or obstruction considerations,

(j) MEL status, and

(k) Pilot recency of experience.

(2) Operators should at least be familiar with the factors listed above, and should provide the necessary training to flightcrews, and dispatchers if applicable, to address the above factors or issues considering that an engine failure may occur during or after takeoff, while en route, prior to approach, after passing the final approach fix, at or below MDA(H) or DA(H) leading to either a landing or go-around, or during missed approach.

b. Category II. For Category II the factors listed above for training and qualification for Category I should be considered, and in addition the following should be addressed. For crews authorized to initiate a Category II approach with an inoperative engine either through Category II flight planning or dispatch procedures or for engine failures which occur en route, appropriate training should be completed to ensure that crews can properly apply the provisions of paragraphs 5.17.1 or 5.17.2. For airlines that do not authorize the initiation of a Category II approach with an engine inoperative as an approved procedure, crews should at least be familiar with the provisions above for Category I and provisions of paragraphs 5.17.3, 5.17.4, and 5.17.5 regarding an engine failure after passing the final approach fix.

7.16.5. Enhanced Vision Systems (EVS), Synthetic Vision Systems (SVS), or Independent Landing Monitor (ILM). Training required for enhanced vision systems or synthetic vision systems, or independent landing monitor may be specified by FAA based on successful completion of proof of concept testing, as applicable. Pertinent requirements are as specified in the applicable FSB report.

8. AIRPORTS, NAVIGATION FACILITIES, AND METEROLOGICAL CRITERIA. U.S. and non-U.S. airports and runways authorized for Category I and II are those either having published part 97 SIAPS, or as otherwise specified on the FAA AFS-400 "Category II status checklist" (Order 8400.8). Requests for authorization to use other airports runways should be coordinated with AFS-400, through the operator's CHDO.

8.1. Use of Standard Navigation Facilities.

a. U.S. Category I approaches may be approved as published by part 97 SIAPS or as special procedures in OpSpecs

b. Category II operations may be approved on standard U.S. or ICAO navigation facilities as follows:

(1) U.S. ILS facilities for which part 97 Category II procedures are published;

(2) Other U.S. ILS facilities deemed acceptable by AFS-400 for the type of aircraft equipment and minima sought;

(3) Non-U.S. facilities meeting ICAO criteria (ICAO Annex 10, ICAO Manual of All Weather Operations DOC 9365/AN910, etc.) and which are promulgated for use for Category II by the "State of the Aerodrome;" and

(4) Category II operations require facilities assessed and classified at least through point D (e.g., II/T/2).

8.2. Use of Other Navigation Facilities or Methods. Category I or II operations may be approved using other types of navigation facilities or using other acceptable position fixing and integrity assurance methods, if proof of concept demonstrations acceptable to FAA are successfully completed:

a. Other U.S. facilities approvable for Category I and II (MLS, DGPS, or ILS used in conjunction with an acceptable aircraft integrity assurance system, etc.) are as determined acceptable by AFS-400;

b. Non-U.S. ILS facilities meeting acceptable criteria other than ICAO (e.g., JAA) may be used as determined to be acceptable by AFS-400;

c. Operations may be approved using other types of navigation facilities or using other acceptable position fixing and integrity assurance methods, if proof of concept demonstrations acceptable to FAA are successfully completed;

d. Other U.S. facilities approvable for Category II (e.g., MLS, DGPS, Type I ILS used in conjunction with an acceptable aircraft integrity assurance system) are as determined acceptable by AFS-400; and

e. Non-U.S. ILS facilities meeting acceptable criteria other than ICAO (e.g., JAA), may be used as determined to be acceptable by AFS-400.

8.3. Lighting Systems. Lighting for Category I is as specified by Standard OpSpecs, part 97 SIAPS, or any special provisions or procedures identified in OpSpecs.

a. Lighting used for Category II must include the following systems, or ICAO equivalent systems, unless approved by AFS-400 (e.g., special provisions for Non-U.S. airports) or specific aircraft systems such as HUD or autoland:

- U.S. Standard ALSF 1 or ALSF 2 approach lights;
- U.S. Standard Touchdown Zone Lights;
- U.S. Standard Runway Centerline Lights; and
- U.S. Standard High Intensity Runway Lights.

b. Exceptions to the above lighting criteria may be authorized only if an equivalent level of safety can be demonstrated by an alternate means (e.g., substitution for required approach lighting components due to use of an approved aircraft system providing equivalent information or performance, such as use of an autoland system, head up display (HUD) with inertially augmented flight path vector display), or availability of redundant, high integrity, computed or sensor based (e.g., high resolution radar) runway information, suitably displayed to a pilot.

8.4. Marking and Signs. Marking and signs for Category I procedures with visibilities less than 3/4 statute mile (RVR 4000) are as specified by the FAA for precision approach runways in the 150/5300 series ACs, except as otherwise authorized by AFS-400.

a. Airports approved for Category II must include the following runway and taxiway markings and airport surface signs, or ICAO equivalent, unless approved by AFS-400 (e.g., for Non-U.S. airports):

(1) U.S. Standard Precision Instrument Runway Markings,

(2) U.S. Standard Taxiway edge and centerline Markings, and

(3) Runway signs, taxiway signs, hold line signs, taxiway reference point markings (if required by SMGCS), and NAVAID (ILS) critical area signs and markings.

b. For Category II, markings and signs must be in serviceable condition, as determined by the operator or FAA CHDO. Markings or signs found in an unacceptable condition by an operator should be reported to the appropriate airport authority and CHDO. Operators should discontinue Category II use of those areas of airport facilities or runways where unsafe conditions are known to exist due to markings or signs being inadequate, until remedial actions are taken by the airport authority (e.g., snow removal, rubber deposit removal on runway touchdown zone markings or centerline markings, critical area hold line or runway centerline marking repainting, runway hold line sign snow removal).

8.5. Low Visibility Surface Movement Guidance and Control System (SMGCS) Plans.

a. Surface movement guidance and control plans are recommended for operations below Category I. Where such plans are used, Operators intending authorization for Category II should coordinate with the airport authority regarding the use of a SMGCS plan prior to OpSpec authorization for that airport. Equivalent coordination should also be completed at non-U.S. airports if such a plan is used by that airport.

b. U.S. airports conducting takeoff or landing operations below 1,200 ft. RVR are required to develop a Surface Movement Guidance and Control System (SMGCS) plan. SMGCS operations facilitate low visibility takeoffs and landings and surface traffic movement by providing procedures and visual aids for taxiing aircraft between the runway(s) and apron(s). Specific low visibility taxi routes are provided on a separate SMGCS airport chart. SMGCS operations also facilitate the safety of vehicle movements that directly support aircraft operations such as aircraft rescue and fire fighting (ARFF), follow-me services, towing, and marshaling.

c. AC 120-57 describes the standards and provides guidance in implementing SMGCS operations such as aircrew training, etc. An operator intending authorization for Category III operations should coordinate with the airport authority regarding their SMGCS plan. Equivalent coordination is also applicable at non-U.S. airports if such a plan is used by that airport.

d. For low visibility operations requiring a SMGCS plan, separation of at least 500 ft should typically exist between the centerline of any runway to be used and the centerline of any adjacent taxi way. When this runway to taxiway distance is less than 500 ft, an on-site evaluation on a case by case basis may be appropriate to establish SMGCS procedures.

8.6. Meteorological Services and RVR.

8.6.1. Meteorological Services. For Category I, standard meteorological reporting required by part 121 and 135 is acceptable. For Category II, appropriate meteorological service (e.g., RVR, RVV, METAR, TAF, Braking Action, NOTAM, etc., reports, as applicable) are necessary for each airport runway intended for use by an operator for Category II, unless otherwise approved by AFS-400. Non-U.S. facilities should meet criteria of ICAO Doc 9365 AN910, second edition, or later.

8.6.2. RVR Availability and Use Requirements.

8.6.2.1. RVR Availability.

a. For Category II, RVR availability requirements for touchdown zone (TDZ), mid runway (MID), and ROLLOUT RVR (or a corresponding international equivalent location) should be provided for any runway over 8000 ft in length. TDZ and ROLLOUT RVR should be provided for runways less than 8000 ft. Exceptions to this requirement for U.S. Operators at international locations may be approved on a case by case basis by AFS-400, if an equivalent level of safety can be established. Factors considered due to local circumstances at foreign airports may include minima requested, landing field length requested, characteristics of prevailing local weather conditions, location of RVR sites or RVR calibration, availability of other supporting weather reports on nearby runways, etc.

b. Aircraft requiring a landing or takeoff distance in normal operation (using operational braking techniques) less than 4000 ft may be approved to use a single TDZ, MID, or ROLLOUT RVR report as applicable to the part of the runway used. For such operations, RVR values not used are optional and advisory, unless the aircraft operation is planned to take place on the part of the runway where a MID or ROLLOUT RVR is located.

8.6.2.2. RVR Use. In general, the controlling RVR for Takeoff, Landing and Rollout are as follows:

a. Take-off:

(1) Where visibility minima are applicable, visibility must be reported sufficiently close to the takeoff runway to be considered valid or applicable. The determination of acceptability, if not otherwise addressed by FAA, may be determined by the operator or CHDO.

(2) Where RVR minima are applicable, RVR must be reported, and the RVR minimum value is considered to be controlling at each relevant RVR reporting point. The RVR/Visibility representative of the initial part of the take-off may be replaced by pilot assessment. For take-off operations the relevant RVR refers to any portion of the runway that is needed for takeoff roll, including that part of the runway that may be needed for a rejected take-off.

b. Landing.

(1) Where visibility minima are applicable, visibility must be reported sufficiently close to the landing runway to be considered valid or applicable. The determination of acceptability, if not otherwise addressed by FAA, may be determined by the operator or CHDO. Where RVR is used, the controlling RVR for all Category I operations is the touchdown RVR. All other readings, if any, are advisory.

(2) The controlling RVR for Category II (for Category III see AC 120-28D) with or without rollout guidance control system is the TDZ RVR or equivalent. Mid and rollout RVR are advisory, unless otherwise specified in OpSpecs.

> **NOTE: An acceptable alternate set of OpSpecs specifying minimum values for MID and ROLLOUT RVRs may be provided for airplanes <u>without</u> a rollout guidance or control system. If determined appropriate by the FAA, and agreed to by the operator, TDZ, MID, and ROLLOUT may be specified as controlling. MID RVR, if relevant, may not be less than 400-ft. (125-meters). ROLLOUT RVR, if relevant, may not be less than 300-ft. (75-meters). For landing operations, the relevant RVR refers to the portion of the runway that is needed for landing down to a safe taxi speed (typically below 60-knots for large turbojet aircraft).**

(3) "Inoperative RVR" requirements for dispatch or continuation of a particular flight operation are as specified in standard OpSpecs Part C, or any special OpSpec provision unique to a particular operator. Unless otherwise approved, in special OpSpecs provisions, the controlling RVR must be operating for all operations based on RVR minima.

c. RVR use by Operators and pilots (controlling and advisory RVR reports) is as specified in standard OpSpecs Part C (see Appendix 7). Since RVR reports can be influenced by runway light step settings, Operators should be familiar with and pilots should be familiar with and appropriately request adjustments to light step settings if necessary, to ensure best visual reference and to appropriately affect RVR reported values.

8.6.2.3. Alternate RVR Requirements for Short Field Length Operations. When approved as an exception in OpSpecs, aircraft capable of certificated landing or takeoff distance of less than 4000 ft (using operational braking techniques) may be approved to use a single TDZ, MID, or ROLLOUT RVR as applicable to the part of the runway used. For such operations, RVR values not used are considered to be optional and advisory, unless the aircraft operation is planned to take place on the part of the runway where a MID or ROLLOUT transmissometer is located.

8.6.2.4. International RVR Reporting and Use Equivalence Considerations. For RVR reporting and use outside of the United States, where international transmissometer locations may be specified by terms or locations other than TDZ, MID, or ROLLOUT as is done in the United States (e.g., International transmissometer locations A, B, C, D, or 1, 2, 3, 4), the operator may appropriately equate international transmissometer locations and reports to equivalent U.S. transmissometer positions and reports for the purpose of applying OpSpecs provisions. This applies to transmissometers installed, available, reports, or controlling minima determinations. Unless specifically precluded from doing so by the State of the Aerodrome, Airport Authority, or FAA, where the number of transmissometers available on a runway is different internationally than typically is available in the United States (e.g., 4 RVR locations on a runway internationally versus 3 in the United States), the operator may determine equivalent suitability of RVR availability, reporting, or minima controlling locations. The operator may correspondingly specify suitable equivalent RVR provisions for flightcrew use. When making such a determination the operator should consider the applicable portions of the runway used by the aircraft type(s) in question for touchdown and landing rollout. For takeoff, the operator should consider portions of the runway used both for a continued takeoff and for a rejected takeoff. The operator may also specify acceptable RVR substitutions that may be made for inoperative transmissometers or missing reports. However, for any such determinations, RVR coverage and reporting should be available that is at least equivalent to that which would be otherwise be permitted at authorized U.S. airports.

8.6.3. Pilot Assessment of Takeoff Visibility Equivalent to RVR. (See also 4.2. b and c). In special circumstances, provisions may be made for pilot assessment of takeoff visibility equivalent to RVR to determine compliance with takeoff minima. Provisions to authorize pilot assessed RVR is provided through Standard Operations Specifications. A pilot may assess visibility at the take off position in lieu of reported TDZ RVR (or equivalent) IAW the requirements detailed below:

a. TDZ RVR is inoperative, or is not reported (e.g., TDZ RVR inoperative, ATS facility is closed); or

b. Local visibility conditions as determined by the pilot indicate that a significantly different visibility exists than the reported RVR (e.g., patchy fog, blowing snow, RVR believed to be inoperative or inaccurate); and

c. Pertinent markings, lighting, and electronic aids are clearly visible and in service (e.g., no obscuring clutter); and

d. The assessment is made using an accepted method regarding identification of an appropriate number of centerline lights, or markings, of known spacing visible to the pilot when viewed from the flight deck when the aircraft is at the take-off point; and

e. Pilot assessment of visibility as a substitute for TDZ (takeoff) RVR is approved for the operator, and observed visibility is determined to be greater than the equivalent of 300 RVR (90m); and

f. A suitable report of the pilot's determination of visibility is forwarded to ATS or to the operator, as applicable (e.g., if an ATS facility is available and providing ATS services, or if the operator elects to receive such reports).

NOTE: A suitable report of a pilot's determination of visibility provided to ATS or to the operator is intended to facilitate other operations and timely distribution of meteorological information. It is not intended to be a verification of minima or limit or restrict minima for the aircraft making the report.

8.7. Critical Area Protection. Airports and runways used for Category I and II must have suitable NAVAID (e.g., ILS) critical area protection, as applicable to the ground and aircraft systems used. Procedures equivalent or more stringent than those in the U.S. AIM and FAA Order 7110.65 are required. Procedures consistent with ICAO DOC 9365/AN910 are acceptable for non-U.S. facilities. Where uncertainty regarding acceptability of non-U.S. airport procedures is a factor, Operators or CHDOs should contact AFS-400 (e.g., for non-U.S. airports and runways listed on the FAA Category II status checklist where doubt exists regarding adequacy of procedures encountered in routine operations) for follow-up.

8.8. Operational Facilities, Outages, Airport Construction, and NOTAMs. For operations to be initially authorized, operations to continue to be authorized, an aircraft to be dispatched with the intention of using a facility described above, or an aircraft to continue to its destination or an alternate with the intent of completing a Category I and II instrument approach procedure, Operators must consider the status of components identified in 8.1 through 8.7 above, as necessary for Category I or II (NAVAIDs, standby power, lighting systems, etc.) and take appropriate action for inoperative components. The following guidelines are considered acceptable unless otherwise precluded in OpSpecs:

a. Outer, Middle, or Inner marker beacons may be inoperative unless a Category I or II operation is predicated on their use (e.g., a DH is predicated on use of an Inner Marker due to irregular terrain, the aircraft system requires use of a marker beacon for proper function).

b. Lighting systems are in normal status except that isolated lights of an approach light, or runway light system may be inoperative; approach light components not necessary for the particular operation such as REIL, VGSI, RAIL, etc. may be inoperative; lights may not be completely obscured by snow or other such contaminants if necessary for the operation (e.g., night).

c. Operations may be continued at airports at which construction projects affect runways, taxiways, signs, markings, lighting, or ramp areas only if the operator has determined that low visibility operations may be safely conducted with the altered or temporary facilities that are provided. In the event of uncertainty as to the suitability of facilities, the operator should consult with their CHDO.

d. NOTAMs for NAVAIDs, facilities, lighting, marking, or other capabilities must be appropriately considered for both dispatch, and for continued flight operations intending to use a Category I or II procedure. Operators and flightcrews must respond appropriately to NOTAMs that could adversely affect the aircraft system operation, or the availability or suitability of Category I or II procedures at the airport of landing, or any alternate airport intended for Category I and II.

e. An operator may make the determination that a NOTAM does not apply to the aircraft system and procedures being used for a particular flight if the safety of the operation can be ensured, considering the NOTAM and situation.

8.9. Use of Military Facilities. Military facilities may be used for Category I and II if authorized by DOD, and if equivalent criteria are met as applicable to U.S. civil airports.

8.10. Special Provisions for Facilities Used for ETOPS or EROPS Alternates. In addition to criteria specified above, an airport used as an ETOPS or EROPS Category II engine-out alternate should meet the following criteria:

a. Sufficient information about pre-threshold terrain, missed approach path terrain, and obstructions must be available so that an operator can ensure that a safe Category II landing can be completed, and that an engine-out missed approach can be completed from the specified DH.

b. Sufficient meteorological and facility status information must be available so that a diverting flightcrew, and dispatcher if applicable, can receive timely status updates on facility capability, weather/RVR, wind components, and braking action reports (if applicable), if conditions could or would adversely affect a planned Category II landing during the period of an ETOPS or EROPS diversion.

c. For any alternate airports not routinely used in normal operations by that operator's flightcrews (e.g., Keflavik, Iceland - BIKF), sufficient information should be provided for flightcrews, or dispatchers if applicable, to be familiar with relevant low visibility and adverse weather characteristics of that airport that might have relevance to an engine-out diversion operation (e.g., unique lighting or markings, any nearby obstructions or frequently encountered local windshear or turbulence characteristics, meteorological report, braking report, and NOTAM interpretation, appropriate ground taxi route and gate location information, emergency services available).

8.11. Alternate Minima. Use of alternate minima are specified in Standard OpSpecs Part C paragraph C055. For applicability of "engine inoperative Category II" capability see paragraph 10.8.

a. Paragraph C055 is issued to all part 121 and part 135 Operators who conduct IFR operations with airplanes. This paragraph provides a three-part table from which the operator, during the initial dispatch or flight release planning segment of a flight, derives alternate airport IFR weather minimums in those cases where it has been determined that an alternate airport is required.

b. The first part of the table is for airports with at least one operational navigational facility providing a straight-in non precision approach procedure, or a straight-in precision approach procedure, or, when applicable, a circling maneuver from an instrument approach procedure. The required ceiling and visibility is obtained by adding 400 ft. to the Category I HAT or, when applicable, the authorized HAA and by adding 1 sm to the authorized Category I landing minimum, etc.

c. Special provisions for Category II and Category III engine-out capability are listed in the third part of the table for airports with at least two operational navigational facilities, each providing a straight-in precision approach, including a precision approach procedure to Category II DA(H) or Category III. The required ceiling and visibility is obtained by adding 200 ft. to the respective lowest Category II or Category III touchdown zone elevation of the two approaches used and by adding RVR 1200 to the lowest authorized minimum.

8.12. Dispatch or Release to Airports that are Below Landing Minima.

a. In certain instances, an operator may dispatch or release an airplane under instrument flight rules when conditional language of the weather forecast states that the weather at the destination and/or alternate airport could be below the authorized weather minimums. This is to permit aircraft to begin a flight if there is a reasonable expectation that at or near the expected time of arrival at the destination airport, weather conditions are expected to permit a landing at or above landing minima.

b. Dispatch or release to such airports is typically authorized by exemption and is considered acceptable under the terms and limitations of the exemption and if the following conditions are met:

(1) All requirements are met to use the landing minimum at the destination airport and at each alternate airport on which the dispatch or release is predicated (e.g., aircraft, crew, airport facilities, NAVAIDs).

(2) If Alternate minima credit is applied based on availability of Category II capability, or engine inoperative Category II capability, then each of the airborne systems otherwise applicable to the use of that capability must be available at the time of dispatch or release (e.g., flight guidance system, thrust reverse capability, as applicable to the aircraft type and Category II authorization for that operator)

(3) ETA at the destination airport considers any necessary holding fuel that may be required while the aircraft waits for weather improvement.

(4) Air Traffic conditions are considered for potential delay due to other aircraft arrivals or departures at the destination airport and at each alternate airport.

(5) At least two qualifying alternates are available, the first of which considers the aircraft flying to the below minima intended destination, then holding for a time as determined by the operator awaiting approach or weather improvement, then flying to the closest alternate, then completing an approach and missed approach at that airport, and then flying to the second alternate and landing with appropriate reserve fuel.

8.13. Temperatures and Temperature Extremes.

a. The operator should address appropriate flightcrew and dispatch (if applicable) use of temperature in degrees C, degrees F, and conversion between C and F, if necessary.

b. The operator should address appropriate flightcrew and dispatch (if applicable) use of procedures to compensate for extremely cold temperatures, if necessary (e.g., below -22F/-30C - See also paragraphs 4.3.1.1 item g, 4.3.4. c., 6.2.13, and 7.1.3. items d and h).

c. The operator should address appropriate flightcrew and dispatch procedures (if applicable) for use of temperatures near or possibly beyond the AFM range, if operations are necessary or are reasonably expected to be conducted at or near AFM limits (e.g., runway temperatures near or above 120 degrees F or near or below -54 degrees F).

8.14. Pressures and Unusually High or Low Pressures.

a. The operator should address appropriate flightcrew and dispatch procedures (if applicable) for identification of and appropriate setting and use of QNH, QNE, and QFE (if used). This should include emphasis on distinguishing appropriate use of metric versus non-metric units for altimeter settings as used by that operator (e.g., hectopascals (HPa), millibars (MB), or inches (in)). Emphasis should be placed on assuring use of proper settings for easily confused values for altimeter settings, particularly when abbreviated settings are used in ATS radiotelephony, ATIS messages, or checklists (e.g., "altimeter 993" being mistakenly confused for 29.93 inches instead of 0993 HPa when the appropriate units are metric).

b. The operator should address any appropriate flightcrew and dispatch procedures (if applicable) for unusually low pressures if necessary for safe operations (e.g., unusable altitudes or flight levels of instrument procedures).

c. The operator should address appropriate flightcrew and dispatch procedures (if applicable) for use of transition Level and transition altitude.

d. If applicable, the operator should address appropriate flightcrew and dispatch procedures or limitations, as necessary, for use of VNAV in states using QFE for approach.

9. CONTINUING AIRWORTHINESS / MAINTENANCE.

9.1. Maintenance Program General Provisions. As approved by FAA, each operator should have an approved continuous airworthiness maintenance program (CAMP) in place. The approved CAMP should include any necessary provisions to address lower landing minima (LLM), or low visibility takeoff, IAW the operator's intended operations and the manufacturers recommended maintenance program. An LLM program may be an extension of a CAMP. A maintenance program should consider any applicable MRB requirements or equivalent requirements (e.g., AD's, mandatory service bulletins) that may relate to low visibility operations. Emphasis should be on maintaining and ensuring total system performance, accuracy, availability, reliability, and integrity for the intended low visibility operations.

9.2. Maintenance Program Requirements. The maintenance program should be compatible with an operator's organization and ability to implement and supervise the program. Maintenance personnel should be familiar with the Operators approved program, their individual responsibilities in accomplishing that program, and availability of any resources within or outside of the maintenance organization that may be necessary to ensure program effectiveness (e.g., getting applicable information related to the manufacturer's recommended maintenance program, getting information referenced in this AC such as service bulletin information).

a. Provision for low visibility operations may be addressed as a specific program or may be integrated with the general maintenance program.

b. Regardless of whether the maintenance program is integrated, or is designated as a specific program for LLM, the maintenance program should at least address the following:

(1) Maintenance procedures necessary to ensure continued airworthiness relative to low visibility operations.

(2) A procedure to revise and update the maintenance program.

(3) A method to identify, record, or designate personnel currently assigned responsibility in managing the program, performing the program, maintaining the program, or performing quality assurance for the program. This includes identification of any contractor or sub-contractor organizations, or where applicable, their personnel.

(4) Verification should be made of the lower landing minima systems and configuration status for each aircraft brought into the maintenance or lower minimum program. Unless otherwise accepted by FAA, each aircraft should meet relevant criteria specified by the applicable aircraft manufacturer or avionics manufacturer for associated systems and equipment (e.g., Valid U.S. Type Certificate (TC), appropriate Supplementary Type Certificate (STC) records and compliance, assessment of status of any engineering orders, Airworthiness Directives (AD), service bulletins or other compliance).

(5) Identification of modifications, additions, and changes which were made to qualify aircraft systems for the intended operation or minima, if other than as specified in the AFM, TC or STC.

(6) Identification of maintenance requirements and log entries necessary to change minima status.

(7) Any discrepancy reporting procedures that may be unique to the low visibility program. If applicable, such procedures should be compatibly described in maintenance documents and operations documents.

(8) Procedures that identify, monitor, and report lower minimum system and component discrepancies for the purpose of quality control and analysis.

(9) Procedures that define, monitor, and report chronic and repetitive discrepancies.

(10) Procedures that ensure aircraft remain out of lower minimum status until successful corrective action has been verified for chronic and repetitive discrepancies.

(11) Procedures that ensure the aircraft system status is placarded properly and clearly documented in the aircraft log book, in coordination with maintenance control, engineering, flight operations, and dispatch, or equivalent.

(12) Procedures to ensure the downgrade of an aircraft low visibility capability status, if applicable, when maintenance has been performed by persons other than those trained, qualified, or authorized to use or approve procedures related to low visibility operations.

(13) Procedures for periodic maintenance of systems ground check, and systems flight check, as applicable. For example, following a heavy maintenance, suitable checks may need to be performed prior to return to service.

(14) Provisions for an aircraft to remain in a specific low visibility capability status (e.g., Category II, Fail-Operational, Fail Passive) or other designated operational status used by the operator.

(15) Provision should be made for periodic operational sampling of suitable performance. Typically, at least one satisfactory approach should have been accomplished within a specified period approved for that operator, unless a satisfactory systems ground check has been accomplished. A recording procedure for both satisfactory and unsatisfactory results should be included. Fleet sampling is not typically acceptable in lieu of specific aircraft assessment. Typically at least one satisfactory low visibility system operational use, or a satisfactory systems ground check, should be accomplished within 6 months, or within a period as specified by the aircraft or avionics manufacturer for an aircraft to remain in Category II status.

NOTE: Maintenance programs meeting requirements for and approved for Category III typically are also considered acceptable for Category II. Aircraft low visibility systems status, however, must be clearly identified for pilots, maintenance, and dispatch, when combined programs are used.

9.3. Initial and Recurrent Maintenance Training.

a. Maintenance personnel should be knowledgeable regarding the information contained in this AC and 14 CFR related to any significant aspects of LLM that may pertain to maintenance. Operator and contract maintenance personnel including mechanics, maintenance controllers, avionics technicians, personnel performing maintenance inspection or quality assurance, or other engineering personnel if applicable, should receive initial and recurrent training as necessary for an effective program. The training curriculum should include specific aircraft systems and operator policies and procedures applicable to low visibility operations. Recurrent training should typically be accomplished at least annually, or when a person has not been involved in the maintenance of the specified aircraft or systems for an extended period (e.g., greater than 6 months). Training may lead to a certification or qualification (e.g., for lower landing minima "LLM") if the operator so designates such qualification in that operator's approved program.

b. The training should at least include, as applicable:

(1) An initial and recurrent training program for appropriate operator and contract personnel. Personnel considered to be included are maintenance personnel, quality and reliability groups, maintenance control, and incoming inspection and stores, or equivalent organizations. Training should include both classroom and at least some "hands-on" aircraft training for those personnel who are assigned aircraft maintenance duties. Otherwise, training may be performed in a classroom, by computer based training, in simulators, in an airplane or in any other effective combination of the above consistent with the approved program, and considered acceptable to FAA.

(2) Subject areas for training should include: Operational concepts, aircraft types and systems affected, aircraft variants and differences where applicable, procedures to be used, manual or technical reference availability

and use, processes, tools, or test equipment to be used, quality control, methods for testing and return to service, signoffs required, proper Minimum Equipment List (MEL) application, general information about where to get technical assistance as necessary, necessary coordination with other parts of the operator's organization (e.g., flight operations, dispatch), and any other maintenance program requirements unique to the operator or the aircraft types or variants flown (e.g., human factors considerations, problem reporting).

(3) Procedures for the use of outside vendors or vendor's parts that ensures compatibility to program requirements and for establishing measures to control and account for parts overall quality assurance.

(4) Procedures to ensure tracking and control of components that are "swapped" between systems for trouble shooting when systems discrepancies can not be duplicated. These procedures should provide for total system testing and/or removal of aircraft from lower minimum status.

(5) Procedures to assess, track, and control the accomplishment of changes to components or systems pertinent to low visibility operations (e.g., ADs, service bulletins, engineering orders, 14 CFR requirements).

(6) Procedures to record and report lower minimum operation(s) that are discontinued/interrupted because of system(s) malfunction.

(7) Procedures to install, evaluate, control, and test system and component software changes, updates, or periodic updates.

(8) Procedures related to the minimum equipment list (MEL) remarks section use, which identify low visibility-related systems and components, specifying limitations, upgrading, and downgrading.

(9) Procedures for identifying and addressing performance assurance for any necessary low visibility-related components and systems, such as for use of "built in test" features, for required inspection items, and for providing quality assurance, whether performed in-house or by contract vendors.

9.4. Test Equipment/Calibration Standards. Test equipment may require periodic re-evaluation to ensure it has the required accuracy and reliability to return systems and components to service following maintenance. A listing of primary and secondary standards used to maintain test equipment that relate to low visibility operations should be maintained. It is the operator's responsibility to ensure these standards are adhered to by contract maintenance organizations. Traceability to a national standard or the manufacturer's calibration standards should be maintained.

9.5. Return To Service Procedures.

a. Procedures should be included to upgrade or downgrade system status concerning low visibility operations capability. The method for controlling operational status of the aircraft should ensure that flightcrews, maintenance and inspection departments, dispatch, and other administrative personnel as necessary are appropriately aware of aircraft and system status.

b. The appropriate level of testing should be specified for each component or system. The manufacturer's recommended maintenance program or maintenance instructions should be considered when determining the role built-in-test-equipment (BITE) should play for return to service (RTS) procedures, or for use as a method for low visibility status upgrade or downgrade.

c. Contract facilities or personnel should follow the operator's FAA-approved maintenance program to approve an aircraft for return to service. The operator is responsible for ensuring that contract organizations and personnel are appropriately trained, qualified, and authorized.

9.6. Periodic Aircraft System Evaluations.

a. The operator should provide a method to continuously assess or periodically evaluate aircraft system performance to ensure satisfactory operation for those systems applicable to Category II. An acceptable method for assuring satisfactory performance of a low visibility flight guidance system (e.g., autoland or HUD) is to periodically use the system and note satisfactory performance. A reliable record such as a logbook entry or computer ACARS record showing satisfactory performance within the previous 6 months for Category II is typically an acceptable method for assuring satisfactory system operation.

b. Periodic flight guidance system/autoland system checks should be conducted IAW procedures recommended by the airframe or avionics manufacturer, or by an alternate procedure approved by the FAA. For periodic assessment, a record should be established to show when and where the flight guidance/autoland system was satisfactorily used, and if performance was not satisfactory, to describe any remedial action taken.

c. Use of the flight guidance/automatic landing system should be encouraged to assist in maintaining its availability and reliability.

9.7. Reliability Reporting And Quality Control.

9.7.1. Reliability Reporting - Category I. No special "Reliability Reporting or Quality Control" requirements are applicable to Category I.

9.7.2. Reliability Reporting - Category II. For a period of 1 year after an applicant has been authorized for Category II, a monthly summary should be submitted to the certificate holding office. The following information should be reported:

a. The total number of approaches tracked, the number of satisfactory approaches tracked, by aircraft/system type, and visibility (RVR), if known or recorded.

b. The total number of unsatisfactory approaches, and reasons for unsatisfactory performance, if known, listed by appropriate category (e.g., poor system performance, aircraft equipment problem/failure; ground facility problem, ATS handling, lack of critical area protection, or other).

c. The total number of unscheduled removals of components of the related avionics systems.

d. Reporting after the initial period should be IAW the Operators established reliability and reporting requirements.

9.8. Configuration Control/System Modifications. The operator should ensure that any modification to systems and components approved for low visibility operations are not adversely affected when incorporating software changes, service bulletins, hardware additions, or modifications. Any changes to system components should be consistent with the aircraft manufacturer's, avionics manufacturer's, industry, or FAA accepted criteria or processes.

9.9. Records.

a. The operator should keep suitable records (e.g., both the operator's own records and access to records of any applicable contract maintenance organization). This is to ensure that both the operator and FAA can determine the appropriate airworthiness configuration and status of each aircraft intended for Category II operation.

b. Contract maintenance organizations should have appropriate records and instructions for coordination of records with the operator.

9.10. Part 129 Foreign Operator Maintenance Programs.

9.10.1. Maintenance of Part 129 Foreign Registered Aircraft. For part 129 Operators of Foreign registered aircraft (e.g., section 129.14 is not applicable), the cognizant Civil Aviation Authority (CAA) is the CAA of the operator. For those situations, FAA may implicitly accept that the maintenance program is considered to be acceptable if the cognizant CAA has approved it, and if the operator or CAA indicates that the program meets U.S.

criteria, U.S. equivalent criteria (e.g., criteria such as JAA criteria), or ICAO criteria (e.g., Annex 6 and Doc 9365 AN910 "Manual of All Weather Operations"), and the cognizant CAA has authorized Category II U.S operations. FAA then issues the pertinent part 129 Category II OpSpec based on the other CAA's approval for that operator. However, FAA reserves the prerogative to ensure competence of both the operator and authorizing and supervising CAA, depending on whether the CAA or operator are considered to be from a category 1, 2, or 3 country (safety classification, not a low visibility landing classification), and if there have been any reported problems with the operator or CAA. Evidence of the operator satisfying or being consistent with the manufacturer's recommended maintenance program should serve as evidence of an acceptable maintenance program, regardless of the capability of the CAA or the operator, unless FAA has specifically addressed maintenance requirements beyond those of the manufacturer for that aircraft type (e.g., required service bulletin compliance or Airworthiness Directive compliance related to the flight guidance system).

9.10.2. Maintenance of Part 129 Foreign Operated U.S. "N" Registered Aircraft. Foreign Operators of U.S. "N" Registered Aircraft (e.g., those Operators to which section 129.14 is applicable) should have maintenance programs equivalent to that required for a U.S. part 121 operator. Use of the part 91 provisions for General Aviation are not applicable or appropriate. POI Approval of Category II OpSpecs for a section 129.14 operator may implicitly be considered to also accept the maintenance program adequacy. Accordingly, coordination between the applicable POI and PMI is necessary before part 129 OpSpec authorization is completed. FAA is ultimately the cognizant CAA for the maintenance program in this instance, if the aircraft is N registered. However, FAA may accept the oversight of the operator's CAA if that CAA is judged by FAA to have equivalent processes, criteria and procedures for oversight of maintenance programs (e.g., JAA countries). The basis for any such maintenance program should be the recommended airframe manufacturer (or avionics vendor) program, considering any adjusted MRB requirements.

10. APPROVAL OF U.S. OPERATORS.

a. Approval for Category I and II is through issuance of, or amendments to, OpSpecs. The authorizations, limitations, and provisions applicable to Category I and II operations are specified in Part C of the OpSpecs. Sample OpSpecs are provided in Appendix 7.

b. OpSpecs authorizing reciprocating and turbo-propeller-powered airplane Category I operations that use ICAO standard NAVAIDs and ASRs, and PARs are normally approved by the certificate holding district office without further review and concurrence, following satisfactory completion of the pertinent items below. Category I turbojet, turbofan, and prop-fan normally require regional flight standards review and concurrence before approval. All Category II operations and operations using NAVAIDs which are not ICAO-standard NAVAIDs (e.g., Loran C, ARA, OSAP, and TLS) normally require both regional flight standards and AFS-400 review and concurrence before approval.

10.1. Operations Manuals and Procedures. Appropriate flightcrew operating manuals, aircraft flight manuals, policy manuals, aircraft checklists, quick reference checklists, maintenance manuals, training manuals or other equivalent operator documents (as necessary), must satisfactorily incorporate pertinent Category I and II provisions prior to Category I and II approval.

a. Manuals.

(1) Prior to approval, appropriate flightcrew operating manuals, flight manuals, airline policy manuals, maintenance manuals, training manuals, and related aircraft checklists, quick reference handbooks, or other equivalent operator information, must satisfactorily incorporate provisions pertinent to each category of operation.

(2) Information covered in ground training, and procedures addressed in flight training should be available to flightcrews, and to dispatchers as applicable, in an appropriate form for reference use.

b. Procedures. Prior to approval of Category I or II operations, provisions of paragraph 6 of this AC that cover procedures, duties, instructions, or any other necessary information to be used by flightcrews, or dispatchers as applicable, should be implemented by the operator.

(1) Flight crewmember duties during the approach, flare, rollout, or missed approach should be described. Duties should at least address responsibilities, tasks of the pilot flying the aircraft and the pilot not flying the aircraft during all stages of the approach, landing, rollout, and missed approach. The duties of additional flight crewmembers, if required, should also be explicitly defined.

(2) Specification of flight crewmember duties should address any needed interaction with dispatch or maintenance (e.g., addressing resolution of aircraft discrepancies and return to Category II/III service).

(3) The applicant's qualification program should incorporate specific procedural responsibilities, appropriate to each category of landing minima being implemented, for the pilot in command and second in command in each of the ground training subject areas listed in paragraph 7.1, and each of the flight training subject areas listed in paragraph 7.2.

10.2. Training Programs and Crew Qualification.

a. Training programs, AQP programs (if applicable), crew qualification and checking provisions and standards, differences qualification (AC 120-53) if applicable, check airmen qualification, line check, route check, and IOE programs should each satisfactorily incorporate necessary Category I and II provisions, as applicable (see paragraphs 7.1 through 7.9). An acceptable method to track pertinent flight crewmember Category I and II qualification must be established.

b. For manually flown Category I and II systems (HUD, FDs, etc.) ensure that provisions are made for each flight crewmember to receive the appropriate training, qualification, and line experience before that particular flight crewmember is authorized to use the pertinent Category I and II minima.

10.3. Dispatch Planning (e.g., MEL, Alternate Airports, ETOPS). Appropriate provisions for MELs and CDLs should be made as necessary to address Category I and II operations. Dispatch procedures to ensure appropriate weather, field condition, facility status, NOTAM information, engine-out MAP performance, crew qualification, aircraft system status, and fuel planning pertinent to Category I and II should be implemented. For ETOPS operations, a satisfactory method to address item 8.10 above should be demonstrated.

10.4. Formulation of Operations Specification Requirements (e.g., RVR limits, DA(H) or MDA(H), equipment requirements, field lengths). Proposed OpSpecs should list pertinent approved airports/runways, RVR limits, required transmissometers, DA(H) use provisions, "Inner Marker based DH" provisions (if applicable), aircraft equipment provisions for "normal" and, if applicable, "engine-out" operations, landing field length provisions, and any other special requirements identified by the CHDO or AFS-400 (ETOPS Category II, etc.). The operator's manuals, procedures, checklists, QRHs, MELs, dispatch procedures etc. must be shown to be consistent with the proposed OpSpecs.

10.5. Operational/Airworthiness Demonstrations. Appropriate "aircraft system suitability" and "operational use suitability" demonstrations must be completed as described in 10.5.1 and 10.5.2, unless otherwise specified by AFS-400. The purpose of these operational demonstrations is to determine or validate the use and effectiveness of the applicable aircraft flight guidance systems, training, flightcrew procedures, maintenance program, and manuals applicable to the program being approved. Operators of aircraft having FAA approved AFMs referencing this AC as the criteria used as the basis for Category I or II airworthiness demonstration already are considered to meet provisions of 10.5.1, and typically need only address provisions of 10.5.2. for verification of operational use suitability.

10.5.1. Aircraft System Suitability Demonstration. FAA regulations addressing low visibility takeoff and landing requirements and Category I and II are primarily operating rules addressed by parts 61, 91, 97, 121, 125, and 135. These provisions apply continuously, as defined at the time of a particular operation. Airworthiness rules (part 23, 25, etc.) primarily apply at the time a "certification basis" is established for TC or STC and do not necessarily reflect "present" requirements, except through issuance of ADs. Accordingly, operationally acceptable demonstrations addressing suitability of aircraft systems for Category II, as applicable, must be successfully completed initially, and acceptable system status must be maintained by an operator to reflect compliance with current operating rules, to initially operate or continue to operate to Category II minima.

a. To minimize the need for repeating initial aircraft system operational suitability demonstrations for each operator, aircraft system suitability is usually demonstrated in conjunction with airworthiness approval (TC or STC) of aircraft system components such as flight guidance systems, autoland, flight directors, HUDs, flight instrument and alerting systems, radio altimeters, inertial systems, and air data systems. This approach to determination of aircraft system suitability is taken to optimize use of analysis and flight demonstration resources for Operators, aircraft manufacturers, avionics manufacturers, and FAA. Accordingly, aircraft system suitability is normally demonstrated through an initial airworthiness demonstration meeting applicable provisions of appendices to this AC (or combined airworthiness/operational evaluation for new systems or concepts, or where otherwise necessary).

b. However, if such a demonstration has not been conducted during airworthiness certification, or the AFM accordingly does not reflect completion of such a Category II demonstration, then the operator may propose and the FAA may approve an assessment and demonstration program by the operator to establish Category II capability of an aircraft or flight guidance system. In such instances, criteria of Appendix 2 may be used as a guideline to formulate the operators assessment and demonstration program. For such a program, the numbers of approaches conducted by the operator and the data collected to establish suitable performance and reliability should be equivalent to that which otherwise would be provided by an airworthiness demonstration IAW Appendix 2.

c. Airworthiness demonstration to an acceptable earlier version of AC 120-29, or equivalent criteria, may continue to be used for demonstration of aircraft aircraft systems initially type certificated prior to issuance of this revision and having the earlier criteria as the type certification basis. However, previously demonstrated aircraft or aircraft systems seeking Category I or Category II credits specified only in provisions of this revised AC 120-29A (e.g., for HUD, or GNSS credit) must meet criteria specified in this AC.

d. Acceptable results of such airworthiness evaluations are usually described in AFM Section 3 (Normal and Non-Normal Procedures) of the FAA approved AFM or AFM Supplement.

e. For ILS approaches, basic type certification of an aircraft for "IFR" is considered to satisfactorily demonstrate Category I. For other systems or sensors, (HUD, GNSS etc.), other demonstrations per the appendices of AC 120-29A may be requested for Category I. CHDOs should ensure that aircraft proposed for Category II have completed an appropriate aircraft system operational suitability demonstration, and that result should normally be reflected in the approved AFM or AFM Supplement, unless operationally demonstrated as described above, or as otherwise specified by AFS-400.

f. For aircraft certified by FAA through section 21.29, certain Non-U.S. manufactured aircraft, any AFM provisions applicable to Category I may be assessed for suitability for an operators' programs by AFM or equivalent Flight Operations Manual review. Assessment of provisions for Category II may vary and may require coordination between the CMO and AFS-400. In certain instances, AFM provisions may not be consistent with U.S. policy (Order 8400.10 or rules (Op-Specs)) applicable to Category II. In such instances, CHDO coordination with AFS-400 is appropriate to provide appropriate guidance to Operators regarding applicability of various AFM provisions (e.g., DH and RVR limitations, acceptable NAVAID use, alerting system use, required versus recommended crew procedures). As a general guideline, AFMs meeting airworthiness standards recognized by or harmonized with the FAA (e.g., JAA, Canada - DOT etc.) may typically be accepted without further demonstration.

g. In the event of consideration of an AFM of an aircraft certificated by a Non-U.S. airworthiness authority other than as described above, or for additional credit for existing systems based on uncertain foreign AFM provisions, operational assessments IAW criteria in this AC, or equivalent criteria, may be necessary. In such instances, the applicable AEG or AFS-400 should be consulted. If necessary, AFS-400 may specify suitable criteria to apply.

10.5.2. "Operator Use Suitability" Demonstration. For Category I, unless a CHDO otherwise specifies that approach demonstrations are necessary due to unusual circumstances or special situations, or as noted in 10.5.3 below for special systems such as "Autoland," Operators may conduct Category I operations without need for special demonstrations, if the aircraft type AFM does not preclude the intended operation.

a. For Category II, at least one hundred (100) successful landings should be accomplished in line operations using the Category II or Category III system installed in each aircraft type, unless fewer approaches are determined to be appropriate by the CHDO. Examples of situations where fewer approaches than 100 may be authorized by the CHDO include credit for an operator also experienced in Category II or III operations, addition of a different or new aircraft type for an operator when that aircraft type already has successful Category II or III experience with a similar operator, or where the CHDO has consulted with AFS-400 and AFS-400 has determined that fewer approaches may apply (e.g., certain long range aircraft using Category III procedures and training, but with interim limitations to use Category II minima).

b. Regardless of credit permitted by the CHDO, if an operator is not aware of current Category II operations at a particular runway by some other operator and similar aircraft type, it is a good practice for the operator to have conducted at least one approach using the Category II or III system to each runway intended for Category II operations in weather better than that requiring use of Category II minima. Such demonstrations may be conducted in line operations, during training flights, or during aircraft type or route proving runs.

c. If an excessive number of failures (e.g., unsatisfactory landings, system disconnects) occur during the landing demonstration program, a determination should be made for the need for additional demonstration landings, or for consideration of other remedial action (e.g., procedures adjustment, wind constraints, system modifications).

d. The system should demonstrate reliability and performance in line operations consistent with the operational concepts specified in paragraph 4. In unique situations where the completion of 100 successful landings could take an unreasonably long period of time due to factors such as a small number of aircraft in the fleet, limited opportunity to use runways having appropriate procedures, and equivalent reliability assurance can be achieved, a reduction in the required number of landings may be considered on a case-by-case basis. Reduction of the number of landings to be demonstrated requires a justification for the reduction, and prior approval fromAFS-400.

e. Landing demonstrations should be accomplished on U.S. facilities or international facilities acceptable to FAA. However, at the operator's option, demonstrations may be made on other runways and facilities if sufficient information is collected to determine the cause of any unsatisfactory performance (e.g., critical area was not protected). No more than 50 percent of the demonstrations may be made on such facilities.

f. If an operator has different models of the same type of aircraft utilizing the same basic flight control and display systems, or different basic flight control and display systems on the same type of aircraft, the operator should show that the various models have satisfactory performance, but the operator need not conduct a full operational demonstration for each model or variant.

10.5.2.1. Data Collection For Airborne System Demonstrations. Each applicant should develop a data collection method to record approach and landing performance (e.g., a form to be used by flightcrew). The resulting data and a summary of the demonstration data should be made available to the CHDO for evaluation. The data should, at a minimum, include the following information:

a. Information regarding the inability to initiate an approach or identify deficiencies related to airborne equipment.

b. Information regarding abandoned approaches, stating the reasons the approach was abandoned and the altitude above the runway at which the approach was discontinued or the automatic landing system was disengaged.

c. Information regarding any system abnormalities which required manual intervention by the pilot to ensure a safe touchdown or touchdown and rollout, as appropriate.

10.5.2.2. Data Analysis. Unsatisfactory approaches using facilities approved for Category II or Category III where landing system signal protection was provided should be fully documented. The following factors should be considered:

a. ATS Factors. ATS factors that result in unsuccessful approaches should be reported. Examples include situations in which a flight is vectored too close to the final approach fix/point for adequate localizer and glide slope capture, lack of protection of ILS critical areas, or ATS requests for the flight to discontinue the approach.

b. Faulty NAVAID Signals. NAVAID (e.g., ILS localizer) irregularities, such as those caused by other aircraft taxiing, over-flying the NAVAID (antenna), or where a pattern of such faulty performance can be established should be reported.

c. Other Factors. Any other specific factors affecting the success of Category II operations that are clearly discernible to the flightcrew should be reported. An evaluation of reports discussed in subparagraphs 10.5.2.1(1), (2), and (3) will be made to determine system suitability for further Category II operations.

10.5.3. Use of Autoland or Head up Guidance at U.S. Type I Facilities or Equivalent (e.g., Type I ILS). For Category I, unless a CHDO otherwise specifies that autoland or HGS may not be used due to unusual circumstances or special situations, systems such as "Autoland" or "HGS" may typically be used at runways with facilities other than those with published Category II or III instrument approach procedures. This is to aid pilots in achieving stabilized approaches and reliable touchdown performance to improve landing safety in adverse weather; for Category II or III training; to exercise the airborne system to ensure suitable performance; for maintenance checks; or for other such reasons. Use of this capability may be particularly important for: pilot workload relief in stressful conditions of fatigue after long international flights; night approaches; cross winds or turbulence; when there may be other aircraft non-normal conditions being addressed; or to aid safe landing performance in otherwise adverse weather, restricted visibility, or with cluttered runways. This is true even though reported visibility may be well above minima (e.g., heavy rain distorting view out the windshield, snow covered runways where markings are not easily visible).

a. Operators may conduct autoland or HGS operations at such facilities without need for special demonstrations, if the aircraft type AFM does not preclude the intended operation, and if for "Autoland" systems, Operations Specification Paragraph C061 is issued. Precautions to be taken for such operations include the following:

(1) The runway and associated instrument procedure should have no outstanding NOTAMs or other applicable "Notes" concerning the procedure precluding the use of the autoland or HGS system (e.g., it should not have notes such as "Localizer unusable inside the threshold," or "Glide Slope unusable below xxx ft."),

(2) Suitable ILS "Critical Area protection" (or equivalent) should be requested from ATS, if applicable. Similar to precautions for a Category II or III procedure, the crew should remain alert to detect any evidence of unsuitable system performance, whether or not critical protection is being provided,

(3) The published ILS glide slope threshold crossing height (or equivalent) should be at least equal to or greater than that required for the aircraft type, and

(4) The particular runway or procedure should not be precluded for "Autoland or HGS operations" by the operator due to known performance anomalies (e.g., not on a list of runways ineligible for or precluded from autoland or HGS operations as determined by that operator).

b. For minima credit for "Category II on Type I facilities," airborne systems including autoland or HGS are assessed for each particular aircraft type and specific runway, IAW 10.5.2 above.

10.6. Eligible Airports and Runways. For Category I, Airports and Runways are eligible as specified in part 97 SIAPs, ICAO accepted international procedures at foreign airports, or special procedures in OpSpecs. For Category II, an assessment of eligible airports, runways, and aircraft systems must be made in order to list appropriate runways on OpSpecs. For Category II, runways authorized for particular aircraft IAW existing operations listed on the AFS-400 Category II status checklist may be directly incorporated in OpSpecs, or incorporated by reference if published part 97 SIAPS are available. Aircraft type/runway combinations not shown should be verified by aircraft system use in line operations at Category I or better minima, prior to authorization for Category II. Airports/aircraft types restricted due to special conditions (e.g., irregular underlying terrain) must be evaluated IAW Appendix 8, prior to OpSpec authorization.

a. If applicable, the operator should identify any necessary provisions for periodic demonstration of the aircraft system on runways other than those having Category II or III procedures (e.g., periodic autoland performance verification, using runways served only by a Category I procedure).

b. A status checklist for facilities that have special Category I and II provisions and published Category II or III procedures can be viewed on the Internet using the following address:

FAA Category II/ III Status List -- http://www.faa.gov/avr/afs/

c. To access this list, scroll down to the Organizations/Other Links menu and select AFS-410, Flight Operations Branch, then scroll down to the Category II/III Status List.

10.7. Irregular Pre-Threshold Terrain and Other Restricted Runways. Airports/runways with irregular pre-threshold terrain, or runways restricted due to NAVAID or facility characteristics (see FAA Category II Category III Status Checklist in Paragraph 10.6) may require special evaluation, or limitations. CHDOs of Operators desiring operations on these runways should contact AFS-400 to identify pertinent criteria and evaluation requirements. Various procedures used by FAA to assess irregular pre-threshold terrain are described in Appendix 8.

10.8. Category II Engine-Inoperative Operations and ETOPS or EROPS Alternates based on Category II.

a. Low visibility landing minima are typically based on normal operations. For non-normal operations, flightcrews and aircraft dispatchers are expected to take the safest course of action to resolve the non-normal condition. The low weather minima capability of the aircraft must be known and available to the flightcrew and, if applicable, aircraft dispatcher.

b. In certain instances, sufficient airborne system redundancy may be included in the aircraft design to permit use of an alternate configuration such as "engine inoperative capability" for alternate planning or initiation of a Category II approach. Use of an engine inoperative configuration is based on the premise that the engine non-normal condition is an engine failure that has not adversely affected other airborne systems. Systems that should be considered include systems such as hydraulic systems, electrical systems, or other relevant systems for Category II that are necessary to establish the appropriate flight guidance configuration.

c. An alternate engine inoperative configuration is also based on the premise that catastrophic engine failure has not occurred which may have caused uncertain, or unsafe collateral damage to the airframe or aerodynamic configuration.

d. In instances when AFM or operational criteria are not met, and a Category II approach is necessary because it is the safest course of action, (e.g., in-flight fire), the flightcrew may use emergency authority. The flightcrew should determine to the extent necessary the state of the aircraft and other diversion options to ensure that an approach in weather conditions less than Category I is the safest course of action.

e. Four cases are useful in considering engine inoperative Category II capability, and engine inoperative approach authorization:

(1) Flight planning (e.g., dispatch consideration of takeoff, destination, or ETOPS or EROPS alternates) is based on aircraft configuration, reliability, and capability for "engine inoperative Category II" (see Paragraph 10.8.2).

(2) An engine fails en route, but prior to final approach (see Paragraph 10.8.3).

(3) An engine fails during the approach after passing the final approach fix, but prior to reaching the Decision Altitude (Height) (see Paragraph 10.8.4).

(4) An engine fails during approach after passing the Decision Altitude(Height) (see Paragraph 10.8.5).

f. Paragraph 5.17 provides criteria for demonstration of Category II engine out capability for the aircraft. Paragraphs 10.8.1 through 10.8.5 below address criteria for use of an aircraft with "engine inoperative Category II" capability.

10.8.1. General Criteria for Engine-Inoperative Category II Authorization. Aircraft capability for "engine-inoperative Category II" should be approved IAW the provisions of paragraph 5.17, and if applicable, Appendix 2.

a. Regardless of whether an operator is or is not operationally authorized for "engine inoperative Category II," it must be clear that having this aircraft capability should not be interpreted as requiring a Category II landing at the "nearest suitable" airport in time (e.g., does not require landing at the nearest suitable Category II qualified airport - 14 CFR section 121.565).

b. POIs should ensure that the following conditions are met:

(1) Operations must be IAW the "engine inoperative Category II" AFM provisions (e.g., within demonstrated wind limits, using appropriate crew procedures), or within operationally determined equivalent provisions and procedures, if not specified in the AFM.

(2) Demonstrated/acceptable configurations must be used (e.g., AFDS modes, flap settings, electrical power sources, MEL provisions).

(3) Engine-inoperative missed approach obstacle clearance from the TDZ must be ensured. Suitable information should be readily available for flight planning (e.g., to the pilot or aircraft dispatcher, if applicable).

(4) Appropriate training program provisions for the Category II engine inoperative approaches must be provided (see paragraph 7.2.6).

(5) Pilots must be aware that they are expected to take the safest course of action, in their judgment, in the event that unforeseen circumstances or unusual conditions occur that are not addressed by the "engine-inoperative" Category II demonstrated configuration (e.g., uncertain aircraft damage, possible fire, weather deterioration).

(6) OpSpecs should identify the type of "engine-inoperative" Category II operations authorized. Types of operations are described in paragraphs 10.8.2 through 10.8.5 below.

10.8.2. Category II Engine Inoperative "Flight Planning."

a. The operator (e.g., pilot or if applicable, aircraft dispatcher) may consider "engine inoperative Category II" capability in planning flights for a takeoff alternate, en route (ETOPS or EROPS) alternate, re-dispatch alternate, destination, or destination alternate only if each of the following conditions are met:

(1) The operator (e.g., pilot or aircraft dispatcher, if applicable) has determined that the aircraft is capable of engine inoperative Category II.

(2) Appropriate procedures, performance, and obstacle clearance information must be provided to the crew to be able to safely accomplish an engine inoperative missed approach at any point in the approach. If applicable, similar information must also be readily available to the aircraft dispatcher.

(3) Appropriate operational weather constraints must be considered and specified as necessary regarding cross wind, head wind, tail wind limits considering the demonstrated capability specified in the AFM, or equivalent operationally demonstrated or specified provisions.

(4) Weather reports or forecast must indicate that specified alternate minimums or landing minimums will be available for the runway equipped with appropriate NAVAID and lighting systems and Category II procedures. The Operators use of engine inoperative capability credit should consider both the availability and reliability of meteorological reports and forecasts, the time factors involved in potential forecast accuracy, the potential for variability in the weather at each pertinent airport, and the ability for the crew and, if applicable, aircraft dispatcher to obtain timely weather reports and forecast updates during the time the flight is en route. Flight planning considerations must account for any expected ATS delays that might be experienced during arrival due to weather, snow removal, or other factors.

(5) Notices to airmen or equivalent information for airport and facility status should be reviewed to ensure that they do not preclude the accomplishment of a safe engine inoperative approach on the designated runway using approved Category II procedures (e.g., temporary obstructions). Any change in NOTAM status of facilities related to use of landing minima or alternate minima must be provided to the crew in a timely manner while en route.

(6) If the engine inoperative configuration is different than a normal landing configuration, a means to determine that a safe landing distance is achievable should be addressed, considering the pertinent engine inoperative aircraft configuration. This assessment is to ensure that sufficient runway is available consistent with the expected flap setting(s), speeds, and reverse thrust available configuration, or other factors that could pertain to an inoperative engine landing (e.g., reduced flap settings may be necessary for an engine inoperative approach).

(7) The expectation for runway surface condition based on pilot and operator (e.g., aircraft dispatcher) interpretation of the available weather reports, field conditions, and forecasts is that the applicable runway is likely to be free from standing water, snow, slush, ice, or other contaminants at the time of landing. The flightcrew must be advised of any adverse change in this expectation while en route.

(8) Criteria otherwise applicable to "all engine" Category II, such as flightcrew or dispatcher training, crew qualification, and availability of suitable procedures must also be addressed for the engine inoperative landing case, if they are not the same as for the "all engine" case.

(9) The operator is approved for operations based on engine inoperative Category II capability. In addition, operator responsibilities for engine inoperative credit should be equivalent to that of current normal operations when an en route landing system failure causes degraded landing capability. If an in-flight failure causes further degradation of engine inoperative landing capability, the flightcrew (if applicable, in conjunction with the aircraft dispatcher) should determine an acceptable alternative course of action (e.g., specification of different en route diversion options, revised fuel reserves plan, or revised flight plan routing).

(10) When engine inoperative Category II provisions are applied to identification of any destination or destination alternate, more than one qualifying destination alternate is required. This is to provide for the possibility of adverse area wide weather phenomena, or unexpected loss of landing capability at the first designated alternate airport.

(11) An appropriate ceiling and visibility increment is added to the lowest authorized minimums when credit for an alternate airport or airports is sought (e.g., 200 ft. DA(H) additive and appropriate RVR additive; see Appendix 7, Standard Operations Specification).

(12) The airborne system should be shown through "in-service" performance that from takeoff to 500 ft. HAT on approach, system availability is at least 95%.

b. It should be noted that even if the aircraft, flightcrews, and operator are authorized for engine inoperative Category II, flightcrews are not required to use Category II approach minima to satisfy requirements of section 121.565 regarding in-flight diversions. Not withstanding section 121.565, pilots may elect to take a safe course of action by landing at a more distant airport than one at which a Category II approach may be available. Conversely, pilots may elect to conduct the Category II approach as a safe or the safest course of action.

10.8.3. Category II Engine Inoperative En Route. For engine failure en route, a pilot may initiate an "engine inoperative" Category II approach under the following conditions:

a. The airplane flight manual normal or non-normal sections, or an equivalent provision of an Operators manual specifies that engine inoperative approach capability has been demonstrated and procedures are available.

b. The pilot and, if applicable, aircraft dispatcher have taken into account the landing runway length needed for the inoperative engine configuration and corresponding approach speeds, and obstacle clearance can be maintained in the event of a missed approach.

c. The pilot and, if applicable, aircraft dispatcher have determined that the approach can be conducted within the wind, weather, configuration, or other relevant constraints demonstrated for the configuration.

d. The pilot and, if applicable, aircraft dispatcher have determined from interpretation of the best available information that the runway is expected to be free from standing water, snow, slush, ice, or other contaminants.

e. The pilot is confident that the aircraft has not experienced damage related to the engine failure that would make an engine inoperative Category II approach unsuccessful or unsafe.

f. The operator is approved and the pilot is qualified to conduct a Category II engine inoperative approach.

g. The pilot and, if applicable, aircraft dispatcher consider that conducting a Category II approach is a safe and appropriate course of action.

10.8.4. Category II Engine Failure During Approach, Prior to Decision Altitude (Height) (DA(H)).

a. If the aircraft, operator, and crew meet paragraphs 5.17 for the aircraft and paragraphs 10.8.2 or 10.8.3 for operational use, a Category II approach may be continued if an engine failure is experienced after passing the final approach fix.

b. In the event that an aircraft has not been demonstrated for engine inoperative Category II approach capability, or the operator or crew have not been authorized for Category II engine inoperative approaches, then, regardless of flight phase, continuation of an approach in the event of an engine failure is permitted only IAW the emergency authority of the pilot to select the safest course of action.

NOTE: For some aircraft configurations, it may be necessary to discontinue the approach after passing the final approach fix or final approach point, re-trim the aircraft for an inoperative engine, and then re-initiate the approach in order to be able to appropriately complete a satisfactory Category II approach and landing.

10.8.5. Category II Engine Failure After Passing Decision Altitude (Height) (DA(H)). If an engine fails after passing the DA(H), the procedure specified in the airplane flight manual or a procedure specified by the operator in the operator's manual for normal or non-normal operations should be followed. Any Category II approval must consider the case of engine failure at, or after, DA(H). Standard OpSpecs are considered to address this case. "Engine inoperative Category II capability" is not specifically a factor in determining response to this situation.

10.8.6. Operators using Combined Category II and Category III Engine-Inoperative Approach Provisions. Unless otherwise specified by FAA, Category II and Category III engine inoperative authorizations and procedures may combined when the operator meets the more stringent criteria of AC120-28D for Category III. Separate demonstrations for AC 120-29A and AC 120-28D is not necessary beyond any inherent differences between Category II and III operations (e.g., application of a DA(H) for Category II versus an Alert Height for certain Category III operations). Operational suitability demonstration programs, qualification programs, and operational provisions may be simultaneously established and used as long as procedures and systems applicable to the respective Category II and Category III capability and minima are appropriately applied. Eligible minima for any particular engine-inoperative operation should be no lower than the highest applicable authorized minima for the aircraft, crew, airport, procedure, or applicable OpSpecs limitation.

10.9. New Category II Operators.

a. New Operators should follow demonstration period provisions of 10.5.2. Additionally, typical acceptable minima step down provisions approvable by FAA are as follows:

(1) Starting from "limited Category I" (e.g., 300 ft. DA(H) and 3/4 mile visibility) to lowest Category I minima (e.g., 200 ft. DA(H) and RVR 1800): First 250 ft. DA(H) and RVR3000, and then DA(H) 200 ft. and RVR 1800.

(2) Starting from Category I to Category II: First DH 100/RVR1600, then DH 100 and RVR 1200.

(3) Starting from Category I for Category III. See AC120-28D.

b. Each runway procedure not already being used by any operator of a similar type aircraft should be successfully demonstrated by a line service or an evaluation approach using the Category II system and procedures, in Category I or better conditions, for each applicable aircraft/system type (e.g., B767, L1011). In addition, the operator must address special airports/runways as noted in the FAA Category II/III Status List.

10.10. Experienced Category II or Category III Operators for New Category II Authorizations.

a. Experienced operators are considered to be those operators having successfully completed their initial 6 month / 100 Category II or III approach or landing demonstration period, and have current OpSpecs authorizing use of lowest applicable or intended Category II minima.

b. Paragraphs 10.10.1 through 10.10.3 below address examples of program changes where "experienced operator" credit may apply.

c. Operators authorized for Category II using one class of system (e.g., autopilot) but who are introducing a significantly different class of system as the basis for a Category II authorization (e.g., manually flown Category II approaches using a HUD) are typically considered to be "New Operators" for the purposes of demonstration period provisions and acceptable minima "step down" provisions for that class of system (see paragraph 10.9).

10.10.1 Category I or II at New Airports/Runways. For ILS or MLS, Category I or II operations may be conducted at facilities with a published part 97 SIAP, or equivalent, or with a "Special" instrument approach procedure typically without additional demonstration. For GLS, Category I operations may be conducted at facilities with a published part 97 SIAP, or with a "Special" instrument approach procedure or equivalent for the particular operator(s) authorized to use the "special" procedure typically without additional demonstration. For other NAVAID systems or operator combinations (e.g., initial GLS Category II, other Operators desiring to use a special instrument procedure developed by a different operator, TLS) demonstration of capability at new airport/runway is typically appropriate as determined by the CHDO. However, standard or special procedures for Category II other than those based on ILS or MLS may be added to an experienced Category II operator's OpSpecs for a similar procedure without further demonstration if the same or equivalent aircraft/aircraft system and procedure for the approach is already used by that operator or is shown on the FAA's Category II status checklist as being conducted at that facility by another operator with similar aircraft or airborne system (e.g., acceptable HUD, GNSS operations). Otherwise, the operator may be requested by the CHDO to accomplish one or more line service landings at Category I or better minima to ensure satisfactory performance before authorizing Category II minima. Special runways on the FAA Category II status checklist (e.g., Irregular Terrain runways) typically require special evaluation for each aircraft or system type (See Paragraph 10.7).

10.10.2. Category II With New Aircraft Systems. Unless otherwise specified by AFS-400, experienced Category II Operators may initially use new or upgraded aircraft system capabilities/components to the lowest authorized minima established for those systems or components, or use reduced length demonstration periods, consistent with the new aircraft systems to be used, FAA FSB requirements, and NAVAIDs, runways, and procedures to be used (e.g., New Category II HUD installations on B737-300s previously authorized for Category II for that operator based on autoland)

10.10.3. Adding a New Category II Aircraft Type. Experienced Category II Operators may operate new or upgraded aircraft types/systems, or derivative types, using reduced length demonstration periods (e.g., less than 6 months/100 landings) when authorized by AFS-400. Demonstration requirements are established considering any applicable FAA FSB criteria, applicability of previous operator service experience, experience with that aircraft type by other operators, experience of crews of that operator for Category II and the type of system, and other such factors, on an individual basis. Appropriate minima reduction steps may also be established for an abbreviated demonstration period, consistent with prior operator experience, NAVAIDs, and runways used, and procedures to be used, etc. (e.g., Newly acquired B757s being added to Category II OpSpecs, in addition to an operator's currently approved Category II A300 and MD-80 fleets).

10.11. Category II Program Status Following Operator Acquisitions/Mergers. Category II Operators involved in acquisitions of other Operators, or mergers, and their respective CHDOs, must ensure compatibility of programs, procedures, aircraft systems, runways served, and any other relevant issues before amending OpSpecs, or advising the surviving or controlling operator of the status of Category II OpSpecs of the acquired or merged operator. If CHDO doubt exists regarding applicability or status of Category II OpSpec provisions for a resulting new, surviving, acquired, or merged carrier, AFS-400 should be consulted.

10.12. Initiating Combined Category I and II, or Category I, II, and III Programs for New Equipment Types. When appropriate provisions of this AC are used for Category I and II programs for a new equipment type (e.g., HUD), those programs may be initiated simultaneously for either a new Category II or Category II/III operator, or for an existing operator currently approved for Category II or III using other systems (e.g., ILS/FD).

10.13. U.S. Carrier Category I and II Operations at Foreign Airports. An applicant having U.S. Category I approval may be authorized to use that minima at foreign airports IAW its OpSpecs and Order 8260.31.

a. Once approved, the operator must comply with both FAA and local requirements. The operator must also ensure current status information for NOTAMs are available and advise its CHDO of incompatible requirements (use of OCA (H) etc.) for resolution by CHDO or AFS-400.

b. Although it is recognized that the systems at foreign airports may not be exactly IAW U.S. standards, it is important that any foreign facilities used for Category II provide the necessary information or functions consistent with the intent of the U.S. standards. Carriers desiring Category II approvals at foreign airports or runways not on the FAA-approved list should submit such requests through its FAA principal operations inspector to AFS-400.

c. Figure 10.13-1 provides a checklist for carrier use to facilitate approval of Category II/III operations at facilities listed in the controlling states Aeronautical Information Publication (AIP). It should be used to ensure suitability of the intended facility and to verify conformance or equivalence with U.S. standards at non-U.S. airports. Completion of this checklist must reflect achieved or completed status - not planned actions. For ICAO states that do not maintain an AIP, a copy of the NOTAM, obstruction data, and/or a reliable and regular method of correspondence with the charting services used by U.S. certificate holders must be attached.

Figure 10.13 - 1

FACILITY CHECKLIST FOR CATEGORY II/III
(FOR NON-US FACILITIES)

AIRPORT (ICAO ID): _______ COUNTRY: __________ DATE: __________

Runway: _______ Length: ________ Width: ________ G/S Angle (deg.): __________

Lowest Minima ____________________ (ft/m) Runway TCH ___________ (ft/m)

Special Limitations (if any):

____.

LIGHTING:
Approach _____ TDZ _____ Centerline ____ HIRL ___ Stopbars _____

Other (e.g., PAPI):

____.

MARKINGS:
Runway_______ Taxiway______ Other (e.g., Taxiway Position) _________________

Critical Area Protection Policy (ceiling/visibility or conditions):
LOC __________________________ G/S _______________________________

METEROLOGICAL DATA: METARs _______ TAFs _________
TRANSMISSOMETERS:

(Locations/Lowest RVR reported /readout step increment)

Touchdown ______________ Mid ________________ Rollout _________________

OBSTRUCTION CLEARANCE ASSESSMENT COMPLETION DATE: ________________
Verified by: certificate holder ________, "state of the aerodrome" _________, other __________
Irregular terrain a factor (Y/N): _______ Similar type aircraft currently operate (Y/N) _________

NOTAM SOURCE/CONTACT: ____
FIELD CONDITIONS SOURCE/CONTACT ___________________________________

Attached procedure has been developed IAW:
FAA Handbook 8260.3B (TERPS) ___ ICAO PANS-OPS Doc. 8168-OPS/611, Vol-11 ___
Other Criteria Accepted by FAA ____ (indicate criteria) ___________________________

Facility reviewed IAW ICAO Manual of All Weather Operations, as revised
(DOC 9365/AN910) Chapters 3, 5, and 6 DATE REVIEW COMPLETED: ________________

Name: ___________________________
Title: ___________________________
Signature: ___________________________
Date: ___________________________

Attachments List:

10.14. Category I and II Operations on Off-Route Charters.

a. Unless otherwise specified by AFS-400, experienced Category I operations using non-traditional systems (HUD, GNSS etc.) and Category II operators may receive authorization to use Category I and II minima at U.S. off-route charter airports and runways as follows:

(1) The runway has a published part 97 SIAP, or equivalent, or

(2) The runway must be on the FAA Category II status checklist, and not require special evaluation, or

(3) The aircraft used must be the same as or equivalent to an aircraft already using the facility by other U.S. operators (e.g., an off route charter with a B737/GNSS) could operate to runways having Category I and II operations by an other operator's B737-300 using same or equivalent system).

b. The OpSpec must authorize off-route charter Category I or II procedures, and

c. If applicable, the CHDO must be advised of the specific airports, aircraft, crew qualifications and any special provisions to be used, prior to the intended operation.

10.15. Approval of Category I and II Minima.

a. Applicants should submit documentation requesting approval to the FAA CHDO or FSDO responsible for that operator's certificate. The application should demonstrate compliance with the appropriate provisions of applicable paragraphs of this AC, particularly Paragraphs 7 through 12. Proposed OpSpecs provisions should be included with the application.

b. Following FAA concurrence, as described in paragraph 10 above, OpSpecs authorizing Category I or II minima may be issued (see Appendix 7 for sample OpSpecs).

c. During the period following the issuance of new or revised OpSpecs for Category II (typically 6 months), the operator must successfully complete a suitable operations demonstration and data collection program in "line service" for each type aircraft, as the final part of the approval process.

d. The approval process is considered to be completed following a successful demonstration period. This is to ensure appropriate performance and reliability of the operator's aircraft, procedures, maintenance, airports, and NAVAIDs. This process must be completed before operations down to lowest requested minima are authorized. Paragraph 10.5 addresses appropriate demonstration process criteria.

e. When the data from the operational demonstration has been analyzed and found acceptable, an applicant may be authorized for the lowest requested minima consistent with this AC and applicable standard OpSpecs. Examples of minima step down provisions acceptable to FAA are provided at paragraphs 10.9 and 10.10.

10.16. Operations Specification Amendments. The operator is responsible for maintaining current OpSpecs reflecting current approvals authorized by FAA. Once FAA has authorized a change for aircraft systems, new runways, or other authorizations, appropriate and timely amendments to affected OpSpecs should be issued. Issuance of amendments to guidance or procedures in other related material such as the Flight Operations Manual or Training Program may also be required. When updated standard OpSpecs provisions are adopted by FAA, provisions of those updated OpSpecs should normally be applied to each operator's program in a timely manner.

10.17. Use of Special Obstacle Clearance Criteria (e.g., MASPS, or non-standard RNP Criteria). This paragraph addresses use of special criteria such as "Required Navigation Performance" (RNP) criteria. Pending implementation of RNP criteria for public use Standard Instrument Approach Procedures (SIAPS), obstacle assessments using RNP criteria will be conducted on a case-by-case basis, only authorized as an element of special procedures for RNP qualified operators, using RNP qualified aircraft. Early application of RNP for special procedures is typically intended to apply to instrument procedure segments classified as a transition to a final approach segment, or to facilitate definition of suitable missed approach segments. Use of special obstacle clearance criteria or non-standard RNP criteria must be approved by AFS-400.

10.18. Proof-of-Concept Requirements for New Systems/Methods.

a. Proof-of-Concept demonstration [PoC] as used in this AC is defined as a generic demonstration in a full operational environment of facilities, weather, crew complement, aircraft systems and any other relevant parameters necessary to show concept validity in terms of performance, system reliability, repeatability, and typical pilot response to failures as well as to demonstrate that an equivalent level of safety is provided.

b. Proof-of-Concept may be established by a combination of analysis, simulation and/or flight demonstrations in an operational environment. PoC is typically a combined effort of FAA airworthiness and operational organizations with the applicant, with input from any associated or interested organizations.

c. A typical PoC program consists of the following elements:

(1) Applicant submits a request to either FAA Aircraft Certification or Flight Standards.

(2) Meetings are arranged to include all disciplines involved: Aircraft certification; Flight Standards; National Resource Specialists; the applicant; and supporting personnel as necessary (e.g., Air Traffic).

(3) A test plan is established which includes input from applicable FAA organizations, the applicant, and as applicable, industry user groups.

(4) The test plan should include as a minimum: system definition, operations procedures, qualification, training, weather and environment definition, normal, rare-normal, and non-normal conditions to be assessed, flightcrew, test subject, and test crew requirements, test procedures, test safety constraints as applicable, assessment criteria, and analysis, simulator and test aircraft requirements.

(5) PoC is conducted using agreed subject pilots, as appropriate.

(6) PoC data is collected in a real-time simulator environment and validated in a realistic airplane environment.

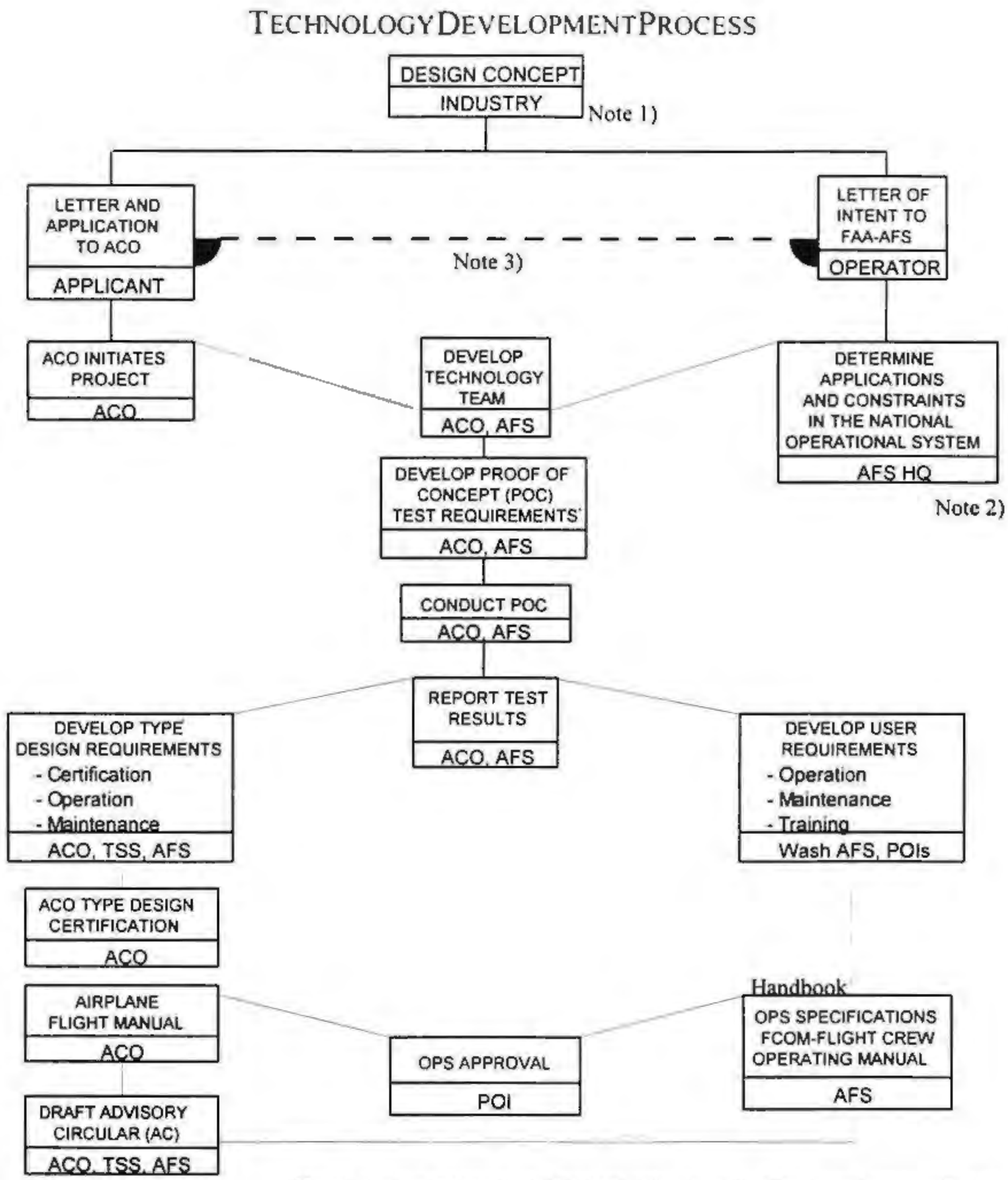
(7) FAA is responsible for assessing the PoC data that is typically provided to FAA as agreed by FAA and the applicant. FAA reports relevant findings to the applicant and if applicable, interested industry representatives.

(8) FAA operations and airworthiness organizations use the data to develop criteria for approval of type designs, certification processes and procedures, operating concepts, facilities, flightcrew and maintenance qualification, OpSpecs, operations procedures, manuals, AFMs, maintenance procedures, and any criteria necessary.

(9) FAA AC criteria for airworthiness and operational approval typically is a product of PoC assessment.

d. This process is presented pictorially in the following figure:

Figure 10.18-1



Note: 1) Futher modifications to the applicant's original Type Design may require additional technology revisions and/or follow on Proof of Concept testing.
2) The AFS group has the responsibility to coordinate with all Industry technology groups (ALPA, APA, ATA, Industry, manufactures, vendors, DOD, NASA, etc.)
3) Both the FAA ACO and FAA AFS should be contacted to provide certification and operational data to the respective offices.

Index: ACO - Aircraft Certification Office (Including Aircraft Evaluation Group)
AFS - Washington Flight Standards Policy Office
TSS - Transport Standards Staff

10.19. RNP Qualification and Authorization.

a. Operators may be authorized for RNP operations based on use of aircraft with an approved AFM specifying RNP capability. For such operations, in addition to AFM provisions, any provisions or constraints associated with that capability should be considered or applied (e.g., Aircraft or avionics manufacturer's guidance material, FCOM, or use assumptions made in associated documentation provided by the manufacturer to the operator or authority).

b. RNP authorizations for RNP-capable aircraft as specified through an AFM may be generic and related directly to use of the provisions of the AFM (e.g., authorization to use RNP addresses any applicable AFM RNP levels and flightcrew procedures).

c. Operators may be authorized for RNP operations based on "fleet qualification" specifying appropriate RNP capability. For such RNP operations, in addition to any necessary operator-specific aircraft type provisions, NAVAID use constraints, area, route, or procedure constraints, should be applied, as necessary.

d. RNP authorizations for fleet qualified RNP aircraft typically should address authorized RNP levels, types of procedures, any necessary NAVAID use provisions, or other conditions or constraints as appropriate.

e. Authorization for use of RNP is through OpSpecs.

f. For associated applicable provisions, also see AC paragraphs 4.4 and 4.5.

11. FOREIGN AIR CARRIER CATEGORY I WITH SYSTEMS OTHER THAN ILS OR CATEGORY II AT U.S. AIRPORTS (PART 129 OPERATIONS SPECIFICATIONS).

11.1. Use of ICAO or FAA Criteria. International operators requesting or authorized for Category II at U.S. airports should meet criteria of 11.1.1 through 11.1.3 below.

11.1.1. Acceptable Criteria.

a. Criteria acceptable for use for assessment of international operator's applications for Category II at U.S. airports includes this AC, equivalent JAA criteria, or the ICAO Manual of All Weather Operations DOC 9365/AN910.

b. International operators previously approved by FAA IAW earlier criteria may continue to apply that earlier criteria. International operators seeking credit for operations addressed only by this revision of AC 120-29A (e.g., Category II HUD operations) must meet criteria of this AC, or equivalent criteria acceptable to FAA, for those applicable provisions.

11.1.2. Foreign Operator AFM Provisions. Unless otherwise authorized by FAA, aircraft used by international operators for Category II within the United States should have AFM provisions reflecting an appropriate level of Category II capability as demonstrated to or authorized by FAA, or demonstrated to or authorized by an authority recognized by FAA as having acceptable equivalent Category II airworthiness criteria (e.g., European JAA, Canada MOT, UK CAA).

11.1.3. Foreign Operator Category II Demonstrations.

a. International (foreign) air carriers meeting FAA criteria, or criteria acceptable to FAA (e.g., European JAA, ICAO criteria including Doc 9365/AN910), and having more than six months experience in use of Category II operations with the applicable aircraft type may be approved for Category II IAW provisions of their own regulatory authority, or IAW standard provisions of part 129 OpSpecs, which ever is the more restrictive.

b. For international (foreign) operators not having the above experience, FAA will confer with the authority of the state of the operator and with the operator to jointly determine suitable provisions for a U.S. Category II authorization for that operator. International (foreign) air carriers not meeting above provisions may be subject to the demonstration requirements of 10.5.2 and 10.9 equivalent to those necessary for U.S. operators, as determined applicable by FAA.

11.2. Issuance of Part 129 Operations Specifications. International (foreign) air carriers operating to U.S. airports that meet applicable provisions above are approved for Category II through issuance of part 129 OpSpecs (see Appendix 7). Operators intending Category II operations at U.S.-designated irregular terrain airports, or airports otherwise requiring special assessments, must successfully complete those assessments prior to use of those facilities.

11.3. Use of Certain Restricted U.S. Facilities.

a. Foreign Operator Category I and II operations may be conducted at facilities not having published Category I and II SIAPS, or may be conducted to minima lower than published on part 97 Category I and II SIAPS if they meet criteria equivalent to that required of a U.S. part 121 carrier, and they are approved by FAA, and the operations are acceptable to the authority of the state of the operator. Similarly, operations may be authorized at other special facilities identified on the FAA Category II/III Status List.

b. For such authorizations the following applies:

(1) The foreign operator and the pertinent authority of the state of that operator must be advised of facility status,

(2) Operator must be approved by the state of the operator's Authority, and

(3) FAA must have evidence from that authority that the operator is specifically authorized at that U.S. facility. Foreign operators typically use Category II procedures in the United States which are available as unrestricted public use procedures. However, FAA may also authorize certain restricted public use procedures and special Category II approach procedures for non-U.S. Operators. Typically, these procedures require special airborne equipment capability, special training, or non-standard facility and obstacle assessments. These special procedures are identified on the Category II/III Status List and are not usually published as a part-97 Category II SIAP.

c. Foreign Operators may be eligible to use certain of these procedures if they meet the same special criteria as would apply to a U.S. operator and if they are approved by their own authority specifically for the use of the procedure. Some procedures may not be eligible for foreign use because of other applicable restrictions such as a restriction placed on private facility use. Special or restricted procedures require both FAA authorization and specific authorization from the state of the operator's controlling authority for each procedure. This is to ensure that both the operator and foreign authority are aware of the special provisions needed, and to ensure equivalent safety in the use of standard ICAO criteria.

d. Each foreign operator seeking Category II procedure authorization at a facility not published as a standard and unrestricted Category II SIAP, or at any other facilities identified as special or restricted on the FAA Category II/III Status List, and that operator's controlling authority must:

(1) Be aware of the restrictions applicable to the procedure (e.g., facility status),

(2) Provide evidence to FAA of the controlling authority's approval of the operator for each special procedure requested, and

(3) Must have the applicable limitations and conditions included in that operator's part 129 OpSpecs for each procedure to be used.

e. Foreign Operators shall not normally be authorized for special Category II operations to minima lower than those specified in part 97 Category II SIAPS consistent with ICAO criteria.

12. OPERATOR REPORTING, AND TAKING CORRECTIVE ACTIONS.

12.1. Operator Reporting. The reporting of satisfactory and unsatisfactory Category II aircraft performance is a useful tool in establishing and maintaining effective maintenance and operating policy and procedures. Additionally, when maintained over longer periods of time, the report data substantiates a successful program and can identify trends or recurring problems that may not be related to aircraft performance. Information obtained from reporting data and its analysis is useful in recommending and issuing appropriate corrective action(s).

a. Accordingly, for a period of at least 1 year after an applicant has been advised that its aircraft and program meet Category II requirements, and reduced minima are authorized, the operator is to provide a monthly summary to the FAA of the following information:

(1) The total number of approaches where the equipment constituting the airborne portion of the Category II system was used to make satisfactory (actual or simulated) approaches to the applicable Category II minima (by aircraft type).

(2) The total number of unsatisfactory approaches by airport and aircraft registration number with explanations in the following categories - airborne equipment faults, ground facility difficulties, aborts of approaches because of ATS instructions, or other reasons.

b. The operator should also notify the certificate-holding office as soon as possible of any system failures or abnormalities that require flightcrew intervention after passing 100 ft. during operations in weather conditions below Category I minima.

c. Upon request, the CHDO will make this information available to AFS-400 for overall Category II program management, or to assist in assessment of program or facility effectiveness.

NOTE: The reporting burden contained in this AC does not require office of management and budget approval under the provisions of the Paperwork Reduction Act of 1980, according to Section 3502(4)(a).

12.2. Operator Corrective Actions.

a. All Programs.

(1) Operators are expected to take appropriate corrective actions when they determine that aircraft, NAVAID, or airport difficulties require program or minima adjustment.

(2) At least the following factors should be considered: NAVAID status or performance problems, NOTAMs, airport facility status, air traffic procedure adjustments, lighting or marking system status, airport construction, adverse weather (snow banks, snow removal, icy runways or taxiways, deep snow in glide slope critical areas at non-U.S. airports, etc.), appropriate limitations or restrictions to minima necessary to ensure safe operations.

b. Category II.

(1) In addition to the corrective actions discussed above, for Category II the operations and maintenance manuals should address any corrections needed. Operators are expected to take appropriate corrective actions when they determine that conditions exist which could adversely affect safe Category II operations. Examples of situations for which an operator may need to take action restricting, limiting, or discontinuing Category II operations include: repeated aircraft system difficulties, repeated maintenance write-ups, chronic pilot reports of unacceptable landing performance, applicable service bulletin issuance, ADs, NAVAID status or performance problems, applicable NOTAMs, airport facility status change, air traffic procedure adjustment, lighting, marking, or standby power system status outages, airport construction, obstacle construction, temporary obstacles, natural disasters, adverse weather,

snow banks, snow removal, icy runways or taxiways, deep snow in glide slope critical areas, inability to confirm appropriate critical area protection at non-U.S. airports, and other such conditions.

(2) Examples of appropriate corrective action could be an adjustment of Category II programs, procedures, training, modification to aircraft, restriction of minima, limitations on winds, restriction of NAVAID facility use, adjustment of payload, service bulletin incorporation, or other such measures necessary to ensure safe operation

APPENDIX 1

DEFINITIONS AND ACRONYMS

This Appendix contains the definition of terms and acronyms used within this Advisory Circular (AC). The appendix also contains certain terms that are not used in this AC but are used in related ACs and are included for convenient reference. Certain definition of terms and acronyms are also provided to facilitate common use of this Appendix for other related ACs.

Some of the definitions and terminology used in this AC are used to describe new operational concepts and technology implementations. Other definitions, including primary and supplemental means of navigation, are evolving terms and are defined in different ways in various documents by the FAA and international aviation community. Although this AC provides a baseline of new definitions and terminology, these updates have not been harmonized throughout the FAA or with the international aviation community.

Definitions

Actual Navigation Performance	A measure of the current estimated navigation performance, excluding Flight Technical Error (FTE). Actual Navigation Performance is measured in terms of accuracy and integrity, and may be affected by the type and availability of navigation signals and equipment. Note: Also see Estimated Position Uncertainty (EPU).
Aeronautical Chart Critical Data	Data for Aeronautical charts determined IAW RTCA or ICAO Annex 4 criteria considered to have a very low probability of significant error and very high probability of validity (e.g., P_{error} per unit data element <1 X 10^{-8})
Aeronautical Chart Essential Data	Data for Aeronautical charts determined IAW RTCA or ICAO Annex 4 criteria considered to have a low probability of significant error and high probability of validity (e.g., P_{error} per unit data element <1 X 10^{-5})
Aeronautical Chart Routine Data	Data for Aeronautical charts determined IAW RTCA or ICAO Annex 4 criteria considered to have a routine possibility of significant error and routine validity (e.g., P_{error} per unit data element <1 X 10^{-3})
Approach Intercept Waypoint (APIWP)	A variable waypoint used when necessary to link a barometric LNAV/VNAV flight path with a Final Approach Segment (FAS) that is fixed in space (e.g., an xLS final segment). The APIWP permits LNAV and barometric VNAV segments, which may vary vertically in location on an approach as a function of barometric pressure setting or temperature variation from standard, to join or be connected to a FAS which is otherwise fixed in vertical location with respect to a runway.

Automatic Dependent Surveillance (ADS)	A surveillance technique in which aircraft automatically provide, via data link, data derived from on-board navigation and position fixing systems, including aircraft identification, four dimensional position and additional data as appropriate (ICAO - IS&RP Annex 6).
Alert Height	A height above the runway based on the characteristics of the aircraft and its fail-operational landing system, above which a Category III approach would be discontinued and a missed approach initiated if a failure occurred in one of the redundant parts of the fail operational landing system, or in the relevant ground equipment. (ICAO - IS&RP Annex 6).
Airborne Navigation System	The airborne equipment that senses and computes the aircraft position relative to the defined path and provides information to the displays and to the flight guidance system. It may include a number of receivers and/or system computers such as a Flight Management Computer and typically provides inputs to the Flight Guidance System.
Automatic Go-Around	A Go-Around which is accomplished by an autopilot following pilot selection and initiation of the "Go-Around" autopilot mode.
Availability	An expectation that systems or elements required for an operations will be available to perform their intended functions so that the operation will be accomplished as planned to an acceptable level of probability.
Balked Landing	A discontinued landing attempt. Term is often used in conjunction with aircraft configuration or performance assessment, as in "Balked landing climb gradient;" Also see "Rejected Landing."
Catastrophic Failure Condition	Failure condition which would result in multiple fatalities, usually with the loss of the airplane.
Category I (US)	An instrument approach or approach and landing with a decision altitude (height) or minimum descent altitude (height) not lower than 60m (200 ft) and with either a visibility not less than 1/2 statute mile (800m), or a runway visual range not less than 550m (1800 ft). (Adapted from ICAO - IS&RP Annex 6).
(ICAO)	A precision instrument approach and landing with a decision height not lower than 60m (200 ft) and with either a visibility not less than 800m (2400 ft), or a runway visual range not less than 550m (1800 ft). (Adapted from ICAO - IS&RP Annex 6).
Category II	An instrument approach or approach and landing with a decision height lower than 60m (200 ft) but not lower than 30m (100 ft) and a runway visual range not less than 350m (1200 ft). (Adapted from ICAO - IS&RP Annex 6).
Category III	An instrument approach or approach and landing with a decision height lower than 30m (100 ft), or no decision height, or a runway visual range less than 350m (1200 ft). (Adapted from ICAO - IS&RP Annex 6).
Category IIIa	An instrument approach and landing with a decision height lower than 30m (100 ft), or no decision height and a runway visual range not less than 200m (700 ft). (Adapted from ICAO - IS&RP Annex 6).
Category IIIb	An instrument approach and landing with a decision height lower than 15m (50 ft), or no decision height and a runway visual range less than 200m (700 ft) but not less than 50m (150 ft). (Adapted from ICAO - IS&RP Annex 6). FAA Note - the United States does not use Decision Heights for Category IIIb.

Category IIIc	An instrument approach and landing with or without a decision height, with a runway visual range less than 50m (150 ft). (Adapted from ICAO - IS&RP Annex 6).
Certificate Holding District Office (CHDO)	That FAA Flight Standards District Office (FSDO), Certificate Management Office (CMO), or Certificate Management Unit (CMU) assigned by FAA to have operating certificate oversight responsibility for a particular operator.
Class I Navigation	Navigation within the service volume of an ICAO Standard NAVAID.
Class II Navigation	A flight operation or portion of a flight operation (irrespective of the means of navigation) which takes place outside (beyond) the designated Operational Service Volume of an ICAO standard airway navigation facility or NAVAID (e.g., VOR, VOR/DME, NDB).
Combiner	The element of the HUD in which the pilot simultaneously views the external visual scene along with synthetic information provided in symbolic form.
Command Information	Information that directs the pilot to follow a course of action in a specific situation (e.g., Flight Director).
Conformal Information	Information which correctly overlays the image of the real world, irrespective of the pilot's viewing position.
Datum Crossing Height (DCH)	The height of the Flight Path Control Point (FPCP) above the Runway Datum Point (RDP). Note: The FPCP may be specified in units of feet or meters, but is typically specified in units of feet.
Decision Altitude (DA)	A specified altitude in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established. (Adapted from ICAO - IS&RP Annex 6).
Decision Altitude (Height) (DA(H))	For Category I, a specified minimum altitude in an approach by which a missed approach must be initiated if the required visual reference to continue the approach has not been established. The "Altitude" value is typically measured by a barometric altimeter or equivalent (e.g., Inner Marker) and is the determining factor for minima for Category I Instrument Approach Procedures. The "Height" value specified in parenthesis is typically a radio altitude equivalent height above the touchdown zone (HAT) used only for advisory reference and does not necessarily reflect actual height above underlying terrain. For Category II and certain Category III procedures (e.g., when using a Fail-Passive autoflight system) the Decision Height (or an equivalent IM position fix) is the controlling minima, and the altitude value specified is advisory. The altitude value is available for cross reference. Use of a barometrically referenced DA for Category II is not currently authorized for 14 CFR part 121, 129, or 135 operations at U.S. facilities (Adapted from ICAO - IS&RP Annex 6).
Decision Height (DH)	A specified height in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established (Adapted from ICAO - IS&RP Annex 6).
Defined Flight Path	The flight path as determined by the path definition function of an aircraft's navigation system.

Design Eye Box	The three dimensional volume in space surrounding the Design Eye Position from which the Head Up Display (HUD) information can be viewed.
Design Eye Position	The position at each pilot's station from which a seated pilot achieves the optimum combination of outside visibility and instrument scan.
Desired Flight Path	The path that the pilot, or pilot and air traffic service, expect the aircraft to fly.
Earth Centered, Earth Fixed (ECEF)	A cartesian coordinate reference system by which GNSS receivers determine a 3-dimensional coordinate frame, and that later is transformed into latitude and longitude measurements (e.g., fixed relative to earth reference and does not vary with barometric pressure).
Enhanced Vision System (EVS)	An electronic means to provide the flightcrew with a sensor derived or enhanced image of the external scene (e.g., Millimeter wave radar, FLIR).
Estimate of Position Uncertainty (EPU), or Estimated Position Error (EPE)	A measure based on a scale which conveys the current position estimation performance - Also called Estimated Position Error (EPE)
Extended Final Approach Segment (EFAS)	That segment of an approach, co-linear with the Final Approach Segment, but which extends beyond the Glidepath Intercept Waypoint (GPIWP) or Approach Intercept Waypoint (APIWP).
External Visual Reference	Information the pilot derives from visual observation of real world cues outside the cockpit.
Extremely Improbable	A probability of occurrence on the order of 1×10^{-9} or less per hour of flight, or per event (e.g., takeoff, landing).
Extremely Remote	A probability of occurrence between the orders of 1×10^{-9} and 1×10^{-7} per hour of flight, or per event (e.g., takeoff, landing).
Fail Operational System	A system capable of completing the specified phases of an operation following the failure of any single system component after passing a point designated by the applicable safety analysis (e.g., Alert Height).
Fail Passive System	A system which, in the event of a failure, causes no significant deviation of aircraft flight path or attitude.
Field of View	As applied to a Head Up Display (HUD) - the angular extent of the display that can be seen from within the design eye box.
Final Approach Course (FAC)	The final bearing/radial/track of an instrument approach leading to a runway, without regard to distance. For certain previously designed approach procedures that are not aligned with a runway, the FAC bearing/radial/track of an instrument approach may lead to the extended runway centerline, rather than to alignment with the runway.
Final Approach Fix (FAF)	The fix from which the final approach to an airport is executed. For standard procedures that do not involve multiple approach segments intercepting the runway centerline near the runway, the FAF typically identifies the beginning of the straight-in final approach segment.
Final Approach Point (FAP)	The point applicable to instrument approaches other than ILS, MLS, or GLS, with no depicted FAF (e.g., only applies to approaches such as an on-airport VOR or NDB), where the aircraft is established inbound on the final approach course from a procedure turn, and where descent to the next procedurally specified altitude, or to minimum altitude, may be commenced.

Final Approach Segment (FAS)	The segment of an approach extending from the Glidepath Intercept Waypoint (GPIWP) or Approach Intercept Waypoint (APIWP), whichever occurs later, to the Glidepath Intercept Reference Point (GIRP). For the purpose of procedure construction, The Final Approach segment is defined as beginning at the FAF and ending at the Flight Path Control Point (FPCP) or point at which the missed approach segment starts (e.g., point of lowest nominal DA(H)).
Flight Guidance System	The means available to the flightcrew to maneuver the aircraft in a specific manner either manually or automatically. It may include a number of components such as the autopilot, flight directors, and relevant display and annunciation elements, and it typically accepts inputs from the airborne navigation system.
Flight Path Alignment Point (FPAP)	The FPAP is a point, usually at or near the stop end of a runway, used in conjunction with the RDP and a vector normal to the WGS-84 ellipsoid at the RDP, to define the geodesic plane of a final approach and landing flight path (e.g., FAS and RWS). The FPAP typically may be the RDP for the reciprocal runway.
Flight Path Control Point (FPCP)	The Flight Path Control Point (FPCP) is a calculated point located above the RDP in a direction normal to the WGS-84 ellipsoid. The FPCP is used to establish the vertical descent path and descent angle of the final approach flight path (e.g., FAS) to the landing runway.
Flight Technical Error (FTE)	The accuracy with which the aircraft is controlled as measured by the indicated aircraft position with respect to the indicated command or defined flight path position. Note: FTE does not include human performance conceptual errors, typically which may be of large magnitude (e.g., entry of an incorrect waypoint or waypoint position, selection of an incorrect procedure, selection of an incorrect NAVAID frequency, failure to select a proper flight guidance mode. FTE can be influenced by factors such as flightcrew response to guidance (e.g., response to Flight Director information), or external environment conditions such as a wind gradient or turbulence).
"Fly By" Vertical Waypoint	A "Fly By" vertical waypoint (WP) is a WP for which an aircraft may initiate a vertical rate or flight path angle change to depart the current segment of a specified vertical path (VNAV path) shortly prior to an active WP, in order to expeditiously capture the next vertical path segment without overshoot.
"Fly Over" Vertical Waypoint	A "Fly Over" vertical waypoint (WP) is a WP for which an aircraft must stay on the defined vertical path (VNAV path) until passing an active WP and may not initiate capture of the next vertical path segment until after passing the active WP.
Frequent	Occurring more often than 1 in 1000 events or 1000 flight hours.
Glide Path Angle (GPA)	The glide path angle is an angle, defined at the FPCP, that establishes the descent gradient for the final approach flight path (e.g., FAS) of an instrument approach procedure. It is measured in the geodesic plane of the approach (defined by the RDP, FPAP, and a vector normal to the WGS-84 ellipsoid at the RDP). The vertical and horizontal references for the GPA are a vector normal to the WGS-84 ellipsoid at the RDP and a plane perpendicular to that vector at the FPCP, respectively.
Glide Path Intercept Waypoint (GPIWP)	The point at which the established glide slope intercept altitude (MSL) meets the Final Approach Segment (FAS), on a standard day, using a standard altimeter setting (1013.2 HPa or 29.92 in).

Glidepath Intercept Reference Point (GIRP)	The GIRP is the point at which the extension of the final approach path (e.g., FAS) intercepts the runway.
GNSS Landing System (GLS)	A differential GNSS (e.g., GPS) based landing system providing both vertical and lateral position fixing capability. Note: Term may be applied to any GNSS based differentially corrected landing system providing lateral and vertical service for approach and landing equivalent to or better than that provided by a U.S. Type I ILS, or equivalent ILS specified by ICAO Annex 10.
Global Positioning System (GPS)	The NAVSTAR Global Positioning System operated by the United States Department of Defense. It is a satellite -based radio navigation system composed of space, control, and user segments. The space segment is composed of satellites. The control segment is composed of monitor stations, ground antennas, and a master control station. The user segment consists of antennas and receiver-processors that derive time and compute a position and velocity from the data transmitted from the satellites.
Global Navigation Satellite System [GNSS]	A world wide position, velocity and time determination system that uses one or more satellite constellations.
Go-around	A transition from an approach to a stabilized climb.
Guidance	Information used during manual control, automatic control, or monitoring of automatic control of an aircraft that is of sufficient quality to be used by itself for the intended purpose of achieving a particular flight path .
Hazardous Failure Condition	Failure Conditions which would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions to the extent that there would be: (i) A large reduction in safety margins or functional capabilities; (ii) Physical distress or higher workload such that the flightcrew cannot be relied upon to perform their tasks accurately or completely; or (iii) Serious or fatal injury to a relatively small number of the occupants.
Head Up Display System	An aircraft system which provides head up guidance to the pilot during flight. It includes the display element, sensors, computers and power supplies, indications, and controls. It may receive inputs from an airborne navigation system or flight guidance system.
Hybrid System	A combination of two or more systems of dissimilar design used to perform a particular operation.
Improbable	A probability of occurrence greater than 1×10^{-9} but less than or equal to 1×10^{-5} per hour of flight, or per event (e.g., takeoff, landing).
Independent Landing Monitor (ILM)	A millimeter wave radar-based sensor (e.g., typically transmitting at 35 GHz, or 94 GHz) used to present a perspective display of a runway to a pilot on an electronic flight deck display during approach, to serve as an independent integrity monitor for another type of landing NAVAID sensor (e.g., ILS, MLS or GLS).
Independent Systems	A system that is not adversely influenced by the operation, computation, or failure of some other identical, related, or separate system (e.g., two separate ILS receivers).
Infrequent	Occurring less often than 1 in 1000 events or 1000 flight hours.

Initial Missed Approach Waypoint (IMAWP)	A Waypoint generally aligned with the runway centerline, beyond the touchdown zone, used to establish a suitable initial climb segment beyond the touchdown zone. The IMAWP intends to provide a safe path and altitude, if applicable, in the vicinity of the runway, to be used to establish a safe initial go-around path following a low altitude go-around or rejected landing.
Initial Missed Approach Segment (IMAS)	That segment of an approach from the Glide Path Intercept Waypoint (GIRP) to the Initial Missed Approach Waypoint (IMAWP).
Instantaneous Field of View	The angular extent of a HUD display which can be seen from either eye from a fixed position of the head.
Integrity	A measure of the acceptability of a system or system element, to contribute to the required safety of an operation.
Landing	For the purpose of this AC, landing will begin at 100 ft., the DH or the AH to the first contact of the wheels with the runway.
Landing Rollout	For the purpose of this AC, rollout starts from the first contact of the wheels with the runway and finishes when the airplane has slowed to a safe taxi speed (in the order of 30 knots).
Major Failure Condition	Failure Condition which would reduce the capability of the airplane or the ability of the crew to cope with adverse operating conditions to the extent that there would be, for example, a significant reduction in safety margins or functional capabilities, a significant increase in crew workload or in conditions impairing crew efficiency, or discomfort to occupants, possibly including injuries.
Minimum Descent Altitude (Height) (MDA(H))	See individual definitions below for MDA and MDH.
Minimum Descent Altitude (MDA)	A specified altitude in a non-precision approach or circling approach below which descent must not be made without the required visual reference. Minimum Descent Altitude (MDA) is referenced to mean sea level. (ICAO - IS&RP Annex 6).
Minimum Descent Height (MDH)	A specified height in an instrument approach other than ILS, MLS, or GLS, or a circling approach, below which descent must not be made without the required visual reference. Minimum Descent Height (MDH) is referenced to aerodrome elevation or to the threshold if that is more than 7 ft. (2m) below the aerodrome elevation. An MDH for a circling approach is referenced to the aerodrome elevation. (ICAO - IS&RP Annex 6). FAA Note - The U.S. does not use Minimum Descent Heights.
Minimum Use Height (MUH)	A height specified during airworthiness demonstration or review above which, under standard or specified conditions, a probable failure of a system is not likely to cause a significant path displacement unacceptably reducing flight path clearance from specified reference surfaces (e.g., airport elevation) or specified obstacle clearance surfaces.
Minor Failure Condition	Failure Condition which would not significantly reduce airplane safety and which involve crew actions that are well within their capabilities. Minor Failure Conditions may include, for example, a slight reduction in safety margins or functional capabilities, a slight increase in crew workload, such as routine flight plan changes, or some inconvenience to occupants.

Missed Approach	The flight path followed by an aircraft after discontinuation of an approach procedure and initiation of a go-around. Typically a "missed approach" follows a published missed approach segment of an instrument approach procedure, or follows radar vectors to a missed approach point, return to landing, or diversion to an alternate.
Missed Approach Segment (MAS)	That segment of an instrument approach procedure from a point on the FAS corresponding to the position where the lowest DA(H) occurs under nominal conditions, to the designated IMAWP, or missed approach holding WP, as specified for the procedure.
Monitored Head Up Display (HUD)	A HUD which has internal or external capability to reliably detect erroneous sensor inputs or guidance outputs, to ensure that a pilot does not receive incorrect or misleading guidance, failure, or status information.
Navigation System Error	An error in the estimation of the aircraft's position. Also called "position estimation error".
Non-Normal Means of Navigation	A means of navigation which does not satisfy one or more of the necessary levels of accuracy, integrity, and availability for a particular area, route, procedure, or operation, and which may require use of a pilot's "emergency authority" to continue navigation.
Non-normal Conditions	Conditions other than those considered normal conditions or rare-normal conditions (e.g., Failure conditions, certain kinds of error conditions)
NOTAM	Notice to Airmen - A notice distributed by means of telecommunication containing information concerning the establishment, condition, or change in any aeronautical facility, service, procedure, or hazard, the timely knowledge of which is essential to personnel concerned with flight operations. (ICAO - IS&RP Annex 6).
Path Definition Error	The difference between the desired path and the defined path. Note: This error may be due to survey errors, database resolution limitations, or other such factors.
Path Steering Error	Any resulting difference (i.e., non-zero deviation) between the estimated aircraft position from the desired flight path. Note: This error includes any display errors along with flight technical error.
Performance	A measure of the accuracy with which an aircraft, a system, or an element of a system operates compared against specified parameters. Performance demonstration(s) typically include the component of Flight Technical Error (FTE).
Position Estimation Error	An error in the estimation of the aircraft's position. Also called "Navigation System Error."
Primary Means of Navigation	A means of navigation which satisfies the necessary levels of accuracy and integrity for a particular area, route, procedure, or operation. The failure of a "Primary Means" of navigation may result in, or require reversion to, a "non-normal" means of navigation, or an alternate level of RNP.
"Rare-Normal" conditions	A condition which must be expected to normally occur, but does so only very infrequently (e.g., unusually strong winds, significant wind gradients, significant turbulence, significant in-flight icing, significant mountain wave activity)

Redundant	The presence of more than one independent means for accomplishing a given function or flight operation. Each means need not necessarily be identical.
Rejected Landing	A discontinued landing attempt. A rejected landing typically is initiated at low altitude but prior to touchdown. If from or following an instrument approach it typically is considered to be initiated below DA(H) or MDA(H). A rejected landing may be initiated in either VMC or IMC. A rejected landing typically leads to or results in a "go around," and if following an instrument approach, a "Missed Approach." If related to consideration of aircraft configuration(s) or performance it is sometime referred to as a "Balked Landing." The term "rejected landing" is used to be consistent with regulatory references such as found in 14 CFR part 121 Appendix E, and policy references as in FAA Order 8400.10.
Remote	A probability of occurrence on the order of greater than 1×10^{-7} but less than or equal to 1×10^{-5} per hour of flight, or per event (e.g., takeoff, landing).
Required Navigation Performance (RNP)	A statement of the navigation performance necessary for operation within a defined airspace (Adapted from ICAO - IS&RP Annex 6). NOTE: Required Navigation Performance is specified in terms of accuracy, integrity, and availability of navigation signals and equipment for a particular airspace, route, procedure, or operation.
Required Navigation Performance Containment (RNP Containment)	RNP Containment represents a bound of the rare-normal performance and specified non-normal performance of a system, typically expressed as 2*RNP(X). When RNP represents Gaussian statistical performance at a two sigma (2 x standard deviation) level, then containment represents a nominal performance bound specified at the level of four sigma (4 x standard deviation). Note: RNP containment use may vary with intended operational applications.
Required Navigation Performance Level or Type (RNP Level or RNP Type)	A value typically expressed as a distance in nautical miles from the intended position within which an aircraft would be for at least 95 percent of the total flying time (Adapted from ICAO - IS&RP Annex 6). NOTE: Applications of RNP to terminal area and other operations may also include a vertical and/or longitudinal component. ICAO may use the term RNP Type, while certain other States, aircraft manuals, procedures, and Operators may use the term RNP Level. Example - RNP 4 represents a navigation lateral accuracy of plus or minus 4 nm (7.4 km) on a 95% basis. RNP is typically defined in terms of its lateral accuracy, and has an associated lateral containment boundary.
Required Visual Reference	That section of the visual aids or of the approach area which should have been in view for sufficient time for the pilots to have made an assessment of the aircraft's position and rate of change of position, in relation to the desired flight path. In Category III operations with a decision height, the required visual reference is that specified for the particular procedure and operations (ICAO - IS&RP Annex 6 - Decision Height definition - Note 2).
Runway Datum Point (RDP)	The RDP is used in conjunction with the FPAP and a vector normal to the WGS-84 ellipsoid at the RDP to define the geodesic plane of a final approach flight path to the runway for touchdown and rollout. It is a point at the designated lateral center of the landing runway defined by latitude, longitude, and ellipsoidal height. The RDP is typically a surveyed reference point used to connect the approach flight path with the runway. The RDP may or may not necessarily be

	coincident with the designated runway threshold
Runway Segment (RWS)	That segment of an approach from the Ground Point of Intercept (GPI) to Flight Path Alignment Point (FPAP).
Situation Information	Information that directly informs the pilot about the status of the aircraft system operation or specific flight parameters including flight path.
Standard Landing Aid (SLA)	A Standard Landing Aid (SLA) is considered to be any navigation service or navigation aid provided by a State which meets internationally accepted performance standards (e.g., ICAO Standards and Recommended Practices (SARPs), or equivalent U.S. or other State standards).
Supplementary Means of Navigation	A means of navigation which satisfies one or more of the necessary levels of accuracy, integrity, or availability for a particular area, route, procedure or operation. The failure of a "Supplementary Means" of navigation may result in, or require reversion to, another alternate "normal" means of navigation for the intended route, procedure, or operation.
Synthetic Reference	Information provided to the flightcrew by instrumentation or electronic displays, that is electronically generated, processed, enhanced, or otherwise augmented. Information may be either command or situation information (e.g., SVS, EVS).
Synthetic Vision System (SVS)	A system used to create a synthetic image (e.g., typically a computer generated picture) representing the environment external to the airplane.
Take off Guidance System	A system which provides directional command guidance to the pilot during a takeoff, or takeoff and aborted takeoff. It includes sensors, computers and power supplies, indications and controls.
Total Field of View	The maximum angular extent of the display that can be seen with either eye, allowing head motion within the design eye box.
Total System Error (TSE)	The difference between the desired flight path and the actual flight path. Typically determined by a sum of the path definition error, navigation system error, and the path steering error (i.e., flight technical error plus any display error).
Touch Down Zone (TDZ)	The first 3000 ft. of usable runway for landing, unless otherwise specified by the FAA, or other applicable ICAO or State authority (e.g., for STOL aircraft, or IAW an SFAR).
Visual Glide Slope Indicator	An electro-optical device that provides a visual indication of vertical position in relation to a defined glidepath. Specific systems in this classification include the Visual Approach Slope Indicator (VASI), the Precision Approach Path Indicator (PAPI), and Precision Landing Aid Slope Indicator (PLASI). This term is defined in FAA Order 8260.3, U.S. Standard for Terminal Instrument Procedures (TERPS).
Visual Guidance	Visual information the pilot derives from the observation of real world cues, out the flight deck window, used as a primary reference for aircraft control or flight path assessment.
WGS-84 Ellipsoid	A mathematical model of the earth's shape based on WGS-84 survey information, used as an element of an earth surface-referenced navigation coordinate frame (see appropriate ICAO or RTCA references for its technical definition and specification - e.g., ICAO "World Geodetic System 1984 Manual - DOC 9674-AN/946").

Acronyms

ACRONYM	EXPANSION
ABAS	Aircraft Based Augmentation System
AC	Advisory Circular
ACI	Adjacent Channel Interface
ACO	FAA Aircraft Certification Office
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADS	Automatic Dependent Surveillance
AEG	FAA Aircraft Evaluation Group
AFCS	Autopilot Flight Control System
AFDS	Autopilot Flight Director System
AFGS	Automatic Flight Guidance System
AFM	Airplane Flight Manual
AH	Alert Height
AHI	All Weather Harmonization Items
AIP	Aeronautical Information Publication
ALS	Approach Light System
ANP	Actual Navigation Performance
APIWP	Approach Intercept Waypoint
APM	Aircrew Program Manager
APU	Auxiliary Power Unit
AQP	Advanced Qualification Program
ARA	Airborne Radar Approach
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATOGW	Allowable Takeoff Gross Weight
ATPC	Airline Transport Pilot Certificate
ATS	Air Traffic Service
AWO	All Weather Operations
BARO	[Abbreviation for "Barometric"]
BC	Back Course (e.g., ILS Back Course)

BITE	Built-In Test Equipment
CAA	Civil Aviation Authority
CDL	Configuration Deviation List
CFR	Code of Federal Regulations
CFR	Crash Fire Rescue
CHDO	Certificate Holding District Office
CL	Centerline Lights
CMO	FAA Certificate Management Office
CMU	FAA Certificate Management Unit
CNS	Communication, Navigation, and Surveillance
CRM	Collision Risk Model
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder
DA	Decision Altitude
DA(H)	Decision Altitude(Height)
DCH	Datum Crossing Height
DD	DME-DME updating
DDM	Difference of Depth Modulation
DEP	Design Eye Position
DGNSS	Differential Global Navigation Satellite System
DH	Decision Height
DME	Distance Measuring Equipment
DOD	(U.S.) Department of Defense
DOT	(U.S.) Department of Transportation
DP	Departure Procedure
EADI	Electronic Attitude Director Indicator
ECEF	Earth Centered Earth Fixed (coordinate frame)
EFAS	Extended Final Approach Segment
EGPWS	Enhanced Ground Proximity Warning System
EHSI	Electronic Horizontal Situation Indicator
EPE	Estimated Position Error
EPU	Estimated Position Uncertainty
EROPS	Extended Range Operations (any number of engines)
ET	Elapsed Time

ET	Error Term [FMS use]
ETOPS	Extended Range Operations with Two-Engine Airplanes
EVS	Enhanced Vision System
FAF	Final Approach Fix
FAP	Final Approach Point
FAR	Federal Aviation Regulation
FAS	Final Approach Segment
FBS	Fixed Base Simulator
FBW	Fly-by-wire
FCOM	Flightcrew Operating Manual
FDR	Flight Data Recorder
FGS	Flight Guidance System
FHA	Functional Hazard Assessment
FLIR	Forward Looking Infrared Sensor
FM	Frequency Modulation
FM	Fan Marker
FMC	Flight Management Computer
FMS	Flight Management System
FPAP	Flight Path Alignment Point
FPA	Flight Path Angle
FPCP	Flight Path Control Point
FSB	Flight Standardization Board
FSDO	(FAA) Flight Standards District Office
FSS	(FAA) Flight Service Station
FTE	Flight Technical Error
GA	Go-Around
GBAS	Ground Based Augmentation System
GCA	Ground Controlled Approach
GIRP	Glidepath Intercept Reference Point
GLS	GPS (or GNSS) Landing System
GNSS	Global Navigation Satellite System
GPA	Glide Path Angle
GPIWP	Glide Path Intercept Waypoint
GPWS	Ground Proximity Warning System

GPS	Global Positioning System
HAA	Height Above Airport
HAT	Height above Touchdown
HDG	Heading
HQRS	Handling Quality Rating System (see AC25-7A, as amended)
HUD	Head Up Display
IAP	Instrument Approach Procedure
IAW	In Accordance With
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
IM	Inner Marker
IMAS	Initial Missed Approach Segment
IMAWP	Initial Missed Approach Waypoint
IMC	Instrument Meteorological Conditions
ILS	Instrument Landing System
INAS	International Airspace System
IOE	Initial Operating Experience
IRS	Inertial Reference System
IRU	Inertial Reference Unit
JAA	Joint Aviation Authority
JAR AWO	Joint Aviation Regulations – All Weather Operations
KRM	(Type of Landing system used in certain foreign States)
LAAS	Local Area Augmentation System
LAD	Local Area Differential
LAHSO	Land And Hold Short Operation
LDA	Localizer-Type Directional Aid (approach type)
LLM	Lower Landing Minima
LMM	Compass Locator Middle Marker
LLTV	Low Light Level TV
LNAV	Lateral Navigation
LOA	Letter of Authorization
LOC	(ILS) Localizer
LOE	Line Operational Evaluation
LOFT	Line Oriented Flight Training

LOM	Compass Locator Outer Marker
LOS	Line Oriented Simulation
MAP	Mode Annunciator Panel
MAP	Missed Approach Point
MAS	Missed Approach Segment
MASPS	Minimum Aviation System Performance Standards
MB	Marker Beacon
MCP	Mode Control Panel
MDA	Minimum Descent Altitude
MDA(H)	Minimum Descent Altitude (Height)
MDH	Minimum Descent Height - NOTE: MDH is not used for U.S. Operations
MEH	Minimum Engage Height
MEL	Minimum Equipment List
METAR	ICAO Routine Aviation Weather Report
MLS	Microwave Landing System
MM	Middle Marker
MMEL	Master Minimum Equipment List
MMR	Multi-mode Receiver
MOT	Ministry of Transport
MRB	Maintenance Review Board
MSL	Mean Sea Level (altitude reference datum)
MUH	Minimum Use Height
MVA	Minimum Vectoring Altitude
NA	Not Authorized or Not Applicable
NAS	National Airspace System
NAVAID	Navigational Aid
ND	Navigation Display
NDB	Navigation Data Base
NDB	Non-directional Beacon
NOTAM	Notice to Airman
NRS	National Resource Specialist
OCA	Obstacle Clearance Altitude
OCH	Obstacle Clearance Height
OCL	Obstacle Clearance Limit

OIS	Obstacle Identification Surface
OM	Outer Marker
OSAP	Offshore Standard Approach Procedure
PAI	Principal Avionics Inspector
PAR	Precision Approach Radar
PC/PT	Proficiency Check/Proficiency Training
PF	Pilot Flying
PFC	Porous Friction Coarse (runway surface)
PIC	Pilot in Command
PIREP	Pilot Weather Report
PNF	Pilot Not Flying
PoC	Proof of Concept
POI	Principal Operations Inspector
PMI	Principal Maintenance Inspector
PRD	Progressive Re-Dispatch
PRM	Precision Radar Monitor
PTS	Practical Test Standard
QFE	Altimeter Setting referenced to airport field elevation
QNE	Altimeter Setting referenced to standard pressure (1013.2HPa or 29.92")
QNH	Altimeter Setting referenced to airport ambient local pressure
QRH	Quick Reference Handbook
RA	Radio Altitude or Radar Altimeter
RAIL	Runway Alignment Indicator Light System
RCLM	Runway Center Line Markings
RCP	Required Communication Performance
RDMI	Radio Direction Magnetic Indicator
RDP	Runway Datum Point
REIL	Runway End Identification Lights
RII	Required Inspection Item
RMI	Radio Magnetic Indicator
RMP	Required Monitoring Performance (e.g., surveillance)
RMS	Root-mean-square
RNAV	Area Navigation
RNP	Required Navigation Performance

RNPx2	RNP Containment Limit (2 times RNP value)
RSP	Required System Performance (Considers RNP, RCP, and RMP)
RTCA	An industry standard setting organization - formerly known as the "Radio Technical Commission for Aeronautics"
RTS	Return to Service
RTO	Rejected Takeoff
RVR	Runway Visual Range
RVV	Runway Visibility Value
RWS	Runway Segment
RWY	Runway
SA	Selective Availability
SARPS	ICAO Standards and Recommended Practices
SBAS	Space Based Augmentation System
SDF	Simplified Directional Facility
SFL	Sequence Flasher Lights
SIAP	Standard Instrument Approach Procedure
SID	Standard Instrument Departure - Note: This term is no longer in use in the U.S., and has been replaced by the term Departure Procedure (DP)
SLA	Standard Landing Aid
SLF	Supervised Line Flying
SMGC	Surface Movement Guidance Control
SMGCP	Surface Movement and Guidance Plan
SMGCS	Surface Movement Guidance Control System
STAR	Standard Terminal Arrival Route
STC	Supplemental Type Certificate
STOL	Short Takeoff and Landing
SRE	(Type of Landing system used in certain foreign States)
SV	Space Vehicle
TACAN	Tactical Air Navigation system (NAVAID)
TAF	Terminal Aviation Forecast
TAWS	Terrain Awareness Warning System
TC	Type Certificate
TCH	Threshold Crossing Height
TDZ	Touchdown Zone
TERPS	U.S. Standard for Terminal Instrument Procedures

TLS	Target Level of Safety
TOGA	Takeoff or Go-Around (FGS Mode)
TSE	Total system error
ua	micro amps
VGSI	Visual Glide Slope Indicator
VDP	Visual Descent Point
VFR	Visual Flight Rules
VHF	Very High Frequency
VIS	Visibility
VOR	VHF Omni-directional Radio Range
VORTAC	Co-located VOR and TACAN
VMC	Visual Meteorological Conditions
VNAV	Vertical Navigation
V_1	Takeoff Decision Speed
V_{ef}	Engine Failure Speed
$V_{failure}$	Speed at which a failure occurs
V_{lof}	Liftoff Speed
V_{mcg}	Ground Minimum Control Speed
WAAS	Wide Area Augmentation System
WAD	Wide Area Differential
WAT	Weight, Altitude, and Temperature
WGS	World Geological Survey
WGS-84	World Geological Survey - 1984
WP	Waypoint
xLS	(Generic term used to denote any one or more of the following NAVAIDs: ILS, MLS, or GLS)

APPENDIX 2. AIRBORNE SYSTEMS FOR CATEGORY I

Mandatory terms used in this AC such as "shall" or "must" are used only in the sense of ensuring applicability of these particular methods of compliance when the acceptable means of compliance described herein is used. This AC does not change, add, or delete regulatory requirements or authorize deviations from regulatory requirements.

1. PURPOSE. This appendix contains airworthiness criteria for the approval of aircraft equipment and installations required to conduct an approach in Category I weather minima.

2. GENERAL.

The type certification approval for the equipment, system installations, and test methods should be based on a consideration of factors such as the intended function of the installed system, its accuracy, reliability, and fail-safe features, as well as the operational concepts contained in the body of this Advisory Circular (AC). The guidelines and procedures contained herein are considered acceptable methods of determining transport category airplane airworthiness to conduct an approach in Category I weather conditions.

The overall assurance of performance and safety of an operation can only be assessed when all elements of the system are considered. This appendix includes a discussion of the non-aircraft elements of a system so that an overall assessment of the operation can be accomplished.

References to JAA All Weather Operations Regulations are provided to facilitate the All Weather Operations Harmonization process. A reference to a JAR provision does not necessarily mean that the FAA and JAA requirements are <u>equivalent</u> but that they are <u>related with similar intent</u>. The FAA typically may identify which JAR provisions are acceptable to FAA at the time a type certification basis is established.

3. INTRODUCTION.

This appendix addresses the approach phase of flight. For the purpose of this appendix, the approach phase of flight is defined as the flight segment from the Final Approach Fix (FAF) to the Category I decision altitude/height. This appendix provides criteria, which represents an acceptable means of compliance with performance, integrity and availability requirements for low visibility approach. An applicant may propose alternative criteria. With new emerging technologies, there is a potential for many ways of conducting low visibility approach operations. This appendix does not attempt to provide criteria for each potential combination of airplane and non-airplane elements.

a. Operations using current ILS or MLS ground-based facilities and airplane elements are in use, and the certification criteria for approval of these airplane systems are established. Other operations, using non-ground based facilities or evolving ground facilities (e.g., local or wide area augmented Global Navigation Satellite System (GNSS)), and the use of some new aircraft equipment require Proof of Concept testing to establish appropriate criteria for operational approval and system certification. The need for a Proof of Concept program is identified in this AC with a [PoC] designator. This appendix provides some general guidelines, but not comprehensive criteria, for airplane systems that require a Proof of Concept.

b. The intended flight path may be established in a number of ways. For systems addressed by this appendix, the reference path may be established by a navigation aid (e.g., ILS, MLS). Other methods may be acceptable if shown feasible by a Proof of Concept [PoC]. Methods requiring PoC include, but are not limited to:

- the use of ground surveyed waypoints, either stored in an on-board data base or provided by data link to the airplane, with path definition by the airborne system,
- sensing of the runway environment (e.g., surface, lighting and/or markings) with a vision enhancement system.

On-board navigation systems may have various sensor elements by which to determine airplane position. The sensor elements may include ILS, MLS, GNSS with ground-based augmentation (GLS), or inertial information. Each of these sensor elements should be used within appropriate limitations with regard to accuracy, integrity and availability.

Indications of the airplane position with respect to the intended path can be provided to the pilot in a number of ways.

- deviation displays with reference to navigation source (e.g., Instrument Landing System (ILS) receiver, Microwave Landing System (MLS) receiver), or

- on-board navigation system computations with corresponding displays of position and reference path, or

- by a vision enhancement system. [PoC]

c. The minimum visibility required for safe operations with such systems and backup means will be specified by FAA Flight Standards in the operational authorization.

4. TYPES OF APPROACH OPERATIONS. The airworthiness criteria in this appendix are intended to be consistent with the operational concepts of paragraph 4.3 of the main body of this AC.

4.1. Operations based on a Standard Landing Aid.

ILS and MLS have been characterized by appropriate International Civil Aviation Organization (ICAO) standards, and for the purpose of certification in accordance with this Appendix may be considered a Standard Landing Aid.

Landing Systems based on the GLS may use interim U.S. criteria, or other FAA-agreed State criteria, or other international standards developed for acceptable combination of space and ground-based elements. Acceptable overall aircraft performance may be established based upon the assumption that these services are used and maintained to the specified standards identified, or as specified in the applicable airworthiness approval.

4.2. Operations based on Required Navigation Performance (RNP). The airworthiness criteria in this appendix support the operational concept for RNP as described in paragraph 4.5 in the main body of this AC.

4.2.1. Standard RNP Types. Approach operations may be specified based upon standard RNP type designations. The type designation identifies the performance standard required to conduct the operation. The RNP Type will have a lateral performance component and may additionally have a vertical component. Refer to Paragraph 4.5.1 in the main body of this AC for Standard RNP Types.

4.2.2. Non-standard RNP Types. Some operations may be approved for Non-Standard RNP Types - refer to paragraph 4.5.2 in the main body of this AC. It is envisioned that the airplane systems approval process for Non-Standard RNP Types will be equivalent to that used for Standard RNP Types unless otherwise agreed with the FAA.

4.3. Operations based on Area Navigation System(s). Paragraphs 4.3.3 through 4.6 of the main body of this AC provide the criteria for operational authorization of the use of area navigation systems for approach.

a. Instrument approach operations may be approved using aircraft area navigation with lateral and vertical or lateral only capability. The navigation system will typically use multi-sensor capability for position fixing (VHF Omni-directional Radio Range (VOR), Distance Measuring Equipment (DME), Global Positioning System (GPS), Inertial Reference System (IRS), Instrument Navigation System (INS), etc.,) to achieve the necessary performance for certain levels of Category I operations.

b. Required levels of accuracy, integrity, and availability for various combinations of sensor-dependent operations (e.g., ILS, GLS, VOR, NDB) or area navigation operations (e.g., Lateral Navigation Vertical Navigation (LNAV VNAV), LNAV only, or RNP), necessary to support either Category I or Category II instrument approach procedures, as applicable, are specified in paragraph 5 of the main body of this AC.

5. TYPES OF APPROACH NAVIGATION SERVICE.

5.1. Instrument Landing System (ILS).

ILS is supported by established international standards for ground station operation. These standards should be used in demonstrating airplane system operation.

The Airplane Flight Manual (AFM) shall indicate that operation is predicated upon the use of an ILS facility with performance and integrity equivalent to, or better than, an ICAO Annex 10 Facility Performance Category I ILS, a U.S. Type I, or equivalent.

5.1.1. ILS Flight Path Definition. The required lateral and vertical flight path is inherent in the design of the ILS. Acceptable performance and integrity standards have been established for ILS.

5.1.2. ILS Airplane Position Determination. The airplane lateral and vertical position relative to the desired flight path is accomplished by an airplane ILS receiver that provides deviation from the extended runway centerline path when in the coverage area.

5.2. Microwave Landing System (MLS).

MLS is supported by established ICAO Annex 10 international standards for ground station operation. These standards should be used in demonstrating airplane system operation.

The AFM shall indicate that operation is predicated upon the use of an MLS facility with performance and integrity equivalent to, or better than, an ICAO Annex 10 Facility Performance Category I MLS, or equivalent.

5.2.1. MLS Flight Path Definition. The lateral and vertical required flight path is inherent in the design of the MLS. Acceptable performance and integrity standards have been established for MLS.

5.2.2. MLS Airplane Position Determination. The airplane lateral and vertical position relative to the desired flight path is accomplished by an airplane MLS receiver that provides deviation from the extended runway centerline path when in the coverage area.

5.3. GNSS with Ground-based Augmentation (GLS) [PoC].

This appendix section is not intended to provide a comprehensive means of compliance for airworthiness approval of GNSS based systems. Currently approved systems are ILS or MLS-based. The application of new technologies and systems will require an overall assessment of the integration of the airplane components with other elements (e.g., new ground-based aids, satellite systems, advanced radar mapping systems, enhanced vision sensor systems) to ensure that the overall safety of the use of these systems for Category I. This GNSS section is included to identify important differences between conventional ILS/MLS-based systems and GNSS based systems that affect GLS criteria development.

The performance, integrity, and availability of any ground station elements, any datalinks to the airplane, any satellite elements and any data base considerations, when combined with the performance, integrity, and availability of the airplane system, should be at least equivalent to the overall performance, integrity, and availability provided by ILS to support Category I operations.

5.3.1. GLS Flight Path Definition. Appropriate specification of the required flight path for approach, or approach, landing, and rollout (as applicable), is necessary to assure safety of the operation to the relevant operational minima. The required flight path should be established to provide adequate clearance between the airplane and fixed obstacles on the ground, between airplanes on adjacent approaches, and to ensure that the airplane stays within the confines of the runway.

a. The effect of the navigation reference point on the airplane flight path and wheel-to-threshold crossing height must be addressed.

b. The required flight path is not inherent in the design of a GNSS based approach, landing, and rollout system; therefore, an airplane navigation system must specify a sequence of earth-referenced path points, or the airplane must receive information from a ground-based system to define the approach, landing, and rollout required path points.

c. Certain path points, waypoints, leg types, and other criteria are necessary to safely implement the approach, or approach, landing, and rollout operations based on satellite and other integrated multi-sensor navigation systems.

d. Figure 4.6-1 in the main body of this AC shows the minimum set of path points, waypoints, and leg types considered necessary to specify the flight path for approach, or approach, landing, and rollout operations.

e. The required flight path may be stored in an airplane database for recall and use by the command guidance and/or control system when required to conduct the approach to relevant minima for landing and rollout.

f. The definition, resolution, and maintenance of the waypoints which define the required flight path and flight segments is key to the integrity of this type of approach, landing, and rollout operation.

g. A mechanism should be established to assure the continued integrity of the flight path designators.

h. The integrity of any database used to define required path points for an approach should be addressed as part of the certification process. The flightcrew shall not be able to modify information in the database that relates to the definition of the required flight path for the final approach, and, if necessary, initial missed approach.

5.3.2. GLS Airplane Position Determination. The safety of an approach operation is, in part, predicated on knowing where the airplane is positioned relative to the required flight path. Navigation satellite systems exist which can provide position information to specified levels of accuracy, integrity, and availability. The accuracy, integrity, and availability can be enhanced by additional space and ground-based elements. These systems provide certain levels of capability to support present low visibility operations and are planned to have additional future capability.

a. Satellite systems have the potential to provide positioning information necessary to guide the airplane during approach. If operational credit is sought for these operations, the performance, integrity, and availability must be established to support that operation. Ground-based aids such as differential position receivers, pseudolites etc., and a data link to the airplane may be required to achieve the accuracy, integrity, or availability for certain types of operation.

b. A level of safety equivalent to current ILS-based operations should be established.

c. The role of the satellite-based elements in the landing system should be addressed as part of the airplane system certification process until such time as acceptable national or international standards for satellite-based systems are established.

Basic GNSS (Un-augmented). This is the basic navigation service provided by a satellite system. No additional navigation service elements are used to enhance accuracy or integrity of the operation.

Differential Augmentation. The role of the differential station in the landing system should be addressed as part of the airplane system certification process, unless an acceptable national or international standard for the ground reference system is established.

Local Area Differential Augmentation. Local Area Differential (LAD) augmentation consists of a set of ground-based GNSS receivers that are used to derive pseudo-range corrections and integrity data referenced to a point on or near the airport. This augmentation data is then provided to the airplane via a local, ground-based data broadcast signal.

Wide Area Differential Augmentation. Wide Area Differential (WAD) augmentation may be used to provide approach capability supporting appropriate levels of Category I procedures.

5.3.3. Data Link [PoC]. A data link may be used to provide data to the airplane to provide the accuracy necessary to support certain operations (e.g., navigation waypoints, differential corrections for GNSS).

a. The integrity of the data link should be commensurate with the integrity required for the operation.

b. The role of the data link in the approach, or approach and landing system should be addressed as part of the airplane system certification process unless an identified acceptable U.S. or international standard(s) for the data link ground system is applicable and is used.

6. BASIC AIRWORTHINESS REQUIREMENTS. This section identifies airworthiness requirements including those for performance, integrity, and availability that apply to all types of airplane systems, independent of the type of approach and landing or navigation system used. The definitions of performance, integrity, and availability are found in Appendix 1. The basic airworthiness criteria are intended to be independent of the specific implementation in the airplane or the type of approach system being used. Criteria may be expanded further in later sections of this appendix as it applies to a particular airplane system or architecture.

> **NOTE: Continuity of Approach Function may involve aircraft systems, ground systems and, in some cases, space-based systems. This AC addresses the aircraft part of the system and aircraft criteria will be defined in terms of aircraft system availability to provide quantifiable criteria for airworthiness compliance.**

6.1. General Requirements. An applicant shall provide a certification plan which describes how any non-aircraft elements of the Approach System relate to the aircraft system from a performance, integrity and availability perspective. Standard Landing Aids (SLA) can be addressed by reference to ICAO Standards and Recommended Practices (SARPS).

a. The plan for certification shall describe the system concepts and operational philosophy to allow the regulatory authority to determine whether criteria and requirements other than those contained in this appendix are necessary.

b. The Approach system performance should be established considering the environmental and deterministic effects that may reasonably be experienced for the type of operation for which certification and operational approval will be sought.

c. Where reliance is placed on the pilot to detect a failure of engagement of a mode when it is selected (e.g., go-around), an appropriate indication or warning must be provided.

d. The effect of the failures of the navigation facilities must be considered taking into account ICAO and other pertinent State criteria.

e. The effect of the aircraft navigation reference point on the airplane flight path and wheel-to-threshold crossing height shall be assessed.

6.2. Approach System Accuracy Requirements. The following items are general criteria that apply to the various types of approach operations.

a. Performance shall be demonstrated by flight test, or analysis validated by flight test, using at least 3 different representative facilities for a minimum of 9 total approaches, with a representative range of environmental and system variables which have an effect on overall performance.

b. The performance assessment shall take into account at least the following variables with the variables being applied based upon their expected distribution:

(1) Configurations of the airplane (e.g., flap settings);

(2) Center of gravity;

(3) Landing weight;

(4) Conditions of wind, turbulence, and wind shear;

(5) Characteristics of ground and space based systems and aids (e.g., ILS, MLS, GLS, GNSS); and

(6) Any other parameter which may affect system performance (e.g., airport altitude, approach path slope, variations in approach speed).

c. The criteria for acceptable approach performance are based upon acquiring and tracking the required flight path to the appropriate minimum altitude for the procedure. The acquisition should be accomplished in a manner compatible with instrument procedure requirements and flightcrew requirements for the type of approach being conducted.

d. An approach guidance system shall not generate command information (e.g., flight director, HUD etc.) which results in flight path control that is oscillatory or requires unusual effort by the pilot to satisfy the performance requirements.

e. An approach control system shall not generate flight path control (e.g., autopilot) with sustained oscillations.

f. The approach system must cause no sustained nuisance oscillations or undue attitude changes or control activity as a result of configuration or power changes or any other disturbance to be expected in normal operation.

6.2.1. ILS. The performance standards for signal alignment and quality contained in ICAO Annex 10 or an equivalent State standard are acceptable standards for operations based on ILS. These standards shall be used in establishing the performance of the operation.

a. Lateral tracking performance from 1000' Height Above Touchdown (HAT) to 200' HAT should be stable without large deviations (i.e., within ±50 microamps deviation) from the indicated course.

b. Vertical tracking performance from 700' HAT to 200' HAT should be stable without large deviations (i.e., within ±75 microamps deviation) from the indicated path.

6.2.2. MLS. The performance standards for signal alignment and quality contained in ICAO Annex 10 or an equivalent State standard are acceptable standards for operations based on MLS. These standards shall be used in establishing the performance of the operation.

a. Lateral tracking performance from 1000' HAT to 200' HAT should be stable without large deviations (i.e., within ±50 microamps deviation) from the indicated course or path.

b. Vertical tracking performance from 700' HAT to 200' HAT should be stable without large deviations (i.e., within ±75 microamps deviation) from the indicated path.

6.2.3. GLS [PoC]. Paragraph 5.3 provides background GLS considerations.

a. Lateral tracking performance from 1000' HAT to 200' HAT should be stable without large deviations (i.e., within ±50 microamps deviation) from the indicated course or path, or equivalent.

b. Vertical tracking performance from 700' HAT to 200' HAT should be stable without large deviations (i.e., within ±75 microamps deviation) from the indicated path, or equivalent.

6.2.4. RNP. The accuracy criteria for RNP are designed to enable a seamless transition from en route RNP to approach RNP. RNP operations are based upon the accuracy of the airplane flight path in absolute terms with respect to the defined flight path over the ground. The Total System Error (TSE) will be characterized by the combined performance of airplane systems and any navigation aids. The certification plan should identify any navigation aid(s) on which the RNP performance will be established and how the airplane performance interacts with the navigation aid(s) to meet the TSE performance requirements. The certification plan should identify the assumed relationship between airplane performance and any navigation aid performance.

a. The approach RNP is specified from the FAF to the point along the final approach segment at which the lowest applicable Decision Altitude (Height) (DA(H)) typically is applied. There may be one or more levels of RNP specified on a final segment. Missed approach RNP, or levels of RNP if more than one level of RNP is specified, is typically specified from a point related to the lowest applicable DA(H), and typically continues to a missed approach holding fix or missed approach waypoint. RNP also may be applied to a "go-around safety" assessment. When applied to a "go-around safety assessment," the RNP level and associated obstacle clearance start at the end of the touchdown zone with an expanding lateral area that widens to match the level of RNP used, and then continues at the RNP level(s) specified. The expanding lateral area starts on the centerline for the approach at the end of the touchdown zone and widens at a 7.5 degree splay, or ICAO 1:8 splay, depending on procedure development criteria used. It is applicable from the end of a touchdown zone to reaching the missed approach holding fix or applicable missed approach waypoint (See Appendix 5).

b. Assumptions regarding the performance for any radio navigation aid(s) used should be consistent with ICAO Annex 10 or an equivalent State standard. In cases where site-specific geometry must be considered in the evaluation of the NSE, limits on the assumed geometry should be identified

c. The guidance or control system shall be demonstrated to maintain a flight path which tracks the defined flight path to the RNP Type as specified in Paragraph 4.5 of the body of this AC, as applicable.

6.2.5. Flight Path Definition. Refer to Paragraph 4.6 in the main body of this AC for consideration on Flight Path Definition when navigation aids are used which do not have the required flight path inherent in the structure of the signal in space.

6.2.6. Area Navigation Systems. The accuracy requirements for area navigation systems are as specified in AC 25-15, Approval of Flight Management Systems in Transport Category Airplanes, AC 20-129, Airworthiness Approval of Vertical Navigation (VNAV) Systems for Use In the U.S. NAS and Alaska, and AC 20-130, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, as amended. In addition, criteria described in the table below may alternately be met and referenced in the AFM.

The guidance or control system shall be demonstrated to track the lateral and vertical flight path or lateral flight path alone, if applicable, to one of the levels shown below.

See paragraph 4.4.4. in the main body of this AC for vertical performance specification.

The basis for demonstration, or the demonstrated values, should be referenced in the AFM

6.3. Approach System Integrity Requirements. The applicant shall provide the certification authority with an overall operational safety assessment plan for the use of systems other than ILS or MLS for "path in space" guidance. This plan shall identify the assumptions and considerations for the non-aircraft elements of the system and how these assumptions and considerations relate to the airplane system certification plan.

a. The onboard components of the landing system, considered separately and in relation to other associated onboard systems, should be designed to comply with Title 14 of the Code of Federal Regulations (14 CFR) part 25, section 25.1309, considering any specific safety-related criteria identified in this appendix, or as identified in accordance with the operating rules.

b. The following criteria are provided as advisory material for the application of section 25.1309 to Landing Systems:

6.3.1. ILS. The aircraft system response to loss of ILS guidance signals (localizer and glideslope) shall be established.

6.3.2. MLS. The aircraft system response to loss of MLS guidance signals (elevation and azimuth) shall be established.

6.3.3. GLS. The aircraft system response to loss of GLS guidance signals shall be established.

6.3.4. RNP. The aircraft system response to loss of the navigation service(s) used to conduct the RNP operation shall be established.

a. The aircraft system response during any switch over to alternate navigation services shall be established.

b. It shall be demonstrated that the airplane will maintain the required flight path within the containment limits (i.e., 2 times the RNP value) when un-annunciated failures not shown to be extremely remote (probability in the order of 10^{-7} per approach, or less) are experienced.

6.3.5. Area Navigation Systems. The integrity requirements for area navigation systems are as specified in AC 25-15, as amended, or equivalent.

6.4. Approach System Availability Requirements. Below 500 ft. on approach, the demonstrated probability of a successful landing should be at least 95% (i.e., no more than 5% of the approaches result in a go-around, due to the combination of failures in the landing system and the incidence of unsatisfactory performance). In addition, a dual or single area navigation (RNAV) approach system installation should meet the availability requirements consistent with the operational objective of 14 CFR part 121, section 121.349, (as applicable to standard Operations Specifications (OpSpecs)).

6.5. Go-around Requirements. A Go-around may be required following a failure in the Approach System, as required by the flightcrew or by Air Traffic Service (ATS) at any time prior to touchdown.

a. It should be possible to initiate a missed approach at any point during the approach until touchdown on the runway. It should be safe to initiate a missed approach that results in a momentary touchdown on the runway.

b. A go-around should not require unusual pilot skill, alertness, or strength.

c. The proportion of approaches terminating in a go-around below 500 ft. (150 m) due to the combination of failures in the landing system and the incidence of unsatisfactory system performance may not be greater than 5%.

d. Information should be available to the operator to assure that a safe go-around flight path can be determined.

6.6. Flightdeck Information, Annunciation, and Alerting Requirements. This section identifies information, annunciations and alerting requirements for the flight deck.

The controls, indicators and warnings must be designed to minimize crew errors that could create a hazard. Mode and system malfunction indications must be presented in a manner compatible with the procedures and assigned tasks of the flightcrew. The indications must be grouped in a logical and consistent manner and be visible under all expected normal lighting conditions.

6.6.1. Flightdeck Information Requirements. This section identifies requirements for basic situational and guidance information.

a. For manual control of approach flight path, the appropriate flight display(s), whether head down or head up, must provide sufficient information, without excessive reference to other cockpit displays, to enable a suitably trained pilot to:

(1) maintain the approach path

(2) to make the alignment with the runway, and if applicable, safely flare and roll out, or

(3) go-around.

b. Sufficient information should be provided in the flight deck to allow the pilots to monitor the progress and safety of the approach operation, using the information identified above and any additional information necessary to the design of the system.

c. Required flight performance monitoring capability includes at least the following:

(1) unambiguous identification of the intended path for the approach, and, if applicable, safely flare and roll out, (e.g., ILS/MLS approach identifier/frequency, and selected navigation source), and

(2) indication of the position of the aircraft with respect to the intended path (e.g., raw data localizer and glide path, or equivalent).

6.6.2. Annunciation Requirements. A positive, continuous, and unambiguous indication should be provided for the modes actually in operation, as well as those that are armed for engagement. In addition, where engagement of a mode is automatic (e.g., localizer and glide path acquisition), clear indication must be given when the mode has been armed by either action of a member of the flightcrew, or automatically by the system (e.g., a pre-land test - LAND 3).

6.6.3. Alerting. Alerting requirements are intended to address the need for warning, caution, and advisory information for the flightcrew.

6.6.3.1. Warnings. Section 25.1309 requires that information must be provided to alert the crew to unsafe system operating conditions and to enable the crew to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. The design should account for crew alerting cues, corrective action required, and the capability of detecting faults.

6.6.3.2. Cautions. A caution is required whenever immediate crew awareness is required and timely subsequent crew action may be required. A means shall be provided to advise the flightcrew of failed airplane system elements that affect the decision to continue or discontinue the approach.

For RNP systems, the guidance or control system shall indicate to the flightcrew when the Actual Navigation Performance (ANP) exceeds the RNP

6.6.3.3. System Status. Appropriate system status and failure annunciations suited to the guidance systems used, navigation sensors used, and any related aircraft systems (e.g., autopilot, flight director, electrical system) should be provided for the operator to determine prior to departure and the flightcrew to determine after departure, the capability of the airplane approach system components to accomplish the intended approach.

a. While en route, the failure of each airplane component affecting the approach capability should be indicated without flightcrew action. The indication should be an advisory (i.e., not a warning or caution, annunciates without flightcrew action, but does not demand immediate flightcrew attention), unless the failure requires a warning or caution for other reasons (e.g., autopilot disconnect warning).

b. A means shall be provided to advise the flightcrew of failed airplane system elements that affect the decision to continue to the destination or divert to an alternate.

c. System Status indications should be identified by names that are different than operational authorization categories (e.g., do not use names such as "CAT I," "CAT II," "CAT III").

6.7. Multiple Landing Systems and Multi-mode Receivers (MMR) for Category I. International agreements have established a number of landing systems as an acceptable means to provide guidance to support the conduct of an instrument approach. This section identifies unique requirements which relate to airplane systems which provide the capability to conduct approach and landing operations using these multiple landing systems (e.g., ILS, MLS, GLS). Typically these multiple landing systems are implemented through use of one or more multi-mode navigation receivers (MMR), capable of providing navigation information for ILS, MLS, and GLS or any one or more combinations of these landing sensor systems.

a. ICAO has specified an ILS protection date of at least 2010 to support international approach and takeoff operations. In addition, MLS or GLS may be used on a regional basis, until GLS based approach, landing, and departure system are in worldwide use. Accordingly, an operator may elect to use ILS, ILS/MLS, ILS/GLS, or ILS/MLS and GLS. If a Multi-mode Receiver (MMR) is used, MMR characteristics should be consistent with applicable related ARINC characteristics for MMR.

b. For systems which elect to use MLS, either FAA criteria or JAR-AWO as amended, (e.g., NPA AWO 9), may be used as a consideration in defining the airworthiness requirements for MLS certification.

6.7.1. General Requirements. Where practicable, the flight deck approach procedure should be the same irrespective of the navigation source being used.

a. A means (for example, the current ILS audio idents) should be provided to confirm that the intended approach aid(s) has been correctly selected.

b. During the approach, an indication of a failure in each non-selected airplane system element must be provided to the flightcrew as an indication of system status; it should not produce a caution or warning;

6.7.2. Indications. The following criteria apply to indications in the flight deck for the use of a multi-mode landing system:

The loss of acceptable deviation data shall be indicated on the display. It is acceptable to have a single failure indication for each axis common to all navigation sources.

6.7.3. Annunciations. The following criteria applies to annunciations in the flight deck when using a multi-mode approach system:

a. The navigation source (e.g., ILS, MLS, GLS, FMS) selected for the approach shall be positively indicated in the primary field of view at each pilot station;

b. The data designating the approach (e.g., ILS frequency, MLS channel, GLS approach identifier) shall be unambiguously indicated in a position readily accessible and visible to each pilot;

c. A common set of mode ARM and ACTIVE indications (e.g., LOC and GS) is preferred for ILS, MLS, and GLS operations;

d. A means should be provided for the crew to determine a failure of the non-selected navigation receiver function, in addition to the selected navigation receiver function. When considering equipment failures, the failure indications should not mislead through incorrect association with the navigation source. For example, it would not be acceptable for the annunciation "ILS FAIL" to be displayed when the selected navigation source is MLS and the failure actually affects the MLS receiver.

6.7.4. Alerting. Flight operations require alternate airports for takeoff, en route diversion, and landing. These alternate airports may have different landing systems. Flight operations may be planned, released, and conducted on the basis of using one or more landing systems.

a. The capability of each element of a multi-mode approach and landing system shall be available to the flightcrew to support dispatch of the airplane.

b. A failure of each element of a multi-mode approach and landing system must be indicated to the flightcrew without pilot action, as an advisory (i.e., not a warning or caution, does not demand immediate flightcrew attention), during en route operation.

c. A failure of the active element of a multi-mode approach and landing system during an approach shall be accompanied by a warning, caution, or advisory (i.e., not a warning or caution, annunciates without flightcrew action, but does not demand immediate flightcrew attention), as appropriate.

d. An indication of a failure in each non-selected element of a multi-mode approach and landing system during an approach may be made available to the flightcrew as an advisory (i.e., not a warning or caution, annunciates without flightcrew action, but does not demand immediate flightcrew attention), but should not produce a caution or warning.

6.7.5. Multi-mode Receivers (MMR). For MMRs using more than one type of landing system, the means of compliance required for certification can be simplified, provided the applicant provides appropriate justification. This section provides guidance for retrofit certifications, for "ILS Look alike" applications, and for certification of ILS installations with either new or modified receivers.

Typical receiver configurations for retrofit applications include:

a. An ILS receiver from a new supplier;

b. A modified ILS receiver from the same supplier (e.g., for purposes of providing improved FM Immunity);

c. A re-packaged receiver from the same supplier (e.g., the ILS partition in an MMR, or the transition from ARINC 700 to 900 series equipment);

d. A stand-alone MLS receiver ("ILS look alike");

e. An MLS partition in an MMR ("ILS look alike");

f. A stand-alone GLS receiver ("ILS look alike"); or

g. A GLS partition in an MMR ("ILS look alike").

6.7.5.1. "ILS Look alike" Definition Applicable to MMR. "ILS Look alike" is defined as the ability of a non-ILS based navigation receiver function to provide operational characteristics and interface functionality to the rest of the aircraft equivalent to that provided by an ILS-based receiver function. Specifically in the case of an MLS or GNSS (GLS) based receiver function, the output should be in DDM microamps, with a sensitivity equivalent to an ILS receiver taking account of the effects of runway length.

6.7.5.2. General Certification Considerations.

6.7.5.2.1. Certification Process. An "impact assessment" should address any new receiver functionality considering:

a. Differences between the current basis of certification and that requested (if applicable).

b. The functionality being added.

c. Credit that can be taken for the existing approval.

6.7.5.2.2. Equipment Approval. TSO/MOPS compliance should be demonstrated where appropriate, including software qualification and receiver environmental qualification to the appropriate levels.

6.7.5.2.3. Aircraft Installation Approval (14 CFR Part 25). The following should be considered:

a. Impact on airplane system safety assessments.

b. Radio approval (e.g., antenna positions, range, polar diagrams, coverage, compatibility between receiver and antenna).

c. EMI/EMC testing.

d. Functional integration aspects of the receiver with respect to other systems, controls, warnings, displays.

e. Electrical loading.

f. Flight data recorder requirements.

g. Suitable Aircraft Flight Manual (AFM) provisions.

h. Certification means of compliance for the receiver installation (e.g., specification of ground and/or flight testing, as necessary).

6.7.5.2.4. Alternative Means of Compliance using JAR-AWO. JAR-AWO may be considered as an acceptable means of compliance for ILS or MLS if the applicant establishes that the proposed new or modified navigation receiver configuration can be considered to have "ILS Look alike" characteristics. The following interpretative material to existing ACJ may be considered for that part of the certification affected by the revised installation:

ACJ AWO 131 Performance Demonstration. 2.1 Flight Demonstrations - Program of Landings for Certification.

ACJ AWO 161(b) Failure Conditions.

ACJ AWO 231 Flight Demonstration. 1.1 Continuous Method (Analysis of Maximum Value).

ACJ AWO 431 Performance (Interpretative Material).

6.7.5.2.5. Recertification of an ILS function following the Introduction of a New or Modified ILS Navigation Receiver Installation. The certification program should consider the differences between the new configuration and the pre-existing ILS receiver system. An "impact assessment" may be used to establish a basis for certification.

6.7.5.2.5.1. New or Modified ILS Impact Assessment.

a. An impact assessment should consider the following aspects of the new or modified ILS receiver, or receiver function, for equivalence with the existing ILS receiver configuration:

(1) hardware design;

(2) software design;

(3) signal processing and functional performance;

(4) failure analysis;

(5) receiver function, installation and integration (e.g., with controls, indicators and warnings).

b. The impact assessment should also identify any additional considerations such as:

(1) Future functionality provisions which have no impact on system operation;

(2) Shared resources to support future functionality.

Based upon the assumption that the ILS receiver, or receiver function, can be shown to be equivalent to the current ILS configuration, the applicant may propose that the new installation be treated as a new ILS receiver for installation on a given airplane type.

6.7.5.2.5.2. New or Modified ILS Failure Analysis. The failure characteristics of the new or modified installation should be reviewed, equivalent to systems using ILS data, to ensure that the failure characteristics are compatible with and do not invalidate any original or previous safety assessments.

6.7.5.2.5.3. New or Modified ILS Autoland or HUD Guidance Landing Function Flight Testing (if necessary). For systems intended to provide Autoland or HUD guidance landing function using a new ILS, MLS, GLS, or combined MMR receiver, a flight test program of typically a minimum of eight approaches terminating in a successful (automatic or HUD) landing and rollout (if applicable) using the flight control/guidance system, including a minimum of two ILS facilities should be completed. Approaches should include captures from both sides of the final approach course, at angles and distances representative of typical instrument approach procedures, and, if applicable, from below and above the glideslope.

The approach and landing performance (flight path deviation, touchdown data, etc.) as appropriate, should be shown to be equivalent to that achieved in the original ILS certification. Recorded flight test data may be required to support equivalency demonstration.

A demonstration of take off guidance performance should be included where applicable.

6.7.5.2.5.4. New or Modified ILS Documentation. The following documentation should be provided for certification:

a. An Impact Assessment including effects on System Safety Assessments.

b. A Flight test report, if applicable.

c. Revisions to the Flight Manual, where appropriate.

6.7.5.2.6. Recertification following the Introduction of an MLS or GLS Navigation Receiver Installation.

6.7.5.2.6.1. MLS or GLS Introduction Impact Assessment. An MLS or GLS receiver or receiver function can be certificated with an "impact assessment" similar to that required for the re-certification of a new or modified ILS receiver, provided that the unit(s) has been shown to have satisfactory "ILS Look alike" characteristics. The "impact assessment" should assess equivalent aspects of the MLS or GLS receiver or receiver function to those for the existing ILS receiver configuration.

Based upon the assumption that the MLS or GLS receiver or receiver function, can be shown to have "ILS look alike" characteristics, the applicant may propose that the new installation be treated as a new ILS receiver for approval on a particular airplane type.

6.7.5.2.6.2. MLS or GLS Failure Analysis. The failure characteristics of the new or modified installation should be reviewed, equivalent to systems using ILS data, to ensure that the failure characteristics are compatible with and do not invalidate any original or previous safety assessments.

6.7.5.2.6.3. MLS or GLS Statistical Performance Assessment. If the flight control/guidance system control algorithms are unchanged or effects of any changes are fully accounted for (e.g., navigation reference point), the statistical performance assessment of a currently certificated automatic landing system or Head Up Display landing or takeoff system should typically not have to be re-assessed for the addition of MLS or GLS functionality. This equivalence is based on the assumption that the MLS or GLS receiver, or the MLS or GLS partition of an MMR, can be shown to have satisfactory "ILS Look alike" characteristics.

6.7.5.2.6.4. MLS or GLS Antenna or Navigation Reference Point Location. The implication of differences in position of the MLS or GLS and ILS aircraft antennas or Navigation Reference Point should be assessed considering:

a. Wheel-to-threshold crossing height;

b. Lateral and vertical antenna position or navigation reference point position effects on flight guidance system performance (including any alignment, flare, or rollout maneuvers).

6.7.5.2.6.5. MLS or GLS Introduction Flight Testing (as necessary). For an installation of MLS or GLS which can be treated as a new ILS receiver, a flight test program of typically a minimum of 10 to15 approaches terminating in a landing and rollout (if applicable) using the flight control/guidance system, including a minimum of two MLS or GLS facilities for each system to be authorized should be completed. The approaches should include captures from both sides of the final approach course using representative angles and distances, should include captures from below and above the glideslope if applicable, and should include representative wind conditions where antenna or navigation reference point positions may impact performance.

The approach and landing performance (flight path deviation, touchdown data etc.) as appropriate, should be shown to be equivalent to that achieved in the original ILS certification. Recorded flight test data may be required to support equivalency.

A demonstration of take off guidance performance should be included where applicable.

6.7.5.2.6.6. MLS or GLS Introduction Documentation. The following documentation should be provided for certification of MLS or GLS:

a. An Impact Assessment including effects on System Safety Assessments.

b. A Flight test report, if applicable.

c. Revisions to the Flight Manual where appropriate.

6.8. Steep Angle Approaches. The following considerations should be considered before AFM provisions are incorporated for steep angle approaches:

a. The descent gradient range to be demonstrated.

b. Suitable "touchdown zone" size considerations, if not standard.

c. Adequate descent gradient abuse recovery.

d. Adequate speed abuse recovery.

e. Engine-failure continuation safety.

f. Engine-failure balked or rejected landing safety.

g. Adverse tailwind gradients on approach.

h. Adverse tailwind component limits at touchdown.

i. De-ice and Anti-ice protection considerations.

j. Suitability of cockpit visibility during approach and flare.

k. Suitability of climb gradient achievable while in the steep angle approach configuration, as necessary.

l. Suitability of descent, flare, and touchdown sink rates.

m. Provision for drag device (e.g., spoiler or auto-feather) failure.

n. Suitability of auto-feather response and time delays, as applicable.

o. Flight guidance system compatibility with steep angle approach paths to be flown.

p. Antenna function for navigation and communication performance are satisfactory.

q. Flight guidance display systems are satisfactory.

r. Suitable procedures are provided for approach, rejected landing, and missed approach for all-engine and engine-inoperative cases, and engine failure is addressed at any time until touchdown, during rollout, or after a go around.

s. Any adverse deck angle effects or landing gear geometry effects.

7. APPROACH SYSTEM EVALUATION. An evaluation should be conducted to verify that the pertinent systems as installed in the airplane meet the airworthiness requirements of paragraph 6 of this appendix. The evaluation should include verification of approach system performance requirements and a safety assessment for verification of the integrity and availability requirements. Engine failure cases and other selected failure conditions identified by the safety assessment should be demonstrated by simulator and/or flight tests.

An applicant shall provide a certification plan(s) that describes:

a. The means proposed to show compliance with the requirements of paragraph 6 of this appendix, with particular attention to methods that differ significantly from those described in this appendix.

b. How any non-airplane elements of the Approach System relate to the airplane system from a performance, integrity, and availability perspective (e.g., appropriate reference to ICAO Annex or U.S. Standard).

c. The assumptions on how the performance, integrity, and availability requirements of the non-airplane elements of the Standard Landing Aid will be assured.

d. The system concepts and operational philosophy to allow the regulatory authority to determine whether criteria and requirements in excess of that contained in this appendix are necessary.

Early agreement between the applicant and the FAA should be reached on the proposed certification plan. Upon completion of an FAA engineering design review and supporting simulation studies, a type inspection authorization (TIA) should be issued to determine if the complete installation of the equipment associated with Category I operations meets the criteria of this appendix.

7.1. Performance Evaluation. The performance assessment can be accomplished "in flight," or credited from similar installations as follows:

a. Performance shall be demonstrated by flight test, or analysis validated by flight test, using at least 3 different representative facilities for a minimum of 9 total approaches, with a representative range of environmental and system variables which have an effect on overall performance.

b. Acceptable performance may be established as a by-product of, or in conjunction with, a more restrictive performance demonstration(s) (e.g., Basic type certification, or as a consequence of successfully meeting Category II/III criteria);

- As a dedicated qualitative "in flight" demonstration of acceptable performance; or
- By establishing similarity with other mature and acceptably performing system installations.

For this provision, "in-flight" demonstration is not necessary, but a functional ground check, bench test, or other equipment check is typically appropriate (e.g., this provision is typically used in the instance of installation of a new model of ILS, VOR, ADF, or DME receiver).

7.2. Safety Assessment. Except as required by any specific safety-related criteria identified in this appendix, or by the operating rules, a safety assessment of the approach system, considered separately and in conjunction with other systems, shall be conducted to show compliance with section 25.1309.

8. AIRBORNE SYSTEM REQUIREMENTS. This section identifies criteria applicable to specific aircraft system architecture selected to conduct the operation. This criteria is developed from operational considerations, approach system considerations, airplane system considerations, and the general operational philosophy contained in the body of this AC.

8.1. General. Various airplane systems are expected to comply with the basic performance, integrity, and availability requirements as identified in paragraph 6 of this appendix.

8.2. Autopilot. Criteria applicable to Autopilot systems is as specified by section 25.1329.

8.3. Head Down Guidance. Criteria applicable to Head Down Guidance systems are specified in the pertinent parts of paragraphs 4 and 5 of this appendix.

8.4. Head Up Guidance. The following criteria is applicable to Head Up Guidance systems:

a. The workload associated with use of the HUD should be considered in showing compliance with section 25.1523.

b. The HUD display medium must not significantly obscure the pilot's view through the cockpit window.

c. Control of Approach Flight Path - the HUD must provide sufficient guidance information, without excessive reference to other cockpit displays, to enable a suitably trained pilot to:

- maintain the approach path
- go-around

d. The pilot should be able to align with the runway without the HUD adversely affecting the pilot task. If command information is provided for the flare and landing, it must not be misleading and should be consistent with the characteristics of normal manual maneuvers.

e. If only one HUD is installed, it should be installed at the pilot-in-command crew station.

f. The HUD guidance must not require exceptional piloting skill to achieve the required performance.

g. The HUD system performance and alerting should be consistent with the intended operational use for duties and procedures of the pilot flying (PF) and pilot not flying (PNF) (see paragraphs 5.6 and 5.8 of the main body of this AC).

h. If the autopilot is used to control the flight path of the airplane to intercept and establish the approach path, the point during the approach at which the transition from automatic to manual flight takes place shall be identified and used for the performance demonstration.

i. Any transition from autopilot to HUD guidance must not require exceptional piloting skill, alertness, strength, or excessive workload.

8.5. Hybrid HUD/Autoland Systems [PoC]. The following criteria is applicable to Hybrid systems:

a. If a HUD is used to monitor an autoflight system, it should be shown to be compatible with the autoflight system and permit a pilot to detect unsuitable autopilot performance.

b. Other hybrid systems (e.g., including EVS) require a proof of concept [PoC] evaluation to establish suitable criteria.

8.6. Satellite-Based Approach System. The following criteria is applicable to satellite-based approach systems:

a. Satellite-based systems should be shown to provide equivalent or better capability than navigation systems based on VOR, DME, or ILS for comparable operations, or meet provisions applicable to RNP.

b. Satellite-based systems should not exhibit undue sensitivity to masking of satellite vehicles, or interference from onboard or external sources.

c. Satellite-based systems should not exhibit adverse characteristics during acquisition or loss of satellites.

8.7. Area Navigation Systems.

a. Area navigation systems should operate consistent with criteria specified in:

(1) AC 25-15, Approval of Flight Management Systems in Transport Category Airplanes;

(2) AC 20-129, Airworthiness Approval of Vertical Navigation (VNAV) Systems for use in the U.S. NAS and Alaska; and

(3) AC 20-130, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, as amended, or equivalent criteria.

b. In addition, area navigation systems used for approach should have at least the following characteristics:

(1) If the operational software (ops program) is modifiable or loadable (e.g., by maintenance action) a "Version" identification must be provided and available for display to the pilot or maintenance personnel (e.g., PS4052520-161, or U7.4, or B767-300.3);

(2) A suitable database must be used which can be assured to be suited for the specific aircraft and navigation system type, and which can be assessed to have current data (e.g., Navigation Database "NW19810001");

(3) Pilot input/output functions, keys, and displays should have standard functions available, and operate consistent with industry standard conventions and practice;

(4) Single systems must be accessible and usable by either pilot located at a pilot or copilot crew station (e.g., the PF or PNF) of a multi-crew aircraft. It is not necessary that such systems also be accessible, or easily accessible, to pilots other than the PF and PNF sitting in a jumpseat (e.g., do not need to be readily accessible to International Relief Officers (IROs)), but it is recommended that such a system be at least visible to such other pilots (if they have assigned duties) for enhancement of crew coordination and monitoring;

(5) Dual (or more) system installations must have a convenient and expedient way to "crossload" and be kept updated. Each system should have CDUs, displays, and annunciations, or equivalent that are at least visible and accessible to both the PF and PNF. This is to provide both for monitoring and use in failure cases. It is not necessary that such systems also be accessible, or easily accessible, to pilots other than the PF and PNF sitting in a jumpseat (e.g., do not need to be readily accessible to IROs), but it is recommended that such a system be at least visible to such other pilots (if they have assigned duties) for enhancement of crew coordination and monitoring;

(6) System performance must be consistent with operational authorizations sought (see paragraphs 4 and 5 of this appendix), or should be consistent with an identifiable performance standard such as for various levels of RNP;

(7) If credit is sought for operating on complex and closely spaced multiple Waypoint paths, an interface with a suitable "track up" or "heading up" navigation map display is necessary;

(8) A means to monitor lateral and vertical deviations should be provided (e.g., displacement display, progress page lateral and vertical deviation);

(9) A means must be provided to assure suitable operation or updating, and if RNP is included, to identify the level of RNP to be used, and ANP (or EPE);

8.8. Autothrottle. If autothrottle capability is installed, the applicant should identify any necessary modes, conditions, procedures, or constraints that apply to its use. Use of the autothrottle should not cause unacceptable performance of any autopilot modes intended for use, and any autopilot mode intended for use with autothrottle should not cause unacceptable autothrottle performance. The autothrottle should expeditiously capture any commanded speed adjustments, acceptably maintain speed, and not cause any hazardous conditions with normal use, or for any probable failure modes, considering pilot intervention using normal piloting skills.

8.9. Data Link [PoC]. A datalink may be used to provide data to the airplane to provide the accuracy necessary to support the approach.

a. The integrity of the datalink should be commensurate with the integrity required for the approach.

b. The role of the datalink in the approach system must be addressed as part of the aircraft system certification process until such time as an acceptable national or international standard for the ground system is established.

9. AIRPLANE FLIGHT MANUAL (AFM). The AFM should contain the following information:

a. Any conditions or constraints on approach performance with regard to airport conditions (e.g., elevation, ambient temperature, approach path slope, runway slope and ground profile under the approach path).

b. The criteria used for the demonstration of the system, acceptable normal and non-normal procedures, the demonstrated configurations and types of facilities used, and any constraints or limitations necessary for safe operation.

c. The type of navigation facilities used as a basis for certification. This should not be taken as a limitation on the use of other facilities. The AFM may contain a statement regarding the type of facilities or condition known to be unacceptable for use.

d. Information should be provided to the flightcrew regarding atmospheric conditions under which the system was demonstrated (e.g., headwind, crosswind, tailwind etc.). The AFM should contain a statement that "Credit may not be predicated on the use of <type of system> if conditions exceed … (those for which the system received airworthiness approval)."

e. Any necessary performance, procedure, or configuration data to permit an operator to determine climb gradient and transition distances for safe obstacle clearance during a missed approach, balked landing, or rejected landing. Note that this information need not be specifically included in the AFM if it is available to the operator using some other method acceptable to the operator and manufacturer (e.g., FCOM, supplementary performance information, separate AFM appendix).

Data may be based on corresponding takeoff performance and obstacle assessment data if appropriate accommodation of configuration change and transition distance can be accounted for. Otherwise, additional information on data that may be useful to an operator for determination of engine-inoperative missed performance, maximum allowable weight, or obstacle assessments is discussed in the main body of this advisory circular in Paragraph 4.3.1.8.

NOTE 1: The AFM limitation section should <u>not</u> specify DA(H) or RVR limitations.

NOTE 2: Section 2 of AC 25.1581-1 discusses AFM contents. The approval status referenced in 2 b (9) (vii) for Category I, II, or III of that AC should be noted in the Normal Procedures Section of the AFM, in accordance with the above provisions of 9. Airplane Flight Manual.

APPENDIX 3. AIRBORNE SYSTEMS FOR CATEGORY II

Mandatory terms used in this Advisory Circular (AC) such as "shall" or "must" are used only in the sense of ensuring applicability of these particular methods of compliance when the acceptable means of compliance described herein are used. This AC does not change, add, or delete regulatory requirements or authorize deviations from regulatory requirements.

1. PURPOSE. This appendix contains airworthiness criteria for the approval of aircraft equipment and installations required to conduct an approach in Category II weather minima.

2. GENERAL.

The type certification approval for the equipment, system installations, and test methods should be based on a consideration of factors such as the intended function of the installed system, its accuracy, reliability, and fail-safe features, as well as the operational concepts contained in the body of this AC. The guidelines and procedures contained herein are considered acceptable methods of determining transport category airplane airworthiness to conduct an approach in Category II weather conditions.

The overall assurance of performance and safety of an operation can only be assessed when all elements of the system are considered. This appendix includes a discussion of the non-aircraft elements of a system so that an overall assessment of the operation can be accomplished.

References to Joint Airworthiness Authority (JAA) All Weather Operations Regulations (JAR) are provided to facilitate the All Weather Operations Harmonization process. A reference to a JAR provision does not necessarily mean that the FAA and JAA requirements are <u>equivalent</u> but that they are <u>related with similar intent</u>. The FAA may typically identify which JAR provisions are acceptable to FAA at the time a type certification basis is established.

3. INTRODUCTION. This appendix addresses the approach phase of flight. For the purpose of this appendix, the approach phase of flight is defined as the flight segment from the Final Approach Fix (FAF) to the Category II decision height. This appendix provides criteria which represents an acceptable means of compliance with performance, integrity, and availability requirements for low visibility approach. An applicant may propose alternative criteria. With new emerging technologies, there is a potential for many ways of conducting low visibility approach operations. This appendix does not attempt to provide criteria for each potential combination of airplane and non-airplane elements.

a. Operations using current ILS or MLS ground-based facilities and airplane elements are in use, and the certification criteria for approval of these airplane systems are established. Other operations, using non-ground based facilities or evolving ground facilities (e.g., local area augmented Global Navigation Satellite System (GNSS)), and the use of some new aircraft equipment require Proof of Concept testing to establish appropriate criteria for operational approval and system certification. The need for a Proof of Concept program is identified in this AC with a [PoC] designator. This appendix provides some general guidelines, but not comprehensive criteria, for airplane systems that require a Proof of Concept.

b. The intended flight path may be established in a number of ways. For systems addressed by this appendix, the reference path may be established by a navigation aid (e.g., ILS, MLS). Other methods may be acceptable if shown feasible by a Proof of Concept [PoC]. Methods requiring PoC include, but are not limited to:

- the use of ground surveyed waypoints, either stored in an on-board data base or provided by data link to the airplane, with path definition by the airborne system
- sensing of the runway environment (e.g., surface, lighting, and/or markings) with a vision enhancement system

On-board navigation systems may have various sensor elements by which to determine airplane position. The sensor elements may include ILS, MLS, GNSS with ground-based augmentation (GLS), or inertial information. Each of these sensor elements should be used within appropriate limitations with regard to accuracy, integrity, and availability.

Indications of the airplane position with respect to the intended path can be provided to the pilot in a number of ways.

- deviation displays with reference to navigation source (e.g., Instrument Landing System (ILS) receiver, Microwave Landing System (MLS) receiver), or
- on-board navigation system computations with corresponding displays of position and reference path, or
- by a vision enhancement system. **[PoC]**

c. The minimum visibility required for safe operations with such systems and backup means will be specified by FAA Flight Standards in the operational authorization.

4. TYPES OF APPROACH OPERATIONS. The airworthiness criteria in this appendix are intended to be consistent with the operational concepts of Paragraph 4.3 of the main body of this AC.

4.1. Operations based on a Standard Landing Aid.

ILS and MLS have been characterized by appropriate International Civil Aviation Organization I (ICAO) standards, and for the purpose of certification in accordance with this Appendix may be considered a Standard Landing Aid.

Landing Systems based on GNSS Landing System (GLS) may use interim United States criteria, or other FAA agreed State criteria, or other international standards developed for acceptable combination of space and ground-based elements. Acceptable overall aircraft performance may be established based upon the assumption that these services are used and maintained to the specified standards identified, or as specified in the applicable airworthiness approval.

4.2. Operations based on Required Navigation Performance (RNP). The airworthiness criteria in this appendix support the operational concept for RNP as described in Paragraph 4.5 in the main body of this AC.

4.2.1. Standard RNP Types. Approach operations may be specified based upon standard RNP type designations. The type designation identifies the performance standard required to conduct the operation. The RNP Type will have a lateral performance component and may additionally have a vertical component. Refer to Paragraph 4.5.1 in the main body of this AC for Standard RNP Types.

4.2.2. Non-standard RNP Types. Some operations may be approved for Non-Standard RNP Types - Refer to Paragraph 4.5.2 in the main body of this AC. It is envisioned that the airplane systems approval process for Non-Standard RNP Types will be equivalent to that used for Standard RNP Types unless otherwise agreed with the FAA.

5. TYPES OF APPROACH NAVIGATION SERVICE.

5.1. ILS.

The ILS is supported by established international standards for ground station operation. These standards should be used in demonstrating airplane system operation.

The airplane system response during a switchover from an active localizer transmitter to a backup transmitter shall be established.

The Airplane Flight Manual shall indicate that operation is predicated upon the use of an ILS facility with performance and integrity equivalent to, or better than, an International Civil Aviation Organization (ICAO) Annex 10 Facility Performance Category II ILS, an U.S. Type II or equivalent.

5.1.1. ILS Flight Path Definition. The required lateral and vertical flight path is inherent in the design of the ILS. Acceptable performance and integrity standards have been established for ILS.

5.1.2. ILS Airplane Position Determination. The airplane lateral and vertical position relative to the desired flight path is accomplished by an airplane ILS receiver that provides deviation from the extended runway centerline path when in the coverage area.

5.2. MLS.

The MLS is supported by established ICAO Annex 10 international standards for ground station operation. These standards should be used in demonstrating airplane system operation.

The airplane system response during a switchover from an active azimuth transmitter to a backup transmitter shall be established.

The Airplane Flight Manual (AFM) shall indicate that operation is predicated upon the use of an MLS facility with performance and integrity equivalent to, or better than, an ICAO Annex 10 Facility Performance Category II MLS, or equivalent.

5.2.1. MLS Flight Path Definition. The lateral and vertical required flight path is inherent in the design of the MLS. Acceptable performance and integrity standards have been established for MLS.

5.2.2. MLS Airplane Position Determination. The airplane lateral and vertical position relative to the desired flight path is accomplished by an airplane MLS receiver that provides deviation from the extended runway centerline path when in the coverage area.

5.3. GNSS Landing System (GLS) [PoC].

This appendix section is not intended to provide a comprehensive means of compliance for airworthiness approval of GNSS-based systems. Currently approved systems are ILS or MLS-based. The application of new technologies and systems will require an overall assessment of the integration of the airplane components with other elements (e.g., new ground-based aids, satellite systems, advanced radar mapping systems, enhanced vision sensor systems) to ensure that the overall safety of the use of these systems for Category II. This GNSS section is included to identify important differences between conventional ILS/MLS-based systems and GNSS based systems that affect GLS criteria development.

The performance, integrity and availability of any ground station elements, any data links to the airplane, any satellite elements and any data base considerations, when combined with the performance, integrity, and availability of the airplane system, should be at least equivalent to the overall performance, integrity, and availability provided by ILS to support Category II operations.

5.3.1. GLS Flight Path Definition. Appropriate specification of the required flight path for approach, or approach, landing, and rollout (as applicable), is necessary to assure safety of the operation to the relevant operational minima. The required flight path should be established to provide adequate clearance between the airplane and fixed obstacles on the ground, between airplanes on adjacent approaches, and to ensure that the airplane stays within the confines of the runway.

a. The effect of the navigation reference point on the airplane flight path and wheel to threshold crossing height must be addressed.

b. The required flight path is not inherent in the design of a GNSS-based approach, landing, and rollout system; therefore, an airplane navigation system must specify a sequence of earth-referenced path points, or the airplane must receive information from a ground-based system, to define the approach, landing, and rollout required path points.

c. Certain path points, waypoints, leg types, and other criteria are necessary to safely implement the approach, or approach, landing, and rollout operations based on satellite and other integrated multi-sensor navigation systems.

d. Figure 4.6-1 in the main body of this AC shows the minimum set of path points, waypoints, and leg types considered necessary to specify the flight path for approach, or approach, landing, and rollout operations.

e. The required flight path may be stored in an airplane database for recall and use by the command guidance and/or control system when required to conduct the approach to relevant minima for landing and rollout.

f. The definition, resolution, and maintenance of the waypoints which define the required flight path and flight segments is key to the integrity of this type of approach, landing, and rollout operation.

g. A mechanism should be established to assure the continued integrity of the flight path designators.

h. The integrity of any database used to define required path points for an approach should be addressed as part of the certification process. The flightcrew shall not be able to modify information in the database that relates to the definition of the required flight path for the final approach, and if necessary, initial missed approach.

5.3.2. GLS Airplane Position Determination. The safety of an approach operation is, in part, predicated on knowing where the airplane is positioned relative to the required flight path. Navigation satellite systems exist which can provide position information to specified levels of accuracy, integrity, and availability. The accuracy, integrity, and availability can be enhanced by additional space and ground-based elements. These systems provide certain levels of capability to support present low visibility operations and are planned to have additional future capability.

a. Satellite systems have the potential to provide positioning information necessary to guide the airplane during approach. If operational credit is sought for these operations, the performance, integrity, and availability must be established to support that operation. Ground-based aids such as differential position receivers, pseudolites, etc., and a data link to the airplane may be required to achieve the accuracy, integrity, or availability for certain types of operation.

b. A level of safety equivalent to current ILS-based operations should be established.

c. The role of the satellite-based elements in the landing system should be addressed as part of the airplane system certification process until such time as acceptable national or international standards for satellite-based systems are established.

Basic GNSS (Un-augmented). This is the basic navigation service provided by a satellite system. No additional navigation service elements are used to enhance accuracy or integrity of the operation.

Differential Augmentation. The role of the differential station in the landing system should be addressed as part of the airplane system certification process, unless an acceptable national or international standard for the ground reference system is established.

Local Area Differential Augmentation. Local Area Differential (LAD) augmentation consists of a set of ground-based GNSS receivers that are used to derive pseudo-range corrections and integrity data referenced to a point on or near the airport. This augmentation data is then provided to the airplane via a local, ground-based data broadcast signal.

Wide Area Differential Augmentation. Wide Area Differential (WAD) augmentation may be used to provide approach capability supporting appropriate levels of Category II procedures.

Typically only LAD systems provide a basis for establishing the necessary position fixing accuracy, integrity, and availability for the final portion of a final approach segment or rollout. Unaugmented GNSS or WAD are typically only suited for support of initial or intermediate segments of an approach, final approach to restricted DA(H)s, or missed approach. GNSS or WAD may, however, be used in conjunction with Category II procedures for applications such as equivalent DME distance, or marker beacon position determination, when authorized by the operating rules.

5.3.3. Data Link [PoC]. A data link may be used to provide data to the airplane to provide the accuracy necessary to support certain operations (e.g., navigation waypoints, differential corrections for GNSS).

a. The integrity of the data link should be commensurate with the integrity required for the operation.

b. The role of the data link in the approach, or approach and landing system should be addressed as part of the airplane system certification process unless an identified acceptable U.S. or international standard(s) for the data link ground system is applicable and is used.

6. BASIC AIRWORTHINESS REQUIREMENTS. This section identifies airworthiness requirements, including those for performance, integrity, and availability that apply to all types of airplane systems, independent of the type of approach and landing or navigation system used. The definitions of performance, integrity, and availability are found in Appendix 1. The basic airworthiness criteria are intended to be independent of the specific implementation in the airplane or the type of approach system being used. Criteria may be expanded further in later sections of this appendix as it applies to a particular airplane system or architecture.

> **Note: Continuity of Approach Function may involve aircraft systems, ground systems and, in some cases, space based systems. This AC addresses the aircraft part of the system, and aircraft criteria will be defined in terms of aircraft system availability to provide quantifiable criteria for airworthiness compliance.**

6.1. General Requirements. An applicant shall provide a certification plan which describes how any non-aircraft elements of the Approach System relate to the aircraft system from a performance, integrity, and availability perspective. Standard Landing Aids (SLA) can be addressed by reference to ICAO Standards and Recommended Practices (SARPS).

a. The plan for certification shall describe the system concepts and operational philosophy to allow the regulatory authority to determine whether criteria and requirements other than those contained in this appendix are necessary.

b. The approach system performance should be established considering the environmental and deterministic effects that may reasonably be experienced for the type of operation for which certification and operational approval will be sought.

c. Where reliance is placed on the pilot to detect a failure of engagement of a mode when it is selected (e.g., go-around), an appropriate indication or warning must be provided.

d. The effect of the failures of the navigation facilities must be considered taking into account ICAO and other pertinent State criteria.

e. The effect of the aircraft navigation reference point on the airplane flight path and wheel-to-threshold crossing height shall be assessed.

6.2. Approach System Accuracy Requirements. The following items are general criteria that apply to the various types of approach operation.

a. Performance shall be demonstrated by flight test, or analysis validated by flight test, using at least 3 different representative facilities for a minimum of 20 total approaches, with a representative range of environmental and system variables which have an effect on overall performance.

b. The performance assessment shall take into account at least the following variables with the variables being applied based upon their expected distribution:

(1) Configurations of the airplane (e.g., flap settings);

(2) Center of gravity;

(3) Landing weight;

(4) Conditions of wind, turbulence, and wind shear;

(5) Characteristics of ground and space based systems and aids (i.e., ILS, MLS, GLS); and

(6) Any other parameter which may affect system performance (e.g., airport altitude, approach path slope, variations in approach speed).

c. The criteria for acceptable approach performance are based upon acquiring and tracking the required flight path to the appropriate minimum altitude for the procedure. The acquisition should be accomplished in a manner compatible with instrument procedure requirements and flightcrew requirements for the type of approach being conducted.

d. An approach guidance system shall not generate command information (e.g., flight director, HUD etc.) which results in flight path control that is oscillatory or requires unusual effort by the pilot to satisfy the performance requirements.

e. An approach control system shall not generate flight path control (e.g., autopilot) with sustained oscillations.

f. The approach system must cause no sustained nuisance oscillations or undue attitude changes or control activity as a result of configuration or power changes or any other disturbance to be expected in normal operation.

6.2.1. ILS. The performance standards for signal alignment and quality contained in ICAO Annex 10, or an equivalent State standard, are acceptable standards for operations based on ILS. These standards shall be used in establishing the performance of the operation.

a. Lateral tracking performance from 300 ft. HAT to 100 ft. HAT should be stable without large deviations (i.e., within ±25 microamps deviation) from the indicated course, for 95% of the time per approach.

b. Vertical tracking performance from 300 ft. HAT to 100 ft. HAT should be stable without large deviations (i.e., within ±35 microamps deviation) from the indicated path or ±12 ft, whichever is greater, for 95% of the time per approach.

Note: When this provision is applied to path tracking in conjunction with Category III, momentary excursions up to ±75 microamps during test demonstrations may be acceptable if flight guidance system touchdown and landing performance is otherwise shown to be satisfactory.

c. The Continuous Method and the Pass/Fail methods found in JAR ACJ AWO 231 may be used in lieu of the 95% of the time per approach and the minimum number of 20 approaches stated above.

6.2.2. MLS. The performance standards for signal alignment and quality contained in ICAO Annex 10 or an equivalent State standard are acceptable standards for operations based on MLS. These standards shall be used in establishing the performance of the operation.

a. Lateral tracking performance from 300 ft. HAT to 100 ft. HAT should be stable without large deviations (i.e., within ±25 microamps deviation) from the indicated course, for 95% of the time per approach.

b. Vertical tracking performance from 300 ft. HAT to 100 ft. HAT should be stable without large deviations (i.e., within ±35 microamps deviation) from the indicated path or ±12 ft, whichever is greater, for 95% of the time per approach.

> **Note: When this provision is applied to path tracking in conjunction with Category III, momentary excursions up to ±75 microamps during test demonstrations may be acceptable if flight guidance system touchdown and landing performance is otherwise shown to be satisfactory.**

c. The Continuous Method and the Pass/Fail methods found in JAR ACJ AWO 231 may be used in lieu of the 95% of the time per approach and the minimum number of 20 approaches stated above.

6.2.3. GLS [PoC]. Paragraph 5.3 provides background GLS considerations.

a. Lateral tracking performance from 300 ft. HAT to 100 ft. HAT should be stable without large deviations (i.e., within ±25 microamps deviation) from the indicated course or path, or equivalent, for 95% of the time per approach.

b. Vertical tracking performance from 300 ft. HAT to 100 ft. HAT should be stable without large deviations (i.e., within ±35 microamps deviation) from the indicated path or ±12 ft, whichever is greater, or equivalent, for 95% of the time per approach.

> **Note: When this provision is applied to path tracking in conjunction with Category III, momentary excursions up to ±75 microamps during test demonstrations may be acceptable if flight guidance system touchdown and landing performance is otherwise shown to be satisfactory.**

c. The Continuous Method and the Pass/Fail methods found in JAR ACJ AWO 231 may be used in lieu of the 95% of the time per approach and the minimum number of 20 approaches stated above.

6.2.4. RNP. The accuracy criteria for RNP are designed to enable a seamless transition from en route RNP to approach RNP to be accomplished. RNP operations are based upon the accuracy of the airplane flight path in absolute terms with respect to the defined flight path over the ground. The Total System Error (TSE) will be characterized by the combined performance of airplane systems and any navigation aids. The certification plan should identify any navigation aid(s) on which the RNP performance will be established and how the airplane performance interacts with the navigation aid(s) to meet the TSE performance requirements. The certification plan should identify the assumed relationship between airplane performance and any navigation aid performance.

a. The approach RNP is specified from the FAF to the point along the final approach segment at which the lowest applicable Decision Altitude (Height) (DA(H)) typically is applied. There may be one or more levels of RNP specified on a final segment. Missed approach RNP, or levels of RNP if more than one level or RNP is specified, is typically specified from a point related to the lowest applicable DA(H), and typically continues to a missed approach holding fix or missed approach waypoint. RNP also may be applied to a "go-around safety" assessment. When applied to a "go-around safety assessment" the RNP level and associated obstacle clearance start at the end of the touchdown zone with an expanding lateral area that widens to match the level of RNP used, and then continues at the

RNP level(s) specified. The expanding lateral area starts on the centerline for the approach at the end of the touchdown zone and widens at a 7.5 degree splay, or ICAO 1.8 splay, depending on procedure development criteria used. It is applicable from the end of a touchdown zone to reaching the missed approach holding fix or applicable missed approach waypoint (See Appendix 5).

b. Assumptions regarding the performance for any radio navigation aid(s) used should be consistent with ICAO Annex 10 or an equivalent State standard. In cases where site specific geometry must be considered in the evaluation of the NSE, limits on the assumed geometry should be identified.

c. The guidance or control system shall be demonstrated to maintain a flight path which tracks the defined flight path to the RNP Type as specified in Paragraph 4.5 of the body of this AC, as applicable.

6.2.5. Flight Path Definition. Refer to Paragraph 4.6 in the main body of this AC for consideration on Flight Path Definition when navigation aids are used which do not have the required flight path inherent in the structure of the signal in space.

6.3. Approach System Integrity Requirements. The applicant shall provide the certification authority with an overall operational safety assessment plan for the use of systems other than ILS or MLS for "path in space" guidance. This plan shall identify the assumptions and considerations for the non-aircraft elements of the system and how these assumptions and considerations relate to the airplane system certification plan.

a. The onboard components of the landing system, considered separately and in relation to other associated onboard systems, should be designed to comply with Title 14 of the Code of Federal Regulations (14 CFR) part 25, section 25.1309, considering any specific safety related criteria identified in this appendix, or as identified in accordance with the operating rules.

b. The following criteria is provided as advisory material for the application of section 25.1309 to Landing Systems:

6.3.1. ILS. The aircraft system response to loss of ILS guidance signals (localizer and glideslope) shall be established.

The aircraft system response during a switchover from an active localizer or glideslope transmitter to a backup transmitter shall be established.

6.3.2. MLS. The aircraft system response to loss of MLS guidance signals (elevation and azimuth) shall be established.

The aircraft system response during a switchover from an active elevation or azimuth transmitter to a backup transmitter shall be established.

6.3.3. GLS. The aircraft system response to loss of GLS guidance signals shall be established.

The aircraft system response during any switchover to alternate differential augmentation, pseudolites, and data link services, as applicable, shall be established.

6.3.4. RNP. The aircraft system response to loss of the navigation service(s) used to conduct the RNP operation shall be established.

a. The aircraft system response during any switch over to alternate navigation services shall be established.

b. It shall be demonstrated that the airplane will maintain the required flight path within the containment limits (i.e., 2 times the RNP value) when un-annunciated failures not shown to be extremely remote (probability on the order of 10^{-7} per approach, or less) are experienced.

6.4. Approach System Availability Requirements. Below 500 ft. on approach, the demonstrated probability of a successful landing should be at least 95% (i.e., no more than 5% of the approaches result in a go-around, due to the combination of failures in the landing system and the incidence of unsatisfactory performance). In addition, a dual or single area navigation (RNAV) approach system installation should meet the availability requirements consistent with the operational objective of 14 CFR part 121, section 121.349, (as applicable to standard Operations Specifications (OpSpecs)).

6.5. Go-around Requirements. A go-around may be required following a failure in the Approach System, as required by the flightcrew or by Air Traffic Service (ATS) at any time prior to touchdown.

a. It should be possible to initiate a missed approach at any point during the approach until touchdown on the runway. It should be safe to initiate a missed approach that results in a momentary touchdown on the runway.

b. A go-around should not require unusual pilot skill, alertness, or strength.

c. The proportion of approaches terminating in a go-around below 500 ft. (150 m), due to the combination of failures in the landing system and the incidence of unsatisfactory system performance, may not be greater than 5%.

d. Information should be available to the operator to assure that a safe go-around flight path can be determined.

6.6. Flightdeck Information, Annunciation, and Alerting Requirements. This section identifies information, annunciations, and alerting requirements for the flight deck.

The controls, indicators, and warnings must be designed to minimize crew errors that could create a hazard. Mode and system malfunction indications must be presented in a manner compatible with the procedures and assigned tasks of the flightcrew. The indications must be grouped in a logical and consistent manner and be visible under all expected normal lighting conditions.

6.6.1. Flightdeck Information Requirements. This section identifies requirements for basic situational and guidance information.

a. For manual control of approach flight path, the appropriate flight display(s), whether head down or head up, must provide sufficient information, without excessive reference to other cockpit displays, to enable a suitably trained pilot to:

(1) maintain the approach path,

(2) to make the alignment with the runway, and if applicable, safely flare and roll out, or

(3) go-around.

b. Sufficient information should be provided in the flight deck to allow the pilots to monitor the progress and safety of the approach operation, using the information identified above and any additional information necessary to the design of the system.

c. Required flight performance monitoring capability includes at least the following:

(1) unambiguous identification of the intended path for the approach, and, if applicable, safely flare and roll out, (e.g., ILS/MLS approach identifier/frequency, and selected navigation source), and

(2) indication of the position of the aircraft with respect to the intended path (e.g., raw data localizer and glide path, or equivalent).

6.6.2. Annunciation Requirements. A positive, continuous, and unambiguous indication should be provided for the modes actually in operation, as well as those that are armed for engagement. In addition, where engagement of a mode is automatic (e.g., localizer and glide path acquisition), clear indication must be given when the mode has been armed by either action of a member of the flightcrew, or automatically by the system (e.g., a pre-land test - LAND 3).

6.6.3. Alerting. Alerting requirements are intended to address the need for warning, caution, and advisory information for the flightcrew.

6.6.3.1. Warnings. Section 25.1309 requires that information be provided to alert the crew to unsafe system operating conditions and to enable the crew to take appropriate corrective action. A warning indication must be provided if immediate corrective action is required. The design should account for crew alerting cues, corrective action required, and the capability of detecting faults.

6.6.3.2. Cautions. A caution is required whenever immediate crew awareness is required and timely subsequent crew action may be required. A means shall be provided to advise the flightcrew of failed airplane system elements that affect the decision to continue or discontinue the approach.

For RNP systems, the guidance or control system shall indicate to the flightcrew when the Actual Navigation Performance (ANP) exceeds the RNP

Deviation alerting. The FAA does not require excessive deviation alerting, but will approve systems that meet appropriate criteria. If a method is provided to detect excessive deviation of the airplane, laterally and vertically during approach to touchdown, and laterally after touchdown, then it should not require excessive workload or undue attention. This provision does not require a specified deviation alerting method or annunciation, but may be addressed by parameters displayed on the Attitude Direction Indicator (ADI), Electronic Attitude Indicator (EADI), Head Up Display (HUD), or PFD. When a dedicated deviation alerting is provided, its use must not cause excessive nuisance alerts.

For systems demonstrated to meet criteria for Category II, compliance with the following criteria, from JAA AWO 236, is an acceptable means of compliance, but is not a required means of compliance:

a. For systems meeting the AWO 236 criteria, excess-deviation alerts should operate when the deviation from the ILS or MLS glide path or localizer centerline exceeds a value from which a safe landing can be made from offset positions equivalent to the excess-deviation alert, without exceptional piloting skill and with the visual references available in these conditions.

b. For systems meeting the AWO 236 criteria, excess-deviation alerts should be set to operate with a delay of not more than one (1) second from the time that the deviation thresholds are exceeded.

c. For systems meeting the AWO 236 criteria, excess-deviation alerts should be active at least from 300 ft. HAT (90 m) to the decision height, but the glide path alert should not be active below 100 ft. HAT (30 m).

6.6.3.3. System Status. Appropriate system status and failure annunciations suited to the guidance systems used, navigation sensors used, and any related aircraft systems (e.g., autopilot, flight director, electrical system) should be provided for the operator to determine prior to departure and the flightcrew to determine after departure, the capability of the airplane approach system components to accomplish the intended approach.

a. While en route, the failure of each airplane component affecting the approach capability should be indicated without flightcrew action. The indication should be an advisory (i.e., not a warning or caution, annunciates without flightcrew action, but does not demand immediate flightcrew attention), unless the failure requires a warning or caution for other reasons (e.g., autopilot disconnect warning).

b. A means shall be provided to advise the flightcrew of failed airplane system elements that affect the decision to continue to the destination or divert to an alternate.

c. System Status indications should be identified by names that are different than operational authorization categories (e.g., do not use names such as "CAT I," "CAT II," "CAT III").

6.7. Multiple Landing Systems and Multi-mode Receivers (MMR) for Category II. International agreements have established a number of landing systems as an acceptable means to provide guidance to support the conduct of an instrument approach. This section identifies unique requirements which relate to airplane systems which provide the capability to conduct approach and landing operations using these multiple landing systems (e.g., ILS, MLS, GLS). Typically, these multiple landing systems are implemented through use of one or more multi-mode receivers (MMR), capable of providing navigation information for ILS, MLS, and GLS or any one or more combinations of these landing sensor systems.

a. ICAO has specified an ILS protection date of at least 2010 to support international approach and takeoff operations. In addition, MLS or GLS may be used on a regional basis, until GLS-based approach, landing, and departure system are in worldwide use. Accordingly, an operator may elect to use ILS, ILS/MLS, ILS/GLS, or ILS/MLS and GLS. If a Multi-mode Receiver (MMR) is used, MMR characteristics should be consistent with applicable related ARINC characteristics for MMR.

b. For systems which elect to use MLS, either FAA criteria or JAR-AWO as amended, (e.g., NPA AWO 9), may be used as a consideration in defining the airworthiness requirements for MLS certification.

6.7.1. General Requirements. Where practicable, the flight deck approach procedure should be the same regardless of the navigation source being used.

a. A means (for example, the current ILS audio idents) should be provided to confirm that the intended approach aid(s) has been correctly selected.

b. During the approach, an indication of a failure in each non-selected airplane system element must be provided to the flightcrew as an indication of system status; it should not produce a caution or warning.

6.7.2. Indications. The following criteria apply to indications in the flight deck for the use of a multi-mode landing system:

The loss of acceptable deviation data shall be indicated on the display. It is acceptable to have a single failure indication for each axis common to all navigation sources.

6.7.3. Annunciations. The following criteria applies to annunciations in the flight deck when using a multi-mode approach system:

a. The navigation source (e.g., ILS, MLS, GLS, FMS) selected for the approach shall be positively indicated in the primary field of view at each pilot station;

b. The data designating the approach (e.g., ILS frequency, MLS channel, GLS approach identifier) shall be unambiguously indicated in a position readily accessible and visible to each pilot;

c. A common set of mode ARM and ACTIVE indications (e.g., LOC and GS) is preferred for ILS, MLS, and GLS operations;

d. A means should be provided for the crew to determine a failure of the non-selected navigation receiver function, in addition to the selected navigation receiver function. When considering equipment failures, the failure indications should not mislead through incorrect association with the navigation source. For example, it would not be acceptable for the annunciation "ILS FAIL" to be displayed when the selected navigation source is MLS and the failure actually affects the MLS receiver.

6.7.4. Alerting. Flight operations require alternate airports for takeoff, en route diversion, and landing. These alternate airports may have different landing systems. Flight operations may be planned, released, and conducted on the basis of using one or more landing systems.

a. The capability of each element of a multi-mode approach and landing system shall be available to the flightcrew to support dispatch of the airplane.

b. A failure of each element of a multi-mode approach and landing system must be indicated to the flightcrew without pilot action, as an advisory (i.e., not a warning or caution, does not demand immediate flightcrew attention), during en route operation.

c. A failure of the active element of a multi-mode approach and landing system during an approach shall be accompanied by a warning, caution, or advisory (i.e., not a warning or caution, annunciates without flightcrew action, but does not demand immediate flightcrew attention), as appropriate.

d. An indication of a failure in each non-selected element of a multi-mode approach and landing system during an approach may be made available to the flightcrew as an advisory (i.e., not a warning or caution, annunciates without flightcrew action, but does not demand immediate flightcrew attention), but should not produce a caution or warning.

6.7.5. Multi-mode Receivers (MMR). For MMRs used for systems for Category II, using more than one type of landing system, the means of compliance required for certification can be simplified, provided the applicant provides appropriate justification. This section provides guidance for retrofit certifications, for "ILS Look alike" applications, and for certification of ILS installations with either new or modified receivers. Equivalent provisions as to those described in Appendix 2, paragraph 6.7.5, except as applicable to criteria for Category II, may be applied.

Typical receiver configurations for retrofit applications include:

a. An ILS receiver from a new supplier;

b. A modified ILS receiver from the same supplier (e.g., for purposes of providing improved FM Immunity);

c. A re-packaged receiver from the same supplier (e.g., the ILS partition in an MMR, or the transition from ARINC 700 to 900 series equipment);

d. A stand-alone MLS receiver ("ILS look alike");

e. An MLS partition in an MMR ("ILS look alike");

f. A stand-alone GLS receiver ("ILS look alike"); or

g. A GLS partition in an MMR ("ILS look alike").

6.7.5.1 "ILS Look alike" Definition applicable to MMR. "ILS Look alike" is defined as the ability of a non-ILS based navigation receiver function to provide operational characteristics and interface functionality to the rest of the aircraft equivalent to that provided by an ILS-based receiver function. Specifically in the case of an MLS or GNSS (GLS) based receiver function, the output should be in DDM/microamps, with a sensitivity equivalent to an ILS receiver taking account of the effects of runway length.

6.7.5.2. General Certification Considerations.

6.7.5.2.1. Certification Process. An "impact assessment" should address any new receiver functionality considering:

a. Differences between the current basis of certification and that requested (if applicable).

b. The functionality being added.

c. Credit that can be taken for the existing approval.

6.7.5.2.2. Equipment Approval. TSO MOPS compliance should be demonstrated where appropriate, including software qualification and receiver environmental qualification to the appropriate levels.

6.7.5.2.3. Aircraft Installation Approval (14 CFR Part 25). The following should be considered:

a. Impact on airplane system safety assessments.

b. Radio approval (e.g., antenna positions, range, polar diagrams, coverage, compatibility between receiver and antenna).

c. EMI/EMC testing.

d. Functional integration aspects of the receiver with respect to other systems, controls, warnings, displays.

e. Electrical loading

f. Flight data recorder requirements

g. Suitable Aircraft Flight Manual (AFM) provisions.

h. Certification means of compliance for the receiver installation (e.g., specification of ground and/or flight testing, as necessary).

6.7.5.2.4. Alternative Means of Compliance using JAR-AWO. JAR-AWO may be considered as an acceptable means of compliance for ILS or MLS if the applicant establishes that the proposed new or modified navigation receiver configuration can be considered to have "ILS Look alike" characteristics. The following interpretative material to existing ACJ may be considered for that part of the certification affected by the revised installation:

ACJ AWO 131 Performance Demonstration. 2.1 Flight Demonstrations - Program of Landings for Certification.

ACJ AWO 161(b) Failure Conditions.

ACJ AWO 231 Flight Demonstration. 1.1 Continuous Method (Analysis of Maximum Value).

ACJ AWO 431 Performance (Interpretative Material).

6.7.5.2.5. Recertification of an ILS function following the Introduction of a New or Modified ILS Navigation Receiver Installation. The certification program should consider the differences between the new configuration and the pre-existing ILS receiver system. An "impact assessment" may be used to establish a basis for certification.

6.7.5.2.5.1. New or Modified ILS Impact Assessment.

a. An impact assessment should consider the following aspects of the new or modified ILS receiver, or receiver function, for equivalence with the existing ILS receiver configuration:

(1) hardware design;

(2) software design;

(3) signal processing and functional performance;

(4) failure analysis;

(5) receiver function, installation and integration (e.g., with controls, indicators, and warnings).

b. The impact assessment should also identify any additional considerations such as:

(1) Future functionality provisions which have no impact on system operation;

(2) Shared resources to support future functionality.

Based upon the assumption that the ILS receiver, or receiver function, can be shown to be equivalent to the current ILS configuration, the applicant may propose that the new installation be treated as a new ILS receiver for installation on a given airplane type.

6.7.5.2.5.2. New or Modified ILS Failure Analysis. The failure characteristics of the new or modified installation should be reviewed, equivalent to systems using ILS data, to ensure that the failure characteristics are compatible with and do not invalidate any original or previous safety assessments.

6.7.5.2.5.3. New or Modified ILS Autoland or HUD Guidance Landing Function Flight Testing (if necessary). For systems intended to provide Autoland or HUD guidance landing function using a new ILS, MLS, GLS, or combined MMR receiver, a flight test program of typically a minimum of eight approaches terminating in a successful (automatic or HUD) landing and rollout (if applicable) using the flight control/guidance system, including a minimum of two ILS facilities should be completed. Approaches should include captures from both sides of the final approach course, at angles and distances representative of typical instrument approach procedures, and, if applicable, from below and above the glideslope.

The approach and landing performance (flight path deviation, touchdown data etc.) as appropriate, should be shown to be equivalent to that achieved in the original ILS certification. Recorded flight test data may be required to support equivalency demonstration.

A demonstration of take off guidance performance should be included where applicable.

6.7.5.2.5.4. New or Modified ILS Documentation. The following documentation should be provided for certification:

a. An Impact Assessment including effects on System Safety Assessments.

b. A Flight test report, if applicable.

c. Revisions to the Flight Manual where appropriate.

6.7.5.2.6. Recertification following the Introduction of an MLS or GLS Navigation Receiver Installation.

6.7.5.2.6.1. MLS or GLS Introduction Impact Assessment. An MLS or GLS receiver or receiver function can be certificated with an "impact assessment" similar to that required for the re-certification of a new or modified ILS receiver, provided that the unit(s) has been shown to have satisfactory "ILS Look alike" characteristics. The "impact assessment" should assess equivalent aspects of the MLS or GLS receiver or receiver function to those for the existing ILS receiver configuration.

Based upon the assumption that the MLS or GLS receiver or receiver function, can be shown to have "ILS look alike" characteristics, the applicant may propose that the new installation be treated as a new ILS receiver for approval on a particular airplane type.

6.7.5.2.6.2. MLS or GLS Failure Analysis. The failure characteristics of the new or modified installation should be reviewed, equivalent to systems using ILS data, to ensure that the failure characteristics are compatible with and do not invalidate any original or previous safety assessments.

6.7.5.2.6.3. MLS or GLS Statistical Performance Assessment. If the flight control/guidance system control algorithms are unchanged or effects of any changes are fully accounted for (e.g., navigation reference point), the statistical performance assessment of a currently certificated automatic landing system or Head Up Display landing or takeoff system should typically not have to be re-assessed for the addition of MLS or GLS functionality. This equivalence is based on the assumption that the MLS or GLS receiver, or the MLS or GLS partition of an MMR, can be shown to have satisfactory "ILS Look alike" characteristics.

6.7.5.2.6.4. MLS or GLS Antenna or Navigation Reference Point Location. The implication of differences in position of the MLS or GLS and ILS aircraft antennas or Navigation Reference Point should be assessed considering:

a. Wheel-to-threshold crossing height;

b. Lateral and vertical antenna position or navigation reference point position effects on flight guidance system performance (including any alignment, flare, or rollout maneuvers).

6.7.5.2.6.5. MLS or GLS Introduction Flight Testing (as necessary). For an installation of MLS or GLS which can be treated as a new ILS receiver, a flight test program of typically a minimum of 10 to15 approaches terminating in a landing and rollout (if applicable) using the flight control/guidance system, including a minimum of two MLS or GLS facilities for each system to be authorized should be completed. The approaches should include captures from both sides of the final approach course using representative angles and distances, should include captures from below and above the glideslope if applicable, and should include representative wind conditions where antenna or navigation reference point positions may impact performance.

The approach and landing performance (flight path deviation, touchdown data, etc.) as appropriate, should be shown to be equivalent to that achieved in the original ILS certification. Recorded flight test data may be required to support equivalency.

A demonstration of take off guidance performance should be included where applicable.

6.7.5.2.6.6. MLS or GLS Introduction Documentation. The following documentation should be provided for certification of MLS or GLS:

a. An Impact Assessment including effects on System Safety Assessments.

b. A Flight test report, if applicable.

c. Revisions to the Flight Manual where appropriate.

7. APPROACH SYSTEM EVALUATION. An evaluation should be conducted to verify that the pertinent systems as installed in the airplane meet the airworthiness requirements of paragraph 6 of this appendix. The evaluation should include verification of approach system performance requirements and a safety assessment for verification of the integrity and availability requirements. Engine failure cases and simulator and/or flight tests should demonstrate other selected failure conditions identified by the safety assessment.

An applicant shall provide a certification plan(s) that describes:

a. The means proposed to show compliance with the requirements of paragraph 6 of this appendix, with particular attention to methods that differ significantly from those described in this appendix.

b. How any non-airplane elements of the Approach System relate to the airplane system from a performance, integrity, and availability perspective (e.g., appropriate reference to ICAO Annex or U.S. Standard).

c. The assumptions on how the performance, integrity, and availability requirements of the non-airplane elements of non-Standard Landing Aids will be assured.

d. The system concepts and operational philosophy to allow the regulatory authority to determine whether criteria and requirements in excess of that contained in this appendix are necessary.

Early agreement between the applicant and the FAA should be reached on the proposed certification plan. Upon completion of an FAA engineering design review and supporting simulation studies, a type inspection authorization (TIA) should be issued to determine if the complete installation of the equipment associated with Category II operations meets the criteria of this appendix.

7.1. Performance Evaluation. Performance for an airborne system intended to meet provisions of this Appendix should be demonstrated by flight test.

The airborne system should be demonstrated in at least the following conditions taking into account manual/coupled autopilot, autothrottle configurations for Category II approaches:

a. Wind Conditions:

20 kts - Head wind component

10 kts - Crosswind component

10 kts - Tailwind component

ATS reported surface winds, or equivalent, may be used.

b. Performance shall be demonstrated by flight test, or analysis validated by flight test, using at least three different representative facilities for a minimum of 20 total approaches, with a representative range of environmental and system variables which have an effect on overall performance. If more than one approach in the series of approaches attempted is unsuccessful, an additional number of successful approaches may be required, as agreed by the applicant and FAA. When applied to path vertical tracking in conjunction with Category III, momentary excursions up to ±75 microamps during test demonstrations may be acceptable if flight guidance system touchdown and landing performance is otherwise shown to be satisfactory.

FAA will accept use of the Continuous Method and the Pass/Fail Method, found in JAR ACJ AWO 231, in lieu of the 95% of the time per approach described in sub-paragraphs of 6.2, and the minimum number of 20 approaches stated above.

7.2. Safety Assessment. Except as required by any specific safety related criteria identified in this appendix, or by the operating rules, a safety assessment of the approach system, considered separately and in conjunction with other systems, shall be conducted to show compliance with section 25.1309.

8. AIRBORNE SYSTEM REQUIREMENTS. This section identifies criteria applicable to specific aircraft system architecture selected to conduct the operation. This criteria is developed from operational considerations, approach system considerations, airplane system considerations, and the general operational philosophy contained in the body of this AC.

8.1. General. Various airplane systems are expected to comply with the basic performance, integrity, and availability requirements as identified in Paragraph 6 of this Appendix.

8.2. Autopilot. The following criteria is applicable to Autopilot systems:

The suitability of pertinent autopilot modes or features applicable to conducting or monitoring an approach, landing, rollout, or go around, as applicable, should be considered in showing compliance with section 25.1523.

The autopilot must not have normal features or performance, or performance in typical adverse environmental conditions which would cause undue crew concern and lead to disconnect (e.g., inappropriate response to ILS beam disturbances or turbulence, unnecessarily abrupt flare or go-around attitude changes, unusual or inappropriate pitch or bank attitudes, or sideslip response).

Control of Approach Flight Path. The autopilot must:

a. maintain the approach path;

b. if applicable, make the alignment with the runway, flare and land the airplane within the prescribed limits; or

c. promptly go-around, with minimum practical loss of altitude.

Autopilot performance must be compatible with either manual speed control, or, if applicable, autothrottle speed control.

Mode definition and logic should be consistent with appropriate industry practice for mode identification and use (e.g., naming, mode arming, and engagement). Definition of new modes or features, not otherwise in common use, should be consistent with their intended function, and consider potential for setting appropriate or adverse precedent.

The autopilot system performance and alerting should be consistent with the intended operational use for duties and procedures of the pilot flying (PF) and pilot not flying (PNF). See paragraphs 5.6 and 5.8 of the main body of this AC.

If the autopilot is used to control the flight path of the airplane to intercept and establish the approach path, the pilot should be able to transition from automatic to manual flight at any time without undue effort, attention, or control forces, and with a minimum of disturbance of flight path.

If an HUD is installed, any transition from autopilot to HUD guidance or vice versa, must not require exceptional piloting skill, alertness, strength, or excessive workload.

A flight director system, or alternative form of guidance, if used, must be compatible with the autopilot and vice versa.

A fault must cause an autopilot advisory, caution, or warning, as necessary. If a warning is necessary, the pilot must be able to detect the warning with a normal level of attention and alertness expected during an approach or go-around.

8.3. Head Down Guidance. The following criteria is applicable to Head Down Guidance systems:

A flight director system, or alternative form of guidance, must be designed so that the probability of display of incorrect guidance commands is remote.

Wherever practical, a fault must cause guidance information to be immediately removed from view. If a warning is given instead, it must be such that the pilot will observe the warning while using the information.

8.4. Head Up Guidance. The following criteria is applicable to Head Up Guidance systems:

a. The workload associated with use of the HUD should be considered in showing compliance with section 25.1523.

b. The HUD display medium must not significantly obscure the pilot's view through the cockpit window.

c. Control of Approach Flight Path - the HUD must provide sufficient guidance information, without excessive reference to other cockpit displays, to enable a suitably trained pilot to:

- maintain the approach path
- go-around

d. The pilot should be able to align with the runway without the HUD adversely affecting the pilot task. If command information is provided for the flare and landing, it must not be misleading and should be consistent with the characteristics of normal manual maneuvers.

e. If only one HUD is installed, it should be installed at the pilot-in-command crew station.

f. The HUD guidance must not require exceptional piloting skill to achieve the required performance.

g. The HUD system performance and alerting should be consistent with the intended operational use for duties and procedures of the pilot flying (PF) and pilot not flying (PNF) (see paragraphs 5.6 and 5.8 of the main body of this AC).

h. If the autopilot is used to control the flight path of the airplane to intercept and establish the approach path, the point during the approach at which the transition from automatic to manual flight takes place shall be identified and used for the performance demonstration.

i. Any transition from autopilot to HUD guidance must not require exceptional piloting skill, alertness, strength, or excessive workload.

j. A flight director system, or alternative form of guidance, must be designed so that the probability of display of incorrect guidance commands is remote.

k. Wherever practical, a fault must cause guidance information to be immediately removed from view. If a warning is given instead, it must be such that the pilot will observe the warning while using the information.

8.5. Hybrid HUD/Autoland Systems [PoC]. The following criteria is applicable to Hybrid systems:

a. If an HUD is used to monitor an autoflight system, it should be shown to be compatible with the autoflight system and permit a pilot to detect unsuitable autopilot performance.

b. Other hybrid systems (e.g., including EVS) require a proof of concept **[PoC]** evaluation to establish suitable criteria.

8.6. Satellite-based Approach System. The following criteria is applicable to Satellite-based Approach systems:

a. Satellite-based systems should be shown to provide equivalent or better capability than navigation systems based on VHF Omni-directional Radio Range (VOR), Distance Measuring Equipment (DME), or ILS for comparable operations, or meet provisions applicable to RNP.

b. Satellite-based systems should not exhibit undue sensitivity to masking of satellite vehicles, or interference from onboard or external sources.

c. Satellite-based systems should not exhibit adverse characteristics during acquisition or loss of satellites.

8.7. Reserved.

8.8. Autothrottle. For Category II, an autothrottle should meet the provisions of paragraph 8.8 of Appendix 2, and in addition:

a. Hold speed within ± 5 knots of the intended speed, except for momentary gusts, in typical environmental conditions expected for use;

b. Provide appropriate status, advisory, caution, and warning information for failures;

c. Provide timely application of "Go-around thrust" if a go-around mode is available; and

d. Not require undue crew attention or skill to recognize and respond to an engine failure during approach or go-around.

8.9. Data Link [PoC]. A data link may be used to provide data to the airplane to provide the accuracy necessary to support the approach.

a. The integrity of the data link should be commensurate with the integrity required for the approach.

b. The role of the data link in the approach system must be addressed as part of the aircraft system certification process until such time as an acceptable national or international standard for the ground system is established.

9. AIRPLANE FLIGHT MANUAL (AFM). The AFM should contain the following information:

a. Any conditions or constraints on approach performance with regard to airport conditions (e.g., elevation, ambient temperature, approach path slope, runway slope, and ground profile under the approach path).

b. The criteria used for the demonstration of the system, acceptable normal and non-normal procedures, the demonstrated configurations, and types of facilities used, and any constraints or limitations necessary for safe operation.

c. The type of navigation facilities used as a basis for certification. This should not be taken as a limitation on the use of other facilities. The AFM may contain a statement regarding the type of facilities or condition known to be unacceptable for use.

d. Information should be provided to the flightcrew regarding atmospheric conditions under which the system was demonstrated (e.g., headwind, crosswind, tailwind). The AFM should contain a statement that "Credit may not be predicated on the use of <type of system> if conditions exceed … (those for which the system received airworthiness approval)."

> **Note 1: The AFM limitation section should <u>not</u> specify DA(H) or Runway Visual Range (RVR) limitations.**

> **Note 2: AC 25.1581-1, Airplane Flight Manual, Section 2, discusses AFM contents. The approval status referenced in 2 b (9) (vii) for Category I, II, or III of that AC should be noted in the Normal Procedures Section of the AFM, in accordance with the above provisions.**

e. For a system meeting provisions of Appendix 3, the Normal Procedures, Normal Operations, or equivalent section, of the AFM should also contain the following statements:

"The airborne system has been demonstrated to meet the airworthiness requirements of AC 120-29A Appendix 3 for <specify the pertinent approach capability section(s) criteria met> when the following equipment is installed and operative:

<list pertinent equipment>"

"This AFM provision does not constitute operational approval or credit for Category III use of this system."

APPENDIX 4.
WIND MODEL FOR APPROACH SIMULATION

Wind models need not be applied to obtain approval of systems related to Appendix 2 or Appendix 3. However, if the applicant elects to use simulation with a wind model to support approval, it is recommended that the model specified in Advisory Circular 120-28D, Criteria for Approval of Category III Landing Weather Minima for Takeoff, Landing, and Rollout, is used.

APPENDIX 5

OBSTACLE ASSESSMENT FOR RNP FOR CATEGORY I OR CATEGORY II

1. Obstacle Assessment for Standard Required Navigation Performance (RNP) Types (e.g., Linear Values of RNP).

1.1. Obstacle Assessment for RNP Approaches and Missed Approaches.

1.1.1. General. This Appendix provides criteria that may be used by procedure designers in the development of RNP approaches for suitably equipped aircraft together with any necessary operational mitigations and procedures. These criteria should be used in conjunction with other considerations in this AC. When authorized by AFS-400, approaches developed in accordance with this appendix may be issued as special non-14 CFR part 97 procedures issued through OpSpecs or a letter of authorization (LOA). These criteria may be used in conjunction with airworthiness demonstrations of airborne equipment, or in the assessment of other States criteria used in international operations for U.S. Operators.

The approach RNP is specified from the Final Approach Fix (FAF) to the point along the final approach segment at which the lowest applicable DA(H) typically is applied. There may be one or more levels of RNP specified on a final segment. Missed approach RNP, or levels of RNP if more than one level or RNP is specified, is typically specified from a point related to the lowest applicable DA(H), and typically continues to a missed approach holding fix or missed approach waypoint. RNP also may be applied to a "go-around safety" assessment.

When applied to a "go-around safety assessment," the RNP level and associated obstacle clearance start at the end of the touchdown zone with an expanding lateral area that widens to match the level of RNP used, and then continues at the RNP level(s) specified. The expanding lateral area starts on the centerline for the approach at the end of the touchdown zone and widens at a 7.5 degree splay. Splay criteria based on ICAO PANS-Ops may alternately be used at the discretion of the procedure designer or operator (e.g., 1:8 splay/ 7.125 degrees). A go-around safety assessment is applicable from the end of a touchdown zone to reaching the missed approach holding fix or applicable missed approach waypoint (see below for specific criteria). When conducting a "go-around safety assessment," the potential growth of ANP following pertinent failures should be appropriately considered, relative to the designated level(s) of RNP in approach or missed approach segments.

Procedures for U.S. air carrier operations (operations conducted IAW Title 14 of the Code of Federal Regulations (14 CFR) part 121 or part 135 should address application of RNP to "go-around safety" (see paragraph 4.3.1.8 of the main body of this AC). It is recommended that other operators also address "go-around safety." A go-around safety assessment is intended to assist operators in assuring safe operations in the rare event of a low altitude go-around with certain failures. It is not intended to preclude or limit operations necessary at any particular location.

Provisions of this appendix may be used for levels of RNP specified in the AFM or for other levels of RNP as authorized by the FAA.

> **NOTE: The United States Standard for Terminal Instrument Procedures (TERPS) is the basis for Standard Instrument Approach Procedures formulation within the United States and its territories.**

1.1.2. Final Approach (FAS), Missed Approach (MAS) and other Related Segments. The criteria presented in this Appendix apply to the Final Approach (FAS) and Missed Approach segments (MAS). The FAS is defined as that segment of an approach extending from the GPIWP or APIWP, whichever occurs later, to GIRP. However, for the purpose of defining RNP obstacle clearance in this appendix, the Final Approach segment (FAS) is considered to begin at the FAF and ends at the FPCP (runway Datum Crossing Height (CH)), or missed approach point (e.g., DA(H)). No specific minimum or maximum length is assigned to the FAS, but the FAF must be located such that consideration is given to how the FMC VNAV operation may be constrained in certain ways at the point the FAS commences. In addition, consideration should be given in the placement of the FAF recognizing that a continuous VNAV descent may be intended to the FAF, instead of a level intermediate segment with a minimum VNAV intercept altitude. The Missed Approach segment is defined as beginning at a point coincident with the lowest applicable DA(H) and ending at a specified missed approach waypoint (e.g., Initial Missed Approach WP, Missed Approach Holding WP). No minimum or maximum length is assigned to the MAS, but consideration should be given to having the aircraft established on an en route transition. Definitions for various segments used in procedure construction are as specified in Table A5-1 below (Also see AC main body paragraph 4.6, and Appendix 1):

Approach and Missed Approach Segments Applicable To RNAV Instrument Procedures Using RNP

Table A5-1

Final Approach Segment (FAS)	The segment of an approach extending from the Glidepath Intercept Waypoint (GPIWP) or Approach Intercept Waypoint (APIWP), whichever occurs later, to the Glidepath Intercept Reference Point (GIRP). For the purpose of procedure construction, The Final Approach segment is defined as beginning at the FAF and ending at the Flight Path Control Point (FPCP) or point at which the missed approach segment starts (e.g., point of lowest nominal DA(H)).
Extended Final Approach Segment (EFAS)	That segment of an approach, co-linear with the Final Approach Segment, but which extends beyond the Glidepath Intercept Waypoint (GPIWP) or Approach Intercept Waypoint (APIWP).
Runway Segment (RWS)	That segment of an approach from the glidepath intercept reference point (GIRP) to Flight Path Alignment Point (FPAP).
Initial Missed Approach Segment (IMAS)	That segment of an approach from the Glide Path Intercept Waypoint (GIRP) to the Initial Missed Approach Waypoint (IMAWP).
Missed Approach Segment (MAS)	That segment of an instrument approach procedure from a point on the FAS corresponding to the position where the lowest DA(H) occurs under nominal conditions, to the designated IMAWP, or missed approach holding WP, as specified for the procedure.

1.1.3. Approach and Missed Approach Conditions To Be Assessed. Three basic conditions are considered in the development of obstacle clearance criteria for RNP approaches and missed approaches:

a. The aircraft arrives at the DA(H), continues with visual reference to a landing on the runway.

b. The aircraft arrives at the DA(H), initiates a missed approach, and experiences an engine failure.

c. The aircraft arrives at the DA(H), continues with visual reference to the runway, initiates a rejected landing at the end of the touchdown zone, and experiences an engine failure.

Each of these conditions has associated criteria for lateral and vertical obstacle clearance protection. In addition to these normal and non-normal conditions, rare-normal conditions must be assessed. Unless wind limitations are specified, these rare normal conditions should be considered as a wind from the most adverse direction at the certificated limit for landing, increasing to 50 knots at 1000 ft. AGL. This rare-normal wind condition shall increase at a gradient of 10 knots per 1000 ft. up to a maximum of 100 knots from the most adverse direction (i.e., tailwind). However, such conditions need not be considered in combination with non-normal events (e.g., engine failure).

In instances, the normal missed approach path and non-normal missed approach path may be different laterally. In such an event, transition from the normal path to the non-normal path should be considered, including performance or energy state of the aircraft, for engine failures that could occur at various critical points along the normal flight path.

1.1.4. Touchdown Zone. A touchdown zone (TDZ) typically is considered to be the first 3000 ft. of a designated landing runway. When appropriate for the purposes of this provision, Operators may propose to use a different designation for a touchdown zone. For example, alternate consideration of a (TDZ) may be appropriate for runways that:

- Are less than 6000 ft. in length and which do not have standard TDZ markings,
- Short runways requiring special aircraft performance information or procedures for landing,
- Runways for STOL aircraft, or
- Runway where markings or lighting dictate that a different TDZ designation would be more appropriate.

1.2. Obstacle Criteria.

1.2.1. Obstacle Identification Surface Between Point Of Lowest DA(H) and the Runway. For condition 1.1.3a, described above, an obstacle identification surface is defined for the visual segment between the DA(H) and the TDZ on the runway. This surface originates at the runway threshold and is inclined at an angle 1 degree less than the VNAV angle for the FAS. This surface is bounded laterally by two rays which originate from the center of the runway at a point 1000 ft. from the threshold, splay at an angle of 10 degrees relative to the runway centerline, or FAS, to the DA(H), or the point at which the lateral limit of 2XRNP is reached. This area should be free of fixed or movable obstacles (regardless of whether they are or are not present by their aeronautical purpose) at the time an instrument approach is conducted inside the FAF. A procedure should not be authorized with an obstacle in this area unless the presence of the obstacle(s) is specifically reviewed and authorized by FAA, and the flightcrew of the landing aircraft is provided information on the location and nature of the obstacle. Other options to resolve a penetration include increasing a VNAV angle, removing the obstacle, displacing the runway threshold, not implementing the approach, adjusting a lateral path, or implementing various combinations of the above options (Figure A5-1).

Figure A5-3 shows a method for determination of RNP obstacle clearance for a final segment controlling obstacle between DA(H) and the runway.

1.2.2. Obstacle Identification Surface Between the Point of Lowest DA(H) and a Missed Approach Waypoint. For the condition described in paragraph 1.1.3b, above, the lateral containment surface is centered on the FAS and bounded on either side by two parallel lines located at a distance of 2XRNP (Figure A5-2). Within the limits of this containment surface, a variable Required Obstacle Clearance (ROC) must be provided which is a function of altitude and temperature. This ROC is established by a Vertical Navigation Error Budget (VEB) evaluation that characterizes the vertical navigation accuracy of the system and provides a parametric methodology to evaluate procedures and assess the impact of obstacles. For example, the Root-Sum-Square (RSS) of the VNAV performance variables that contribute to errors in the vertical axis include, but are not limited to, horizontal along-track navigation system errors, temperature induced barometric altimetry errors, flight technical errors, static source errors, minimum waypoint resolution, minimum vertical path angle resolution, etc. ROC increases along the FAS from a lower reference point up to the upper elevation reference point typically at the FAF. By subtracting the ROC from the VNAV elevation at defined locations, a sloping Obstacle Identification Surface (OIS) beneath the VNAV path is established. The OIS is anchored by the lower reference point at the path's 250 ft. height above touchdown point and by the upper elevation reference point typically 2000 ft. above field elevation. The DA(H) is defined as the Required Obstacle Clearance plus 50 ft. above the point on the OIS where the aircraft must be established in a climb to clear all obstacles. The climb gradient used for this analysis is established for a particular aircraft by evaluating the worst case condition. This may include one-engine inoperative, maximum permissible tailwind, maximum permissible landing weight, icing/temp/altitude degradations, etc. A variable DA(H) may be employed if certain conditions are specifically excluded (e.g., no icing). For Instrument Approaches other than ILS, GLS, or MLS (see 4.3.3), developed by a VEB evaluation, the minimum ROC is 250 ft.

The methodology for determining the DA(H) is the same regardless of whether the controlling obstacle is in the FAS or MAS.

Figure A5-4 shows a method for determination of RNP obstacle clearance for a missed approach segment controlling obstacle.

Figure A5-5 shows the normal instrument approach case that has neither an approach or missed approach controlling obstacle.

1.2.3. Obstacle Identification Surface Between the End of the TDZ and a Missed Approach Waypoint. For the condition 1.1.3c, described above, a lateral containment surface is centered on the MAS and bounded on either side by two rays which originate from a point 200 ft. either side of the runway centerline at the end of the TDZ (typically 3000 ft. from the approach end of the runway - see 1.1.4 above). These rays splay at an angle of 7.5 degrees out to a maximum distance from the MAS centerline of 2XRNP. Within the lateral limits of this containment surface, a minimum of 35 ft. ROC must be provided below the one engine inoperative net flight path of the aircraft (Figure A5-6). Splay criteria based on ICAO PANS-Ops may alternately be used at the discretion of the procedure designer or operator (e.g., 1:8 splay/ 7.125 degrees). For curved initial missed approach segments (e.g., segments based on an ARINC 424 "RF" leg type), an equivalent lateral splay providing equivalent lateral clearance along the path arc length may be used.

Extreme cold temperature considerations should be assessed for VNAV angles, and safe obstacle clearance assured for any initial or intermediate segments (see paragraph 6.2.13).

1.2.4. FAS Turn Construction. Final Approach Segment (FAS) turns are constructed using appropriate lateral path guidance algorithms of the navigation system for which the procedure is designed, or by using generic algorithms which take numerous navigation system characteristics representative of the range of systems to be used into consideration.

Navigation database-defined turns defined through short leg WP sequences or ARINC 424 "RF" Leg types may also be used. If used, appropriate consideration should be made for anticipated ground speeds to be used, leg sequencing, and for "roll in' and "roll out" of an RF leg. Normally, an RF leg should not be based on an assumed nominal bank angle greater than 25 degrees, to allow for path recovery in the event of path displacement disturbances.

1.2.4.1. FAS Turn Construction for Fly-by Waypoints. For turns on the FAS (other than for an RF leg), the outside (of the turn) lateral containment surface is constructed via an arc of radius 2XRNP, which is centered on the turn waypoint. For the inside lateral containment surface, the ground speed condition which results in the greatest amount of turn anticipation (earliest departure from and latest return to the FAS centerline) is used for construction. For this condition, the containment surface can be constructed in two ways. The first method uses a straight line which extends between the intersections of the two perpendiculars, located at the start and end points of the turn anticipation arc, and the 2XRNP containment surface which is parallel to the segments before and after the turn waypoint. The second method uses an arc of radius equal to the turn anticipation arc minus 2XRNP (Figure A5-7). For RF legs, the RNPX2 surface is as defined by the specified RNP level.

1.2.4.2. FAS Turn Construction for Fly-over Waypoints. In the event that this type of turn is required (rare use), the ground speed which results in the greatest amount of overshoot and latest return to the FAS centerline should be determined. For this condition, the outside containment surface is constructed as an arc and straight segment combination parallel to and at a distance of 2XRNP from the computed flight path. The inside containment surface is constructed using the conservative assumption of no overshoot. Given this condition, the containment surface is simply defined as the intersection of the 2XRNP surfaces parallel to the Final Approach Segments (Figure A5-8)

1.2.5. MAS Turn Construction. MAS turns are constructed in a manner identical to turns in the FAS, unless the turn occurs prior to the point at which the containment surfaces are fully expanded to the 2XRNP value (e.g., balked or rejected landing). In this event, only fly-by waypoints should be used because of the complexity which results from constructing the outside containment surface for the fly-over waypoints.

1.2.5.1. MAS Turn Construction for Fly-by Waypoints. For turns on the MAS, prior to the point at which the containment surfaces are fully expanded to the 2XRNP value, the containment surface should be constructed in the following manner:

- The outside lateral containment surface is constructed by transferring the width of the splay abeam the turn waypoint via an arc to the following segment.
- The arc is of radius equal to the attained half-width of the preceding segment and is centered at the turn waypoint.
- The arc is extended to a line perpendicular to the centerline of the following segment and passes through the turn waypoint.
- The splay is continued from that point by an angle of 7.5 degrees to a distance of 2XRNP from the centerline. To simplify the containment surface construction for the inside of the turn, a straight line is drawn between the earliest point of departure and the latest point of return back to the following segment for the fly-by of the turn waypoint.
- For other than RF legs, the containment surface expands by a 7.5 degree splay angle using the simplified inside turn approximation as the reference centerline. This splay is continued until reaching the 2XRNP displacement from the reference centerline (Figure A5-9). Splay criteria based on ICAO PANS-Ops may alternately be used at the discretion of the procedure designer or operator (e.g., 1:8 splay/ 7.125 degrees).
- For RF legs, the RNPX2 surface is as defined by the specified RNP level.

1.2.5.2. MAS Turn Construction For Fly-over Waypoints. Fly-over waypoints are not used for a MAS.

1.2.6. RNP Reductions. RNP reductions would normally be expected to occur at waypoints marking the transition from the enroute airway to a transition feeder route to an approach (typically at the IAF). Upon reaching the IAF, there are typically no further RNP reductions throughout the approach and missed approach. RNP reductions should be considered based on the anticipation of the first longitudinal point where the lower level of RNP is required and assurance that appropriate alerting can be provided prior to the time that the lower level of RNP is needed.

If required, RNP reductions on the FAS should be considered based on anticipation of the first longitudinal point where the lower level of RNP is required, and assurance that appropriate alerting can be provided prior to the time the lower level RNP is needed. No transition area is required. However, the RNP reduction should be located such that consideration is given to the maximum latency of RNP alerting messages, maximum ground speed, crew response time, height of any obstacles immediately beyond the change in RNP, and the one-engine inoperative climb gradient. This distance, "d," is shown in Figure A5-10. RNP increases, particularly on a MAS or at the beginning of a MAS, do not require this special consideration, thus distance "b" in Figure A5-10 could be zero.

RNP reductions are not typically used on a MAS.

1.2.7. Coordinate Systems. Waypoint coordinates shall be defined in the WGS-84 or NAD-83 coordinate system (or equivalent international system for locations outside the US). Waypoint resolution shall be provided to at least 0.01 arc minutes.

1.2.8. Obstruction and Terrain Charts. The best source(s) of topographical or obstruction charts that are available should be used.

1.2.8.1. Recommended Use of USGS Charts. Use of USGS 1:25,000 or 1:24,000 charts (or equivalent) is recommended wherever possible.

1.2.8.2. Vertical Clearance Adjustments for Certain Topographical Charts. FAA Order 8260.19C assigns an accuracy code of "2C" to the 1:24,000 topographical charts. This does not meet the minimum accuracy standard for a precision final segment of an approach. For this reason, a 40 ft. horizontal and 20 ft. vertical adjustment is required to the obstacle values taken directly from the topographical chart. These adjustments are applied in the horizontal and vertical direction that most adversely affects the procedure (i.e., the range is reduced by 40 ft. and the height increased by 20 ft.).

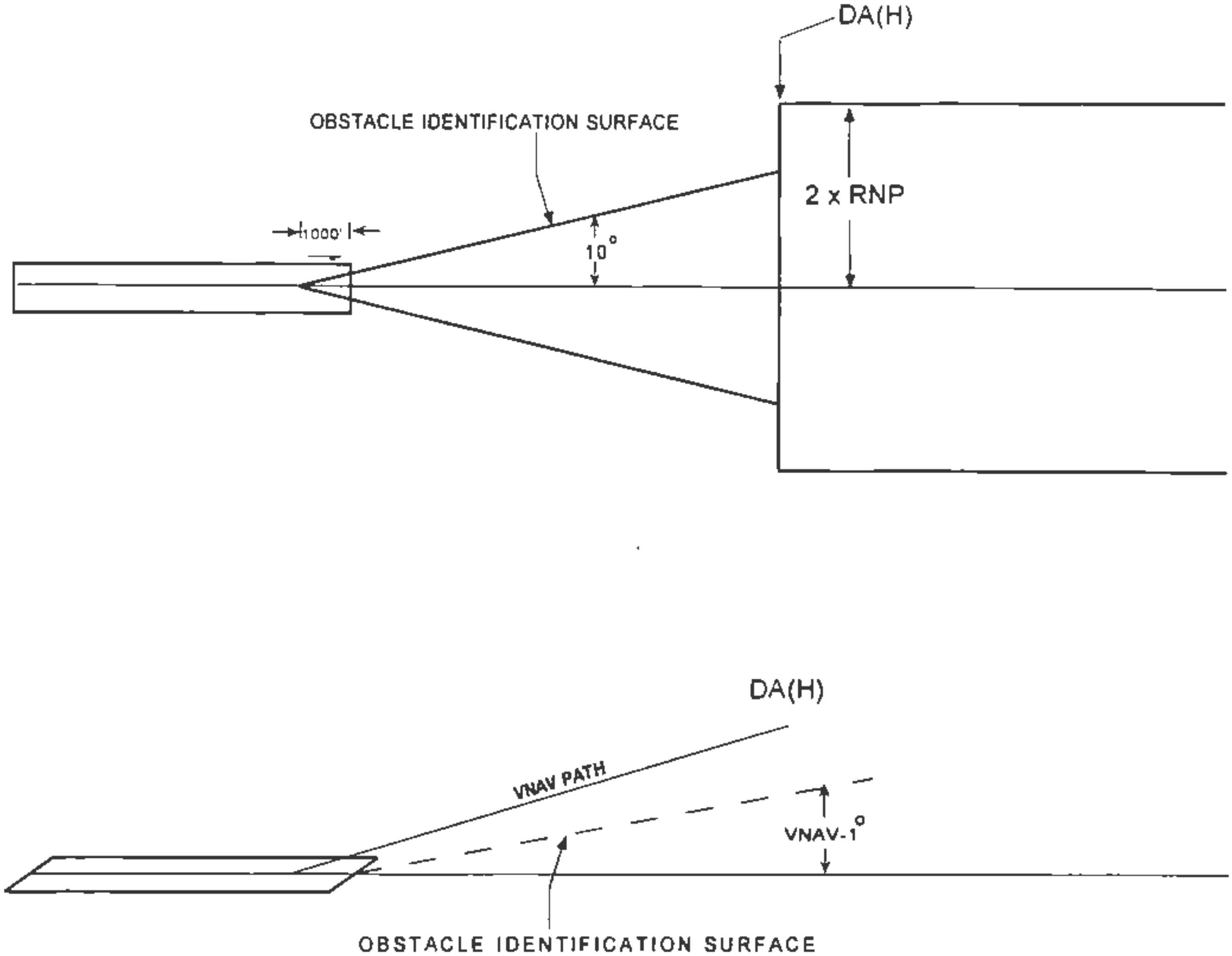
1.2.8.3. Tree Heights. Tree heights consistent with the maximum found in the area must be added to all contour elevations, unless specific survey heights are used in areas of interest.

1.2.8.4. Assumptions for Terrain Elevations. Assumptions for terrain elevations should be conservative. If an obstacle of interest falls between two gradient lines, the obstacle should be assigned a height equal to the next higher gradient line minus one unit of elevation. For terrain elevations which are critical (or controlling), the terrain should be assumed to rise to a height equal to the next higher gradient line minus one unit of elevation, at an incremental distance beyond the gradient line in question.

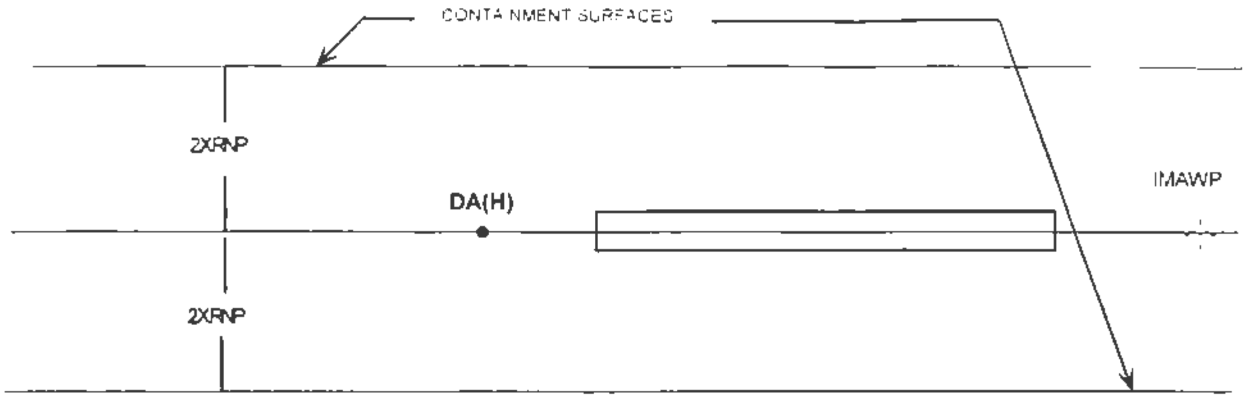
1.2.9. Man-Made Obstacle Data. Man-made obstacle data may be obtained from the U.S. Department of Commerce Quarterly Obstacle Memo Digital Obstacle File, Airport Obstruction Chart, FAA IAPA database, or ICAO equivalent. Horizontal and vertical adjustments are applied as a function of the accuracy code assigned to each obstacle. For areas of interest beyond 14 CFR part 77 (or ICAO equivalent) surfaces (e.g., initial and intermediate segments), proper consideration should be made for obstacles which would not be part of the official obstacle records. This consideration may be an appropriate additive to all terrain contours or some other equivalent means (e.g., flight inspection or survey).

1.2.10. Wheel To Navigation Reference Point or Longitudinal Navigation Reference Points. Aircraft which have a wheel to navigation reference point (e.g., altimeter reference) vertical height less than 19 ft., or a longitudinal navigation reference point (e.g., altimeter reference point) to lowest and most aft wheel distance of 125 ft. or less at the normal approach pitch attitude and speed need not account for altimeter vertical and longitudinal displacement from wheel height. Aircraft, which have vertical or longitudinal distances that exceed these values, should include suitable correction factors along with any RSS analysis of potential vertical path displacement errors.

1.3. Examples of completed RNP Forms. Examples of completed FAA Forms 8260 for RNP Procedures are shown in Figures A5-11 and A5-12 for an "RNAV" Procedure with RNP-based minima and for an "xLS and RNAV" procedure with RNP-based minima.

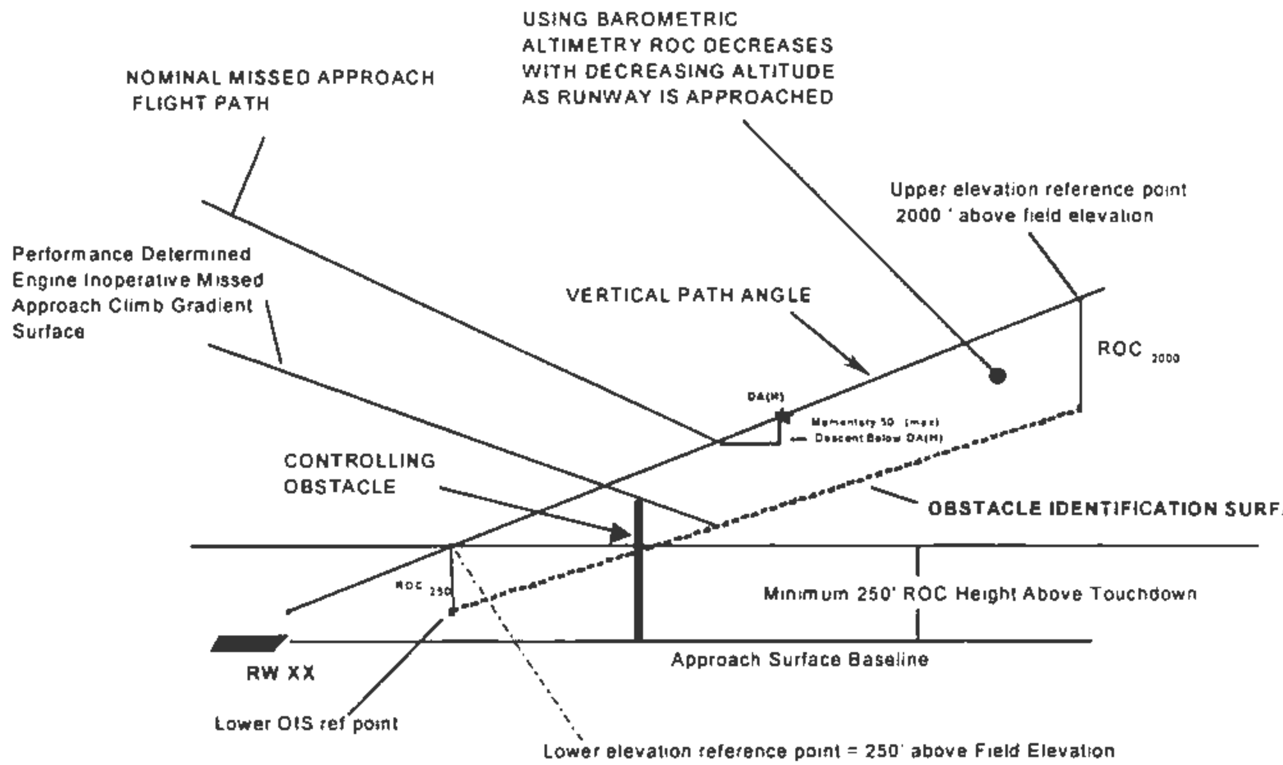


OBSTACLE IDENTIFICATION - VISUAL SEGMENT
Figure A5-1



RNP LATERAL AREA TO CONSIDER - MISSED APPROACH FROM DA(H)
Figure A5-2

OBSTACLE IDENTIFICATION SURFACE IS
DEFINED AS THE NOMINAL VNAV FLIGHT
PATH REDUCED BY THE VNAV ERROR BUDGET

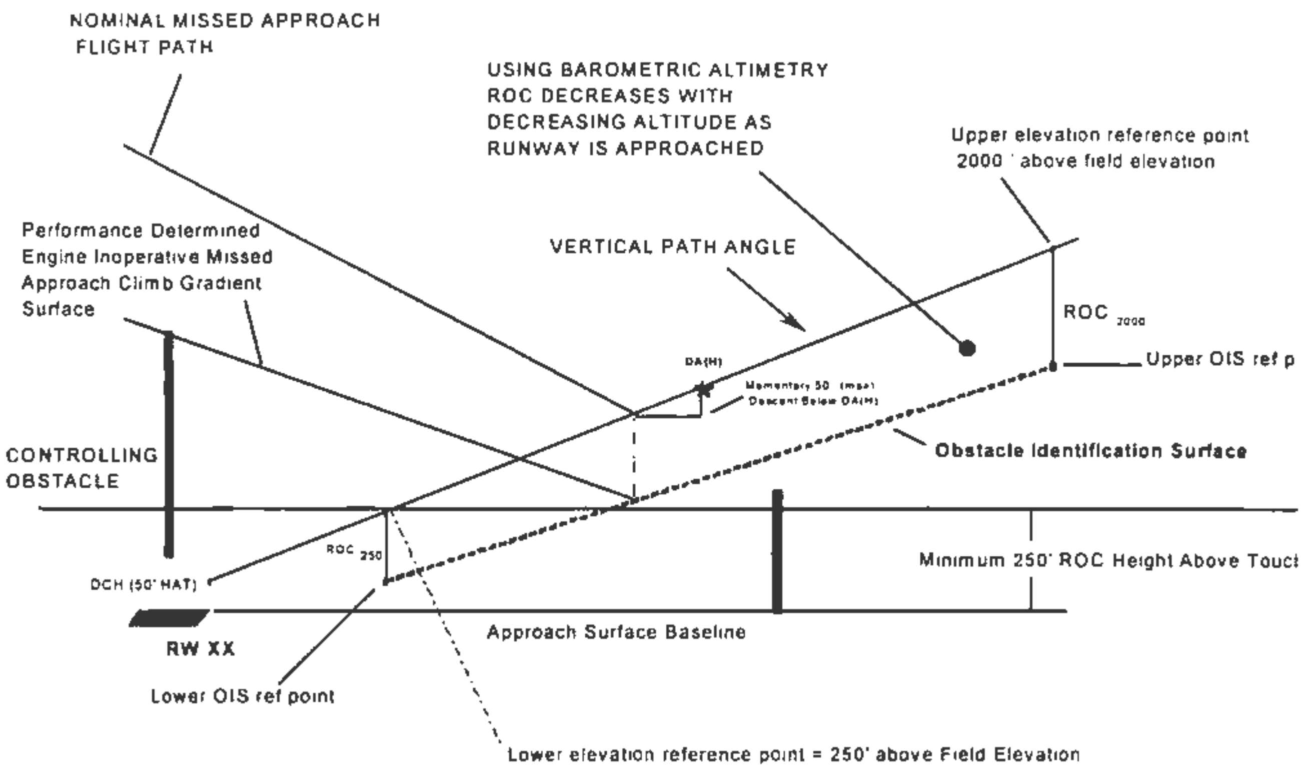


- DA(H) DETERMINED BY AIRCRAFT PERFORMANCE
- ASSUMING WORST-CASE CUMULATIVE VNAV ERRORS AIRCRAFT WOULD BE STARTING MISSED APPROACH FROM THE OIS AND CLIMBING ON THE ENGINE INOPERATIVE MISSED APPROACH CLIMB GRADIENTSURFACE
- THE 'ENGINE INOPERATIVE MISSED APPROACH' CLIMB GRADIENT SURFACE MUST CLEAR ALL OBSTACLES

RNP OBSTACLE CLEARANCE - FINAL SEGMENT
CONTROLLING OBSTACLE (BETWEEN THE DA(H) AND THE RUNWAY)

Figure A5-3

OBSTACLE IDENTIFICATION SURFACE IS DEFINED AS THE NOMINAL VNAV FLIGHT PATH REDUCED BY THE VNAV ERROR BUDGET

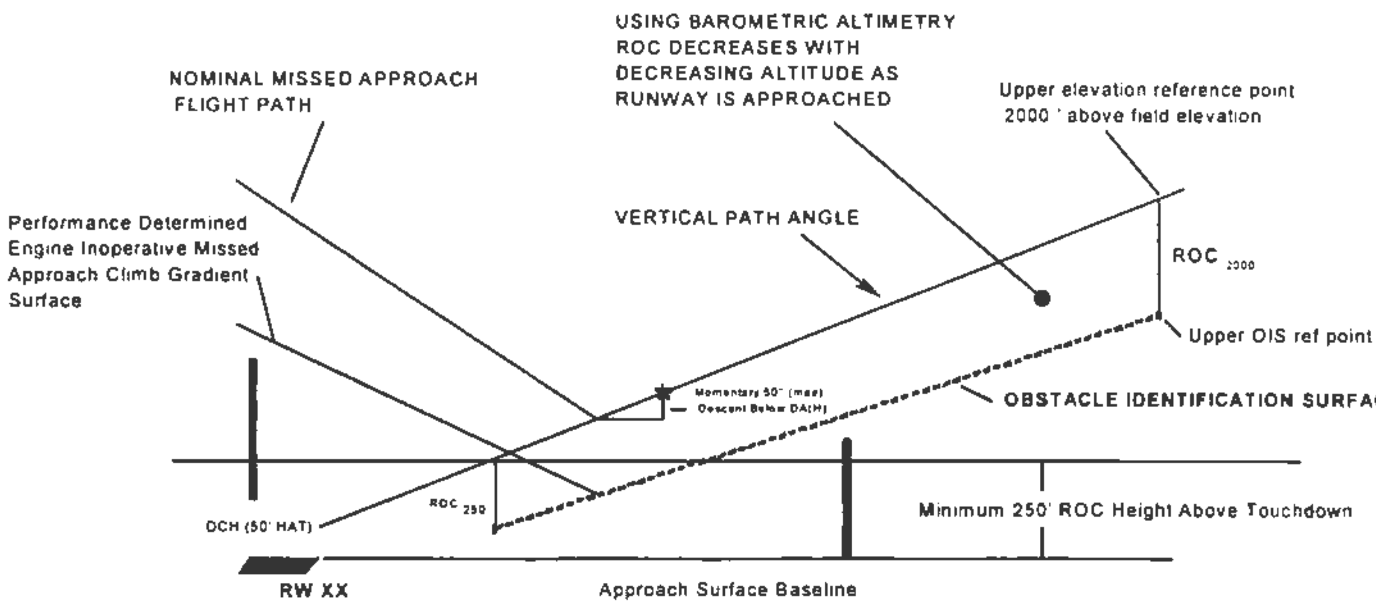


- DA(H) DETERMINED BY AIRCRAFT PERFORMANCE
- ASSUMING WORST-CASE CUMULATIVE VNAV ERRORS AIRCRAFT WOULD BE STARTING MISSED APPROACH FROM THE OIS AND CLIMBING ON THE ENGINE INOPERATIVE MISSED APPROACH CLIMB GRADIENTSURFACE
- THE 'ENGINE INOPERATIVE MISSED APPROACH' CLIMB GRADIENT SURFACE MUST CLEAR ALL OBSTACLES

RNP OBSTACLE CLEARANCE - MISSED APPROACH SEGMENT CONTROLLING OBSTACLE

Figure A5-4

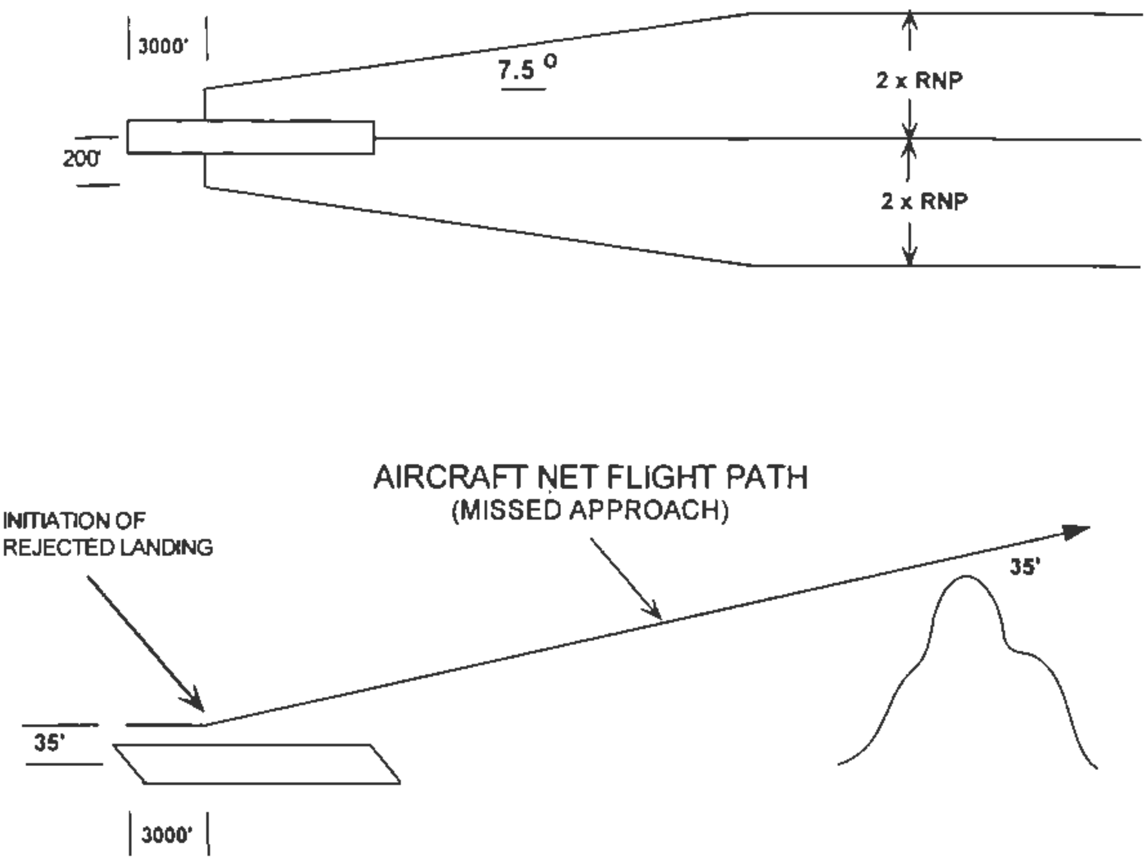
OBSTACLE IDENTIFICATION SURFACE IS
DEFINED AS THE NOMINAL VNAV FLIGHT
PATH REDUCED BY THE VNAV ERROR BUDGET



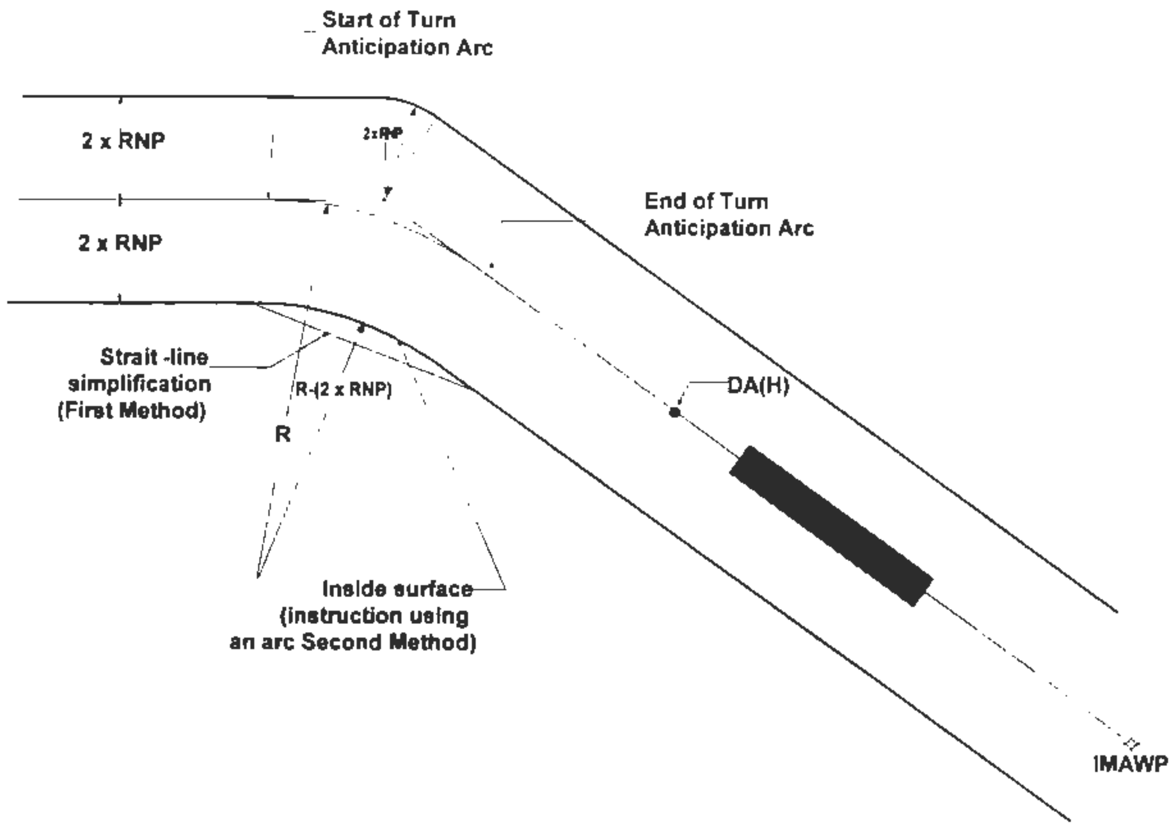
- DA(H) DETERMINED BY AIRCRAFT PERFORMANCE
- ASSUMING WORST-CASE CUMULATIVE VNAV ERRORS AIRCRAFT WOULD BE STARTING MISSED APPROACH FROM THE OIS AND CLIMBING ON THE ENGINE INOPERATIVE MISSED APPROACH CLIMB GRADIENTSURFACE
- THE 'ENGINE INOPERATIVE MISSED APPROACH' CLIMB GRADIENT SURFACE MUST CLEAR ALL OBSTACLES

RNP OBSTACLE CLEARANCE - NO CONTROLLING OBSTACLE

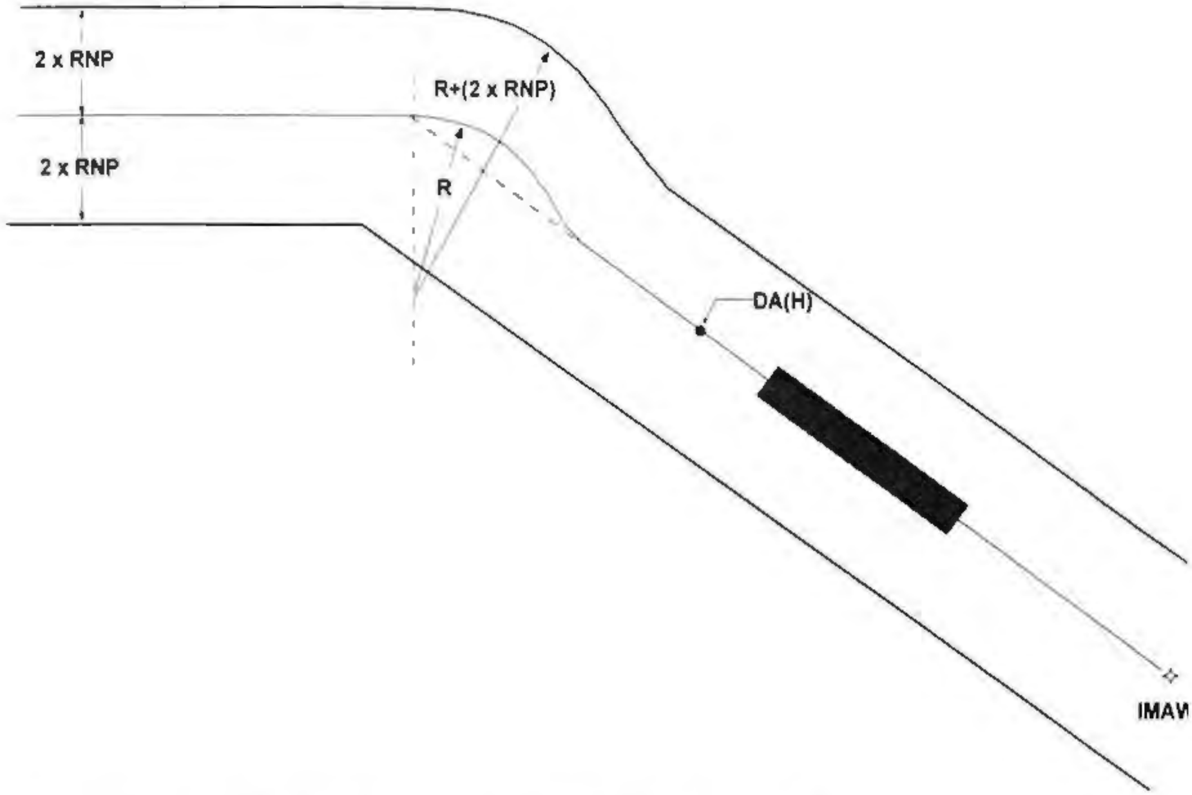
Figure A5-5



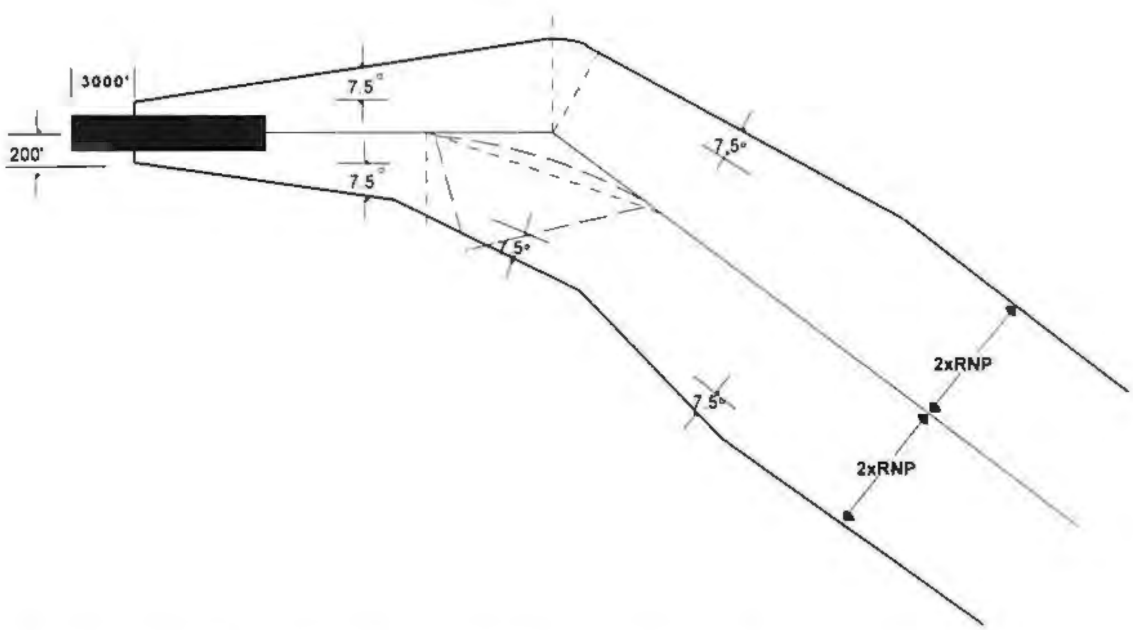
RNP LATERAL AREA TO CONSIDER - REJECTED LANDING
Figure A5-6



RNP LATERAL AREA TO CONSIDER - TURNS
Figure A5-7

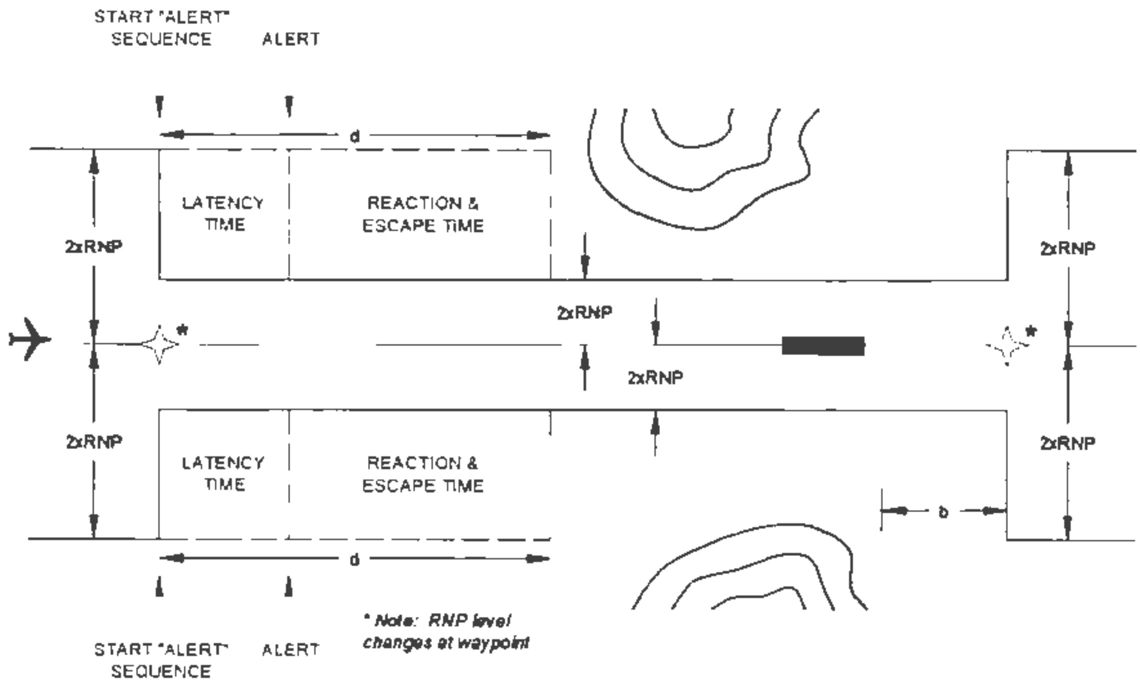


RNP LATERAL AREA TO CONSIDER - "FLY OVER WAYPOINTS"
Figure A5-8



RNP LATERAL AREA TO CONSIDER - REJECTED LANDING (WITH TURNS)
Figure A5-9

RNP LATERAL AREA TO CONSIDER - CHANGE OF RNP TYPE
Figure A5-10



SAMPLE OF A COMPLETED FAA FORM 8260-7
Instrument Approach Procedure - RVAV with RNP Based Minima
(Side 1)

RNP RNAV

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION -- FLIGHT STANDARDS SERVICE
SPECIAL INSTRUMENT APPROACH PROCEDURE -- FLIGHT STANDARDS SERVICE

[illegible]

[illegible]

TERMINAL ROUTES

FROM	TO	COURSE AND DISTANCE	ALTITUDE
CASHS WP	RW7B WP	017.94/14.82	4600
RW7B WP (IAF)	MA30B WP	185.55/4.70	4400
MA30B WP	MA30A WP	174.02/4.92	GP3100
MA30A WP	RW7A WP	127.16/3.92	GP1870
RW7A WP	RWD7 WP	070.99/1.96	GP1283

MISSED APPROACH
MAP: AT THE DA(H)
CLIMB TO 4000' VIA THE RNP RNAV MISSED APPROACH TRACK TO CRUMM WP AND HOLD

1. PT R SIDE OF COURSE 008.52 OUTBOUND 5700' FT WITHIN 10 MILES OF RW7B WP
2.
3. FAC VARIES FAF MA30A WP DIST FAF TO MAP 5.20 THLD 5.88
4. MIN ALT MA30B WP 4400', MA30A WP 3100', RW7A WP 1870
5. DIST TO THLD FROM OM ______ MM ______ IM ______ 150 HAT ______ 100 HAT ______ GS ANT ______
6. MIN GS INCPT 3100 GS ALT AT: ______ OM ______ MM ______ IM
7. GS ANGLE 3.00 TCH 50
8. MSA FROM RWD7 WP: 360 090: 5500 ; 090 180: 7700 ; 180 360: 10600'

RAFI ADDITIONAL FLIGHT DATA
CRUMM WP: SOUTHEAST, RIGHT TURNS 274 DEGREES INBOUND 4000'

MAG VAR: 19E EPOCH YEAR: 1995

MINIMUMS

TAKEOFF: STANDARD SEE NOTES ALTERNATE: N A

CATEGORY	A			B			C			D			E		
	DH MDA	VIS	HAT HAA	DH MDA	VIS	HAT HAA	DH MDA	VIS	HAT HAA	DH MDA	VIS	HAT HAA	DH MDA	VIS	HAT HAA
S RNP 0.3 VNAV				1486	3/4	208									

NOTES: SPECIAL AIRCREW TRAINING REQUIRED
FOR USE BY SLANT E (E) DUAL GPS EQUIPPED, RNP CERTIFIED AIRCRAFT ONLY
CIRCLING NOT AUTHORIZED

CHART THE FOLLOWING NAVAIDS. WENATCHEE VOR 111.0 EAT

BALL TAG 1: MAX HOLDING SPEED 230 KTS

APPROACH FEEDER SEGMENTS ARE ALL RNP 0.5
APPROACH AND MISSED APPROACH SEGMENTS ARE ALL RNP 0.3

FOR INOPERATIVE ODALS, INCREASE CAT D VISIBILITY TO 1 MILE

CITY AND STATE	ELEVATION 1245' TDZE 1203' AIRPORT NAME	FACILITY IDENTIFIER	PROCEDURE NO., AMDT NO., EFFECTIVE DATE	SUP NONE / AMDT / DATE
WENATCHEE, WA	PANGBORN MEMORIAL	RWD7	RNP RNAV RWY 07, ORIGINAL	

FAA FORM 8260 - 7 / February 1995 (computer generated) PAGE 1 OF 1 PAGES

Figure A5-11

(Cont.) SAMPLE OF A COMPLETED FAA FORM 8260-7
Instrument Approach Procedure - RVAV with RNP Based Minima

(Side 2)

NOTES CONTINUED **MISSED APPROACH**

FROM	TO	COURSE AND DISTANCE
RW07 WP	RW308 WP	104.07/4.59
RW308 WP	SHAKER WP	126.57/2.86
SHAKER WP	CRUMM WP	93.87/5.72

AIR CARRIER NOTES

The procedure on the other side and the foregoing data are hereby

FLIGHT CHECKED BY		
NAME	FIFO	DATE

DEVELOPED BY		
NAME	FIFO	DATE

RECOMMENDED BY		
NAME	FIFO MANAGER	DATE

APPROVED BY		
NAME	REGION, FLT STANDARDS	DATE

OPERATIONS SPECIFICATIONS – AIRPORT

__________ holding Air Carrier Operating Certificate No. __________ hereby acknowledges receipt of Operations Specifications

to operate into and out of the airport named on the other side ☐ Regular ☐ Refueling ☐ Alternate ☐ Provisional for __________

airport with the following type aircraft:

Unless otherwise authorized in the Operations Specifications – Airport, an instrument approach of this type shall be conducted in accordance with the procedure specified on the other side and the air carrier minimums specified above with the following exceptions:

DATE _____ RECEIVED FOR THE AIR CARRIER BY __________ (SIGNATURE) TITLE _____

AMENDMENT NO. _____

BY DIRECTION OF THE ADMINISTRATOR __________ (SIGNATURE) __________ (TITLE)

EFFECTIVE DATE __________

Figure A5-12

2. FINAL APPROACH OBSTACLE ASSESSMENT - NON-STANDARD LEVELS OF RNP

2.1. Obstacle Assessment For Non-Standard Levels of RNP. Category I or Category II instrument approach procedures may be based on various criteria for obstacle clearance including FAA AC 120-29 as amended, Standards for Terminal Instrument procedures (FAA Order 8260.31, TERPS), ICAO PANS-OPS, or other state criteria for operations within those States. Category I or II operations may also be based on Non-Standard Levels or Types of RNP when approved by FAA.

2.2. OBSTACLE CRITERIA.

2.2.1. The obstacle assessment criteria described below may be used for Category I or Category II procedures which are based on ILS, MLS, GLS (GNSS/Differential GNSS) or other systems which provide equivalent performance.

2.2.2. Airborne Systems previously assessed against earlier criteria of Advisory Circular (AC) 120-29 through Change 3, or Systems for Category III assessed using AC 120-28 through AC 120-28C, Criteria for Approval of Category III Landing Weather Minimal, or equivalent ILS/MLS criteria (BCARs, JAR, etc.) are considered to have met the criteria below, without further demonstration.

2.2.3. Airborne systems may be demonstrated to successfully perform to a value of HAT other than the lowest applicable standard HAT (e.g., 100 ft. HAT for Category II; or 200 ft. HAT for Category I). When such demonstrations (e.g., for FMS) are conducted, the operational DA(H) authorized may be limited to corresponding higher minima, based on the lowest HAT successfully demonstrated (e.g., 250 ft. HAT, 300 ft. HAT).

2.2.4. While the criteria of this appendix is primarily intended for Category I or Category II, it also may have other applications such as for assuring acceptable performance along the final approach segment of a Category III procedure, down to 100 ft. HAT.

2.3. USE OF THESE CRITERIA FOR AIRBORNE SYSTEM AIRWORTHINESS DEMONSTRATIONS WITH NON-STANDARD LEVELS OF RNP. When this criteria is used in conjunction with airworthiness demonstrations of airborne systems using Non-Standard RNP Criteria, the following assumptions should be applied, unless use of other assumptions is determined to be acceptable to FAA.

2.3.1. LATERAL PERFORMANCE.

2.3.1.1. The lateral dimensions defined by containment should contain the structure of the aircraft, except that compensation for varying pitch attitudes, bank angles, or yaw/drift angles during approach need not be applied. A maximum wing semi-span of 115 ft. may be assumed.

2.3.1.2. The lateral window at 100 ft. HAT may be considered to be equivalent to that specified for a value of RNP .01, and its related containment (e.g., A 470 ft. lateral window at 100 ft. HAT equivalent to RNP .01). A 470 foot lateral window may be assumed, and may be related to RNP .01 as follows:

> [(RNP .01nm x 2= 120 ft. containment limit)+(115 ft. wing semi-span) = ±235 ft. half-lateral approach window, or a 470 ft. lateral approach window at 100 ft. HAT]

2.3.2. VERTICAL PERFORMANCE.

2.3.2.1. A maximum of 19 ft. wheel to G/S antenna/navigation reference point height, and a level terrain DA(H) of 81 ft. RA may be assumed at the 100 ft. HAT point.

2.3.2.2. A value of ±12 ft. (2 sigma) vertical tracking performance based on an equivalent performance level to that specified previously in superseded AC 120-29 Change 3 may be used, and may be assumed to be met at 100 ft. HAT (81 ft.

RA). This performance level is considered to provide for 4 sigma navigation reference point containment of ± 24 ft., or a vertical window of 48 ft. at 100 ft. HAT.

2.4. OTHER CONSIDERATIONS. Use of RNP criteria does not affect and should not affect application of other applicable obstacle assessment processes related to obstacle construction (e.g., Obstacle Identification analysis or aeronautical studies assessing obstructions in navigable airspace per part 77). This criteria is not intended to replace criteria established by FAA for airspace planning (e.g., Air Traffic planning for simultaneous instrument approach operations).

APPENDIX 6.

GROUND SYSTEM AND OBSTRUCTION CLEARANCE CRITERIA FOR CATEGORY II APPROACH AND LANDING OPERATIONS

1. PURPOSE. This Appendix outlines ground system and obstruction clearance criteria for Category II approach and landing operations supported by ILS, MLS, or GLS (e.g., GPS/DGPS LAAS), or for Category II operations based on RNP. To the extent that this criteria relates to or is referenced by criteria in AC 120-28D, Criteria for Approval of Category III Landing Weather Minima for Takeoff, Landing, and Rollout, as amended, for Category III, it may also be used as the basis for Category III criteria.

2. GENERAL. Category II procedures are based on both navigation and visual guidance systems. The navigation system must be capable of guiding an aircraft to the runway reference datum (e.g., the ILS, MLS, GLS, or RNP-based glide path reference datum) with appropriate accuracy. The visual guidance system must provide appropriate visual cues to the pilot on approach from at least the decision altitude (height), down to and including touchdown, and along the runway for rollout, under the appropriate visibility conditions.

In order for a runway to qualify for Category II operations, the runway must be capable of supporting the lowest Category I minimums.

Runways which do not meet the criteria established in this appendix, but where an operational or other evaluation identifies that an equivalent level of safety exists, may be authorized appropriate Category II minimums. Such an evaluation shall be conducted by Flight Standards Service on a case-by case basis as required.

This circular, Standard Operations Specifications (OpSpecs), as amended, and the criteria in the Air Transportation Operations Inspectors Handbook, FAA Order 8400.10, establish the lowest approach and landing minimums which can be authorized for Category II operations for air carriers operating under Title 14 of the Code of Federal Regulations (14 CFR) part 121 or 135. These minima may also apply to commercial Operators operating under 14 CFR part 125. The implementation guidelines in Order 8260.36A may be used for new ILS, GLS, or MLS. Criteria in TERPS or ICAO PANS-Ops may be used for established ILS Procedures and facilities.

Foreign airports served by U.S. air carriers or commercial operators under part 121, 125, or 135 may be approved in accordance with the provisions of pertinent ICAO Annexes, Standards, or Recommended Practices (SARPS), on the basis of a comparable level of safety.

3. SUPPORTING NAVIGATION AIDS OR SENSORS FOR CATEGORY II PROCEDURES.

a. NAVAID System(s). A system which meets appropriate integrity, continuity and reliability performance standards for a U.S. Category II procedure and provides continuous electronic guidance at least to the ILS reference datum (or equivalent for RNP) should be provided, consistent with the elements described below:

(1) Localizer or Localizer Equivalent Sensor Capability. The localizer or equivalent (e.g., LAAS/DGPS), or RNP equivalent lateral guidance should be provided from the specified coverage limit down to the specified reference datum, or equivalent, as indicated in the U.S. Standard Flight Inspection Manual, FAA Order 8200.1, United States Standard Flight Inspection Manual, as amended.

(2) Glide Slope or Glide slope Equivalent. The glide slope or elevation antenna, or glide slope equivalent (e.g., LAAS/DGPS), or RNP equivalent, should provide guidance in the vertical plane from the specified coverage limit down to the ILS reference datum, or equivalent, as indicated in the U.S. Standard Flight Inspection Manual.

(3) VHF Marker Beacons. In addition to the outer and middle marker beacons for ILS, a 75 MHz inner marker beacon should be provided at each runway intended for a Public Use Published 14 CFR part 97 Category II Procedure based on ILS. Special procedures authorized through OpSpecs need not have one or more of the standard installed marker beacons if another suitable means to determine longitudinal position and suitable glideslope is available to the operator. Marker beacons may be provided, or equivalent waypoints, fixes, or methods may be provided for Category II Procedures based on GLS or MLS.

b. Visual Guidance and Lighting Systems. The lighting system should provide suitable visual guidance from at least the point where an approaching aircraft is at the lowest applicable DA(H), through the remainder of the approach, flare, landing, and rollout. The system should consist of at least the following components or capabilities:

(1) Approach Lighting System. Lighting standards are as outlined in FAA Order 6850.2, Visual Guidance Lighting Systems, as amended, except that a negative approach light plane gradient is not permitted in the inner 1500 ft. zone prior to threshold (unless otherwise approved by AFS-1). Where required, approved flush approach lighting system may be installed (i.e., for a displaced landing threshold). For Special Category II procedures authorized through OpSpecs, approach lighting at least equivalent to a MALSR should be installed, unless a different approach lighting configuration is approved by FAA for use by each applicable operator.

(2) Touchdown Zone Lighting System. A lighting system should be provided defining the runway TDZ and conforming to AC 150/5340-4C, Installation Details for Runway Centerline Touchdown Zone Lighting Systems, as amended. For Special Category II procedures authorized through OpSpecs, TDZ lighting need not necessarily be installed if the runway's lighting configuration is reviewed and approved by FAA for use by each applicable operator (e.g., based on use of autoland or HUD guidance systems).

(3) Centerline Lighting System. A centerline lighting system defining the runway centerline and conforming to AC 150/5340-4C, as amended, using L-843 and L-850 runway centerline lighting systems (or equivalent) should be provided. For Special Category II procedures authorized through OpSpecs, centerline lighting need not necessarily be installed if the runway's lighting configuration is reviewed and approved by FAA for use by each applicable operator (e.g., based on use of autoland or HUD guidance systems).

(4) High Intensity Runway Edge Lighting. A high intensity runway edge lighting system (or equivalent) should be provided defining the lateral and longitudinal limits of the runway and conforming to AC 150/5340-24, Runway and Taxiway Edge Lighting System, as amended.

(5) Taxiway Turnoff Lighting Systems. Unless otherwise approved for Special Category II procedures authorized through OpSpecs, taxiway turnoff lighting systems, stop bar, runway guard lighting, and critical area taxiway lighting designations should be provided in accordance with AC 120-57, Surface Movement Guidance and Control System, as amended, and the AC 150/5340 series, as amended.

(6) All Weather Runway Markings. Runways should be marked with all-weather runway markings as specified in AC 150/5340-1G, Standards for Airport Markings, as amended.

c. Meteorological Reporting and Other Requirements. Unless otherwise authorized for Special Category II procedures, the following additional meteorological reporting systems or other capabilities should be provided in conjunction with Category II procedures.

(1) Runway Visual Range (RVR). An RVR system should be provided to support Category II instrument procedures. For U.S. Operators, RVR is considered to be an instrumentally derived measurement system reporting minimum visibility in units of feet or meters, located adjacent to the applicable runway (see Appendix 1).

(a) For Category II procedures on runways greater than 8000 ft. in length, RVR for at least TDZ, Mid, and Rollout should be available. For Category II procedures on runways less than or equal to 8000 ft. in length, RVR for at least TDZ and Rollout should be available.

(b) For runways with more than 3 RVR reporting facilities (e.g., certain European locations) FAA may determine which and how many transmissometers may apply to U.S. Operators operations, unless specifically addressed by the state of the Aerodrome.

(c) If approved by AFS-1, Category II procedures may be approved on a case by case basis using only TDZ RVR, adjacent or nearby runway RVR reports. Where transmissometers from other runways are used, they should typically be located within a radius of 2000 ft. of the applicable portion of the runway being served, and provide a minimum of 1000 ft. coverage volume of the pertinent area along the intended runway.

(d) Timely reports for TDZ, mid, and rollout RVR values should be provided to the air traffic system (e.g., Tower, TACON, ARTCC, as applicable) for transmission to pilots of arriving aircraft, and for transmission to meteorological services, for timely distribution to pilots and Operators for pre-flight and en route flight planning.

(e) Existing RVR systems with minimum RVR value reporting capability of 600 RVR may continue to be used until replaced or upgraded.

(f) New or replacement RVR systems should have the capability to report RVR ranging from a minimum value of 300 ft., to a maximum value of at least 6000 ft. Readout increments should be in at least 100 ft. increments up to at least 1000 RVR, and thereafter increments of 200 ft. to 3000 RVR. Where possible, RVR systems with a useful reporting range of 50 ft. RVR to 6500 ft. RVR are desirable. Preferred reporting increments are 50 ft. to 1000 RVR, 200 ft. to 3000 RVR, and 500 ft. beyond 3000 RVR. New or replacement systems should, if possible, be capable of reporting in units of feet or meters, so that if metric reports are introduced into the National Aviation System (NAS) or International Aviation System (INAS), RVR systems are easily capable of converting to use the alternate metric units.

(g) FAA Standard 008, as amended, prescribes installation criteria for RVR equipment, and AC 97-1, Runway Visual Range (RVR), as amended, describes RVR measuring equipment and its use.

(2) Radar (Radio) Altimeter Height. Radar (radio) altimeter heights will be provided on the FAA Form 8260.3, (or equivalent operator reference material for Special Category II Procedures) indicating the vertical distance at the 100/150 ft. DA(H), assuming a 19 ft. wheel to navigation reference point height (e.g., glide slope antenna height) and the terrain on runway extended centerline beneath this aircraft reference point.

(3) Facility Status Remote Monitoring. Remote facility status monitoring should be provided for the following NAVAIDs or visual aids (see FAA Order 6750.24, as amended). For Special Category II procedures authorized through OpSpecs, remote monitoring capability is desired, but is not required. If not provided, a method to assure timely reporting of failures reported to ATS or the airport to flightcrews should be established.

(a) NAVAIDs.

(b) Approach lighting system.

(c) Relevant electrical power sources or systems

(d) Runway edge, centerline and TDZ lights.

(e) Critical taxiway lighting, runway guard lights, and stop bars.

(4) Facility Status Monitoring by Periodic Inspection or After Reported Failures. The following systems may require inspection by airport management or FAA personnel or pilot reports to determine if they are operating in accordance with specified criteria, reference AC 120-57, as amended. Monitoring procedures should be capable of detecting when more than 10 percent of the lights are inoperative. The lighting system/configuration should be considered inoperative when more than 10 percent of the lights are not functioning. Taxiway lights and individual airport/runway lights do not have to be remotely monitored. However, when visual aid lighting systems which support Category II are monitored by observation, the inspection interval should ensure that undetected failures of more than 10 percent of the lights, or more than two adjacent lights would be unlikely, taking into consideration lamp expected life, environmental conditions, etc. The procedure to visually verify operation of runway edge, centerline, and TDZ lights should specify that a visual inspection take place within one day prior to commencement of anticipated Category II operations, or at least daily for continued Category II operations. The following systems should be considered:

(a) Touchdown zone and centerline lights.

(b) Runway edge lights.

(c) Runway markings.

(d) Runway guard lights.

(e) Taxiway centerline lights.

(f) Taxiway clearance bar lights.

(g) Taxiway signs.

(h) Taxiway markings.

For Special Category II procedures authorized through OpSpecs, NAVAID, lighting, and marking monitoring may be authorized for each operator if a procedure is equivalent to the above provisions, and is approved by FAA considering use by each applicable operator.

d. **Critical Areas.** Obstacle-critical areas will be marked and lighted to ensure that ground traffic does not violate critical areas during specified operations. These areas may differ depending on the type of NAVAIDs used. Procedural methods may be used for Special Category II procedures, if assurance can be provided that critical areas can be suitably protected for each operator using the special procedure.

(1) Glide Path Critical Area. The glide path critical area for ILS installations is specified in FAA Order 6750.16B, as amended. The glide path critical area of the elevation antenna for MLS installations is specified in FAA Order 6830.5, as amended.

(2) Localizer Critical Area. The localizer critical area for ILS installations is specified in FAA Order 6750.16B, as amended. The Azimuth Antenna critical area for MLS installations is specified in FAA Order 6830.5, as amended.

4. OBSTACLE CLEARANCE CRITERIA. Unless otherwise specified by AFS-1 the criteria found in FAA Orders 8260.3B and 8260.36 or this AC should be used to establish Category II minimums for each new ILS, MLS, or GLS based procedure. Order 8260.3B TERPS criteria may be used for previously established ILS systems. Appendix 5 of this AC contains guidance for RNP final approach and missed approach segments.

APPENDIX 7

Standard Operations Specifications

1. General. This appendix provides samples of standard operations specifications (OpSpecs) provisions typically issued for operations described in this AC. Standard OpSpecs are developed by the Federal Aviation Administration (FAA) Flight Standards Service, Washington D.C., and are issued by certificate holding district offices (CHDO) to each specific operator. CHDOs incorporate any necessary specific information applicable to that operator, to that operator's fleet of aircraft, or to that operator's specific operational environment or requirements (e.g., areas of operation).

OpSpecs specify limitations, conditions, and other provisions which Operators must comply with to comply with Title 14 of the Code of Federal Regulations (14 CFR). Standard OpSpecs are normally coordinated with industry prior to issuance to ensure a mutual and clear understanding of content and applicability and to pre-determine the effect they may have on operations. After appropriate coordination, new standard provisions, or amendments to existing provisions, are incorporated into the FAA's computer-based OpSpecs program used by field offices.

Use of standard OpSpecs provisions facilitates application of equivalent safety criteria for various operators, aircraft types, and operating environments. Occasionally, it may be necessary to issue OpSpecs provisions that are non-standard because of unique situations not otherwise addressed by standard provisions. Non-standard OpSpec provisions may be more or less restrictive than standard provisions, depending on the circumstances necessary to show appropriate safety for the intended application. Nonstandard OpSpecs provisions typically should not be contrary to the provisions of standard paragraphs. In cases when a non-standard paragraph is more or less restrictive than a standard paragraph, appropriate justification must be provided.

The following Standard OpSpec paragraphs are provided:

Part A - General

- A002 Definitions and Abbreviations

Part C - Airplane Terminal instrument Procedures and Airport Authorizations and Limitations

- C051 Terminal Instrument Procedures
- C052 Basic Instrument Approach Procedure Authorizations -- All Airports
- C053 Straight-in Category I Approach Procedures other than ILS, MLS, or GPS and IFR Landing Minimums - All Airports
- C054 Special Limitations and Provisions for Instrument Approach Procedures and IFR Landing Minimums
- C055 Alternate Airport IFR Weather Minimums
- C056 IFR Standard Takeoff Minimums, Part 121 Operations -- All Airports
- C059 Category II Instrument Approach and Landing Operations
- C061 Flight Control Guidance Systems for Automatic Landing Operations Other Than Category II and III
- C062 Manually Flown Flight Control Guidance Systems Certified for Landing Operations Other Than Category II or III
- C074 Straight-in Category I Precision Approach Procedures and IFR Landing Minimums - All Airports All Airports.
- C075 CAT I Landing Minimums - Circling Approach Procedures
- C076 Category I IFR Landing Minimums -- Contact Approaches
- C078 IFS Lower Than Standard Takeoff Minimums, 14 CFR Part 121 Airplane Operations - All Airports
- C090 Required Navigation Performance (RNP)

2. 14 CFR Part 121 Operations Specifications - PART A. The following pertinent excerpts are provided from Operations Specifications Part A:

Instrument Approach Categories are defined as follows:

Category I	An instrument approach or approach and landing with a decision altitude (height) or minimum descent altitude (height) not lower than 60 m (200 ft) and with either a visibility not less than 1/2 statute mile (800m), or a runway visual range not less than 550 m (1800 ft).
Category II	An instrument approach or approach and landing with a decision height lower than 60 m (200 ft) but not lower than 30 m (100 ft) and a runway visual range not less than 350 m (1200 ft).
Category III	An instrument approach or approach and landing with a decision height lower than 30 m (100 ft), or no decision height, or a runway visual range less than 350 m (1200 ft).
Category IIIa	An instrument approach and landing with a decision height lower than 30 m (100 ft), or no decision height and a runway visual range not less than 200 m (700 ft).
Category IIIb	An instrument approach and landing with a decision height lower than 15 m (50 ft), or no decision height and a runway visual range less than 200 m (700 ft) but not less than 50 m (150 ft).
Category IIIc	An instrument approach and landing with or without a decision height, with a runway visual range less than 50 m (150 ft).

Other related definitions as follows:

Class I Navigation. Class I navigation is any en route flight operation or portion of an operation that is conducted entirely within the designated Operational Service Volumes (or International Civil Aviation Organization (ICAO) equivalent) of ICAO standard airway navigation facilities (VHF Omni-directional Radio Range (VOR), VOR/Distance Measuring Equipment (DME), NDB). Class I navigation also includes en route flight operations over routes designated with an "MEA GAP" (or ICAO equivalent). En route flight operations conducted within these areas are defined as "Class I navigation" operations irrespective of the navigation means used. Class I navigation includes operations within these areas using pilotage or any other means of navigation which does not rely on the use of VOR, VOR/DME, or NDB.

Class II Navigation. Class II navigation is any en route flight operation which is not defined as Class I navigation. Class II navigation is any en route flight operation or portion of an en route operation irrespective of the means of navigation which takes place outside (beyond) the designated Operational Service Volume (or ICAO equivalents) of ICAO standard airway navigation facilities (VOR, VOR/DME, NDB). However, Class II navigation does not include en route flight operations over routes designated with an "MEA GAP" (or ICAO equivalent).

Operational Service Volume. The Operational Service Volume is that volume of airspace surrounding a NAVAID which is available for operational use and within which a signal of usable strength exists and where that signal is not operationally limited by co-channel interference. Operational Service Volume includes all of the following:

a. The officially designated Standard Service Volume excluding any portion of the Standard Service Volume which has been restricted.

b. The Expanded Service Volume.

c. Within the United States, any published instrument flight procedure (victor or jet airway, Standard Instrument Departure (SID), Standard Terminal Arrival Routes (STAR), Standard Instrument Approach Procedure (SIAP), or instrument departure).

d. Outside the U.S., any designated signal coverage or published instrument flight procedure equivalent to U.S. standards.

3. 14 CFR Part 121 Operations Specifications - PART C. The following pertinent excerpts are provided from Operations Specifications Part C:

C051, Terminal Instrument Procedures.

a. The certificate holder is authorized to conduct terminal instrument operations using the procedures and minimums specified in these operations specifications, provided one of the following conditions is met:

(1) The terminal instrument procedure used is prescribed by these operations specifications.

(2) The terminal instrument procedure used is prescribed by Title 14 of the Code of Federal Regulations (14 CFR) part 97, Standard Instrument Approach Procedures.

(3) At U.S. military airports, the terminal instrument procedure used is prescribed by the U.S. military agency operating the airport.

(4) If authorized foreign airports, the terminal instrument procedure used at the foreign airport is prescribed or approved by the government of an ICAO contracting state. The terminal instrument procedure must meet criteria equivalent to that specified in either the United States Standard for Terminal Instrument Procedures (TERPS); or ICAO Document 8168-OPS; Procedures for Air Navigation Services-Aircraft Operations (PANS-OPS), Volume II; or Joint Aviation Authorities, Joint Aviation Requirements, operational agreements, Part 1 (JAR-OPS-1).

b. If Applicable, Special Limitations and Provisions for Instrument Approaches at Foreign Airports.

(1) Terminal instrument procedures may be developed and used by the certificate holder for any foreign airport, provided the certificate holder makes a determination that each procedure developed is equivalent to U.S. TERPS, ICAO PANS-OPS, or JAR-OPS-1 criteria and submits to the FAA a copy of the terminal instrument procedure with supporting documentation.

(2) At foreign airports, the certificate holder shall not conduct terminal instrument procedures determined by the FAA to be "not authorized for United States air carrier use." In these cases, the certificate holder may develop and use a terminal instrument procedure provided the certificate holder makes a determination that each procedure developed is equivalent to U.S. TERPS, ICAO PANS-OPS, or JAR-OPS-1 criteria and submits to the FAA a copy of the terminal instrument procedure with supporting documentation.

(3) When operating at foreign airports, RVR values or meteorological visibility might be shown in meters. When the minimums are specified only in meters, the certificate holder shall use the metric operational equivalents as specified in the RVR Conversion Table (Table 1) or the Meteorological Visibility Conversion Table (Table 2) for both takeoff and landing. Values not shown may be interpolated.

TABLE 1	
RVR CONVERSION	
FEET	METERS
300 ft	75 m
400 ft	125 m
500 ft	150 m
600 ft	175 m
700 ft	200 m
1000 ft	300 m
1200 ft	350 m
1600 ft	500 m
1800 ft	550 m
2000 ft	600 m
2100 ft	650 m
2400 ft	750 m
3000 ft	1000 m
4000 ft	1200 m
4500 ft	1400 m
5000 ft	1500 m
6000 ft	1800 m

TABLE 2		
METEOROLOGICAL VISIBILITY CONVERSION		
STATUTE MILES	METERS	NAUTICAL MILES
¼ sm	400 m	¼ nm
3/8 sm	600 m	3/8 nm
1/2 sm	800 m	1/2 nm
5/8 sm	1000 m	5/8 nm
3/4 sm	1200 m	7/10 nm
7/8 sm	1400 m	7/8 nm
1 sm	1600 m	9/10 nm
1 1/8 sm	1800 m	1 1/8 nm
1 ¼ sm	2000 m	1 1/10 nm
1 ½ sm	2400 m	1 3/10 nm
1 ¾ sm	2800 m	1 ½ nm
2 sm	3200 m	1 ¾ nm
2 ¼ sm	3600 m	2 nm
2 ½ sm	4000 m	2 2/10 nm
2 ¾ sm	4400 m	2 4/10 nm
3 sm	4800 m	2 6/10 nm

(5) When operating at foreign airports where the published landing minimums are specified in RVR, the RVR may not be available, therefore the meteorological visibility is reported. When the minimums are reported in meteorological visibility, the certificate holder shall convert meteorological visibility to RVR by multiplying the reported visibility by the appropriate factor, shown in Table 3. The conversion of reported meteorological visibility to RVR is used only for Category I landing minimums, and shall not be used for takeoff minima, CAT II or III minima, or when a reported RVR is available.

TABLE 3 [RVR = (reported meteorological visibility) X (factor)]		
AVAILABLE LIGHTING	DAY	NIGHT
High Intensity approach and runway lighting	1.5	2.0
Any type of lighting installation other than above	1.0	1.5
No lighting	1.0	N/A

C052, Basic Instrument Approach Procedure Authorizations - All Airports.

The certificate holder is authorized to conduct the following types of instrument approach procedures and shall not conduct any other types.

a. Instrument Approach Procedures Other Than ILS, MLS, and GLS

[NOTE: In the new OPSS, the POI will select the approaches that apply to the air carrier. If the OPSS is not available, the POI should delete the approach types that do not apply.]

VOR	VOR/DME	NDB	NDB/DME	LOC
LOC 'BC	LOC/DMESDF	TACAN	ASR	LDA
LDA/DME	LDA (w/Glide Slope)	RNAV	GPS	AZI
AZI/DME	AZI/DME Back Course			

b. ILS, MLS, and GLS Instrument Approach Procedures
ILS
ILS/PRM
GLS
MLS
PAR
ILS/DME

c. Other Conditions and Limitations (as required).

C053, Straight-In Category I Approach Procedures Other Than ILS, MLS, or GLS and IFR Landing Minimums - All Airports.

The certificate holder shall not use any IFR Category I landing minimum lower than that prescribed by the applicable published instrument approach procedure. The IFR landing minimums prescribed in this paragraph are the lowest Category I minimums authorized for use at any airport.

a. Category I Approach Procedures Other Than ILS, MLS, or GLS. The certificate holder shall not use an IFR landing minimum for straight-in approach procedures other than ILS, MLS, or GLS, lower than that specified in the following table. Touchdown zone (TDZ) RVR reports, when available for a particular runway, are controlling for all approaches to and landings on that runway (See NOTE 6).

Straight-In Category I Approaches (Approaches other than ILS, MLS, or GPS Landing System (GLS))					
		Aircraft Category A, B, and C		Aircraft Category D	
Approach Light Configuration	HAT (See NOTES 1, 2, & 3)	Visibility in Statute Miles	TDZ RVR In Feet	Visibility in Statute Miles	TDZ RVR In Feet
No Lights	250	1	5,000	1	5,000
ODALS	250	3/4	4,000	1	5,000
MALS, or SALS	250	5/8	3,000	1 (See NOTE 5)	5,000 (see NOTE 5 & 6)

MALSR, or SSALR, or ALSF-1, or ALSF-2	250	½ (See NOTE 4)	2,400 (See NOTE 4 & 6)	1 (See NOTE 5)	5,000 (See NOTE 5 & 6)
DME ARC, any light configuration	500	1	5,000	1	5,000

NOTE 1: For NDB approaches with a FAF, add 50 ft. to the HAT.
NOTE 2: For NDB approaches without a FAF, add 100 ft. to the HAT.
NOTE 3: For VOR approaches without a FAF, add 50 ft. to the HAT.
NOTE 4: For NDB approaches, the lowest authorized visibility is ¾ and the lowest RVR is RVR 4000.
NOTE 5: For LOC approaches, the lowest authorized visibility is ¾ and the lowest RVR is RVR 4000.
NOTE 6: The mid RVR and rollout RVR reports (if available) provide advisory information to pilots. The mid RVR report may be substituted for the TDZ RVR report if the TDZ RVR report is not available.

b. Special Limitations and Provisions for Instrument Approach Procedures at Foreign Airports. If the certificate holder operates to foreign airports the following applies:

(1) Foreign approach lighting systems equivalent to U.S. standards are authorized for instrument approaches. Sequenced flashing lights are not required when determining the equivalence of a foreign approach lighting system to U.S. standards.

(2) For straight-in landing minimums at foreign airports where an MDA(H) or DA(H) is not specified, the lowest authorized MDA(H) or DA(H) shall be obtained as follows:

(a) When an obstruction clearance limit (OCL) is specified, the authorized MDA(H) or DA(H) is the sum of the OCL and the touchdown zone elevation (TDZE). If the TDZE for a particular runway is not available, threshold elevation shall be used. If threshold elevation is not available, airport elevation shall be used. For approaches other than ILS, MLS, or GLS, the MDA(H) may be rounded to the next higher 10-foot increment.

(b) When an obstacle clearance altitude (OCA)/obstacle clearance height (OCH) is specified, the authorized MDA(H) or DA(H) is equal to the OCA/OCH. For approaches other than ILS, MLS, or GLS, the authorized MDA(H) may be expressed in intervals of 10 ft.

(c) The HAT or HAA used for approaches other than ILS, MLS, or GLS, shall not be below those specified in subparagraph a above of this operations specification.

(3) When only an OCL or an OCA/OCH is specified, visibility and/or RVR minimums appropriate to the authorized HAA/HAT values determined in accordance with subparagraph b(2) above will be established in accordance with criteria prescribed by U.S. TERPS or Joint Aviation Authorities, Joint Aviation Requirements, operational agreements, Part 1 (JAR-OPS-1).

(4) When conducting an instrument approach procedure outside the United States, the certificate holder shall not operate an aircraft below the prescribed MDA(H) or continue an approach below the DA(H), unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and at least one of the following visual references is clearly visible to the pilot:

(a) Runway, runway markings, or runway lights.

(b) Approach light system (in accordance with 14 CFR, part 91, section 91.175(c)(3)(i)).

(c) Threshold, threshold markings, or threshold lights.

(d) Touchdown zone, touchdown zone markings, or touchdown zone lights.

(e) Visual glidepath indicator (such as, VASI, PAPI).

(f) Runway end identifier lights.

C054. Limitations and Provisions for Instrument Approach Procedures and IFR Landing Minimums.

a. High Minimum Pilot-in-Command Provisions. Pilots-in-command who have not met the requirements of Title 14 of the Code of Federal Regulations (14 CFR) section 121.652 or 135.225(d) as appropriate, shall use the high minimum pilot RVR landing minimum equivalents as determined from the following table.

RVR Landing Minimum as Published	**RVR Landing Minimum Equivalent required for High Minimum Pilots**
RVR 1800	RVR 4500
RVR 2000	RVR 4500
RVR 2400	RVR 5000
RVR 3000	RVR 5000
RVR 4000	RVR 6000
RVR 5000	RVR 6000

b. Limitations on the Use of Landing Minimums for Turbojet Airplanes.

(1) A pilot-in-command of a turbojet airplane shall not conduct an instrument approach procedure when visibility conditions are reported to be less than ¾ statute mile or RVR 4000 until that pilot has been specifically qualified to use the lower landing minimums.

(2) A pilot-in-command of a turbojet airplane shall not begin an instrument approach procedure when the visibility conditions are reported to be less than ¾ statute mile or RVR 4000, unless the following conditions exist:

(a) Fifteen percent additional runway length is available over the landing field length specified for the destination airport by the appropriate sections of 14 CFR.

(b) Suitable instrument (all weather) runway markings or runway centerline lights are operational on that runway.

C055. Alternate Airport IFR Weather Minimums.

a. The certificate holder is authorized to derive alternate airport weather minimums from the "Alternate Airport IFR Weather Minimums" table listed below.

b. Special limitations and provisions.

(1) In no case shall the certificate holder use an alternate airport weather minimum other than any applicable minimum derived from this table.

(2) In determining alternate airport weather minimums, the certificate holder shall not use any published instrument approach procedure which specifies that alternate airport weather minimums are not authorized.

(3) Credit for alternate minima based on CAT II or CAT III capability is predicated on authorization for engine inoperative CAT III operations for the certificate holder, aircraft type, and qualification of flightcrew for the respective CAT II or CAT III minima applicable to the alternate airport.

Alternate Airport IFR Weather Minimums [sm = statute mile]		
Approach Facility Configuration	**Ceiling**	**Visibility**
For airports with at least one operational navigational facility providing a straight-in instrument approach procedure, or, when applicable, a circling maneuver from an instrument approach procedure.	A ceiling derived by adding 400 ft. to the authorized Category I HAT or, when applicable, the authorized HAA	A visibility derived by adding 1 sm to the authorized Category I landing minimum.
For airports with at least two operational navigational facilities, each providing a straight-in Instrument approach procedure to different, suitable runways. (However, when an airport is designated as an ER-OPS En Route Alternate Airport in these operations specifications, the approach procedures used must be to separate, suitable runways).	A ceiling derived by adding 200 ft. to the higher Category I HAT of the two approaches used.	A visibility derived by adding ½ sm to the higher authorized Category I landing minimum of the two approaches used.
For airports with a published CAT II or CAT III approach, and at least two operational navigational facilities, each providing a straight-in ILS, MLS, or GLS approach procedure to different, suitable runways.	CAT II procedures, a ceiling of at least 300 ft. HAT, or for CAT III procedures, a ceiling of at least 200 ft. HAT.	CAT II procedures, a visibility of at least RVR 4000, or for CAT III procedures, a visibility of at least RVR 1800.

C056, IFR Takeoff Minimums, Part 121 Airplane Operations - All Airports.

a. Standard takeoff minimums are defined as 1 statute mile visibility or RVR 5000 for airplanes having 2 engines or less and ½ statute mile visibility or RVR 2400 for airplanes having more than 2 engines.

b. RVR reports, when available for a particular runway, shall be used for all takeoff operations on that runway. All takeoff operations, based on RVR, must use RVR reports from the locations along the runway specified in this paragraph.

c. When a takeoff minimum is not published, the certificate holder may use the applicable standard takeoff minimum and any lower than standard takeoff minimums authorized by these operations specifications. When standard takeoff minimums or greater are used, the Touchdown Zone RVR report, if available, is controlling.

d. When a published takeoff minimum is greater than the applicable standard takeoff minimum and an alternate procedure (such as a minimum climb gradient compatible with aircraft capabilities) is not prescribed, the certificate holder shall not use a takeoff minimum lower than the published minimum. The Touchdown Zone RVR report, if available, is controlling.

C059, Category II Instrument Approach and Landing Operations.

The certificate holder is authorized to conduct Category II (CAT II) instrument approach and landing operations to the airports and runways listed in subparagraph g using the procedures and minimums specified in this paragraph and shall conduct no other CAT II operations.

a. CAT II Approach and Landing Minimums. The certificate holder shall not use any CAT II IFR landing minimums lower than those prescribed by any applicable published CAT II instrument approach procedure. The CAT II IFR landing minimums prescribed by these operations specifications are the lowest CAT II minimums authorized for use at any airport.

b. The certificate holder is authorized to use the following CAT II straight-in approach and landing minimums at the authorized airports and runways listed in Table 3, for the aircraft listed in Table 1 below, provided the limitations in subparagraph g. are met.

Table 1

CAT II Approach and Landing Minimums		
Airplane M/M/S	**DH Not less Than**	**Lowest Authorized RVR**

c. Lower than standard CAT II. If the certificate holder is authorized lower than standard CAT II minimums with a decision height of 100 ft. and RVR 1000 ft. (300 meters), it shall be entered in Table 1 above. If authorized in Table 1, the following limitations and provisions must be met:

(1) Used only when conducting an autoland approach, or when using a head up guidance system (HGS) to touchdown.
(2) The airplane and its automatic flight control guidance system or manually flown guidance system must be approved for approach and landing operations as specified by operations specifications paragraphs C060, C061, or C062 of these operations specifications.
(3) The autopilot or HGS must be listed in the required CAT II airborne equipment in subparagraph d, Table 2, of this operations specification.

d. Required CAT II Airborne Equipment. The flight instruments, radio navigation equipment, and other airborne systems required by the applicable Section of the Title 14 of the Code of Federal Regulations (14 CFR) and the FAA-approved Airplane Flight Manual for the conduct of CAT II operations must be installed and operational. The additional airborne equipment listed or referenced in Table 2 below is also required and must be operational for CAT II operations.

Table 2

Kind of CAT II Operation		
Airplane M/M/S	**Additional Equipment & Special Provisions**	**Manual/Auto Pilot**

e. Required RVR Reporting Equipment. The certificate holder shall not conduct any CAT II operation, unless the following RVR reporting systems are installed and operational for the runway of intended landing:

(1) For authorized landing minimums not less than RVR 1600, the touchdown zone RVR reporting system is required and must be used. This RVR report is controlling for all operations.
(2) For authorized landing minimums less than RVR 1600, the touchdown zone and the rollout RVR reporting systems are required and must be used. The touchdown zone RVR report is controlling for all operations and the rollout RVR report provides advisory information to pilots. The mid RVR report (if available)

provides advisory information to pilots and may be substituted for the rollout RVR report if the rollout RVR report is not available

f. Pilot Qualifications. A pilot-in-command shall not conduct CAT II operations in any airplane until that pilot has successfully completed the certificate holder's approved CAT II training program, and has been certified as being qualified for CAT II operations by one of the certificate holder's check airmen properly qualified for CAT II operations or an FAA inspector. Pilots-in-command who have not met the requirements of 14 CFR Section 121.652 shall use high minimum pilot landing minima not less than RVR 1800.

g. Operating Limitations. The certificate holder shall not begin the final approach segment of an instrument approach procedure, unless the latest reported controlling RVR is at or above the minimums authorized for the operation being conducted. If the aircraft is established on the final approach segment and the controlling RVR is reported to decrease below the authorized minimums, the approach may be continued to the DH applicable to the operation being conducted. The certificate holder shall not begin the final approach segment of an instrument approach procedure when the touchdown zone RVR report is less than RVR 1800, unless all of the following conditions are met:

(1) The airborne equipment required by subparagraph d above is installed and operating satisfactorily.
(2) The required components of the CAT II ground system are installed and in normal operation including all of the following:

(a) Each required component of the ground based CAT II navigation system. For ILS operations, a precision or surveillance radar fix, a designated NDB, VOR, DME fix, or a published minimum GSIA fix may be used in lieu of an outer marker. Except for CAT II instrument approach procedures designated as "RA NA" (radar/radio altimeter not authorized) operative radar/radio altimeters may be used in lieu of an inner marker. A middle marker is not required.
(b) ALSF-1 or ALSF-2 approach lighting systems or foreign authorizations acceptable to FAA. Sequenced flashing lights are required only at U.S. airports.
(c) High intensity runway lights.
(d) Approved touchdown zone lights and runway centerline lights.

(3) The RVR reporting systems required by subparagraph e above are operating satisfactorily.
(4) The crosswind component on the landing runway is less than the airplane flight manual's crosswind limitations, or 15 knots or less, whichever is more restrictive.
(5) Fifteen percent additional runway length is available over the landing field length specified for destination airport in 14 CFR section 121.195(b) or section 135.385(b), as appropriate.
(6) CAT II landing minimums to airports listed in Table 3 without touchdown zone and centerline lighting are authorized only when an auto-coupled approach or HGS is used to touch down.
(7) Additionally, MALSR or ALSF-1 or ALSF-2 approach lighting system or equivalent are required for the operations listed in Table 3.

h. Missed Approach Requirements. A missed approach shall be initiated when any of the following conditions exist:

(1) Upon reaching the authorized decision height, the pilot has not identified the required visual references to safely continue the approach by visual reference alone.
(2) After passing the authorized decision height, the pilot loses contact with the required visual references, or a reduction in visual reference occurs which prevents the pilot from safely continuing the approach by visual reference alone.
(3) The pilot determines that a landing cannot be safely accomplished within the touch down zone.
(4) Before arriving at DH, any of the required elements of the CAT II ground system becomes inoperative.
(5) Any of the airborne equipment required for the particular CAT II operation being conducted becomes inoperative. However, if the certificate holder is authorized for both manually flown and automatically flown CAT II operations, an automatic approach may be continued manually using the approved manual systems, provided the automatic system has malfunctioned and is disengaged higher than 1,000 ft. above the elevation of the touchdown zone.

(6) The crosswind component at touch down is expected to be greater than 15 knots, or greater than airplane flight manual crosswind limitations, whichever is more restrictive.

i. Authorized CAT II Airports and Runways. The certificate holder is authorized CAT II operations at airports and runways approved for CAT II operations in 14 CFR part 97. CAT II operations are also authorized for the airports and runways listed in table 3 below.

Table 3

Airport Name/Identifier	Runways	Special Limitations

C061. Flight Control Guidance Systems for Automatic Landing Operations Other Than Categories II and III

The certificate holder is authorized to conduct automatic approach and landing operations (other than Categories II and III) at suitably equipped airports. The certificate holder shall conduct all automatic approach and landing operations in accordance with the provisions of this paragraph.

a. Authorized Airplanes and Flight Control Guidance Systems. The certificate holder is authorized to conduct automatic approach and landing operations using the following aircraft and automatic flight control guidance systems.

Airplane Type M/M/S	**Flight Control Guidance Systems** **Manufacturer**	**Model**

b. Special Limitations.

(1) The certificate holder shall conduct all operations authorized by this paragraph in accordance with the applicable section of Title 14 of the Code of Federal Regulations and the airworthiness certification basis of the automatic flight control guidance system used.
(2) The certificate holder shall not conduct automatic landing operations to any runway using these systems, unless the certificate holder determines that the flight control guidance system being used permits safe, automatically flown approaches and landings to be conducted at that runway.
(3) The certificate holder shall not conduct any operations authorized by this paragraph, unless the certificate holder's approved training program provides training in the equipment and special procedures to be used.
(4) Except when automatic approaches and landings are performed under the supervision of a properly qualified check airman, any pilot used by the certificate holder to conduct automatic approaches and landings must be qualified in accordance with the certificate holder's approved training program.

C062. Manually Flown Flight Control Guidance System Certified for Landing Operations Other Than Categories II and III.

The certificate holder is authorized to conduct approach and landing operations (other than Categories II and III) at suitably equipped airports using manually flown flight control guidance systems approved for landing operations. The certificate holder shall conduct all approach and landing operations authorized by this paragraph in accordance with the provisions of this paragraph.

a. Authorized Airplanes and Manual Flight Control Systems. The certificate holder is authorized to conduct approach and landing operations using the following aircraft and manually flown flight control guidance systems which are certified for landing operations.

Airplane Type M/M/S	Manual Flight Control Guidance Systems Manufacturer	Model

b. Special Limitations.

(1) The certificate holder shall conduct all operations authorized by this paragraph in accordance with applicable section of Title 14 of the Code of Federal Regulations and the airworthiness certification basis of the manually flown flight control guidance system being used.
(2) The certificate holder shall not conduct landing operations to any runway using these systems, unless the certificate holder determines that the flight control guidance system being used permits safe manually flown approaches and landings to be conducted at that runway.
(3) The certificate holder shall not conduct any operations authorized by this paragraph, unless the certificate holder's approved training program provides training in the equipment and special procedures to be used.
(4) Except when operations are performed under the supervision of a properly qualified check airman, any pilot used by the certificate holder to conduct manually flown approaches and landings using these systems must be qualified for the operation being conducted in accordance with the certificate holder's approved training program.

C074, Category I, ILS, MLS, or GLS Approach Procedures and IFR Landing Minimums - All Airports.

The certificate holder shall not use any IFR Category I landing minimum lower than that prescribed by the applicable published instrument approach procedure. The IFR landing minimums prescribed in this paragraph are the lowest Category I minimums authorized for use at any airport.

a. Category I, ILS, MLS, or GPS Landing System (GLS) Approach Procedures. The certificate holder shall not use an IFR landing minimum for ILS, MLS, or GLS approach procedures lower than specified in the following table. Touchdown zone RVR reports, when available for a particular runway, are controlling for all approaches to and landings on that runway.

ILS/MLS/GLS APPROACHES (Require operative lateral and vertical guidance)			
Approach Light Configuration	**HAT**	**Aircraft Category A, B, C, and D**	
		Visibility in Statute Miles	**TDZ RVR in Feet** (See NOTE 2)
No Lights or ODALS	200	3/4	4000
MALS or SALS	200	5/8	3000
MALSR, or SSALR, or ALSF-1 or ALSF-2	200	1/2	2400
MALSR with TDZ and CL, or SSALR with TDZ and CL, or ALSF-1/ALSF-2 with TDZ and CL	200	visibility not authorized (See NOTE 1)	1800
MALS, or MALSR, or SSALR, or ALSF- 1/ALSF-2, or REILS and HIRL, or RAIL, and HIRL	200	visibility not authorized	1800 (See NOTE 3)

NOTE 1: Visibility values below ½ statute mile are not authorized and shall not be used.
NOTE 2: The mid RVR and rollout RVR reports (if available) provide advisory information to pilots. The mid RVR report may be substituted for the TDZ RVR report if the TDZ RVR report is not available.
NOTE 3: These minimums apply to autoland or HGS-equipped aircraft when operated by a properly qualified flightcrew and flown in the appropriate CAT III annunciation mode at the authorized airports and runways listed in paragraph b. below.

b. The certificate holder is authorized ILS, MLS, or GLS Category I landing minimums as low as 1800 RVR without touchdown zone and centerline lights with autoland or HGS-equipped aircraft at the following airports and runways:

Airport 4- Letter Identifier	Runways	Special Limitation

c. Special Aircrew, Aircraft Authorized Minimums. The certificate holder shall not use an IFR landing minimum for straight-in Category I approaches labeled as "Special Aircrew, Aircraft Authorization Required" except in accordance with subparagraph a of this operations specification and the following:

(1) The authorized aircraft must be equipped with an approved approach coupler, flight director, or a head up guidance system (HGS) which provides guidance to decision height. Pilots-in-command (PIC) must be required to engage the autopilot coupler, flight director, or HGS as applicable and use it to decision height or initiation of missed approach unless adequate visual references with the runway environment are established which allow safe continuation to a landing.
(2) Should the autopilot, flight director, or HGS malfunction or be disengaged during the approach, the PIC must execute a missed approach not later than arrival at standard minimums unless visual reference to the runway environment has been established.
(3) Pilots must be trained in the use of the autopilot coupler, flight director, or HGS as applicable and demonstrate proficiency in ILS approaches to minimums using this equipment on checks conducted to satisfy 14 CFR section 121.441 or section 135.297.

d. Limitations and Provisions for Instrument Approach Procedures at Foreign Airports. If the certificate holder operates to foreign airports, the following applies:

(1) Foreign approach lighting systems equivalent to U.S. standards are authorized for instrument approaches. Sequenced flashing lights are not required when determining the equivalence of a foreign approach lighting system to U.S. standards.
(2) For straight-in landing minimums at foreign airports where an MDA(H) or DA(H) is not specified, the lowest authorized MDA(H) or DA(H) shall be obtained as follows:

(a) When an obstruction clearance limit (OCL) is specified, the authorized MDA(H) or DA(H) is the sum of the OCL and the touchdown zone elevation (TDZE). If the TDZE for a particular runway is not available, threshold elevation shall be used. If threshold elevation is not available, airport elevation shall be used. For approaches other than ILS, MLS, or GLS, the MDA(H) may be rounded to the next higher 10-foot increment.
(b) When an obstacle clearance altitude (OCA)/obstacle clearance height (OCH) is specified, the authorized MDA(H) or DA(H) is equal to the OCA/OCH. For approaches other than ILS, MLS, or GLS, the authorized MDA(H) may be expressed in intervals of 10 ft.
(c) The HAT or HAA used for ILS, MLS, or GLS approaches shall not be below those specified in subparagraph a of this operations specification.

(3) When only an OCL or an OCA/OCH is specified, visibility and/or RVR minimums appropriate to the authorized HAA/HAT values determined in accordance with subparagraph d(2) above will be established in accordance with criteria prescribed by U.S. TERPS or Joint Aviation Authorities, Joint Aviation Requirements, operational agreements, Part 1 (JAR-OPS-1).
(4) When conducting an instrument approach procedure outside the United States, the certificate holder shall not operate an aircraft below the prescribed MDA(H) or continue an approach below the DA(H), unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and at least one of the following visual references is clearly visible to the pilot:

(a) Runway, runway markings, or runway lights.
(b) Approach light system (in accordance with 14 CFR section 91.175(c)(3)(i)).
(c) Threshold, threshold markings, or threshold lights.
(d) Touchdown zone, touchdown zone markings, or touchdown zone lights.
(e) Visual glidepath indicator (such as VASI, PAPI).
(f) Runway end identifier lights.

C075. Category I IFR Landing Minimums - Circling Maneuvers

The certificate holder shall not use any IFR Category I landing minimum lower than that prescribed by the applicable published instrument approach procedure. The IFR landing minimums prescribed in this paragraph are the lowest Category I minimums authorized for use at any airport.

a. Circling Maneuvers. The certificate holder shall not conduct circling maneuvers when the ceiling is less than 1,000 ft. or the visibility is less than 3 statute miles, unless the flightcrew has satisfactorily completed an approved training program for the circling maneuver or satisfactorily completed a flight check for the circling maneuver. When conducting an instrument approach procedure which requires a circling maneuver to the runway of intended landing, the certificate holder shall not use a landing minimum lower than the minimum prescribed for the applicable circling maneuver or a landing minimum lower than specified in the following table, whichever is higher. The lowest authorized IFR landing minimum for instrument approaches which require a circling maneuver to the runway of intended landing shall be determined for a particular aircraft by using the speed category appropriate to the highest speed used during the circling maneuver.

Speed Category	HAA	Visibility in Statute Miles
less than 91 kts	350	1
91 to 120 kts	450	1
121 to 140 kts	450	1 ½
141 to 165 kts	550	2
above 165 kts	1000	3

b. Unless flying with a check airman, a pilot may not fly the circling maneuver if there is a restriction on that pilot's certificate that restricts or limits the circling approach to visual flight rules only.

c. If Applicable, Special Limitations and Provisions for Instrument Approach Procedures at Foreign Airports.

(1) Foreign approach lighting systems equivalent to U.S. standards are authorized for instrument approaches. Sequenced flashing lights are not required when determining the equivalence of a foreign approach lighting system to U.S. standards.

(2) For straight-in landing minimums at foreign airports where an MDA(H) or DA(H) is not specified, the lowest authorized MDA(H) or DA(H) shall be obtained as follows:

(a) When an obstruction clearance limit (OCL) is specified, the authorized MDA(H) or DA(H) is the sum of the OCL and the touchdown zone elevation (TDZE). If the TDZE for a particular runway is not available, threshold elevation shall be used. If threshold elevation is not available, airport elevation shall be used. For approaches other than ILS, MLS, or GLS, the MDA(H) may be rounded to the next higher 10-foot increment.

(b) When an obstacle clearance altitude (OCA)/obstacle clearance height (OCH) is specified, the authorized MDA(H) or DA(H) is equal to the OCA/OCH. For approaches other than ILS, MLS, or GLS, the authorized MDA(H) may be expressed in intervals of 10 ft.

(c) The HAT or HAA used for ILS, MLS, or GLS approaches shall not be below those specified in subparagraph a of this operations specification.

(3) When only an OCL or an OCA/OCH is specified, visibility and/or RVR minimums appropriate to the authorized HAA/HAT values determined in accordance with subparagraph b(2) above will be established in accordance with criteria prescribed by U.S. TERPS or Joint Aviation Authorities, Joint Aviation Requirements, operational agreements, Part 1 (JAR-OPS-1).

(4) When conducting an instrument approach procedure outside the United States, the certificate holder shall not operate an aircraft below the prescribed MDA(H) or continue an approach below the DA(H), unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and at least one of the following visual references is clearly visible to the pilot:

(a) Runway, runway markings, or runway lights.
(b) Approach light system (in accordance with 14 CFR section 91.175(c)(3)(i)).
(c) Threshold, threshold markings, or threshold lights.
(d) Touchdown zone, touchdown zone markings, or touchdown zone lights.
(e) Visual glidepath indicator (such as VASI, PAPI).
(f) Runway end identifier lights.

d. Notwithstanding the requirements of 14 CFR part 121 appendices E and F, the certificate holder is authorized to apply the requirements of SFAR 58 (AQP), if applicable, for flightcrew training to proficiency in circling maneuvers. The certificate holder may not perform circling maneuvers in weather minimums lower than 1,000 ft. and 3 miles with an HAA no lower than 1,000 ft. or the published minimum for the circling approach, whichever is higher.

<u>C076. Category I IFR Landing Minimums - Contact Approaches.</u>

The certificate holder shall not use any IFR Category I landing minimum lower than that prescribed by the applicable published instrument approach procedure. The IFR landing minimums prescribed in paragraphs C053 for *instrument approaches* "other than ILS, MLS, or GLS" approaches and C074 for "ILS, MLS, or GLS" approaches of these operations specifications are the lowest Category I minimums authorized for use at any airport.

a. <u>Contact Approaches</u>. The certificate holder shall not conduct contact approaches unless the pilot-in-command has satisfactorily completed an approved training program for contact approaches. In addition, the certificate holder shall not conduct a contact approach unless the approach is conducted to an airport with an approved instrument approach procedure for that airport, and all of the following conditions are met:

(1) The flight remains under instrument flight rules and is authorized by ATC to conduct a contact approach.
(2) The reported visibility/RVR for the runway of intended landing is at or above the authorized IFR minimum for the Category I approach, other than ILS, MLS, or GLS established for that runway or one statute mile (RVR 5000), whichever is higher.
(3) The flight is operating clear of clouds and can remain clear of clouds throughout the contact approach. The flight visibility must be sufficient for the pilot to see and avoid all obstacles and safely maneuver the aircraft to the landing runway using external visual references.
(4) The flight does not descend below the MEA/MSA, MVA, or the FAF altitude, as appropriate, until:

(a) The flight is established on the instrument approach procedure, operating below the reported ceiling, and the pilot has identified sufficient prominent landmarks to safely navigate the aircraft to the airport, or
(b) The flight is operating below any cloud base which constitutes a ceiling, the airport is in sight, and the pilot can maintain visual contact with the airport throughout the maneuver.

(5) The flight does not descend below the highest circling MDA prescribed for the runway of intended landing until the aircraft is in a position from which a descent to touchdown, within the touchdown zone, can be made at a normal rate of descent using normal maneuvers.

b. If Applicable, Special Limitations and Provisions for Instrument Approach Procedures at Foreign Airports.

(1) Foreign approach lighting systems equivalent to U.S. standards are authorized for instrument approaches. Sequenced flashing lights are not required when determining the equivalence of a foreign approach lighting system to U.S. standards.
(2) For straight-in landing minimums at foreign airports where an MDA(H) or DA(H) is not specified, the lowest authorized MDA(H) or DA(H) shall be obtained as follows:

(a) When an obstruction clearance limit (OCL) is specified, the authorized MDA(H) or DA(H) is the sum of the OCL and the touchdown zone elevation (TDZE). If the TDZE for a particular runway is not available, threshold elevation shall be used. If threshold elevation is not available, airport elevation shall be used. For approaches other than ILS, MLS, or GLS, the MDA(H) may be rounded to the next higher 10-foot increment.
(b) When an obstacle clearance altitude (OCA)/obstacle clearance height (OCH) is specified, the authorized MDA(H) or DA(H) is equal to the OCA/OCH. For approaches other than ILS, MLS, or GLS, the authorized MDA(H) may be expressed in intervals of 10 ft.
(c) The HAT or HAA used for ILS, MLS, or GLS approaches shall not be below those specified in subparagraph a. of this operations specification.

(3) When only an OCL or an OCA/OCH is specified, visibility and/or RVR minimums appropriate to the authorized HAA/HAT values determined in accordance with subparagraph b(2) above will be established in accordance with criteria prescribed by U.S. TERPS or Joint Aviation Authorities, Joint Aviation Requirements, operational agreements, Part 1 (JAR-OPS-1).

(4) When conducting an instrument approach procedure outside the United States, the certificate holder shall not operate an aircraft below the prescribed MDA(H) or continue an approach below the DA(H), unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and at least one of the following visual references is clearly visible to the pilot:

(a) Runway, runway markings, or runway lights.
(b) Approach light system (in accordance with 14 CFR section 91.175(c)(3)(i)).
(c) Threshold, threshold markings, or threshold lights.
(d) Touchdown zone, touchdown zone markings, or touchdown zone lights.
(e) Visual glidepath indicator (such as VASI, PAPI).
(f) Runway end identifier lights.

C078. IFR Lower Than Standard Takeoff Minimums, 14 CFR Part 121 Airplane Operations - All Airports

Standard takeoff minimums are authorized in operations specification paragraph C056. The certificate holder is authorized to use lower than standard takeoff minimums in accordance with the limitations and provisions of this operations specification as follows.

a. Runway visual range (RVR) reports, when available for a particular runway, shall be used for all takeoff operations on that runway. All takeoff operations, based on RVR, must use RVR reports from the locations along the runway specified in this paragraph.

b. When takeoff minimums are equal to or less than the applicable standard takeoff minimum, the certificate holder is authorized to use the lower than standard takeoff minimums described below:

(1) Visibility or runway visual value (RVV) ¼ statute mile or touchdown zone RVR 1600, provided at least one of the following visual aids is available. The touchdown zone RVR report, if available, is controlling. The mid RVR report may be substituted for the touchdown zone RVR report if the touchdown zone RVR report is not available.

(a) Operative high intensity runway lights (HIRL).
(b) Operative runway centerline lights (CL).
(c) Serviceable runway centerline marking (RCLM).
(d) In circumstances when none of the above visual aids are available, visibility or RVV ¼ statute mile may still be used, provided other runway markings or runway lighting provide pilots with adequate visual reference to continuously identify the takeoff surface and maintain directional control throughout the takeoff run.

[NOTE: If an operator is not authorized RVR 1000 the POI will not select RVR 1000 in the OPSS. If the OPSS is not available the POI should delete subparagraph b(2), b(3), & b(4) from the word boilerplate.]

(2) Touchdown zone RVR 1000 (beginning of takeoff run) and rollout RVR 1000, provided all of the following visual aids and RVR equipment are available.

(a) Operative runway centerline lights (CL).
(b) Two operative RVR reporting systems serving the runway to be used, both of which are required and controlling. A mid-RVR report may be substituted for either a touchdown zone RVR report if a touchdown zone report is not available or a rollout RVR report if a rollout RVR report is not available.

[NOTE: If an operator is not authorized RVR 500 the POI will not select RVR 500 in the OPSS. If the OPSS is not available the POI should delete subparagraph b(3), & b(4) from the word boilerplate.]

(3) Touchdown zone RVR 500 (beginning of takeoff run), mid RVR 500, and rollout RVR 500, provided all of the following visual aids and RVR equipment are available.

(a) Operative runway centerline lights (CL).
(b) Runway centerline markings (RCLM).
(c) Operative touchdown zone and rollout RVR reporting systems serving the runway to be used, both of which are controlling, or three RVR reporting systems serving the runway to be used, all of which are controlling. However, if one of the three RVR reporting systems has failed, a takeoff is authorized, provided the remaining two RVR values are at or above the appropriate takeoff minimum as listed in this subparagraph.

(4) At foreign airports which have runway lighting systems equivalent to U.S. standards, takeoff is authorized with a reported touchdown zone RVR of 150 meters, mid RVR of 150 meters, and rollout RVR of 150 meters. At those airports where it has been determined that the runway lighting system is not equivalent to U.S. standards, the minimums in subparagraphs a(1) or (2), as appropriate, apply.

c. Takeoff Guidance System, If Applicable. If the certificate holder is authorized to use takeoff minimums based upon the use of takeoff guidance systems, the minimums will be specified for the aircraft listed in the Table 1 below. The certificate holder shall conduct no other takeoffs using these takeoff minimums. If subparagraph c is not authorized, N/A will be annotated in each of the columns in the table.

(1) Special provisions and limitations.
   (a) Operative high intensity runway lights (HIRL).
   (b) Operative runway centerline lights (CL).
   (c) Serviceable runway centerline markings (RCLM).
   (d) Front course guidance from the localizer must be available and used (if applicable to guidance systems used).
   (e) The reported crosswind component shall not exceed 10 knots.
   (f) Operative touchdown zone, and rollout RVR reporting systems serving the runway to be used, both of which are controlling, or three RVR reporting systems serving the runway to be used, all of which are controlling. However, if one of the three RVR reporting systems has failed, a takeoff is authorized, provided the remaining two RVR values are at or above the appropriate takeoff minimum as listed in this subparagraph.
   (g) The pilot-in-command and the second-in-command have completed the certificate holders approved training program for these operations.
   (h) All operations using these minimums shall be conducted to runways which provide direct access to taxi routings which are equipped with operative taxiway centerline lighting which meets U.S. or ICAO criteria for CAT III operations; or other taxiway guidance systems approved for these operations.

(2) The certificate holder is authorized to use the following takeoff minimums for the airplanes listed below.

Table 1 (N/A = Not Authorized)

Airplane M/M/S	Lowest Authorized RVR	Required Takeoff Guidance System

[NOTE: If an operator is not authorized pilot assessment the POI will not select this statement in the OPSS. If the OPSS is not available the POI should delete subparagraph d in its entirety from the word boilerplate.]

d. Pilot Assessment of RVR for Takeoff (if applicable). In circumstances when the touchdown zone RVR reporting system has failed, is inaccurate, or is not available, the certificate holder is authorized to substitute pilot assessment of equivalent RVR for any touchdown zone RVR report required by this operations specification paragraph provided that:

(1) The pilot has completed the FAA-approved training program for visibility assessment in lieu of RVR, and
(2) Runway markings or runway lighting is available to provide adequate visual reference for the assessment.

C090. Required Navigation Performance (RNP).
The certificate holder is authorized to conduct terminal area RNAV operations using area navigation systems approved for RNP operations and shall conduct all such operations in accordance with the provisions of these operations specifications.

a. Standard Terminal Area RNP Levels. The certificate holder shall not conduct any operation authorized by this paragraph, unless the required navigation performance (RNP level) for the specified procedure or operation has been specified to the aircraft navigation system and the actual navigation performance (ANP) or estimated position error (EPE) is less than the specified RNP.

STANDARD TERMINAL AREA RNP Levels

RNP Levels	Applicability/Operation (Approach segment)
RNP 1	Initial/Intermediate approach
RNP 0.5	Initial/Intermediate/Final approach
RNP 0.3	Initial/Intermediate/Final approach

b. Aircraft and Equipment with Airplane Flight Manual Authorization for RNP. The certificate holder is authorized to conduct terminal area instrument operations using the following aircraft and area navigation systems to comply with RNP requirements when operated in accordance with the approved airplane flight manual.

Airplane Type M/M/S	Area Navigation Systems M/M	Lowest Authorized RNP
B737-400	Smiths/U-10.2	RNP 0.15 (see note 3)
A319-112	Honeywell/Sextant FMGC B546 CAM 0102 Software SWPS406625-931	RNP 0.15 See Notes 3 and 7

c. Other Aircraft and Equipment Authorization for RNP. The certificate holder is authorized to conduct terminal area instrument operations using the following aircraft and area navigation systems to comply with RNP requirements when operated in accordance with the approved airplane flight manual.

Airplane Type M/M/S	Area Navigation Systems M/M	Lowest Authorized RNP
B737-400	Smiths/U7.4	RNP 1.0 (See Notes 1 and 5)

d. Special Limitations.

(1)

(2)

NOTES:
1. Departure Only
2. Approach Only
3. Autopilot required for approach operations at RNP levels of 0.3 or less.
4. When the automatic runway position update is utilized by line selecting the departure runway on the CDU.
5. When the automatic runway position update is utilized by selecting the TO/GA switch during takeoff.
6. When a quick alignment of the inertial reference units to the departure runway coordinates contained in the airborne navigation database is conducted within 1,000 ft. of the departure runway threshold and within 15-minutes of departure.
7. When the required navigation performance (RNP level) for the specified procedure or operation has been specified to the aircraft navigation system and the actual navigation performance (ANP) or estimated position error (EPE) is less than the specified RNP. The RNP level may be specified to the navigation system either manually, through the data base, or use the navigation system default value.
8. Unless otherwise specified on the instrument procedure, approaches other than ILS, MLS or GLS require use of RNP of 0.3 or less.
9. Other RNP Levels, not otherwise specified in an approved terminal area or instrument approach procedure, are as specified below:

Other RNP Levels Approved(Example only)

RNP Type	**Applicability/Operation (Approach segment)**
RNP 0.3/125	Initial/Intermediate/Final approach with specified barometric vertical guidance (VNAV)
RNP 0.03/45	Final approach with specified vertical guidance
RNP 0.01/15	Final approach with specified vertical guidance
RNP .003/15	Final approach with specified vertical guidance

APPENDIX 8

Use Of Alternative Operating Minima

1. General.

This appendix provides a basis for determining optional operating minima which an operator may use if authorized by operations specifications, in lieu of otherwise published minima. Use of these minima are limited to use within the United States, within any Joint Airworthiness Authority (JAA) (European) State that authorizes use of these minima or equivalent, or in other States which accept or apply Federal Aviation Administration (FAA) or JAA criteria.

Alternate minima may be based on the tables and conversions agreed by FAA and JAA as reflected in the harmonized values of this appendix. Minima based on these tables and conversions which have been determined to be acceptable to FAA may be approved for use by U.S. operators, or for international operators flying to U.S. airports when those Operators have implemented applicable provisions and criteria of the main body of this Advisory Circular (AC), or for international operators, equivalent provisions to FAA or JAA criteria.

These minima provide a basis for determination of a single table for Aerodrome Operating Minima regardless of approach type, and are intended for use by aircraft flying a stabilized descent path and instrument procedures and flightcrew procedures which are based on use of a stabilized descent path to the runway (e.g., using an xLS (e.g., ILS, MLS, or GLS) glide slope, Vertical Navigation (VNAV), or other specifically approved method for maintaining a constant vertical descent path or rate during final approach). Use of minima in this table for other procedures not using a glide slope or constant VNAV descent path to minima is considered only on a case by case basis, by FAA.

This table is intended to cover all categories of straight-in approach procedures including xLS and approaches other than xLS (e.g., Area Navigation (RNAV), Localizer (LOC), BCRS, VHF Omni-directional Radio Range (VOR), NDB). Any procedure based on U.S. TERPS or ICAO PANS-OPS, or special procedures otherwise approved by FAA are eligible to use minima of this appendix. Approaches with glide slope angles or VNAV descent paths in excess of 3.77 degrees, or special procedures at certain airports which require specific knowledge or training, are not typically eligible for use of the approach minima listed in this Appendix.

2. Terminology.

A Stabilised approach is considered to mean an approach where:

- A constant, predetermined descent path (usually 3 degrees) is flown from the final approach fix or point to the runway using:
  - xLS Glide path, or
  - RNAV(VNAV), or
  - Height cross check as a function of distance (e.g., Distance Measuring Equipment (DME)), or
  - Height cross check as a function of time (e.g., timing from an approach fix), and

- A missed approach is executed upon reaching Decision Altitude/height (DA(H) or Minimum Descent Altitude/height (MDA(H)) as applicable to the approach, if the pilot has not established the necessary visual reference.

3. "Go-Around" Transition To A Missed Approach When Using a DA(H) or MDA(H).

When using minima based on this appendix in conjunction with a DA(H), flightcrew procedures for timely initiation of a go-around and anticipated altitude loss below the DA(H) during the momentary transition to a go-around are assumed to be the same as those specified for ILS, MLS, or GLS. The procedures used may be as specified by the operator or by the aircraft manufacturer, as applicable.

When using minima based on this appendix in conjunction with an MDA(H), it is recognised that the missed approach path following a stabilised approach may momentarily descend below MDA(H) while initiating the missed approach. This momentary and slight descent below MDA(H) during the transition to a missed approach is considered acceptable and is assumed to typically result in a displacement below MDA(H) of 50 ft. or less.

4. Alternative RVR/Visibility Value Table.

The following minimum RVR/Visibility values are specified in relation to various HAT values for DA(H) or MDA(H). These values, or equivalent values in terms of RVR or miles of visibility, may be used as the basis to specify various landing minima. These tables apply to formulation of minima for instrument procedures other than those for Category II or III, except as specified in the Notes associated with the table(s) below. The values in these tables may be used as a basis for determination of minima in lieu of values specified by U.S. TERPS or ICAO PANS-OPS. These values are considered applicable to any Category of aircraft (e.g., Instrument approach Category A, B, C, or D) and are applicable up to a 3.77 degree final approach segment descent gradient.

Table A8-1

Alternative RVR/Visibility Values
for Various Heights Above Touchdown (HAT)

(RVR/Visibility when based on units related to *Feet*)

HAT Band (ft)	RVR/Visibility (feet)			
	FF	IF	BF	NF
200 - 209	1800	2000	2700	3000
210 - 219	1800	2000	2850	3250
220 - 229	1800	2000	3000	3400
230 - 239	1800	2000	3150	3550
240 - 249	1800	2350	3300	3700
250 - 259	1800	2500	3450	3850
260 - 279	1800	2700	3700	4100
280 - 299	2050	3000	4000	4400
300 - 319	2350	3300	4300	4700
320 - 339	2650	3600	4600	5000
340 - 359	2950	3950	4900	5300
360 - 379	3250	4250	5200	5600
380 - 399	3550	4550	5500	5900
400 - 419	3850	4850	5800	6200
420 - 439	4150	5150	6100	6500
440 - 459	4450	5450	6450	6800
460 - 479	4750	5750	6750	7150
480 499	5050	6050	7050	7450

HAT Band (ft)	RVR/Visibility (feet)			
	FF	IF	BF	NF
500 - 519	5350	6350	7350	7750
520 - 539	5650	6650	7650	8050
540 - 559	6000	6950	7950	8350
560 - 579	6300	7250	8250	8650
580 - 599	6600	7550	8550	8950
600 - 619	6900	7850	8850	9250
620 - 639	7200	8200	9150	9550
640 - 559	7500	8500	9450	9850
660 - 679	7800	8800	9750	10150
680 - 699	8100	9100	10050	10450
700 - 719	8400	9400	10350	10750
720 - 739	8700	9700	10700	11050
740 - 759	9000	10000	11000	11350
760 - 799	9450	10450	11450	11850
800 - 849	10150	11150	12100	12500
850 - 899	10900	11900	12900	13250
900 - 949	11650	12650	13650	14050
950 - 1000	12450	13400	14400	14800

Table A8-1 Note 1- An RVR/Visibility less than 1800 ft may be authorized for certain runways with full facilities (FF - e.g., ALSF I or ALSF II) and TDZ/CL lights; An RVR/Visibility less than 1800 ft may be authorized for certain runways with MALSR or equivalent (with or without TDZ/CL lights), if automatic landing or flight guidance HUD based approaches are conducted. (See paragraph 5.3.2., Special Category II Authorizations).

Table A8-2

Alternative RVR/Visibility Values
for Various Heights Above Touchdown (HAT)

(RVR/Visibility when based on units related to *Meters*)

HAT BAND (ft)	RVR/Visibility (meters)			
	FF	IF	BF	NF
200 - 209	550	700	850	1000
210 - 219	550	700	850	1000
220 - 229	550	700	900	1050
230 - 239	550	700	950	1100
240 - 249	550	700	1000	1150
250 - 259	600	750	1050	1200
260 - 279	600	850	1150	1250
280 - 299	600	900	1200	1350
300 - 319	700	1000	1300	1450
320 - 339	800	1100	1400	1500
340 - 359	900	1200	1500	1600
360 - 379	1000	1300	1600	1700
380 - 399	1100	1400	1700	1800
400 - 419	1150	1450	1750	1900
420 - 439	1250	1550	1850	2000
440 - 459	1350	1650	1950	2100
460 - 479	1450	1750	2050	2150
480 499	1550	1850	2150	2250

HAT BAND (ft)	RVR/Visibitlity (meters)			
	FF	IF	BF	NF
500 - 519	1650	1950	2250	2350
520 - 539	1750	2050	2350	2450
540 - 559	1800	2100	2400	2550
560 - 579	1900	2200	2500	2650
580 - 599	2000	2300	2600	2750
600 - 619	2100	2400	2700	2800
620 - 639	2200	2500	2800	2900
640 - 659	2300	2600	2900	3000
660 - 679	2400	2700	3000	3100
680 - 699	2450	2750	3050	3200
700 - 719	2550	2850	3150	3300
720 - 739	2650	2950	3250	3350
740 - 759	2750	3050	3350	3450
760 - 799	2900	3200	3500	3600
800 - 849	3100	3400	3700	3800
850 - 899	3350	3650	3950	4050
900 - 949	3550	3850	4150	4300
950 - 1000	3800	4100	4400	4500

Table A8-2 Note 1 - An RVR/Visibility less than 600 m may be authorized for certain runways with full facilities (FF - e.g., ALSF I or ALSF II) and TDZ/CL lights; An RVR/Visibility less than 600 m may be authorized for certain runways with MALSR or equivalent (with or without TDZ/CL lights), if automatic landing or flight guidance HUD based approaches are conducted. (See paragraph 5.3.2., Special Category II Authorizations).

Table A8-1 and A8-2 Note 2 - Minima values higher than the values shown in Table A8-3 below need not be applied to determination of minima when a higher value is otherwise shown in Table A8-1 or A8-2.

Table A8-1 and A8-2 Note 3 - Unless otherwise specified by FAA, no resulting minima RVR/visibility value need necessarily result in a value greater than the applicable values shown in Table A8-4 below.

Table A8-1 and A8-2 Note 4 - Category A or B aircraft using an acceptable stabilised approach method may use the lower of the minima specified in either the table above, or minima as specified in accordance with U.S. TERPS.

Table A8-3

Limitations on RVR/Visibility Minimum Values for Approaches Other than xLS or 3-D RNAV RNP

Aircraft category	A	B	C	D	Facility Requirements
Minimum RVR/visibility	750m (2400ft)	750m (2400ft)	750m (2400ft)	750m (2400ft)	NDB, VOR, VOR/DME, LOC, LOC/DME, VDF, LDA, SDF, SRE, 2D-RNAV with a procedure meeting at least the following criteria: - FAS offset from Rwy track ≤ 5 degrees, - A FAF is designated, - Distance to Rwy information is available (e.g., via DME or RNAV), and - Distance from NAVAID facility to Rwy Threshold ≤ 8 nm
Minimum RVR/visibility	1000m (3000ft)	1000m (3000ft)	1200m (4000ft)	1200m (4000ft)	Instrument approach types or cases where the above criteria are not met.

The above table is not applicable to xLS or 3-D RNAV RNP based Minima. Table A8-1 and A8-2 are used directly for determination of 3-D RNAV RNP based minima, without respect to use of the limiting values of Table A8-3.

Table A8-4

Limitations on "Upper cut-off" Values for RVR/Visibility Minima

Aircraft category	A	B	C	D
Maximum required RVR/Visibility	1500 m (5000 ft/)	1500 m (5000 ft)	2400 m (1 1/2 sm)	2400 m (1 1/2 sm)

Unless otherwise specified by FAA, values higher than the values shown in Table A8-4 above need not be applied when determining RVR/Visibility minima from tables A8-1 or A8-2.

5. Approach and Runway Lighting Systems Definition, Classification, And Equivalence.

Table A8-5

Visual Aid Classification for Determination of RVR/Visibility for Instrument Approaches

European Lighting Systems (JAA)		U.S. Lighting Systems (FAA)	
Class of facility	**Length and Intensity of approach lights**	**Class of facility**	**Length of approach lights**
Full (Calvert or Barette centerline configuration)	720m or more HI/MI	ALSF1/ALSF2/ALSR/SSALR MALSR	>720m
Intermediate (simplified approach light system)	420m - 719m HI/MI	MALSF, MALS SSALF, SALS	>420-719m
Basic (no ICAO standard exists)	210 - 419 m HI, MI or LI including one crossbar	ODALS	<420m
Nil	No approach lights	No approach lights	No approach lights

6. Applicability to Various Classes of Instrument Approach Procedures.

U.S. Instrument Approach procedures are classified as Category I, II, or III by U.S. Operation Specifications (OpSpecs), to address any type of instrument approach. The terms Category II and Category III apply to xLS approach types (i.e., ILS, GLS, or MLS). For U.S. Operators, Category I applies to xLS approaches and also applies to approach types other than xLS (e.g., also applies to RNAV, LOC, VOR, or NDB). States other than the U.S. may or may not apply the term Category I in this manner, or may only apply the term Category I to xLS approaches (e.g., ILS, MLS, or GLS).

Nonetheless, the above equivalent minima provisions based on FAA/JAA harmonized Tables A8-1 through A8-5 may be applied to determine minima for any Category I or II approach type for a U.S. operator regardless of classification (e.g., not withstanding former classifications such as precision or non-precision), unless the FAA or other State of an Aerodrome specifically preclude use of minima based on these tables.

7. Transition Provisions.

Transitions provisions may be proposed by operators and may be approved by CHDOs to implement provisions of AC120-29A, as applicable to this appendix. This is to facilitate timely transition to use of these alternate minima. Transition provisions may address such issues as the operator's use of interim charting provisions, interim flight procedures, the operators optional use of either traditional or alternative minima during the transition period, or other issues as determined appropriate by the operator or CHDO.

8. Authorized RVR Minima Conversions between "Feet and Meters."

The RVR equivalent visibility values shown in Table A8-6 expressed in feet or meters may be used where necessary. When appropriate, the operator may propose and the CHDO may approve use of the necessary equivalent RVR visibility determinations for meters or feet conversion operationally, or for instrument procedure minima development.

Table A8 - 6

Acceptable "Meters to Feet" or "Feet to Meters" Conversions for RVR

RVR	
Feet	**Meters**
100ft	25 m
150 ft	50 m
300 ft	75 m
400 ft	125 m
500 ft	150 m
600 ft	175 m
700 ft	200 m
800 ft	250 m
900 ft	275 m
1000 ft	300 m
1200 ft	350 m
1300 ft	400 m
1400 ft *	420 m *
1500 ft	450 m *
1600 ft	500 m
1800 ft	550 m
2000 ft	600 m
2100 ft	650 m *
2300 ft	700 m
2400 ft	720 m **
2500 ft *	750 m *
2600 ft	800 m
2800 ft	900 m *
3000 ft	1000 m
4000 ft	1200 m
4500 ft	1400 m
5000 ft	1500 m
6000 ft	1800 m

* = Denotes a value not operationally used at present

** = Standard Op-Specs specify 750m

9. Acceptable Meteorological Visibility or RVR Equivalence or Conversions.

The following conversion tables may be used in conjunction with the minima tables above to specify RVR Visibility minima in terms of feet, meters, or meteorological visibility when appropriate. Interpolations are permitted where necessary. The operator may propose and the CHDO may approve use of the necessary equivalent RVR visibility values for use operationally, or for instrument procedure minima development.

Table A8 - 7

Acceptable Statute Mile/Meter/Nautical Mile Conversions

RVR/Visibility		
Statute Miles	**Meters**	**Nautical Miles**
1/8 sm	200 m	1/9 nm
1/4 sm	400 m	1/4 nm
3/8 sm	600 m	3/8 nm
1/2 sm	800 m	1/2 nm
5/8 sm	1000 m	5/8 nm
3/4 sm	1200 m	7/10 nm
7/8 sm	1400 m	7/8 nm
1 sm	1600 m	9/10 nm
1 1/8 sm	1800 m	1 1/8 nm
1 1/4 sm	2000 m	1 1/10 nm
1 1/2 sm	2400 m	1 3/10 nm
1 3/4 sm	2800 m	1 1/2 nm
2 sm	3200 m	1 3/4 nm
2 1/4 sm	3600 m	2 nm
2 1/2 sm	4000 m	2 1/2 nm
2 3/4 sm	4400 m	2 4/10 nm
3 sm	4800 m	2 6/10 nm

Interpolation for above RVR/visibility values is permitted

Federal Register

Thursday,
June 7, 2007

Part II

Department of Transportation

Federal Aviation Administration

14 CFR Parts 1, 91, 97 et al.

Area Navigation (RNAV) and Miscellaneous Amendments; Final Rule

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Parts 1, 91, 97, 121, 125, 129, and 135

[Docket No. FAA–2002–14002; Amdt. Nos. 1–57, 91–296, 97–1336, 121–333, 125–52, 129–42, 135–110]

RIN 2120–AH77

Area Navigation (RNAV) and Miscellaneous Amendments

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The FAA is amending its regulations to reflect technological advances that support area navigation (RNAV); include provisions on the use of suitable RNAV systems for navigation; amend certain terms for consistency with those of the International Civil Aviation Organization (ICAO); remove reference to the middle marker in certain sections because a middle marker is no longer operationally required; clarify airspace terminology; and incorporate by reference obstacle departure procedures into Federal regulations. The changes will facilitate the use of new navigation reference sources, enable advancements in technology, and increase efficiency of the National Airspace System.

DATES: *Effective date:* August 6, 2007. The incorporation by reference of certain publications listed in the rule is approved by the Director of the Federal Register as of August 6, 2007.

FOR FURTHER INFORMATION CONTACT: Ernest Skiver, Flight Technologies and Procedures Division, Flight Standards Service, AFS–400, Federal Aviation Administration, 800 Independence Ave., SW., Washington, DC 20591; telephone: (202) 385–4586.

SUPPLEMENTARY INFORMATION:

Authority for This Rulemaking

The FAA's authority to issue rules regarding aviation safety is found in Title 49 of the United States Code. Subtitle I, section 106 describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the agency's authority.

This rulemaking is promulgated under the authority described in Subtitle VII, Part A, Subpart III, Section 44701, ''General requirements.'' Under Section 44701, the FAA is charged with prescribing regulations and minimum standards for practices, methods, and procedures the Administrator finds necessary for safety in air commerce.

This regulation is within the scope of that authority because it will facilitate air navigation from other than ground-based navigation aids, enable new technology and provide for consistency between FAA and ICAO terminology.

Guide to Terms and Acronyms Frequently Used in This Document

AC—Advisory Circular
APV—Approach procedure with vertical guidance
ARAC—Aviation Rulemaking Advisory Committee
ATC—Air Traffic Control
ATS—Air Traffic Service
DA—Decision altitude
DH—Decision height
DME—Distance measuring equipment
EFVS—Enhanced Flight Vision System
FL—Flight level
GPS—Global Positioning System
ICAO—International Civil Aviation Organization
IAP—Instrument approach procedure
IFR—Instrument flight rules
ILS—Instrument landing system
MDA—Minimum descent altitude
MEA—Minimum en route IFR altitude
MOCA—Minimum obstruction clearance altitude
MSL—Mean sea level
NAS—National Airspace System
ODP—Obstacle departure procedure
Over the top—Over the top of clouds
RNAV—Area navigation
RNP—Required navigation performance
RVR—Runway visual range
TAOARC—Terminal Area Operations Aviation Rulemaking Committee
TERPS—U.S. Standard for Terminal Instrument Procedures
VOR—Very high frequency omnidirectional range

Table of Contents

I. Background

I.A. Previous Rulemaking Actions

On December 17, 2002, the FAA published a notice of proposed rulemaking (NPRM) titled ''Area Navigation (RNAV) and Miscellaneous Amendments'' (67 FR 77326; Dec. 17, 2002). The comment period closed on January 31, 2003, and several commenters requested that the FAA extend the comment period. The comment period was reopened for an additional 60 days until July 7, 2003 (68 FR 16992; April 8, 2003) to receive comments specifically on the proposed RNAV operations and equipment requirements. The FAA received approximately 30 comments from industry groups, aircraft manufacturers, navigation equipment manufacturers, communication service providers, and air carriers.

On April 8, 2003 (68 FR 16943; April 8, 2003), the FAA issued a final rule with request for comments titled

''Designation of Class A, B, C, D, and E Airspace Areas; Air Traffic Service Routes; and Reporting Points,'' which adopted certain proposed amendments to parts 1, 71, 95, and 97 from the RNAV NPRM. In that rule, the FAA adopted the following:

§ 1.1 General definitions: Air Traffic Service (ATS) route revised as proposed; area navigation (RNAV) revised as proposed; area navigation high route removed as proposed; area navigation low route removed as proposed; area navigation (RNAV) route revised as proposed; RNAV waypoint removed as proposed; and route segment revised as proposed.

Part 71: Subpart A heading transferred and revised (with wording modification) as proposed; §§ 71.11, 71.13, and 71.15 added as proposed; §§ 71.73, 71.75, 71.77, and 71.79 removed as proposed.

Part 95: § 95.1 revised as proposed.

Part 97: § 97.20 revised as proposed with minor modifications. (Note that this section is further amended in this final rule.)

Except for § 97.20 described above, the foregoing amendments are not addressed in this document. Comments received in response to the April 8, 2003 final rule are contained in docket number FAA–2003–14698. (See ''V. Availability of Rulemaking Documents'' for information on how to access the docket.)

Also, on January 9, 2004 (69 FR 1620; Jan. 9, 2004), the FAA issued the ''Enhanced Flight Vision Systems'' (EFVS) final rule. The EFVS rule did not incorporate any proposed RNAV terminology. Certain sections amended by the EFVS final rule are further amended in this rule to update the terminology as appropriate.

I.B. Terminal Area Operations Aviation Rulemaking Committee (TAOARC)

The Regional Airline Association (RAA), United Parcel Service (UPS), and the Airline Transport Association (ATA) all suggested that the FAA allow the Terminal Area Operations Aviation Rulemaking Committee (TAOARC) to review the comments and recommend action to the FAA. The TAOARC (now under a new charter as the Performance-Based Operations Aviation Rulemaking Committee (PARC)) is an FAA-chartered advisory committee composed of government and industry representatives which provides a forum for the United States aviation community to discuss and resolve issues, provide direction for United States flight operations criteria, and produce U.S. consensus positions for global harmonization. The FAA asked TAOARC to review the comments filed in the docket on the RNAV NPRM and provide recommendations.

TAOARC held a public meeting on December 9, 2003, in Arlington, VA, to present its recommendations and request comments. Minutes from this meeting and the TAOARC recommendations are available in the docket. The recommendations are included with the discussion of comments below.

I.C. Concept of Performance-Based Criteria

Many civil aviation authorities (CAAs), including the FAA, recognize the need to change the way airspace is managed due to increased demands for the use of certain airspace within a particular geographic area. Moving towards a performance-based National Airspace System (NAS) may necessitate, for example, the establishment of performance requirements for aircraft communication and navigation equipment needed to manage instrument flight rule (IFR) aircraft, which could ultimately increase capacity in certain airspace. For reasons discussed below, aircraft communication and navigation equipment performance criteria will be addressed in future rulemaking.

In this rule, the FAA is updating its communication and navigation operating regulations to allow flexibility in accommodating technological advances. Part of the FAA's plan to implement a performance-based NAS is to update its regulations and remove prescriptive references to ground-based navigation systems in the operating regulations and to permit the use of non-ground based navigation systems. In a performance-based NAS, operational flexibility depends upon many factors including the performance capability of the aircraft communication and navigation equipment, the availability of the communication and navigation facilities along the route to be flown, and the performance capabilities of those (communication and navigation) facilities that are made available for use by air traffic management service providers.

II. Discussion of the Final Rule

II.A. General

Northwest Airlines stated that, as the FAA is moving toward a required navigation performance (RNP)-based infrastructure, the RNAV system should be performance-based to allow operators to use both existing navigation aids and any future satellite-based systems as sensors to navigate using the concept of RNP. Continental, Boeing, and Airbus expressed concern that the NPRM did not address RNP.

This rulemaking lays the groundwork for navigation equipment and other operational requirements for the RNP environment and is consistent with planned RNP implementation. The FAA already has established RNP criteria for RNAV systems used to conduct certain instrument approach procedures. The agency plans to establish RNP criteria for RNAV systems used in the en route environment in the near future.

Rockwell Collins recommended that the rule clearly state whether there is any change to Wide-Area Augmentation System (WAAS) or LPV (localizer performance with vertical guidance) and their roles within the NAS.

This rule allows for the use of WAAS or any other system where it satisfies the performance requirements and is suitable for the operation to be conducted. The rule also applies to all phases of flight, including LPV approaches.

II.B. Terminology and Definitions (§§ 1.1, 1.2, and 97.3)

To facilitate RNAV operations, the FAA proposed to change certain terminology for area navigation, en route operations, instrument approach procedures, and landings. These amendments were proposed in §§ 1.1 General definitions, 1.2 Abbreviations and symbols, and 97.3 Symbols and terms. Conforming changes to other sections in parts 91, 95, 97, 121, 125, 129, and 135 were also proposed. The FAA proposed removing the words ''ground'' and ''radio'' in the regulations where using those words restricted the type of navigation and communication systems permitted in order for operators to take advantage of future technology and still meet NAS requirements.

Airbus commented generally that several of the proposed amendments to § 1.1 would have an undesirable ''ripple effect'' on other rules in parts 91, 97, 121, 125, 129, and 135.

Rockwell Collins asked if the new terminology would be applied retroactively. While the FAA finds this question somewhat unclear, it confirms that the rule does not impose retrofit requirements for older RNAV equipment. If it becomes necessary, however, to impose future conditions and limitations on the use of RNAV equipment, the FAA will do so through future rulemaking.

The following table sets forth the proposed terms, definitions and their dispositions in this final rule. (Note that terms and definitions adopted in the April 8, 2003 rule are not included in the table.) A discussion of the comments on these terms and the FAA's responses follows the table.

Proposed definitions and abbreviations	FAA decision reflected in the final rule
Approach procedure with vertical guidance (APV) (§ 1.1)	Withdrawn and action deferred until reviewed by joint industry/government working groups.
Category I, II, & III, IIIa, IIIb, and IIIc approaches (§ 1.1)	Withdrawn and action deferred until reviewed by joint industry/government working groups.
Decision altitude (DA) (§ 1.1)	Adopted.
Decision height (DH) (§ 1.1)	Adopted with modification.
Final approach fix (FAF) (§ 1.1)	Adopted.
HAT (Height above threshold) (§ 97.3)	Withdrawn.
Helipoint (§ 97.3)	Adopted.
Instrument approach procedure (IAP) (§ 1.1)	Adopted with modification.
Minimum descent altitude (MDA) (§ 1.1)	Adopted with modification.
MSA (minimum safe altitude) (§ 97.3)	Adopted.
Night (§ 1.1)	Withdrawn.
Nonprecision approach procedure (NPA) (§ 1.1)	Withdrawn and action deferred until reviewed by joint industry/government working groups.
Person	Adopted as appropriate to section.
Pilot	Adopted as appropriate to section.
Precision approach procedure (PA) (§ 1.1)	Withdrawn and action deferred until reviewed by joint industry/government working groups.
Precision final approach fix (PFAF) (§ 1.1)	Withdrawn and action deferred until reviewed by joint industry/government working groups.
RNAV (abbreviation) (§ 1.2)	Adopted.
Visibility minimum (§ 97.3)	Adopted.

II.B.1. Classification of Instrument Approach Procedures (§ 1.1: APV, NPA, PA)

The FAA proposed to redefine ''nonprecision approach procedure (NPA)'' and ''precision approach procedure (PA).''

For the term ''nonprecision approach procedure (NPA),'' the proposal eliminated reference to ''electronic glide slope'' and defined it as, ''* * * an instrument approach procedure based on a lateral path and no vertical glide path.''

Similarly, the proposed definition of ''precision approach procedure (PA)'' deleted reference to ''electronic glide slope'' and ''standard instrument procedure'' and defined that term as ''* * * an instrument approach procedure based on a lateral path and a vertical glide path.'' This definition would provide lateral course and track information with vertical glide path information.

The term ''approach procedure with vertical guidance (APV)'' was proposed as ''* * * an instrument approach procedure based on lateral path and vertical glide path. These procedures may not conform to requirements for precision approaches.''

ATA, the Aircraft Owners and Pilots Association (AOPA), American Airlines, Continental Airlines, Alaska Airlines, Airbus, Boeing, and American Trans Air all objected to the above three proposed definitions. They recommended withdrawing the definitions for reconsideration because the terms were either inconsistent with, or were in direct conflict with, the same terms defined in Advisory Circular (AC) 120–28D ''Criteria for Approval of Category III Weather Minima for Takeoff, Landing, and Rollout,'' and AC 120–29A ''Criteria for Approval of Category I and Category II Weather Minima for Approach.''

In addition, RAA and Airbus contended that adopting the term ''approach with vertical guidance (APV)'' would impose additional crewmember training requirements and require the updating of training materials.

TAOARC commented that the Aviation Rulemaking Advisory Committee's (ARAC's) All Weather Operations Working Group has already initiated a review of this terminology and that the FAA should defer final action until that group completes its review.

Based on the above comments, and the fact that these terms are currently under review by ARAC, the FAA concludes that it is inappropriate to adopt these terms and definitions at this time. The FAA anticipates that working groups within the ARAC, PARC, and civil aviation authorities will review the terms and submit recommendations to the agency for future consideration. Therefore, all proposed amendments using these three proposed terms are withdrawn.

II.B.2. Category I, II, III, IIIa, IIIb, and IIIc Operations (§ 1.1)

The FAA proposed to add a definition of ''Category I;'' expand the definitions of ''Category II, and III, IIIa, IIIb, and IIIc operations'' to accommodate precision RNAV approaches; and replace the terms ''ILS [instrument landing system] approach'' and ''instrument approach'' with ''precision approach'' or ''precision instrument approach,'' respectively. The proposed definitions are as follows.

''Category I (CAT I) operation is a precision instrument approach and landing with a decision altitude that is not lower than 200 feet (60 meters) above the threshold and with either a visibility of not less than ½ statute mile (800 meters), or a runway visual range of not less than 1,800 feet (550 meters).

''Category II (CAT II) operation is a precision instrument approach and landing with a decision height lower than 200 feet (60 meters), but not lower than 100 feet (30 meters), and with a runway visual range of not less than 1,200 feet (350 meters).

''Category III (CAT III) operation is a precision instrument approach and landing with a decision height lower than 100 feet (30 meters) or no DH, and with a runway visual range less than 1200 feet (350 meters).

''Category IIIa (CAT IIIa) operation is a precision instrument approach and landing with a decision height lower than 100 feet (30 meters), or no decision height, and with a runway visual range of not less than 700 feet (200 meters).

''Category IIIb (CAT IIIb) operation is a precision instrument approach and landing with a decision height lower than 50 feet (15 meters), or no decision height, and with a runway visual range of less than 700 feet (200 meters), but not less than 150 feet (50 meters).

''Category IIIc (CAT IIIc) operation is a precision instrument approach and landing with no decision height and with a runway visual range less than 150 feet (50 meters).''

ATA, Delta, Alaska Airlines, AOPA, Helicopter Association International (HAI), RAA, and American Trans Air objected to the proposed definitions because the terms would specify the approaches as ''precision.'' As discussed previously, numerous commenters objected to the proposal with respect to redefining ''precision'' and ''nonprecision.''

In addition, HAI stated that the definition of ''Category I'' should take into account the capabilities of helicopters and better define the parameters for helicopter operations to execute Category I operations.

TAOARC recommended withdrawing the above definitions until studies on precision/nonprecision procedures, decision altitude, decision height, and a concept for a new categorization of approach procedures to support the evolution of a performance-based NAS are completed.

In view of the comments and because the FAA is not adopting the proposed definitions for precision approach (PA) and nonprecision approach (NPA), it is inappropriate to amend these terms as proposed until the joint industry/government working groups review the issues.

II.B.3. Decision Altitude (DA) and Decision Height (DH) (§ 1.1)

The FAA proposed to redefine ''decision height (DH)'' as ''the specified height AGL [above ground level], at which a person must initiate a missed approach during a Category II or III approach if the person does not see the required visual reference.'' [1]

The FAA proposed a new definition of ''decision altitude (DA)'' to describe the altitude in feet above mean sea level (MSL) at which a person must initiate a missed approach if he or she does not see the required visual reference.

The FAA proposed these terms to be consistent with similar International Civil Aviation Organization (ICAO) terminology and, more importantly, to accurately identify the point where a pilot must decide to either continue the approach or execute a missed approach, depending on the instrument approach procedure.

Airbus commented that because the proposed definition of ''decision height (DH)'' only applies to Category II and Category III procedures, this would preclude the use of decision height in any future Category I procedures. Airbus also points to several Category II procedures that currently use an inner marker or a DA as the decision point and that have been safely conducted for more than 40 years.

TAOARC opposed adopting the term ''decision height (DH)'' because it may create charting, training, and performance-based systems implementation problems in the near term.

These comments raised valid concerns with respect to the proposed definition of decision height. The type of altitude-or height-measuring device that is selected by instrument approach procedure developers to accurately determine the height or altitude for the missed approach decision point depends on the underlying topography associated with the instrument approach procedure (IAP). The term decision altitude currently is not codified in the regulations, but it has become a term of reference in instrument approach procedure construction and is used by the aviation community.

In response to the comments, the FAA is modifying the term ''decision height (DH)'' by striking the words ''during a Category II or III approach,'' which will permit the use of DH in Category I approaches, if appropriate, as well as continuing to allow the use of DA in Category II approaches, if appropriate. In addition, the FAA is clarifying in both definitions that, if ''DA'' or ''DH'' is specified in an instrument approach procedure, it is the altitude or height at which the pilot must decide whether to initiate an immediate missed approach or to continue the approach.

Northwest Airlines expressed two concerns—(1) that the proposals to amend the flight data recorder requirements in part 121 (§ 121.344 and appendix M) and part 135 (§ 135.152 and appendix M) to record DA would require a costly software modification to certain aircraft; and (2) that although it supports the distinction between decision height and decision altitude, this distinction could require a software modification to add a ''discrete'' code to the flight data recorder parameters to differentiate between DH and DA.

The FAA did not intend for the NPRM to require modifications to the Flight Data Recorder requirements or software changes. The FAA agrees with Northwest that the proposals could result in these modifications and therefore, these proposals are withdrawn.

DA/DH (combined acronyms): Even though Boeing and ATA agreed with the FAA's distinction between ''altitude'' and ''height,'' they did not agree with the combined acronym of ''DA/DH'' for these terms.

Boeing, RAA, and Airbus stated that adopting this acronym would require them to change their charts, manuals, and training programs to conform to the FAA's acronyms.

The FAA has used the term ''DA(H)'' for several years in its handbook guidance to refer to the terms decision height and decision altitude and adopting this acronym now is not a substantive change. Operators and aircraft manufacturers will need to revise these documents accordingly; however, these revisions can be accomplished during their normal revision cycles.

II.B.4. Final Approach Fix (FAF) (§ 1.1)

The FAA proposed to add the term ''final approach fix (FAF)'' to provide that the final approach fix defines the beginning of the nonprecision final approach segment and the point where final segment descent may begin.

Delta and Alaska Airlines commented that the agency only proposed ''final approach fix'' relative to a nonprecision approach, but that AC 120–29A applies final approach fix to both nonprecision and precision approaches with no distinction. TAOARC recommended withdrawing the definition, but did not provide adequate rationale for this comment.

Because the term ''final approach fix'' is used in numerous operating rules and instrument approach procedures, the FAA finds it prudent to adopt this definition. However, the FAA agrees with the commenters that the proposal erroneously limited the term to nonprecision approach procedures instead of applying to both categories. Consequently, the FAA is adopting the term, but is removing the word ''nonprecision'' so that it applies to both precision and nonprecision procedures.

II.B.5. HAT as Acronym for ''Height Above Threshold'' (§ 97.3)

The FAA proposed to change the acronym ''HAT'' from ''height above touchdown'' to ''height above threshold.''

[1] Prior to this rule, the term decision height meant the height at which a decision must be made during an ILS or PAR instrument approach to either continue the approach or to execute a missed approach.

Boeing and Airbus commented that the ''height above touchdown'' is an important point in design of autoland systems and head-up displays, and said that the proposed change could have adverse consequences on aircraft design.

AOPA commented that ''height above touchdown'' provides pilots with more information about the portion of the runway where a landing will take place. AOPA contended that ''height,'' when referring to the threshold only, is misleading because the threshold height may not be the highest part of the ''touchdown zone.'' Furthermore, AOPA stated, general aviation pilots are trained that ''touchdown zone'' is larger than the runway threshold, and that the highest point in that area provides information about runway slope characteristics.

TAOARC supported this proposal.

While the FAA does not find that Boeing's and Airbus's comments are convincing, the agency does agree with AOPA's comment, and consequently is not proceeding with the proposed change. The agency recognizes the long-standing use of the current acronym ''HAT'' to mean ''height above touchdown.''

II.B.6. Helipoint (§ 97.3)

In the NPRM, the FAA proposed to add the term ''helipoint'' as ''* * * the aiming point for the final approach course for heliports. It is normally the center point of the touchdown and lift-off area (TLOF). The helipoint elevation is the highest point on the TLOF and is the same elevation as heliport elevation.'' In the NPRM, the FAA stated that the helipoint is usually the designated arrival and departure point located in the center of an obstacle-free area, 150-feet square overlying an approved landing area.

The Helicopter Association International (HAI) stated that many heliports do not have a 150-foot square obstacle-free area that would meet the requirements of the proposed term. HAI suggested, and TAOARC agreed, that instead, the FAA should add the term ''heliport reference point (HRP),'' which would be consistent with AC 150/5390–2B, ''The Heliport Design Guide.'' (At the time, HAI based its comment on the draft version of AC 150/5390–2B. The FAA published the AC after the publication of the RNAV NPRM.) HRP is defined in the AC as ''the geographic position of the heliport expressed as the latitude and longitude at—(1) the center of the FATO [final approach and takeoff area], or the centroid of multiple FATOs for heliports having visual and nonprecision instrument approach procedures; or (2) the center of the Final Approach Reference Area (FARA) when the heliport has a precision instrument approach procedure.''

Commenters are advised that a helipoint is the geographic point on the ground to which an approach is designed and it should not be confused with an HRP. The helipoint may or may not be coincident with the HRP, particularly where multiple landing areas are specified at a heliport. The helipoint and HRP are different terms serving different purposes. The AC defines both HRP (as stated by HAI) and helipoint. Under AC 150/5390–2B, a helipoint is ''the aiming point for the final approach course. It is normally the center point of the touchdown and lift-off area (TLOF).'' The proposed definition of ''helipoint'' and the term in the AC are substantively the same; therefore, the FAA adopts the term as proposed.

II.B.7. Instrument Approach Procedure (IAP) (§ 1.1)

The FAA proposed to define ''instrument approach procedure'' as—''A predetermined ground track and vertical profile that provides prescribed measures of obstruction clearance and assurance of navigation signal reception capability. An IAP enables a person to maneuver a properly equipped aircraft with reference to approved flight instruments from a specified position and altitude to—(1) a position and altitude from which a landing can be completed; or (2) a position and altitude at which holding or en route flight may begin.''

ATA commented that the word ''approach'' should be removed, as the definition includes the phrase ''en route flight may begin,'' which is not necessarily restricted to being on an approach. ATA also said this could confuse future airspace enhancement strategies and technology applications.

The FAA is not persuaded by ATA's comment and believes that removing the word ''approach'' is inappropriate. A pilot executing an instrument approach procedure is conducting a specific maneuver developed to permit a safe letdown to an airport. In this case, it is not appropriate to use general terminology that could be misunderstood as to the proper ground tracks and vertical profiles to be flown. TAOARC recommended that the FAA revise the definition to match the ICAO definition of IAP, which is, ''a series of predetermined maneuvers by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en route obstacle clearance criteria apply.''

The FAA agrees to modify the definition to mirror the ICAO definition, but is retaining the clause ''and assurance of navigation signal reception capability'' from the NPRM. By including this clause, the FAA is requiring that the signal used by an aircraft's navigation equipment to position that aircraft on an IAP, with the required performance established for the procedure, is available and suitable for use on the route to be flown.

II.B.8. Minimum Descent Altitude (MDA) (§ 1.1)

The FAA proposed to define minimum descent altitude (MDA) as ''the lowest altitude to which a person may descend on a nonprecision final approach, or during a circle-to-land maneuver, until the visual reference requirements of § 91.175(c) of this chapter are met. Minimum descent altitude is expressed in feet above mean sea level.''

In the proposed definition, the MDA was limited to non-precision final approaches and references to ''standard instrument approach procedure'' and ''electronic glide slope'' were deleted. These changes were intended to clarify that an MDA is applicable only to a non-precision instrument approach procedure.

Alaska Airlines objected to using ''nonprecision'' in this definition because AC 120–29A applies to instrument procedures generally and does not distinguish precision and nonprecision. Boeing, Airbus, Continental, and TAOARC agreed that the definition should refer to instrument procedures generally until the joint industry/government working groups and the FAA review the categorization issues associated with precision and nonprecision approaches.

The FAA is adopting the definition with several modifications. A precise definition of this term is critical to both the safe execution of the instrument approach procedure and the supporting design criteria. The FAA agrees with deleting reference to ''nonprecision,'' in view of the comments on this term and previously addressed in this document. In the final rule, the definition retains the current phrase ''instrument approach procedure.''

After further review, the FAA finds that this definition should be modified by replacing the words ''in execution of an instrument approach procedure, where no electronic glide slope is provided'' with the words ''specified in an instrument approach procedure.'' This more general phrasing accommodates RNAV IAPs specific to the use of RNAV.

Lastly, the proposed definition did not include visual reference requirements added to § 91.175(l) by the Enhanced Flight Vision Systems rule (69 FR 1620; Jan. 9, 2004). Therefore, the words ''until the pilot sees the required visual references for the heliport or runway of intended landing'' are added for consistency with current § 91.175(l) and to clarify that, when an MDA is specified in an instrument approach procedure, that altitude is the lowest altitude to which the pilot is authorized to descend until he or she sees the required visual references to continue the approach to an intended landing.

II.B.9. MSA—Minimum Safe Altitude (§ 97.3)

The FAA proposed to revise the definition of ''minimum safe altitude (MSA)'' as ''expressed in feet above mean sea level, depicted on an approach chart that provides at least 1,000 feet of obstacle clearance for emergency use within a certain distance from the specified navigation facility or fix.'' TAOARC recommended that the FAA accept the definition as proposed.

AOPA commented that, while it would appear that the use of any navigational aid (NAVAID) or fix to be the reference point for MSA is beneficial, poor or inconsistent application of selection criteria for fixes or NAVAIDs could raise safety issues. AOPA contended that the FAA should establish regulatory criteria for the consistent application of MSA.

The FAA disagrees with AOPA and is adopting the definition as proposed. The FAA's ''Instrument Procedures Handbook'' (FAA–H–8261–1) and the ''Instrument Flying Handbook'' (FAA–H–8083–15) appropriately provide standardized guidance for the selection and depiction of the fix or NAVAID that forms the basis of the minimum safe altitude on the approach chart. AOPA did not cite any cases where this guidance has resulted in poor site selection or pilot confusion.

II.B.10. Night (§ 1.1)

The FAA proposed to revise the definition of ''night'' either to be the period of time published in the American Air Almanac, converted to local time, or other period between sunset and sunrise, as prescribed by the FAA.

Boeing, American, Delta, American Trans Air, AOPA, and ATA commented that the proposed definition could have operational impacts at particular locations, where terrain may cause sunset earlier than the American Air Almanac indicates. RAA asked where the local definition of ''night'' would be published.

TAOARC recommended that the FAA withdraw the definition and explore alternate methods that might address the local determination of the hours of darkness and how to impose those limitations.

In view of these comments, the FAA is withdrawing this proposal and will request that the term ''night'' be studied by joint industry/government working groups.

II.B.11. Use of the Word ''Pilot'' or ''Person''

The FAA proposed to change the word ''pilot'' to ''person'' in a number of sections depending on the context of the regulations. (See table below.) In certain regulations, the word ''person'' is appropriate if it applies to those individuals in an operator's organization, including pilots, who are authorized to develop the policies and procedures under which its aircraft are to be operated, and who are responsible for compliance with the requirements in the regulations.

Boeing and Continental argued that this change would be inappropriate, because ''pilots'' fly aircraft. Boeing added that the current definitions are adequate and familiar to pilots. TAOARC also objected to the change.

The FAA re-examined each proposed amendment in context to determine whether the requirement applies to an organization and its pilots or other persons used in its operations, or only to the pilots conducting the operation. Based on this re-examination, the term ''person'' or ''pilot'' is adopted as follows:

Section	FAA decision reflected in the final rule
§ 1.1 Decision altitude	The word "pilot" retained.
§ 1.1 Decision height	The word "pilot" retained.
§ 91.129 (e)	The word "pilot" retained.
§ 91.175 (e) and (j)	The word "pilot" retained.
§ 91.177	The word "person" adopted.
§ 91.189	The word "pilot" retained.
§ 121.347	The word "person" adopted.
§ 125.381	The word "pilot" retained (as adopted in the EFVS final rule of January 9, 2004).
§ 129.16 (renumbered as § 129.22 in the final rule) (a) and (b)	The word "person" changed to "foreign air carrier" to be consistent with terminology in part 129.
§ 129.17 (b) and (d)	The word "person" changed to "foreign air carrier" to be consistent with terminology in part 129.
§ 135.161	The word "person" adopted.
§ 135.165 (a), (b), (e), (f), and (g)	The word "pilot" retained.
§ 135.225	The word "pilot" retained (as adopted in the EFVS final rule of January 9, 2004).

II.B.12. Precision Final Approach Fix (PFAF) (§ 1.1)

The FAA proposed to add the definition of ''precision final approach fix (PFAF)'' as a final approach fix for a precision approach or an approach procedure with vertical guidance (APV).

ATA and Alaska Airlines commented that the use of ''precision'' and ''nonprecision'' is inappropriate and inconsistent with AC 120–29A because the AC does not differentiate between precision and nonprecision.

As previously discussed, the FAA is withdrawing the definition of ''approach procedure with vertical guidance (APV)'' pending its review by joint industry/government working groups. Consequently, the term ''precision final approach fix'' is withdrawn for the same reason.

II.B.13. RNAV (Acronym) (§ 1.2)

The FAA proposed to include the acronym ''RNAV'' for the term ''area navigation'' in § 1.2.

American Trans Air and Continental Airlines requested that the FAA withdraw the proposed acronym ''RNAV'' because, in their view, it needs industry input. Furthermore, American Trans Air said that ''RNAV'' appears to be a charting acronym and is not necessary for inclusion in § 1.2. TAOARC, however, supported the acronym.

''RNAV'' is a long-standing acronym that the industry and the FAA have used to refer to area navigation for several decades. It is unclear what ''industry input'' would be necessary with respect to merely codifying a universally accepted acronym. Therefore, the FAA is adopting the acronym ''RNAV'' for ''area navigation.'' The definition of ''RNAV'' in § 1.1 was adopted in the April 8, 2003 final rule, ''Designation of Class A, B, C, D, and E Airspace Areas; Air Traffic Service Routes; and Reporting Points.'' However, in that rule, the acronym ''RNAV'' was inadvertently left out of § 1.2.

II.B.14. Visibility Minimum (§ 97.3)

In the NPRM, the FAA did not propose any substantive amendments to the term ''visibility minimum.'' The term is defined as ''* * * the minimum visibility specified for approach, landing, or takeoff, expressed in statute miles, or in feet where RVR [runway visual range] is reported.''

Boeing, however, recommended adding the words, ''Unless otherwise specified'' to the beginning of the definition of ''visibility minimum'' to allow for alternative units of measure, such as meters.

TAOARC recommended adopting the definition as proposed.

FAA regulations uniformly refer to miles (nautical and statute) or feet, and the agency does not intend to introduce new units of measure in the foreseeable future. It is also noted that certain operators are issued operations specifications containing a feet-to-meters conversion table. Consequently, having one regulation that includes an alternative unit of measure, when numerous other regulations do not, would generate additional questions.

II.C. Communications Requirements

II.C.1. Communications Facilities (§ 121.99)

The FAA proposed the following amendment to § 121.99, Communications facilities:

(1) Change the requirement for a ''two-way radio communication system available over the entire route under normal operating conditions'' to a ''two-way communication system under normal operating conditions,'' which would permit the use of data link as opposed to just voice communication;

(2) Change the words ''point-to-point circuits'' to ''communication links;''

(3) Add the requirement for a communication system to have two-way voice communication capability for use between each airplane and the appropriate dispatch office, and between each airplane and the appropriate air traffic control (ATC) unit for non-normal and emergency conditions; and

(4) Define the term ''rapid communications'' in this section to mean that the caller must be able to establish communications with the called party in less than 4 minutes.

The Airline Dispatchers Federation commented that the new voice communications requirements would contribute to aviation safety and that the 4-minute time limit as used in the proposed definition of ''rapid communications'' is reasonable and technologically achievable.

The majority of other commenters, including airlines, industry associations, communication service providers, and aircraft manufacturers, objected to the proposed requirement for a communication system to have two-way voice communication capability for use between each airplane and the appropriate dispatch office for non-normal and emergency conditions. These commenters also did not support the proposed definition of ''rapid communications'' to mean that the caller must be able to establish communications with the called party in less than 4 minutes. The commenters cited the diminishing availability of communication service providers who use high frequency (HF) radio communications systems for long-range communications, e.g., oceanic and polar, the limitations of HF voice communications due to propagation characteristics, and the high costs of equipping their aircraft with satellite communication systems which would be one means of meeting these two proposed requirements. Several of these commenters stated that because of the limitations of HF communications and the costs of satellite communications they use only data link for dispatch office communications on certain routes and only maintain voice communication capability with ATC on those routes. Furthermore, nearly all of these commenters objected to the proposed definition of ''rapid communications'' stating that the proposed requirement is unrealistic especially in view of the limitations of HF voice communications systems and the lack of safety justification provided by the FAA.

Delta further commented that paragraph (b) of this section should be amended to permit domestic and flag operators, in an emergency, to communicate with their dispatch offices using an ATC facility communication link between the airplane and the dispatch office.

TAOARC recommended instead that ''rapid communication under normal operating conditions'' between the pertinent parties be established within 5–10 minutes, unless otherwise authorized by the Administrator. TAOARC also did not support requiring voice communication with dispatch in non-normal and emergency situations, but did not expand on the comment.

Delta commented that the § 121.99 proposals pertaining to two-way voice communication capability for use between each airplane and the appropriate dispatch office, and the proposed definition of ''rapid communications'' would require equipping its aircraft with both data link and satellite voice communication equipment under § 121.349.

Upon further consideration, the FAA is making the following changes to proposed paragraph (a) in the final rule: (1) The words ''under normal operating conditions'' are struck from the first sentence because they are redundant, and the acronym ''FAA'' is replaced with the words ''certificate holding district office;'' (2) in the second sentence, the words ''except as specified in § 121.351(c)'' are struck because they are no longer applicable to the rule as it has been modified. The FAA acknowledges the comments that opposed the proposal regarding ''rapid communication under normal operating conditions'' and proposed definition of ''rapid communications,'' and therefore, removes these statements from the rule text. Finally, the FAA is adopting Delta's recommendation to amend § 121.99(b) to permit, in an emergency, domestic and flag operators the use of U.S. ATC communication facilities to communicate with their dispatch offices.

II.C.2. Aircraft Communication Equipment (§§ 91.205, 91.511, 91.711, 121.345, 121.347, 121.349, 121.351, 125.203, 129.16 (Adopted as § 129.22), 129.17, 135.161, and 135.165)

In conjunction with the § 121.99(a) proposals for communications facilities described above, the FAA proposed to amend the related aircraft communication equipment requirements in parts 91, 121, 125, 129, and 135 to make them less prescriptive. This would allow for the expanded use of different kinds of communication systems technology for aeronautical operational control and air traffic management as the NAS increasingly becomes more performance-based.

Upon further consideration, the agency has determined that many of the aircraft communication equipment proposals are premature because the future communication infrastructure needs for air traffic management of the NAS have not yet been determined, nor has the international aviation community made decisions regarding its respective air traffic communications. Accordingly, the FAA is withdrawing many of the associated proposed aircraft communication equipment amendments so that joint industry/government working groups may study the issues and provide recommendations to the FAA for the NAS communications infrastructure and for compatible aircraft communication equipment.

Specifically the agency has concluded that, where it had proposed to remove or omit reference to ''radio'' in order to refer generally to just ''communication,'' the existing language (use of the term ''radio'') should be retained for NAS and foreign air traffic service provider communication infrastructures.[2]

In proposing to add new § 129.16 (adopted as § 129.22), the FAA similarly proposed to require ''communication'' equipment; however, the word ''radio'' is added to this section for uniformity and consistency in the requirements for parts 121, 125, 129 and 135.

The FAA did not receive comments on the following issues; however, upon review the agency finds that further modifications are necessary.

This rule amends §§ 121.347(a)(2), 129.22(a)(2) (proposed as § 129.16), and 135.161(a)(2), as proposed, to clarify the communication requirement with appropriate air traffic control facilities within a Class E surface area and not in Class E airspace generally.

The agency's proposal to modify the factors considered by the FAA to approve the installation and use of a single long-range communication system (LRCS) and a single long-range navigation system (LRNS) under §§ 125.203(f)(2) and 135.165(g)(2) was incorrect and mistakenly makes these paragraphs inconsistent with the remainder of the section. Consequently, this proposed amendment is withdrawn and the factor considered by the FAA, among others, is for the length of the route.

The FAA sought to permit operators under parts 121, 125, and 135 to use a single LRNS and a single LRCS, if among other considerations, the aircraft was equipped with only very high frequency (VHF) communication equipment.[3] Upon review, the FAA has concluded that specifying VHF equipment unduly limits the communication gap exception requirement (found in §§ 121.351(c)(3), 125.203(f)(3), and 135.165(g)(3)) to VHF and would not permit the use of other kinds of communication systems to be included in the exception. This result was not intended and therefore, this proposal is also withdrawn.

The FAA proposed to add a requirement in parts 121, 129, and 135[4] that ''for non-normal and emergency operating conditions, at least one of the independent communication systems must have two-way voice communication capability.'' Although no comments were received regarding this proposal, the FAA has reconsidered and is removing the words ''Except as required in § 121.99'' and ''non-normal and emergency operating conditions,'' wherever they appear in those sections which expands the applicability of those sections. The FAA believes that voice communication is necessary in other than non-normal or emergency conditions.

Further, the FAA has concluded that it is necessary to modify the proposed communication equipment requirement language in §§ 121.349, 129.17, and 135.165 from ''For normal operating conditions'' to ''under normal operating conditions'' to be consistent with the FAA's legal interpretation issued on April 16, 1964.[5] The legal interpretation makes it clear that, in conjunction with §§ 121.99 and 121.347 and the modifications to these proposals, a temporary interruption of communications capability of the aircraft communication systems by conditions other than ''normal operating conditions'' is not intended to preclude the suitability of such communication systems for the routes to be flown.

The proposed caption of paragraph § 121.349(e), which read ''Additional communication system equipment requirements'' is misleading because it indicates that it applies to all part 121 operators. In the final rule, the caption is clarified and reads ''Additional communication system equipment requirements for operators subject to § 121.2.'' There is no substantive change.

There were no comments received on the following proposals and these proposals are adopted in this final rule. Proposed § 129.16 is adopted as § 129.22. Shortly before the NPRM was issued, the FAA added another section numbered § 129.16 (''Supplemental inspections for U.S.-registered aircraft'') via a separate rulemaking and the numbering adjustment inadvertently was not made in the RNAV NPRM. Therefore, the section is renumbered accordingly in this final rule.

As proposed, references to ''ground facilities'' are removed in order to permit the use of non-ground based navigational facilities in certain sections of parts 91, 121, and 135.[6]

The FAA is adopting the following proposed amendments to § 125.203: (1) Change the requirement that an airplane must have two-way radio communication equipment, able to transmit to and receive from appropriate facilities from ''25 miles away'' to ''22 nautical miles away''; and (2) add the requirement for two independent communication systems, one of which must have two-way voice communication capability, capable of transmitting to, and receiving from, at least one appropriate facility from any place on the route to be flown.

II.C.3. Flight Operations Communications Requirements (§§ 91.183, 91.185, 129.21, and 135.79)

The FAA did not receive any comments to its proposals to amend §§ 91.183, 91.185, 129.21, and 135.79. The FAA therefore is adopting the following proposed amendments: (1) Removing the words ''by radio'' in § 91.183(a); (2) removing the word ''radio'' from § 91.185 heading and paragraph (a); (3) removing the word ''ground'' from § 129.21; and (4) replacing the words ''radio or telephone communications'' with the word ''communication'' in § 135.79.

These amendments provide operators with greater flexibility to take advantage of future technology and to determine the appropriate communication equipment based on the availability of compatible communication facilities on the route to be flown.

Upon reconsideration, however, the FAA is further modifying § 91.183. The NPRM would have allowed for the use

[2] See proposed §§ 91.205(d)(2), 91.511(a)(1), 91.711(c)(1)(i), 121.345, 121.347, 125.203(a), and 135.161.

[3] See proposed §§ 121.351(c)(3), 125.203(f)(3), and 135.165(g)(3).

[4] See proposed §§ 121.349, 129.17 and 135.165(d)(2).

[5] The interpretation is included in the docket for this rulemaking.

[6] See proposed §§ 91.205(d)(2), 121.347, 135.161 and 135.165.

of advanced communications, other than by voice, in meeting the reporting requirements in the rule. The NPRM also sought to require pilots in command to monitor the frequency. While the rule does not require voice communication to monitor frequencies, it does require that the pilot get permission from ATC to be off the frequency previously required to be monitored, as ATC is the appropriate entity to determine when the frequency does not need to be continuously monitored. Also, the FAA is clarifying the requirement to monitor the frequency by specifying that if there is a two-pilot crew, either pilot can monitor the frequency.

II.D. Navigation Equipment Requirements

II.D.1. Aircraft Navigation Equipment Requirements

The FAA proposed to amend the aircraft navigation equipment requirements in parts 91, 121, 125, 129, and 135 to allow the use of navigation systems that use satellite navigation aids and to require that the navigation equipment must be suitable for the route to be flown. These proposals would allow for the use of future navigation system technology that does not rely on ground-based navigation aids (e.g., global positioning systems (GPS)). The proposals also sought to facilitate the use of RNAV equipment throughout all phases of flight (departure, en route, and approach).

The NPRM contained several proposed amendments to the rules addressing IFR operation equipment requirements. Specifically, the FAA proposed to add the words ''suitable RNAV system'' in several sections.[7] In other sections,[8] however, the FAA proposed adding the words ''suitable IFR-approved RNAV system.'' (Note that the word ''suitable'' was inadvertently omitted from the proposed text of § 91.711 (e).) Both phrases were intended to convey the same requirements, but only one phrase should have been proposed. The phrase ''IFR-approved'' implies a higher standard than the phrase ''suitable RNAV system'' and is misleading, in that some IFR-approved RNAV systems may not be suitable for providing accurate distance information to or from distance measuring equipment (DME) facilities. The term ''suitable RNAV system'' means that the navigation system is designed and installed to perform its intended function. Therefore, ''suitable RNAV system'' is adopted in this rule. (See the discussion under ''II.D.1.a. Suitability of RNAV systems,'' for a description of the assessment strategies used to determine whether certain RNAV systems are ''suitable'' substitutions for certain ground-based navigation facilities or fixes identified in a standard ILS instrument approach procedure.)

In part 129, the FAA proposed that equipment used to receive signals en route also may be used to receive signals on approach, if it is capable of receiving both signals. (See proposed § 129.17(a).) The proposed language is identical to current regulations in other parts governing U.S. operators.[9] Upon review, the FAA has determined that it is no longer necessary to include this phrase in any of the cited regulations because it is redundant. Therefore, this proposal is not adopted and the phrase is removed from §§ 121.349, 125.203 and 135.165. There are legacy navigation systems capable of receiving both signals and operators may continue to use those systems.

This rule replaces, as proposed, the requirement under § 121.349(a) for two independent navigational receivers with the requirement for two independent navigation systems. These two systems are not required to be identical.

The FAA proposed to amend §§ 121.103 and 121.121 to make these sections performance-based by requiring that the navigation aids must be available over the route to navigate the airplane along the route ''with the required accuracy,'' so that any suitable navigation system could be used. The agency believed that the required accuracy would be defined by the route specifications (including route width) or by ATC if not operating on the route. The agency has reviewed the current regulatory text, which requires that the navigation aids used for the route must be used to navigate ''within the degree of accuracy required for ATC.'' This current language does permit the use of any suitable navigation system but also importantly continues the ATC expectation (and requirement under § 91.181, Course to be flown) that, unless otherwise authorized by ATC, aircraft must fly the centerline of an airway. The FAA concludes that the current language is clear and permits the use of any suitable navigation system and consequently, it is not necessary to adopt this proposed amendment.

Based on the above conclusion with respect to §§ 121.103 and 121.121, and supported by TAOARC's preference for consistency between the navigation equipment requirements of § 121.349 and the route accuracy requirements of §§ 121.103 and 121.121, the FAA has determined that it is necessary to further modify § 121.349(a) and (c) to require that the airplane's independent navigation systems be suitable for navigating the airplane along the route to be flown ''within the degree of accuracy required for ATC.'' Although the route accuracy requirement was not proposed for this particular section, the FAA finds that its inclusion here does not pose additional operating requirements but is clarifying the accuracy performance necessary for ATC purposes. (Further discussion on this proposal in relation to §§ 121.349, 125.203, 129.17, and 135.165 are found in ''II.D.3. En route navigation facilities.'')

Also in §§ 121.349(a), the FAA proposed to include a statement that only one navigation system need be provided for precision approach and APV operations.''[10] Since this rule does not adopt the terms precision approach and APV operations, references to these terms are withdrawn. The current regulatory text provides that only one marker beacon receiver providing visual and aural signals and one ILS receiver is needed.

In §§ 121.349(a) and (c)(2),[11] the FAA proposed a requirement that the navigation systems used to meet the navigation equipment requirements be authorized in the operations specifications issued to the operator. The FAA finds this proposal unnecessarily broad because the navigation capabilities of equipment such as very high frequency omnidirectional range (VOR) and ADF are well known. Therefore, the FAA is limiting the operations specifications navigation equipment authorization requirements to RNAV systems only in the sections referenced.

For part 121 operators,[12] the FAA proposed to retain the requirement for two long-range navigation systems (LRNS) when VOR or ADF radio navigation equipment is unusable along a portion of the route. In the final rule, the FAA is adopting (in the introductory text of paragraph (a)) the requirement for two LRNSs; however, the words ''when VOR or ADF radio navigation equipment requirement is unusable along a portion of the route'' are

[7] See proposed §§ 91.131(c)(1), 91.175(k), and 91.205.

[8] See proposed §§ 91.711(e), 121.349(d), 125.203(e), 129.17(d) and 135.165(c).

[9] See proposed §§ 121.349, 125.203 and 135.165.

[10] Identical amendments were proposed in §§ 125.203(c)(5), 129.17(a), 135.165(a).

[11] Identical amendments were proposed in §§ 125.203(c)(5) and (d)(2), 129.17(a) and (c)(2), and 135.165(a) and (b)(2).

[12] See proposed § 121.351(a)(4).

removed. The references to VOR and ADF are removed because these navigation systems are rarely used in extended overwater operations. In addition, in the proposed rule, the FAA inadvertently did not include a reference to navigation systems in the introductory text of § 121.351(a). This reference is added in the final rule.

The FAA proposed to change one of the operational factors the Administrator may consider in authorizing the use of a single long-range navigation system and a long-range communication system from ''the ability of the flightcrew to reliably fix the position of the airplane within the degree of accuracy required by ATC'' to ''the ability of the flightcrew to navigate the airplane along the route with the required accuracy.'' [13] This proposal is not adopted in this rule because the NPRM did not include the route navigation accuracy performance requirements. (See the discussions under ''II.D.1.a. Suitability of RNAV systems'' and ''II.D.3. En route navigation facilities.'')

II.D.1.a. Suitability of RNAV Systems

Aircraft that use some of the older RNAV equipment cannot execute RNAV instrument approach procedures because that equipment cannot support the accuracy requirements necessary for those procedures. Also, some of the older RNAV systems are not capable of meeting the performance necessary for certain established departure procedures, in particular those RNAV systems that cannot process GPS and DME information.

In the various proposed amendments to aircraft navigation equipment requirements, the FAA proposed to include a ''suitable RNAV'' system. The NPRM, however, did not explain the term suitable. In order to clarify for operators with RNAV systems that they must ensure that aircraft's RNAV system is suitable, the agency believes that it is necessary to adopt a definition of that term in § 1.1. Consequently, a suitable RNAV system is defined as an RNAV system that—(1) meets the required performance established for a type of operations, e.g. IFR; and (2) is suitable for operation over the route to be flown in terms of any performance criteria (including accuracy) established by the air navigation service provider for certain routes , e.g. oceanic, ATS routes, and IAPs. An RNAV system's suitability is dependent upon the availability of ground and/or satellite navigation aids that are needed to meet any route performance criteria that may be prescribed in route specifications to navigate the aircraft along the route to be flown.

The FAA has published numerous Advisory Circulars on RNAV system operations, which may be found at: *http://www.airweb.faa.gov/Regulatory_and_Guidance_Library/rgAdvisoryCircular.nsf/MainFrame?OpenFrameSet*.

II.D.1.b. Aircraft Navigation Requirements

Airbus commented that in the case of a GPS-equipped aircraft operating within the operational service volume of ground-based navigation aids, operators would have to show at each point along these routes that the aircraft retains the capability to ''navigate the airplane along the route with the required degree of accuracy.'' Airbus argued that this means that the aircraft can never be outside the operational service volume of the existing NAVAID network, which would be unreasonable, unnecessary, and a costly constraint. Moreover, it would significantly impede implementation of a performance-based NAS and the achievement of the safety and efficiency benefits of RNAV systems that use GPS information.

TAOARC contends that permitting the use of a single independent navigation system but mandating that the system must be able to ''navigate safely to a suitable airport'' in the event of a signal loss would result in an unrealistic requirement for operations in the future NAS under the FAA's plan to decommission ground-based navigation aids such as VOR and TACAN. TAOARC therefore, recommended that the word ''navigating'' be changed to ''proceeding'' because, under the GPS-sensor-interference scenario described in the proposal for § 121.349, the FAA would require operators to use ground-based navigation aids and be limited to operating within the service volume established for those navigation aids.

The FAA agrees with Airbus and TAOARC and replaces the words ''navigat(ing) safely to a suitable airport'' with the words ''proceed(ing) safely to a suitable airport'' in the final rule.[14] Proceeding to another airport can be accomplished many ways, such as reverting to ground-based navigation aids or reverting to inertial-referenced navigation systems. This exception does not require the alternative system to be capable of navigating within the degree of accuracy required for ATC, but rather to provide a safe means for the pilot to continue the flight to a suitable diversion airport.

The FAA realizes that in crafting the NPRM, a current equipment requirement in § 121.349(a) was omitted inadvertently. While no party commented on the omission, the agency believes it is critical to flight safety to maintain the requirement that the airplane's navigation systems must be capable to ''receive navigation signals from all primary en route and approach navigational facilities to be used.'' The pertinent language is updated and clarified so as to require the en route navigation aids necessary for navigating the aircraft along the route (e.g. ATS routes, arrival and departure routes and instrument approach procedures, including missed approach procedures if a missed approach routing is specified in the procedure), are available and suitable for use.[15] This clarifies that the route, for example, may be an ATS route (under part 71) or other ATS routing, or a part 97 instrument approach procedure.

AOPA requested that the FAA consider IFR-certified GPS equipment as a ''suitable RNAV system'' as an option to meet existing equipage requirements in lieu of the DME. (Note that currently DME is required to operate in certain airspace areas and at altitudes of flight level (FL) 240 and above.)

The FAA agrees that an RNAV system used to navigate under IFR operations may constitute a ''suitable RNAV system'' that can be used to substitute for the DME currently required to operate in certain airspace areas and at altitudes of FL 240 and above if the RNAV system is suitable for performing that function. Not all RNAV systems may be suitable to substitute for DME. Suitable navigation aids, e.g., GPS, must be available along the route to be flown to permit the system to provide distance information analogous to the distance information provided by DME, subject to any operating limitations or provisions that may be specified in the approved Airplane or Rotorcraft Flight Manual, AFM supplement, or pilot's guide.

Lastly, the FAA corrects § 91.131 to require that a VOR ''or'' TACAN receiver must be operable if an RNAV system is not available.

The FAA will issue an Advisory Circular containing guidance on what constitutes a suitable RNAV system that may be used to substitute for an ILS component or a ground-based navigation facility in the near future.

[13] See proposed §§ 121.351(c), 125.203(f) and 135.165(g).

[14] See adopted §§ 121.349(c)(1), 125.203, 129.17, and 135.165.

[15] Identical text is inserted in §§ 125.203, 129.17 and 135.165.

II.D.1.c. Navigation System Configurations

Airbus and others commented that the NPRM was unclear on the combinations of navigation sensors and/or aircraft equipment that would satisfy the proposed navigation system requirements. Northwest Airlines requested examples of the permitted combinations.

The FAA proposed to replace the requirement for two independent receivers with a requirement for two independent navigation systems to enable the use of new types of navigation systems such as autonomous inertial navigation systems (INS). A single VOR and a single suitable RNAV system may satisfy the requirement. The FAA also clarifies that this requirement can be met either by use of autonomous navigation systems or by use of ground and/or satellite navigation aids that are suitable and available for en route operations and for the intended instrument approach procedures.

Aircraft navigation systems are considered independent if there is no probable failure or event that will affect both systems. This ensures that, before dispatch or flight release, there will be no potential single point of failure or event that could affect an aircraft's navigation systems and cause loss of the ability to navigate along the intended route or to proceed safely to a suitable diversion airport. Therefore, the FAA is providing an exception [16] for operations on routes using only one navigation system suitable for navigating the aircraft along the route as discussed in the previous paragraph, provided that the aircraft is equipped with at least one other independent navigation system for purposes of proceeding to a suitable airport.

Although not proposed, the FAA finds it necessary to add a requirement under the exception that the certificate holder must show, by appropriate description in the certificate holder's operating manuals or by another means acceptable to the FAA, that the other independent navigation system is suitable, in the event of loss of the navigation capability of the single system at any point along the route, to enable the aircraft to proceed safely to a suitable airport and complete an instrument approach. For example, an operation that is currently permitted over routes on which navigation is based on low-frequency radio range or automatic direction-finding (ADF) navigation aids may use an airplane equipped with two VOR receivers and only one low-frequency radio range or ADF receiver. In the case of failure of the single low-frequency radio range receiver, or ADF receiver, the flight must be able to proceed safely to a suitable airport by means of VOR navigation aids and complete an instrument approach by use of the remaining aircraft VOR equipment. The FAA is making this change in the final rule to ensure that aircraft avoid collision with obstacles on the ground and other aircraft during flight.

II.D.2. Global Navigation Satellite System (GNSS) or Other Satellite Navigation Aids, e.g., Global Positioning Systems (GPS)

The FAA requires two independent navigation systems to ensure that there is no single point of failure or ''event'' that could result in losing the ability to navigate along the intended route or to navigate to a suitable diversion airport. This proposal addresses the vulnerability of GPS, which uses very weak signals that are susceptible to interference that may cause a loss of integrity, or total loss of usable signals, thus degrading the use of the GPS for IFR operations. Such single point of failure or an event is one that could lead to increased workload, the inability of the flight crew to cope, or prevent continued safe flight and landing.

Airbus commented that there are no known industry or agency criteria for determining which GPS systems can be considered ''independent.'' Furthermore, Airbus contended that the FAA did not define the probability of interference, nor state what the government might do to reduce or eliminate the generation of interfering signals.

Although the risk of intentional jamming of GPS is low in the United States, the FAA routinely issues Notices to Airmen (NOTAMs) indicating that GPS is unreliable in certain areas and during certain times due to planned testing. Unintentional interference is frequently encountered in some areas of the world, but historically is infrequent in the United States. Airbus states that interference in oceanic areas has not been experienced and can be expected to be very rare. The FAA agrees that the likelihood of interference varies by region, and the possibility of intentional interference could increase.

On December 15, 2004, the President of the United States issued the ''U.S. Space-Based Positioning, Navigation and Timing Policy'' acknowledging the vulnerability of GPS, and tasking the Department of Transportation, in coordination with the Secretary of Homeland Security, to—

> * * * develop, acquire, operate, and maintain backup position, navigation, and timing capabilities that can support critical transportation, homeland security, and other critical civil and commercial infrastructure applications within the United States, in the event of a disruption of the Global Positioning System or other space-based positioning, navigation, and timing services, consistent with Homeland Security Presidential Directive-7, Critical Infrastructure Identification, Prioritization, and Protection, dated December 17, 2003;

In keeping with this policy, the FAA will continue to maintain adequate ground-based navigation aids for navigation services. The FAA does not believe it is appropriate or necessary, however, to restrict all operations to the service volume of ground-based navigation aids. As technology is developed, tested and accepted, it is the FAA's intention to permit the use of that technology when its use can be done in a safe and appropriate manner.

Under GPS interference scenarios, operations of aircraft that are not equipped for this contingency may be severely limited. Therefore, a DME infrastructure and a VOR network must remain in place for the foreseeable future. As the NAS evolves and navigation technology improves, however, a satellite-based system may become the core of the aviation navigation infrastructure.

II.D.3. En Route Navigation Facilities (§§ 121.103, 121.121, and 125.51)

The FAA proposed to use the term ''navigation systems'' in the headings of §§ 121.103 and 121.121 and the term ''navigation aids'' in the heading of § 125.51. Northwest Airlines pointed out that, while the FAA proposed to use the word ''systems'' in the headings of those sections, it addressed requirements for navigation aids in the text. American Trans Air recommended that the headings read ''Enroute navigation'' because use of the words ''systems,'' ''aids,'' and ''facilities'' confuses the rule. TAOARC recommended removing the word ''systems'' from the proposed headings of §§ 121.103 and 121.121.

After considering the comments, the FAA has concluded that ''facilities'' is appropriate under the current infrastructure and is changing the headings of §§ 121.103, 121.121, and 125.51 in the final rule to ''En route navigation facilities.''

Currently, §§ 121.103(a), 121.121(a), and 125.51(a) all provide that ''nonvisual ground aids'' must be available over the route for navigating an aircraft within the degree of accuracy required for ATC. The FAA proposed to replace reference to ''nonvisual ground

[16] See §§ 121.349 (c), 125.203 (d), 129.17 (c) and 135.165 (b).

aids'' in these sections with ''navigation aids.'' No comments were received and this rule adopts that amendment.

II.E. International Standards

An individual commenter objected to conforming FAA regulations to ICAO standards and argued that since the majority of aviation activity occurs within the United States, ICAO should conform to United States standards.

AOPA commented that there are significant differences between the United States and European operating environments and that harmonization with ICAO is not necessarily a good model for future changes to the domestic system. Moreover, AOPA contended that the FAA should only harmonize with ICAO when there is an operational benefit to users of the NAS.

The FAA recognizes that there are differences between the United States and European general aviation operating environments; however, harmonization of international standards remains a high priority for the FAA whenever it is in the public interest.

In the NPRM, the FAA erroneously stated that there are no current ICAO standards that corresponded to the proposed rule. The requirements proposed in §§ 121.349, 125.203, 129.17, and 135.165 are consistent with the current international standards in parts 1, 2, and 3 of ICAO Annex 6, ''Aeroplane Communication and Navigation Equipment'' for air carrier and general aviation operations, and ''Helicopter Communication and Navigation Equipment'' for helicopter operations.

American Trans Air asked whether the rule would apply to foreign operators in U.S. Gulf of Mexico airspace. Foreign operators are advised to review the regional procedures in the United States Aeronautical Information Publication (AIP) to determine the applicability of certain portions of this rule.

II.F. Elimination of Middle Markers (§§ 91.129 and 91.175)

In the NPRM, the FAA proposed deleting reference to the middle marker in §§ 91.129(e) and 91.175(k) because a middle marker is no longer operationally required. There are some middle markers still in use, but there are no middle markers being installed at new ILS sites by the FAA.

The FAA did not receive any comments on the §§ 91.129(e) and 91.175(k) proposals to remove the middle marker as a required component of an ILS, and the amendments are adopted as proposed.

II.G. DME Requirements for Aircraft Operating At or Above FL 180 Versus FL 240 (§§ 91.205 and 91.711)

The FAA proposed to lower the altitude for which DME is required from flight level (FL) 240 to FL 180.[17] This would make the altitude for which DME is required consistent with the floor of Class A airspace. The FAA believed that most aircraft operating in Class A airspace already have DME.

AOPA and Boeing objected to this proposal. AOPA argued that the justification is inadequate and that some operators must change or supplement their navigation systems, which would impose costs. AOPA estimated that approximately 30% of the aircraft capable of operating at or above FL 180 are equipped with DME. The number of aircraft equipped with a suitable RNAV system is unknown.

Boeing contends that maintaining FL 240 is necessary to address lead turn radius at high true airspeed. Boeing also argues that RNAV should also be permitted in lieu of DME. In view of the comments and after further consideration, the FAA concludes that this amendment may inadvertently create additional airspace congestion below FL 180 by restricting non-DME-equipped aircraft to operate at or below 18,000 feet. Consequently, the FAA withdraws this proposal.

II.H. Minimum Altitudes for Use of Autopilot (§§ 121.579 and 135.93)

The FAA proposed to amend §§ 121.579(b)(1) and (b)(2) and 135.93(b) and (c) to change references from ILS to precision approaches.

Boeing, ATA, and TAOARC suggested completely rewriting §§ 121.579 and 135.93 to reflect the previous input of ARAC's Flight Guidance System Harmonization Working Group. The FAA is currently reviewing the recommendations of this group. In the meantime, as the term ''precision approach'' is not being adopted in this rule, it is necessary to withdraw this proposal.

III. Discussion of Comments on Specific Sections

Section 91.129 Operations in Class D Airspace

ATA recommended removing the word ''glide'' from any definitions. The FAA does not agree with the commenter because the word ''glide'' must be associated with either the word ''slope'' or ''path'' in the context of this section. However, the FAA is changing the reference to ''glide slope'' proposed in paragraph (e)(4) to ''glide path'' because the term ''glide path'' is appropriate to all approaches with vertical guidance.

Section 91.175 Takeoff and Landing Under IFR

Upon reconsideration, the FAA has concluded that in paragraph (b), the terminology in the regulation as currently published is accurate and that it is appropriate to retain the language ''when the approach procedure being used provides for and requires the use of a DA/DH or MDA.''

In addition, the FAA is amending its proposal in paragraph (b)(3) from, ''The DA/DH or MDA for which the aircraft is equipped'' to ''The DA/DH or MDA appropriate for the aircraft equipment available and used during the approach.'' While this change is editorial, it is more precise and is consistent with the FAA's efforts to promote a performance-based NAS.

In paragraph (c), the FAA is deleting the phrase ''at any airport'' as the words are not necessary.

In paragraph (f), the FAA proposed to require that, if published civil takeoff weather minimums in part 97 are specified for a particular departure route, pilots must comply with these minimums and the published route unless an alternative route has been assigned by ATC. In order to ensure adequate obstacle clearance, the associated published weather minimums may only be applicable based upon a particular routing, i.e. departure procedure. For numerous airports, departure procedures are predicated upon obstacles located in the flight path(s) of the takeoff runway.

Airbus, Boeing, and Continental argued that it would be unnecessary, unsafe and economically onerous to require air carrier pilots to adhere to published departure procedures if in determining compliance with the aircraft takeoff limitations of § 121.189, air carriers have safely used a flight track significantly different from the flight track published in a part 97 procedure. In this case, Airbus argued that, in an engine-out situation, the pilot should fly the track that was determined to be compliant with § 121.189 and, in that case, it would be unsafe for the pilot to continue flying the part 97 departure procedure.

American Airlines contended that many part 121 operators already have approved engine-out procedures in place that are negotiated with air traffic control and provide for the safe operation of aircraft in such situations. American Airlines also argued that part 97 departure procedures are not based on engine-inoperative obstacle clearance

[17] See proposed §§ 91.205 and 91.711.

requirements contained in the airplane performance operating limitation regulations in parts 121 and 135. It also argued that it is too costly to conduct obstacle assessments for each departure procedure specified in part 97 and that negotiated departure procedures provide carriers with the flexibility and safe operating procedures.

TAOARC commented that the proposal does not contemplate the high standards for obstacle clearance in parts 121 and 135.

The FAA agrees in part with the above comments. Where takeoff minimums clearly are specified for a particular departure route, as a matter of safety, pilots must follow that routing. However, an exception is permitted. An operator may use an alternate departure route (see definition of ''T'' for an alternate departure route under § 97.3), if it is negotiated in advance with ATC and that alternative departure route allows part 121 and part 135 operators and certain part 129 operators to use a takeoff obstacle clearance or avoidance procedure that ensures compliance with the applicable airplane performance operating limitations requirements under part 121, subpart I or part 135, subpart I, or that ensures compliance with the airplane performance operating limitations for takeoff prescribed by the State of the operator, if applicable, at that airport. The provisions of subpart I in both part 121 and part 135 contain higher performance standards than that provided for in part 97 departure procedure. It is not the FAA's intention to disrupt or force operators to stop using established departure procedures that are safe and have been approved by the FAA. Therefore, these alternative routes may be used in lieu of the specified obstacle departure routes under § 97.1.

The FAA proposed to delete the runway visual range (RVR) table in paragraph (h) of § 91.175 and instead refer to the RVR table in FAA Order 8260.3, ''U.S. Standard for Terminal Instrument Procedures (TERPs).'' At the time of the NPRM, FAA Order 8260.3 was incorporated by reference in § 97.20.

Alaska Airlines and AOPA recommend using advisory circulars to disseminate the RVR table. AOPA and American Trans Air suggested that the agency list all the publications that provide the RVR table, i.e. the Aeronautical Information Manual, etc. ATA and Boeing recommended that these conversions go into carrier operations specifications.

Conversely, Delta maintained that the RVR table must have a regulatory source. American Trans Air also opposes incorporating the RVR table into an FAA order, and argues that the proposal would permit the FAA to change it without public input.

TAOARC endorsed putting the RVR table into the FAA Order because that Order was previously incorporated by reference into part 97, which makes it a regulatory provision.

On May 3, 2005, the FAA removed the incorporation by reference of FAA Order 8260.3. (See ''Revision of Incorporation by Reference Provisions'' final rule published on May 3, 2005 (70 FR 23002)). The agency concludes that the RVR table must have a regulatory basis and therefore, leaves the Comparable Values of RVR and Ground Visibility table in § 91.175.

The FAA proposed to amend paragraph (k) to allow certain locations on the ILS to be fixed by other than ground-based navigation aids.

AOPA requested clarification as to whether RNAV equipment, including IFR-approved GPS, can be used to identify certain locations on the ILS. AOPA estimated that less than one-third of all general aviation aircraft have the equipment necessary to identify a database fix. AOPA objected to any ILS implementation where RNAV equipage is a required component for completion of the approach because this would, as argued by AOPA, mandate the use of GPS for general aviation aircraft to access ''non-GPS'' procedures.

The FAA made an editorial error in paragraph (k) of § 91.175 that listed the means that may be used to substitute for the outer marker as ''requiring'' a suitable RNAV system instead of stating that a suitable RNAV systems was one of the many possible means of meeting this requirement.

AOPA also suggested modifying paragraph (h) to permit a pilot to use the ILS glide slope interception and altitude crosscheck as an acceptable substitute for an outer marker. Boeing recommended that a compass locator or precision radar may be substituted for the outer or middle marker.

AOPA's request to substitute an ILS glide slope interception and altitude crosscheck for an outer marker and Boeing's request to substitute a compass locator or precision radar for the outer or middle marker are beyond the scope of this rulemaking.

Published FAA guidance material advises that if a required fix for a particular instrument approach procedure is not in the aircraft's navigation database, then the pilot should not fly the procedure, nor enter such fix manually. (See Aeronautical Information Manual, Chapter 5, Air Traffic Procedures.) This reduces the risk of human error with respect to an incorrect manual fix entry and incorrect estimation of fix location while flying the instrument approach procedure. Pilot actions of this nature could result in controlled flight into terrain or manmade obstacles.

Boeing and Continental suggested adding a paragraph to § 91.175 to explicitly facilitate the introduction of new technology for low visibility approach and landing, when it can be shown that the new technology is appropriate. The commenters went on to state that the use of new technology could then be authorized through Operations Specifications or other suitable means.

The proposed recommendation is beyond the scope of the NPRM; however, the FAA already addressed the authorization of certain new technology in low-visibility approach and landing in the January 9, 2004 EFVS final rule (69 FR 1620).

Section 91.177 Minimum Altitudes for IFR Operations

The FAA proposed to clarify § 91.177(a) by stating that the section applies to both minimum en route IFR altitudes (MEA) and minimum obstruction clearance altitudes (MOCA) for a particular route or route segment. This would permit operators using other than ground-based navigation systems that meet navigation requirements to operate along the route at the MOCA.

The commenter stated that many general aviation IFR operations are done outside of radar contact while en route, and that more approach and departure procedures are flown to and from airports in a non-radar environment. AOPA said that while en route, general aviation aircraft remain at lower altitudes and, with the approval to operate at the minimum obstruction clearance altitude (MOCA), use of minimum altitudes along airways will increase. AOPA recommended that the FAA make every effort to accommodate area navigation operations outside of radar coverage because the NPRM appeared to revoke these capabilities, not expand them.

The FAA agrees that flights may be conducted at the MOCA if communication, navigation, and surveillance requirements are met, irrespective of whether the operation is in a radar environment. ATC may decide not to clear a flight to operate at the MOCA on a particular route if ATC is concerned that a flight may not be able to meet applicable separation standards. Additionally, ATC may require a flight requesting radar advisory services to operate at the MEA as opposed to the MOCA because satisfactory communication can only be assured when operating at the MEA, not at the MOCA.

American Airlines, Air Transport Association of America, Boeing Commercial Airplanes, and Continental Airlines all commented that, instead of establishing a prescriptive value of 4 nautical miles horizontal distance from the course to be flown as the basis for identifying the highest obstacle within that space and applying the altitude value above that obstacle as the minimum altitude, the rule should also allow the use of RNP values for determining the space having the highest obstacle therein when applicable navigation performance requirements for routes are established.

The FAA did not propose to establish navigation performance requirements for certain routes. Therefore the commenters' recommendations are outside the scope of the rulemaking.

American Trans Air recommended revising the language in proposed paragraph (a)(1) to remove the words ''provided the applicable navigation signals are available'' and add a new sentence to read, ''Except when using VOR navigation, operations at MOCA beyond 22 nautical miles of the VOR concerned (based on the pilot's reasonable estimate of that distance) is not permitted.'' This change would allow other navigation without further specifying types of avionics, RNAV, GPS, etc.

The FAA does not agree with American Trans Air's suggestion. The suggestion appears to reverse the proposal and prohibit the use of navigation facilities other than VOR. The FAA believes that the suggested language could result in unsafe operations because it is essential that the applicable navigation signals for the navigation means used must be available over the route or route segment.

TAOARC recommended adding the phrase ''or when otherwise authorized by the Administrator'' to the proposed language in paragraph (a) of the proposal, but did not provide rationale; therefore, the FAA declines further consideration of this recommendation.

Section 97.1 Applicability

The FAA proposed to change § 97.1 to describe the applicability of part 97 as follows:

(1) Expand part 97 to include obstacle departure procedures;

(2) Clarify that civil takeoff weather minimums at certain airports are based on a specified route, and that pilots must comply with that route unless an alternative route has been assigned by ATC; and

(3) Minor editorial changes.

In the NPRM, the FAA referred to departure procedures generally, which includes obstacle departure procedures (ODPs) as well as non-regulatory departure procedures issued by ATC. The FAA's intention was only to include obstacle departure procedures in this rulemaking.

In addition to the comments received on § 91.175(f) (discussed above), Boeing, Airbus, and Continental Airlines stated that § 97.1(b) would not be the appropriate regulation in which to require compliance with obstacle departure procedures.

The FAA agrees with the commenters and has amended § 91.175(f) to require compliance with ODPs when applicable. (See discussion of § 91.175(f).)

Section 97.3 Symbols and Terms Used in Procedures

The FAA proposed to revise § 97.3 to organize the terms alphabetically. In addition, the FAA proposed to revise several of the terms in the section, and to add others.

The FAA received comments on the proposed definitions of ''height above touchdown (HAT),'' ''helipoint,'' ''minimum safe altitude (MSA),'' and ''visibility minimum.'' These comments, and the FAA's responses, are discussed under ''II.B. Terminology and Definitions.''

The FAA included the term ''Aircraft approach category'' in the proposed revision of § 97.3 so that the text of the section could be shown in its entirety for the convenience of the reader. The text of that definition was not different from that in the CFR at the time that the NPRM was drafted. However, in a separate rulemaking (unrelated to RNAV) on November 26, 2002 (67 FR 70828), the FAA amended the lead-in text of the definition, but inadvertently omitted the amended text from the NPRM. The FAA therefore is including the current text of ''Aircraft approach category'' in this final rule.

Section 97.10 General

The FAA proposed to remove and reserve § 97.10 because it prescribes standard instrument approach procedures ''other than those based on the criteria contained in FAA Order 8260.3, U.S. Standard for Terminal Instrument Approach Procedures (TERPS).'' The FAA proposed to remove § 97.10 because these types of approach procedures no longer exist.

American Trans Air, Continental Airlines, Boeing, ATA, and American Airlines recommended leaving the text in § 97.10, as it is currently written to allow for the development of instrument approaches based on criteria other than that stated in the U.S. TERPS.

The FAA disagrees. The sole purpose of § 97.10 was to allow procedures developed pre-TERPS to remain in effect until they came into compliance with TERPS criteria; however, the section is no longer valid. All public instrument approach procedures published are in compliance with current FAA criteria. The FAA may authorize special procedures using non-standard criteria on a case-by-case basis. These special procedures are usually for private use only and are authorized under § 91.175(a). Thus, the FAA is removing and reserving the text of § 97.10, as proposed.

Section 97.20 General

The NPRM proposed to incorporate FAA Orders 8260.3 and 8260.19 by reference into § 97.20, as well as the terminal aeronautical charts. On April 8, 2003, the FAA adopted this amendment (68 FR 16948). The incorporation by reference (IBR) of the two above-referenced orders and the aeronautical charts was in error and resulted in the inappropriate designation of certain material as regulatory. The FAA subsequently corrected this error in a final rule adopted on May 3, 2005 (70 FR 23002) that removed those FAA orders from § 97.20. Also, in that final rule, the FAA instead incorporated by reference into part 97 the information documented on FAA Forms 8260–3, 8260–4, 8260–5, and 8260–15A, which are the forms that depict instrument procedures and the associated weather takeoff minimums.

As discussed in § 91.175(f) and unless specifically excluded, this rule requires a pilot to use an ODP if such a procedure is prescribed under part 97. ODPs are depicted on form 8260–15A. This rule provides for the IBR of the ODPs on form 8260.15A in § 97.20. The Director of the Federal Register approved the IBR of the material on August 6, 2007.

IV. Rulemaking Analyses and Economic Evaluation

IV.A. Paperwork Reduction Act

The Paperwork Reduction Act of 1995 (44 U.S.C. 3507(d)) requires that the FAA consider the impact of paperwork and other information collection burdens imposed on the public. The FAA has determined that there is no current or new requirement for information collection associated with these amendments.

IV.B. International Compatibility

In keeping with U.S. obligations under the Convention on International Civil Aviation, it is FAA policy to comply with International Civil Aviation Organization (ICAO) Standards and Recommended Practices to the maximum extent practicable. The FAA has reviewed the corresponding ICAO Standards and Recommended Practices and has identified no differences with these regulations.

IV.C. Regulatory Evaluation Summary

Changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 (Pub. L. 96–354) requires agencies to analyze the economic impact of regulatory changes on small entities. Third, the Trade Agreements Act (Pub. L. 96–39) prohibits agencies from setting standards that create unnecessary obstacles to the foreign commerce of the United States. In developing U.S. standards, the Trade Act requires agencies to consider international standards and, where appropriate, that they be the basis of U.S. standards. Fourth, the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires agencies to prepare a written assessment of the costs, benefits, and other effects of proposed or final rules that include a Federal mandate likely to result in the expenditure by State, local, or tribal governments, in the aggregate, or by the private sector, of $100 million or more annually (adjusted for inflation with base year of 1995). This portion of the preamble summarizes the FAA's analysis of the economic impacts of this final rule.

Department of Transportation Order DOT 2100.5 prescribes policies and procedures for simplification, analysis, and review of regulations. If the expected cost impact is so minimal that a proposed or final rule does not warrant a full evaluation, this order permits that a statement to that effect, and the basis for it, be included in the preamble if a full regulatory evaluation of the cost and benefits is not prepared. Such a determination has been made for this final rule.

The final rule will impose minimal costs on aircraft operators because it does not require changes to current navigation systems. Cost savings may result because the rule will enable the use of advanced RNAV navigation routes the FAA has been developing. These routes are typically more direct and shorter than current Federal airways and jet routes and therefore may result in less fuel and time for aircraft to reach their destinations.

The FAA has, therefore, determined that this final rule is not a ''significant regulatory action'' as defined in section 3(f) of Executive Order 12866, and is not ''significant'' as defined in DOT's Regulatory Policies and Procedures.

IV.D. Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (Pub. L. 96–354) (RFA) establishes ''as a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of the businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration.'' The RFA covers a wide-range of small entities, including small businesses, not-for-profit organizations, and small governmental jurisdictions.

Agencies must perform a review to determine whether a rule will have a significant economic impact on a substantial number of small entities. If the agency determines that it will, the agency must prepare a regulatory flexibility analysis as described in the RFA. However, if an agency determines that a rule is not expected to have a significant economic impact on a substantial number of small entities, section 605(b) of the RFA provides that the head of the agency may so certify and a regulatory flexibility analysis is not required. The certification must include a statement providing the factual basis for this determination, and the reasoning should be clear.

This rule is definitionally clarifying, incorporates existing orders, and provides cost saving as it enables more direct routes requiring less time and fuel. Therefore, as the FAA Administrator, I certify that this rule will not have a significant economic impact on a substantial number of small entities.

IV.E. International Trade Impact Assessment

The Trade Agreements Act of 1979 (Pub. L. 96–39) prohibits Federal agencies from establishing any standards or engaging in related activities that create unnecessary obstacles to the foreign commerce of the United States. Legitimate domestic objectives, such as safety, are not considered unnecessary obstacles. The statute also requires consideration of international standards and, where appropriate, that they be the basis for U.S. standards. The FAA has assessed the potential effect of this final rule and has determined that it will impose the same costs on domestic and international entities and thus has a neutral affect on international trade.

IV.F. Unfunded Mandate Assessment

Title II of the Unfunded Mandates Reform Act of 1995 (Pub. L. 104–4) requires each Federal agency to prepare a written statement assessing the effects of any Federal mandate in a proposed or final agency rule that may result in an expenditure of $100 million or more (adjusted annually for inflation with the base year 1995) in any one year by State, local, and tribal governments, in the aggregate, or by the private sector; such a mandate is deemed to be a ''significant regulatory action.'' The FAA currently uses an inflation-adjusted value of $128.1 million in lieu of $100 million. This final rule does not contain such a mandate.

IV.G. Executive Order 13132, Federalism

The FAA has analyzed this final rule under the principles and criteria of Executive Order 13132, Federalism. The FAA has determined that this action will not have a substantial direct effect on the States, or the relationship between the national Government and the States, or on the distribution of power and responsibilities among the various levels of government, and therefore does not have federalism implications.

IV.H. Environmental Analysis

FAA Order 1050.1E identifies FAA actions that are categorically excluded from preparation of an environmental assessment or environmental impact statement under the National Environmental Policy Act (NEPA) in the absence of extraordinary circumstances. The FAA has determined this rulemaking action qualifies for the categorical exclusion identified in paragraph 312f and involves no extraordinary circumstances.

IV.I. Regulations That Significantly Affect Energy Supply, Distribution, or Use

The FAA has analyzed this final rule under Executive Order 13211, Actions Concerning Regulations that Significantly Affect Energy Supply, Distribution, or Use (May 18, 2001). The

FAA has determined that it is not a ''significant energy action'' under the executive order because it is not a ''significant regulatory action'' under Executive Order 12866, and it is not likely to have a significant adverse effect on the supply, distribution, or use of energy.

V. Availability of Rulemaking Documents

You can get an electronic copy of rulemaking documents using the Internet by—

1. Searching the Department of Transportation's electronic Docket Management System (DMS) Web page (*http://dms.dot.gov/search*);

2. Visiting the FAA's Regulations and Policies Web page at *http://www.faa.gov/regulations_policies/*; or

3. Accessing the Government Printing Office's Web page at *http://www.gpoaccess.gov/fr/index.html.*

You can also get a copy by sending a request to the Federal Aviation Administration, Office of Rulemaking, ARM–1, 800 Independence Avenue, SW., Washington, DC 20591, or by calling (202) 267–9680. Be sure to identify the amendment number or docket number of this rulemaking.

Anyone is able to search the electronic form of all comments received into any of our dockets by the name of the individual submitting the comment (or signing the comment, if submitted on behalf of an association, business, labor union, etc.). You may review DOT's complete Privacy Act statement in the **Federal Register** published on April 11, 2000 (Volume 65, Number 70; Pages 19477–78) or you may visit *http://dms.dot.gov.*

VI. Small Business Regulatory Enforcement Fairness Act

The Small Business Regulatory Enforcement Fairness Act (SBREFA) of 1996 requires FAA to comply with small entity requests for information or advice about compliance with statutes and regulations within its jurisdiction. If you are a small entity and you have a question regarding this document, you may contact your local FAA official, or the person listed under the **FOR FURTHER INFORMATION CONTACT** heading at the beginning of the preamble. You can find out more about SBREFA on the Internet at *http://www.faa.gov/regulations_policies/rulemaking/sbre_act/*.

List of Subjects

14 CFR Part 1

Air transportation.

14 CFR Part 91

Agriculture, Air traffic control, Aircraft, Airmen, Airports, Aviation safety, Freight, Noise control, Reporting and recordkeeping requirements.

14 CFR Part 97

Air traffic control, Airports, Incorporation by Reference, Navigation (air), Weather.

14 CFR Part 121

Air carriers, Aircraft, Airmen, Aviation safety, Charter flights, Reporting and recordkeeping requirements, Safety, Transportation.

14 CFR Part 125

Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements.

14 CFR Part 129

Air carriers, Aircraft, Aviation safety, Reporting and recordkeeping requirements, Security.

14 CFR Part 135

Air taxis, Aircraft, Airmen, Aviation safety, Reporting and recordkeeping requirements.

The Amendments

■ In consideration of the foregoing, the Federal Administration Aviation amends chapter I of 14 CFR as follows:

PART 1—DEFINITIONS AND ABBREVIATIONS

■ 1. The authority citation for part 1 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701.

■ 2. Amend § 1.1 as follows:
■ a. Remove the definitions of ''Decision height'' and ''Minimum descent altitude''.
■ b. Add definitions for ''Decision altitude (DA)'', ''Decision height (DH)'', ''Final approach fix (FAF)'', ''Instrument approach procedure (IAP)'', ''Minimum descent altitude (MDA)'', and ''Suitable RNAV system'' in alphabetical order to read as set forth below.

§ 1.1 General definitions.

* * * * *

Decision altitude (DA) is a specified altitude in an instrument approach procedure at which the pilot must decide whether to initiate an immediate missed approach if the pilot does not see the required visual reference, or to continue the approach. Decision altitude is expressed in feet above mean sea level.

Decision height (DH) is a specified height above the ground in an instrument approach procedure at which the pilot must decide whether to initiate an immediate missed approach if the pilot does not see the required visual reference, or to continue the approach. Decision height is expressed in feet above ground level.

Final approach fix (FAF) defines the beginning of the final approach segment and the point where final segment descent may begin.

* * * * *

Instrument approach procedure (IAP) is a series of predetermined maneuvers by reference to flight instruments with specified protection from obstacles and assurance of navigation signal reception capability. It begins from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point:

(1) From which a landing can be completed; or

(2) If a landing is not completed, to a position at which holding or en route obstacle clearance criteria apply.

* * * * *

Minimum descent altitude (MDA) is the lowest altitude specified in an instrument approach procedure, expressed in feet above mean sea level, to which descent is authorized on final approach or during circle-to-land maneuvering until the pilot sees the required visual references for the heliport or runway of intended landing.

* * * * *

Suitable RNAV system is an RNAV system that meets the required performance established for a type of operation, e.g. IFR; and is suitable for operation over the route to be flown in terms of any performance criteria (including accuracy) established by the air navigation service provider for certain routes (e.g. oceanic, ATS routes, and IAPs). An RNAV system's suitability is dependent upon the availability of ground and/or satellite navigation aids that are needed to meet any route performance criteria that may be prescribed in route specifications to navigate the aircraft along the route to be flown. Information on suitable RNAV systems is published in FAA guidance material.

* * * * *

■ 3. Amend § 1.2 by adding the abbreviations ''NM'' and ''RNAV'' in alphabetical order to read as follows:

§ 1.2 Abbreviations and symbols.

* * * * *

NM means nautical mile.

* * * * *

RNAV means area navigation.

* * * * *

PART 91—GENERAL OPERATING AND FLIGHT RULES

■ 4. The authority citation for part 91 continues to read as follows:

Authority: 49 U.S.C. 106(g), 1155, 40103, 40113, 40120, 44101, 44111, 44701, 44704, 44709, 44711, 44712, 44715, 44716, 44717, 44722, 46306, 46315, 46316, 46504, 46506–46507, 47122, 47508, 47528–47531, articles 12 and 29 of the Convention on International Civil Aviation (61 stat. 1180).

■ 5. Amend § 91.129 by revising paragraph (e) to read as follows:

§ 91.129 Operations in Class D airspace.

* * * * *

(e) *Minimum altitudes when operating to an airport in Class D airspace.* (1) Unless required by the applicable distance-from-cloud criteria, each pilot operating a large or turbine-powered airplane must enter the traffic pattern at an altitude of at least 1,500 feet above the elevation of the airport and maintain at least 1,500 feet until further descent is required for a safe landing.

(2) Each pilot operating a large or turbine-powered airplane approaching to land on a runway served by an instrument approach procedure with vertical guidance, if the airplane is so equipped, must:

(i) Operate that airplane at an altitude at or above the glide path between the published final approach fix and the decision altitude (DA), or decision height (DH), as applicable; or

(ii) If compliance with the applicable distance-from-cloud criteria requires glide path interception closer in, operate that airplane at or above the glide path, between the point of interception of glide path and the DA or the DH.

(3) Each pilot operating an airplane approaching to land on a runway served by a visual approach slope indicator must maintain an altitude at or above the glide path until a lower altitude is necessary for a safe landing.

(4) Paragraphs (e)(2) and (e)(3) of this section do not prohibit normal bracketing maneuvers above or below the glide path that are conducted for the purpose of remaining on the glide path.

* * * * *

■ 6. Amend § 91.131 by revising paragraph (c)(1) to read as follows:

§ 91.131 Operations in Class B airspace.

* * * * *

(c) * * *

(1) *For IFR operation.* An operable VOR or TACAN receiver or an operable and suitable RNAV system; and

* * * * *

■ 7. Amend § 91.175 by revising paragraphs (a), (b), (c) introductory text, (e)(1)(ii), (f), and (k) to read as follows:

§ 91.175 Takeoff and landing under IFR.

(a) *Instrument approaches to civil airports.* Unless otherwise authorized by the FAA, when it is necessary to use an instrument approach to a civil airport, each person operating an aircraft must use a standard instrument approach procedure prescribed in part 97 of this chapter for that airport. This paragraph does not apply to United States military aircraft.

(b) *Authorized DA/DH or MDA.* For the purpose of this section, when the approach procedure being used provides for and requires the use of a DA/DH or MDA, the authorized DA/DH or MDA is the highest of the following:

(1) The DA/DH or MDA prescribed by the approach procedure.

(2) The DA/DH or MDA prescribed for the pilot in command.

(3) The DA/DH or MDA appropriate for the aircraft equipment available and used during the approach.

(c) *Operation below DA/ DH or MDA.* Except as provided in paragraph (l) of this section, where a DA/DH or MDA is applicable, no pilot may operate an aircraft, except a military aircraft of the United States, below the authorized MDA or continue an approach below the authorized DA/DH unless—

* * * * *

(e) * * *

(1) * * *

(ii) Upon arrival at the missed approach point, including a DA/DH where a DA/DH is specified and its use is required, and at any time after that until touchdown.

* * * * *

(f) *Civil airport takeoff minimums.* This paragraph applies to persons operating an aircraft under part 121, 125, 129, or 135 of this chapter.

(1) Unless otherwise authorized by the FAA, no pilot may takeoff from a civil airport under IFR unless the weather conditions at time of takeoff are at or above the weather minimums for IFR takeoff prescribed for that airport under part 97 of this chapter.

(2) If takeoff weather minimums are not prescribed under part 97 of this chapter for a particular airport, the following weather minimums apply to takeoffs under IFR:

(i) For aircraft, other than helicopters, having two engines or less—1 statute mile visibility.

(ii) For aircraft having more than two engines—½ statute mile visibility.

(iii) For helicopters—½ statute mile visibility.

(3) Except as provided in paragraph (f)(4) of this section, no pilot may takeoff under IFR from a civil airport having published obstacle departure procedures (ODPs) under part 97 of this chapter for the takeoff runway to be used, unless the pilot uses such ODPs.

(4) Notwithstanding the requirements of paragraph (f)(3) of this section, no pilot may takeoff from an airport under IFR unless:

(i) For part 121 and part 135 operators, the pilot uses a takeoff obstacle clearance or avoidance procedure that ensures compliance with the applicable airplane performance operating limitations requirements under part 121, subpart I or part 135, subpart I for takeoff at that airport; or

(ii) For part 129 operators, the pilot uses a takeoff obstacle clearance or avoidance procedure that ensures compliance with the airplane performance operating limitations prescribed by the State of the operator for takeoff at that airport.

* * * * *

(k) *ILS components.* The basic components of an ILS are the localizer, glide slope, and outer marker, and, when installed for use with Category II or Category III instrument approach procedures, an inner marker. The following means may be used to substitute for the outer marker: Compass locator; precision approach radar (PAR) or airport surveillance radar (ASR); DME, VOR, or nondirectional beacon fixes authorized in the standard instrument approach procedure; or a suitable RNAV system in conjunction with a fix identified in the standard instrument approach procedure. Applicability of, and substitution for, the inner marker for a Category II or III approach is determined by the appropriate 14 CFR part 97 approach procedure, letter of authorization, or operations specifications issued to an operator.

* * * * *

■ 8. Amend § 91.177 by revising paragraph (a) to read as follows:

§ 91.177 Minimum altitudes for IFR operations.

(a) *Operation of aircraft at minimum altitudes.* Except when necessary for takeoff or landing, no person may operate an aircraft under IFR below—

(1) The applicable minimum altitudes prescribed in parts 95 and 97 of this chapter. However, if both a MEA and a MOCA are prescribed for a particular route or route segment, a person may operate an aircraft below the MEA down to, but not below, the MOCA, provided the applicable navigation signals are available. For aircraft using VOR for navigation, this applies only when the aircraft is within 22 nautical miles of that VOR (based on the reasonable

estimate by the pilot operating the aircraft of that distance); or

(2) If no applicable minimum altitude is prescribed in parts 95 and 97 of this chapter, then—

(i) In the case of operations over an area designated as a mountainous area in part 95 of this chapter, an altitude of 2,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown; or

(ii) In any other case, an altitude of 1,000 feet above the highest obstacle within a horizontal distance of 4 nautical miles from the course to be flown.

* * * * *

■ 9. Amend § 91.179 by adding introductory text to read as follows:

§ 91.179 IFR cruising altitude or flight level.

Unless otherwise authorized by ATC, the following rules apply—

* * * * *

§ 91.181 [Amended]

■ 10. Amend § 91.181 by removing the words ''a Federal airway'' and adding in their place the words ''an ATS route'' in paragraph (a).

■ 11. Amend § 91.183 by revising the heading and the introductory text to read as follows:

§ 91.183 IFR communications.

Unless otherwise authorized by ATC, the pilot in command of each aircraft operated under IFR in controlled airspace must ensure that a continuous watch is maintained on the appropriate frequency and must report the following as soon as possible—

* * * * *

§ 91.189 [Amended]

■ 12. Amend § 91.189 (c) and (d) by removing the term ''DH'' and adding in its place the term ''DA/DH'' wherever it appears.

■ 13. Amend § 91.205 by revising paragraphs (d)(2) and (e) to read as follows:

§ 91.205 Powered civil aircraft with standard category U.S. airworthiness certificates: Instrument and equipment requirements.

* * * * *

(d) * * *

(2) Two-way radio communication and navigation equipment suitable for the route to be flown.

* * * * *

(e) *Flight at and above 24,000 feet MSL (FL 240).* If VOR navigation equipment is required under paragraph (d)(2) of this section, no person may operate a U.S.-registered civil aircraft within the 50 states and the District of Columbia at or above FL 240 unless that aircraft is equipped with approved DME or a suitable RNAV system. When the DME or RNAV system required by this paragraph fails at and above FL 240, the pilot in command of the aircraft must notify ATC immediately, and then may continue operations at and above FL 240 to the next airport of intended landing where repairs or replacement of the equipment can be made.

* * * * *

§ 91.219 [Amended]

■ 14. Amend § 91.219 (b)(5) by removing the term ''DH'' and adding in its place the term ''DA/DH''.

■ 15. Amend 91.511 by revising the heading and paragraph (a)(1) introductory text to read as follows:

§ 91.511 Communication and navigation equipment for overwater operations.

(a) * * *

(1) Radio communication equipment appropriate to the facilities to be used and able to transmit to, and receive from, at least one communication facility from any place along the route:

* * * * *

■ 16. Amend § 91.711 by revising paragraphs (c)(1)(ii) and (e) introductory text to read as follows:

§ 91.711 Special rules for foreign civil aircraft.

* * * * *

(c) * * *

(1) * * *

(ii) Navigation equipment suitable for the route to be flown.

* * * * *

(e) *Flight at and above FL 240.* If VOR navigation equipment is required under paragraph (c)(1)(ii) of this section, no person may operate a foreign civil aircraft within the 50 States and the District of Columbia at or above FL 240, unless the aircraft is equipped with approved DME or a suitable RNAV system. When the DME or RNAV system required by this paragraph fails at and above FL 240, the pilot in command of the aircraft must notify ATC immediately and may then continue operations at and above FL 240 to the next airport of intended landing where repairs or replacement of the equipment can be made. A foreign civil aircraft may be operated within the 50 States and the District of Columbia at or above FL 240 without DME or an RNAV system when operated for the following purposes, and ATC is notified before each takeoff:

* * * * *

PART 97—STANDARD INSTRUMENT PROCEDURES

■ 17. The authority citation for part 97 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40103, 40106, 40113, 40114, 40120, 44502, 44514, 44701, 44719, and 44721–44722.

■ 18. Revise the heading for part 97 to read as set forth above.

■ 19. Revise § 97.1 to read as follows:

§ 97.1 Applicability.

(a) This part prescribes standard instrument approach procedures to civil airports in the United States and the weather minimums that apply to landings under IFR at those airports.

(b) This part also prescribes obstacle departure procedures (ODPs) for certain civil airports in the United States and the weather minimums that apply to takeoffs under IFR at civil airports in the United States.

■ 20. Revise § 97.3 to read as follows:

§ 97.3 Symbols and terms used in procedures.

As used in the standard instrument procedures prescribed in this part—

Aircraft approach category means a grouping of aircraft based on a speed of VREF, if specified, or if VREF is not specified, 1.3 V_{so} at the maximum certificated landing weight. VREF, V_{so}, and the maximum certificated landing weight are those values as established for the aircraft by the certification authority of the country of registry. The categories are as follows—

(1) Category A: Speed less than 91 knots.

(2) Category B: Speed 91 knots or more but less than 121 knots.

(3) Category C: Speed 121 knots or more but less than 141 knots.

(4) Category D: Speed 141 knots or more but less than 166 knots.

(5) Category E: Speed 166 knots or more.

Approach procedure segments for which altitudes (minimum altitudes, unless otherwise specified) and paths are prescribed in procedures, are as follows—

(1) Initial approach is the segment between the initial approach fix and the intermediate fix or the point where the aircraft is established on the intermediate course or final approach course.

(2) Initial approach altitude is the altitude (or altitudes, in high altitude procedure) prescribed for the initial

approach segment of an instrument approach.

(3) Intermediate approach is the segment between the intermediate fix or point and the final approach fix.

(4) Final approach is the segment between the final approach fix or point and the runway, airport, or missed approach point.

(5) Missed approach is the segment between the missed approach point, or point of arrival at decision altitude or decision height (DA/DH), and the missed approach fix at the prescribed altitude.

Ceiling means the minimum ceiling, expressed in feet above the airport elevation, required for takeoff or required for designating an airport as an alternate airport.

Copter procedures means helicopter procedures, with applicable minimums as prescribed in § 97.35. Helicopters may also use other procedures prescribed in subpart C of this part and may use the Category A minimum descent altitude (MDA), or decision altitude or decision height (DA/DH). For other than ''copter-only'' approaches, the required visibility minimum for Category I approaches may be reduced to one-half the published visibility minimum for Category A aircraft, but in no case may it be reduced to less than one-quarter mile prevailing visibility, or, if reported, 1,200 feet RVR. Reduction of visibility minima on Category II instrument approach procedures is prohibited.

FAF means final approach fix.

HAA means height above airport and is expressed in feet.

HAL means height above landing and is the height of the DA/MDA above a designated helicopter landing area elevation used for helicopter instrument approach procedures and is expressed in feet.

HAS means height above the surface and is the height of the DA/MDA above the highest terrain/surface within a 5,200-foot radius of the missed approach point used in helicopter instrument approach procedures and is expressed in feet above ground level (AGL).

HAT means height above touchdown.

HCH means helipoint crossing height and is the computed height of the vertical guidance path above the helipoint elevation at the helipoint expressed in feet.

Helipoint means the aiming point for the final approach course. It is normally the center point of the touchdown and lift-off area (TLOF).

Hold in lieu of PT means a holding pattern established under applicable FAA criteria, and used in lieu of a procedure turn to execute a course reversal.

MAP means missed approach point.

More than 65 knots means an aircraft that has a stalling speed of more than 65 knots (as established in an approved flight manual) at maximum certificated landing weight with full flaps, landing gear extended, and power off.

MSA means minimum safe altitude, expressed in feet above mean sea level, depicted on an approach chart that provides at least 1,000 feet of obstacle clearance for emergency use within a certain distance from the specified navigation facility or fix.

NA means not authorized.

NOPT means no procedure turn required. Altitude prescribed applies only if procedure turn is not executed.

Procedure turn means the maneuver prescribed when it is necessary to reverse direction to establish the aircraft on an intermediate or final approach course. The outbound course, direction of turn, distance within which the turn must be completed, and minimum altitude are specified in the procedure. However, the point at which the turn may be begun, and the type and rate of turn, is left to the discretion of the pilot.

RA means radio altimeter setting height.

RVV means runway visibility value.

SIAP means standard instrument approach procedure.

65 knots or less means an aircraft that has a stalling speed of 65 knots or less (as established in an approved flight manual) at maximum certificated landing weight with full flaps, landing gear extended, and power off.

T means nonstandard takeoff minimums or specified departure routes/procedures or both.

TDZ means touchdown zone.

Visibility minimum means the minimum visibility specified for approach, landing, or takeoff, expressed in statute miles, or in feet where RVR is reported.

■ 21. Amend § 97.5 by revising the heading and paragraph (a) to read as follows:

§ 97.5 Bearings, courses, tracks, headings, radials, miles.

(a) All bearings, courses, tracks, headings, and radials in this part are magnetic, unless otherwise designated.

* * * * *

§ 97.10 [Removed and reserved]

■ 22. Remove and reserve § 97.10.

■ 23. Revise § 97.20 to read as follows:

§ 97.20 General.

(a) This subpart prescribes standard instrument approach procedures and takeoff minimums and obstacle departure procedures (ODPs) based on the criteria contained in FAA Order 8260.3, U.S. Standard for Terminal Instrument Procedures (TERPs), and other related Orders in the 8260 series that also address instrument procedure design criteria.

(b) Standard instrument approach procedures and associated supporting data adopted by the FAA are documented on FAA Forms 8260–3, 8260–4, 8260–5. Takeoff minimums and obstacle departure procedures (ODPs) are documented on FAA Form 8260–15A. These forms are incorporated by reference. The Director of the Federal Register approved this incorporation by reference pursuant to 5 U.S.C. 552(a) and 1 CFR part 51. The standard instrument approach procedures and takeoff minimums and obstacle departure procedures (ODPs) are available for examination at the FAA's Rules Docket (AGC–200) and at the National Flight Data Center, 800 Independence Avenue, SW., Washington, DC 20590, or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202–741–6030, or go to *http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html*.

(c) Standard instrument approach procedures and takeoff minimums and obstacle departure procedures (ODPs) are depicted on aeronautical charts published by the FAA National Aeronautical Charting Office. These charts are available for purchase from the FAA's National Aeronautical Charting Office, Distribution Division, 6303 Ivy Lane, Suite 400, Greenbelt, MD 20770.

PART 121—OPERATING REQUIREMENTS: DOMESTIC, FLAG, AND SUPPLEMENTAL OPERATIONS

■ 24. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. 106(g), 1153, 40101, 40102, 40103, 40113, 41721, 44105, 44106, 44111, 44701–44717, 44722, 44901, 44903, 44904, 44906, 44912, 44914, 44936, 44938, 46103, 46105.

■ 25. Amend § 121.99 by revising paragraphs (a) and (b) to read as follows:

§ 121.99 Communications facilities—domestic and flag operations.

(a) Each certificate holder conducting domestic or flag operations must show that a two-way communication system, or other means of communication approved by the FAA certificate holding district office, is available over the entire route. The communications may be direct links or via an approved communication link that will provide reliable and rapid communications under normal operating conditions between each airplane and the appropriate dispatch office, and between each airplane and the appropriate air traffic control unit.

(b) Except in an emergency, for all flag and domestic kinds of operations, the communications systems between each airplane and the dispatch office must be independent of any system operated by the United States.

* * * * *

■ 26. Revise § 121.103 to read as follows:

§ 121.103 En route navigation facilities.

(a) Except as provided in paragraph (b) of this section, each certificate holder conducting domestic or flag operations must show, for each proposed route (including to any regular, provisional, refueling or alternate airports), that suitable navigation aids are available to navigate the airplane along the route within the degree of accuracy required for ATC. Navigation aids required for approval of routes outside of controlled airspace are listed in the certificate holder's operations specifications except for those aids required for routes to alternate airports.

(b) Navigation aids are not required for any of the following operations—

(1) Day VFR operations that the certificate holder shows can be conducted safely by pilotage because of the characteristics of the terrain;

(2) Night VFR operations on routes that the certificate holder shows have reliably lighted landmarks adequate for safe operation; and

(3) Other operations approved by the certificate holding district office.

■ 27. Revise § 121.121 to read as follows:

§ 121.121 En route navigation facilities.

(a) Except as provided in paragraph (b) of this section, no certificate holder conducting supplemental operations may conduct any operation over a route (including to any destination, refueling or alternate airports) unless suitable navigation aids are available to navigate the airplane along the route within the degree of accuracy required for ATC. Navigation aids required for routes outside of controlled airspace are listed in the certificate holder's operations specifications except for those aids required for routes to alternate airports.

(b) Navigation aids are not required for any of the following operations—

(1) Day VFR operations that the certificate holder shows can be conducted safely by pilotage because of the characteristics of the terrain;

(2) Night VFR operations on routes that the certificate holder shows have reliably lighted landmarks adequate for safe operation; and

(3) Other operations approved by the certificate holding district office.

■ 28. Amend § 121.347 by revising the heading, paragraphs (a) introductory text, (a)(1), (a)(2), and (b) to read as follows:

§ 121.347 Communication and navigation equipment for operations under VFR over routes navigated by pilotage.

(a) No person may operate an airplane under VFR over routes that can be navigated by pilotage unless the airplane is equipped with the radio communication equipment necessary under normal operating conditions to fulfill the following:

(1) Communicate with at least one appropriate station from any point on the route;

(2) Communicate with appropriate air traffic control facilities from any point within Class B, Class C, or Class D airspace, or within a Class E surface area designated for an airport in which flights are intended; and

* * * * *

(b) No person may operate an airplane at night under VFR over routes that can be navigated by pilotage unless that airplane is equipped with—

(1) Radio communication equipment necessary under normal operating conditions to fulfill the functions specified in paragraph (a) of this section; and

(2) Navigation equipment suitable for the route to be flown.

■ 29. Revise § 121.349 to read as follows:

§ 121.349 Communication and navigation equipment for operations under VFR over routes not navigated by pilotage or for operations under IFR or over the top.

(a) *Navigation equipment requirements—General.* No person may conduct operations under VFR over routes that cannot be navigated by pilotage, or operations conducted under IFR or over the top, unless—

(1) The en route navigation aids necessary for navigating the airplane along the route (e.g., ATS routes, arrival and departure routes, and instrument approach procedures, including missed approach procedures if a missed approach routing is specified in the procedure) are available and suitable for use by the aircraft navigation systems required by this section;

(2) The airplane used in those operations is equipped with at least—

(i) Except as provided in paragraph (c) of this section, two approved independent navigation systems suitable for navigating the airplane along the route to be flown within the degree of accuracy required for ATC;

(ii) One marker beacon receiver providing visual and aural signals; and

(iii) One ILS receiver; and

(3) Any RNAV system used to meet the navigation equipment requirements of this section is authorized in the certificate holder's operations specifications.

(b) *Communication equipment requirements.* No person may operate an airplane under VFR over routes that cannot be navigated by pilotage, and no person may operate an airplane under IFR or over the top, unless the airplane is equipped with—

(1) At least two independent communication systems necessary under normal operating conditions to fulfill the functions specified in § 121.347 (a); and

(2) At least one of the communication systems required by paragraph (b)(1) of this section must have two-way voice communication capability.

(c) *Use of a single independent navigation system for operations under VFR over routes that cannot be navigated by pilotage, or operations conducted under IFR or over the top.* Notwithstanding the requirements of paragraph (a)(2)(i) of this section, the airplane may be equipped with a single independent navigation system suitable for navigating the airplane along the route to be flown within the degree of accuracy required for ATC if:

(1) It can be shown that the airplane is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single independent navigation system permitted by this paragraph at any point along the route, for proceeding safely to a suitable airport and completing an instrument approach; and

(2) The airplane has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(d) *Use of VOR navigation equipment.* If VOR navigation equipment is used to comply with paragraph (a) or (c) of this section, no person may operate an airplane unless it is equipped with at least one approved DME or suitable RNAV system.

(e) *Additional communication system equipment requirements for operators subject to § 121.2.* In addition to the requirements in paragraph (b) of this section, no person may operate an airplane having a passenger seat configuration of 10 to 30 seats, excluding each crewmember seat, and a maximum payload capacity of 7,500 pounds or less, under IFR, over the top, or in extended over-water operations unless it is equipped with at least—

(1) Two microphones; and

(2) Two headsets, or one headset and one speaker.

■ 30. Amend § 121.351 by revising the heading and paragraphs (a) and (c)(1) to read as follows:

§ 121.351 Communication and navigation equipment for extended over-water operations and for certain other operations.

(a) Except as provided in paragraph (c) of this section, no person may conduct an extended over-water operation unless the airplane is equipped with at least two independent long-range navigation systems and at least two independent long-range communication systems necessary under normal operating conditions to fulfill the following functions—

(1) Communicate with at least one appropriate station from any point on the route;

(2) Receive meteorological information from any point on the route by either of two independent communication systems. One of the communication systems used to comply with this paragraph may be used to comply with paragraphs (a)(1) and (a)(3) of this section; and

(3) At least one of the communication systems must have two-way voice communication capability.

* * * * *

(c) * * *

(1) The ability of the flightcrew to navigate the airplane along the route within the degree of accuracy required for ATC,

* * * * *

§ 121.419 [Amended]

■ 31. Amend § 121.419 (a)(1)(vii) by removing the term ''DH'' and adding in its place the term ''DA/DH''.

§ 121.559 [Amended]

■ 32. Amend § 121.559 (c) by removing the words ''ground radio station'' and adding in their place the words ''communication facility''.

■ 33. Amend § 121.561 by revising the heading as set forth below and by amending paragraph (a) by removing the words ''ground or navigational facility'' and adding in their place the words ''ground facility or navigation aid''.

§ 121.561 Reporting potentially hazardous meteorological conditions and irregularities of ground facilities or navigation aids.

* * * * *

§ 121.565 [Amended]

■ 34. Amend § 121.565 (c) by removing the words ''ground radio station'' and adding in their place the words ''communication facility'' and by removing the word ''station'' and adding in its place the word ''facility''.

§ 121.579 [Amended]

■ 35. Amend § 121.579 (b) introductory text by removing the words ''decision height'' and adding in their place the term ''DA/DH''.

§ 121.651 [Amended]

■ 36. Amend § 121.651 by replacing the term ''DH'' with the term ''DA/DH'' wherever it appears in paragraphs (c) and (d).

§ 121.652 [Amended]

■ 37. Amend § 121.652 (a) by removing the term ''DH'' and adding in its place the term ''DA/DH''.

PART 125—CERTIFICATION AND OPERATIONS: AIRPLANES HAVING A SEATING CAPACITY OF 20 OR MORE PASSENGERS OR A MAXIMUM PAYLOAD CAPACITY OF 6,000 POUNDS OR MORE; AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 38. The authority citation for part 125 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44705, 44710–44711, 44713, 44716–44717, 44722.

■ 39. Revise § 125.51 to read as follows:

§ 125.51 En route navigation facilities.

(a) Except as provided in paragraph (b) of this section, no certificate holder may conduct any operation over a route (including to any destination, refueling or alternate airports) unless suitable navigation aids are available over the route to navigate the airplane along the route within the degree of accuracy required for ATC. Navigation aids required for routes outside of controlled airspace are listed in the certificate holder's operations specifications except for those aids required for routes to alternate airports.

(b) Navigation aids are not required for any of the following operations—

(1) Day VFR operations that the certificate holder shows can be conducted safely by pilotage because of the characteristics of the terrain;

(2) Night VFR operations on routes that the certificate holder shows have reliably lighted landmarks adequate for safe operations; and

(3) Other operations approved by the certificate holding district office.

■ 40. Revise § 125.203 to read as follows:

§ 125.203 Communication and navigation equipment.

(a) *Communication equipment—general.* No person may operate an airplane unless it has two-way radio communication equipment able, at least in flight, to transmit to, and receive from, appropriate facilities 22 nautical miles away.

(b) *Navigation equipment for operations over the top.* No person may operate an airplane over the top unless it has navigation equipment suitable for the route to be flown.

(c) *Communication and navigation equipment for IFR or extended over-water operations—General.* Except as provided in paragraph (f) of this section, no person may operate an airplane carrying passengers under IFR or in extended over-water operations unless—

(1) The en route navigation aids necessary for navigating the airplane along the route (e.g., ATS routes, arrival and departure routes, and instrument approach procedures, including missed approach procedures if a missed approach routing is specified in the procedure) are available and suitable for use by the aircraft navigation systems required by this section;

(2) The airplane used in those operations is equipped with at least the following equipment—

(i) Except as provided in paragraph (d) of this section, two approved independent navigation systems suitable for navigating the airplane along the route within the degree of accuracy required for ATC;

(ii) One marker beacon receiver providing visual and aural signals;

(iii) One ILS receiver;

(iv) Two transmitters;

(v) Two microphones;

(vi) Two headsets or one headset and one speaker; and

(vii) Two independent communication systems, one of which must have two-way voice communication capability, capable of transmitting to, and receiving from, at least one appropriate facility from any place on the route to be flown; and

(3) Any RNAV system used to meet the navigation equipment requirements of this section is authorized in the certificate holder's operations specifications.

(d) *Use of a single independent navigation system for operations under IFR—not for extended overwater operations.* Notwithstanding the requirements of paragraph (c)(2)(i) of this section, the airplane may be equipped with a single independent navigation system suitable for navigating the airplane along the route to be flown within the degree of accuracy required for ATC if—

(1) It can be shown that the airplane is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single independent navigation system permitted by this paragraph at any point along the route, for proceeding safely to a suitable airport and completing an instrument approach; and

(2) The airplane has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(e) *Use of VOR navigation equipment.* If VOR navigation equipment is required by paragraph (c) or (d) of this section, no person may operate an airplane unless it is equipped with at least one approved DME or a suitable RNAV system.

(f) *Extended over-water operations.* Notwithstanding the requirements of paragraph (c) of this section, installation and use of a single long-range navigation system and a single long-range communication system for extended over-water operations in certain geographic areas may be authorized by the Administrator and approved in the certificate holder's operations specifications. The following are among the operational factors the Administrator may consider in granting an authorization:

(1) The ability of the flight crew to navigate the airplane along the route to be flown within the degree of accuracy required for ATC;

(2) The length of the route being flown; and

(3) The duration of the very high frequency communications gap.

■ 41. Amend § 125.321 by revising the heading to read as set forth below and by removing the words ''ground or navigational facility'' and adding in their place the words ''ground facility or navigation aid''.

§ 125.321 Reporting potentially hazardous meteorological conditions and irregularities of ground facilities or navigation aids.

* * * * *

§ 125.379 [Amended]

■ 42. Amend § 125.379 (a) by removing the term ''DH'' wherever it appears and adding in its place the term ''DA/DH''.

§ 125.381 [Amended]

■ 43. Amend § 125.381 (c)(2) by revising the reference to ''DH'' to read ''DA/DH''.

PART 129—OPERATIONS: FOREIGN AIR CARRIERS AND FOREIGN OPERATORS OF U.S.-REGISTERED AIRCRAFT ENGAGED IN COMMON CARRIAGE

■ 44. The authority citation for part 129 continues to read as follows:

Authority: 49 U.S.C. 1372, 40113, 40119, 44101, 44701–44702, 44705, 44709–44711, 44713, 44716–44717, 44722, 44901–44904, 44906, 44912, 46105, Pub. L. 107–71 sec.

■ 45. Revise § 129.17 to read as follows:

§ 129.17 Aircraft communication and navigation equipment for operations under IFR or over the top.

(a) *Aircraft navigation equipment requirements—General.* No foreign air carrier may conduct operations under IFR or over the top unless—

(1) The en route navigation aids necessary for navigating the aircraft along the route (e.g., ATS routes, arrival and departure routes, and instrument approach procedures, including missed approach procedures if a missed approach routing is specified in the procedure) are available and suitable for use by the aircraft navigation equipment required by this section;

(2) The aircraft used in those operations is equipped with at least the following—

(i) Except as provided in paragraph (c) of this section, two approved independent navigation systems suitable for navigating the aircraft along the route to be flown within the degree of accuracy required for ATC;

(ii) One marker beacon receiver providing visual and aural signals; and

(iii) One ILS receiver; and

(3) Any RNAV system used to meet the navigation equipment requirements of this section is authorized in the foreign air carrier's operations specifications.

(b) *Aircraft communication equipment requirements.* No foreign air carrier may operate an aircraft under IFR or over the top, unless it is equipped with—

(1) At least two independent communication systems necessary under normal operating conditions to fulfill the functions specified in § 121.347(a) of this chapter; and

(2) At least one of the communication systems required by paragraph (b)(1) of this section must have two-way voice communication capability.

(c) *Use of a single independent navigation system for operations under IFR or over the top.* Notwithstanding the requirements of paragraph (a)(2)(i) of this section, the aircraft may be equipped with a single independent navigation system suitable for navigating the aircraft along the route to be flown within the degree of accuracy required for ATC if:

(1) It can be shown that the aircraft is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single independent navigation system permitted by this paragraph at any point along the route, for proceeding safely to a suitable airport and completing an instrument approach; and

(2) The aircraft has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(d) *VOR navigation equipment.* If VOR navigation equipment is required by paragraph (a) or (c) of this section, no foreign air carrier may operate an aircraft unless it is equipped with at least one approved DME or suitable RNAV system.

■ 46. Revise § 129.21 to read as follows:

§ 129.21 Control of traffic.

(a) Subject to applicable immigration laws and regulations, each foreign air carrier must furnish sufficient personnel necessary to provide two-way voice communications between its aircraft and stations at places where the FAA finds that communication is necessary but cannot be maintained in a language with which station operators are familiar.

(b) Each person furnished by a foreign air carrier under paragraph (a) of this section must be able to speak English and the language necessary to maintain communications with its aircraft and must assist station operators in directing traffic.

■ 47. Add § 129.22 to read as follows:

§ 129.22 Communication and navigation equipment for rotorcraft operations under VFR over routes navigated by pilotage.

(a) No foreign air carrier may operate a rotorcraft under VFR over routes that can be navigated by pilotage unless the rotorcraft is equipped with the radio communication equipment necessary under normal operating conditions to fulfill the following:

(1) Communicate with at least one appropriate station from any point on the route;

(2) Communicate with appropriate air traffic control facilities from any point within Class B, Class C, or Class D airspace, or within a Class E surface area designated for an airport in which flights are intended; and

(3) Receive meteorological information from any point en route.

(b) No foreign air carrier may operate a rotorcraft at night under VFR over routes that can be navigated by pilotage unless that rotorcraft is equipped with—

(1) Radio communication equipment necessary under normal operating conditions to fulfill the functions specified in paragraph (a) of this section; and

(2) Navigation equipment suitable for the route to be flown.

■ 48. Amend Appendix A to part 129 by revising paragraph (b), Section IV, to read as follows:

Appendix A to Part 129—Application for Operations Specifications by Foreign Air Carriers

* * * * *

(b) * * *

Sec. IV. Communications facilities. List all communication facilities to be used by the applicant in the conduct of the proposed operations within the United States and over that portion of the route between the last point of foreign departure and the United States.

* * * * *

PART 135—OPERATING REQUIREMENTS: COMMUTER AND ON DEMAND OPERATIONS AND RULES GOVERNING PERSONS ON BOARD SUCH AIRCRAFT

■ 49. The authority citation for part 135 continues to read as follows:

Authority: 49 U.S.C. 106(g), 41706, 44113, 44701–44702, 44705, 44709, 44711–44713, 44715–44717, 44722, 45101–45105.

■ 50. Amend § 135.67 by revising the heading to read as set forth below and by removing the words ''ground communications or navigational facility'' and adding in their place the words ''ground facility or navigation aid''.

§ 135.67 Reporting potentially hazardous meteorological conditions and irregularities of ground facilities or navigation aids.

* * * * *

■ 51. Add § 135.78 to read as follows:

§ 135.78 Instrument approach procedures and IFR landing minimums.

No person may make an instrument approach at an airport except in accordance with IFR weather minimums and instrument approach procedures set forth in the certificate holder's operations specifications.

§ 135.79 [Amended]

■ 52. Amend § 135.79 (a)(3) by removing the words ''radio or telephone communications'' and adding in their place the word ''communications''.

■ 53. Revise § 135.161 to read as follows:

§ 135.161 Communication and navigation equipment for aircraft operations under VFR over routes navigated by pilotage.

(a) No person may operate an aircraft under VFR over routes that can be navigated by pilotage unless the aircraft is equipped with the two-way radio communication equipment necessary under normal operating conditions to fulfill the following:

(1) Communicate with at least one appropriate station from any point on the route;

(2) Communicate with appropriate air traffic control facilities from any point within Class B, Class C, or Class D airspace, or within a Class E surface area designated for an airport in which flights are intended; and

(3) Receive meteorological information from any point en route.

(b) No person may operate an aircraft at night under VFR over routes that can be navigated by pilotage unless that aircraft is equipped with—

(1) Two-way radio communication equipment necessary under normal operating conditions to fulfill the functions specified in paragraph (a) of this section; and

(2) Navigation equipment suitable for the route to be flown.

■ 54. Revise § 135.165 to read as follows:

§ 135.165 Communication and navigation equipment: Extended over-water or IFR operations.

(a) *Aircraft navigation equipment requirements—General.* Except as provided in paragraph (g) of this section, no person may conduct operations under IFR or extended over-water unless—

(1) The en route navigation aids necessary for navigating the aircraft along the route (e.g., ATS routes, arrival and departure routes, and instrument approach procedures, including missed approach procedures if a missed approach routing is specified in the procedure) are available and suitable for use by the navigation systems required by this section:

(2) The aircraft used in extended over-water operations is equipped with at least two-approved independent navigation systems suitable for navigating the aircraft along the route to be flown within the degree of accuracy required for ATC.

(3) The aircraft used for IFR operations is equipped with at least—

(i) One marker beacon receiver providing visual and aural signals; and

(ii) One ILS receiver.

(4) Any RNAV system used to meet the navigation equipment requirements of this section is authorized in the certificate holder's operations specifications.

(b) *Use of a single independent navigation system for IFR operations.* The aircraft may be equipped with a single independent navigation system suitable for navigating the aircraft along the route to be flown within the degree of accuracy required for ATC if:

(1) It can be shown that the aircraft is equipped with at least one other independent navigation system suitable, in the event of loss of the navigation capability of the single independent navigation system permitted by this paragraph at any point along the route, for proceeding safely to a suitable airport and completing an instrument approach; and

(2) The aircraft has sufficient fuel so that the flight may proceed safely to a suitable airport by use of the remaining navigation system, and complete an instrument approach and land.

(c) *VOR navigation equipment.* Whenever VOR navigation equipment is required by paragraph (a) or (b) of this section, no person may operate an aircraft unless it is equipped with at least one approved DME or suitable RNAV system.

(d) *Airplane communication equipment requirements.* Except as permitted in paragraph (e) of this section, no person may operate a turbojet airplane having a passenger seat configuration, excluding any pilot seat, of 10 seats or more, or a multiengine airplane in a commuter operation, as defined in part 119 of this chapter, under IFR or in extended over-water operations unless the airplane is equipped with—

(1) At least two independent communication systems necessary under normal operating conditions to fulfill the functions specified in § 121.347(a) of this chapter; and

(2) At least one of the communication systems required by paragraph (d)(1) of this section must have two-way voice communication capability.

(e) *IFR or extended over-water communications equipment requirements.* A person may operate an aircraft other than that specified in paragraph (d) of this section under IFR or in extended over-water operations if it meets all of the requirements of this section, with the exception that only one communication system transmitter is required for operations other than extended over-water operations.

(f) *Additional aircraft communication equipment requirements.* In addition to the requirements in paragraphs (d) and (e) of this section, no person may operate an aircraft under IFR or in extended over-water operations unless it is equipped with at least:

(1) Two microphones; and

(2) Two headsets or one headset and one speaker.

(g) *Extended over-water exceptions.* Notwithstanding the requirements of paragraphs (a), (d), and (e) of this section, installation and use of a single long-range navigation system and a single long-range communication system for extended over-water operations in certain geographic areas may be authorized by the Administrator and approved in the certificate holder's operations specifications. The following are among the operational factors the Administrator may consider in granting an authorization:

(1) The ability of the flight crew to navigate the airplane along the route within the degree of accuracy required for ATC;

(2) The length of the route being flown; and

(3) The duration of the very high frequency communications gap.

§ 135.225 [Amended]

■ 55. Amend § 135.225(c)(2) and (e) by revising the reference ''DH'' to read ''DA/DH''.

§ 135.345 [Amended]

■ 56. Amend § 135.345(a)(7) by removing the term ''DH'' and adding in its place the term ''DA/DH''.

§ 135.371 [Amended]

■ 57. Amend § 135.371(c)(2) by removing the word ''radio''.

§ 135.381 [Amended]

■ 58. Amend § 135.381(b)(2) by removing the word ''radio''.

Issued in Washington, DC, on May 24, 2007.

Marion C. Blakey,

Administrator.

[FR Doc. E7–10609 Filed 6–6–07; 8:45 am]

BILLING CODE 4910–13–P