

U.S. Department of Transportation

Federal Aviation Administration

# Aeronautical Information Manual

# Change 2 January 8, 2015

DO NOT DESTROY BASIC DATED APRIL 3, 2014

# **Aeronautical Information Manual**

**Explanation of Changes** 

#### Effective: January 8, 2015

#### a. 1–1–14. User Reports Requested on NAVAID or Global Navigation Satellite System (GNSS) Performance or Interference

This change provides an electronic option for reporting GNSS problems using the agency's Global Positioning System (GPS) Anomaly Reporting Form.

#### b. 1–1–18. Global Positioning System (GPS)

This change updates the GPS chapter to reflect current policies and procedures.

# c. 1–1–19. Wide Area Augmentation System (WAAS)

This change updates the the description of WAAS system components and the example Notices to Airmen (NOTAMS).

#### d. 1–2–1. Area Navigation (RNAV) 1–2–2. Required Navigation Performance (RNP)

This change is updated to include Performance– Based Navigation and introduce RNAV navigation specifications. The graphics have also been updated as appropriate.

#### e. 4–1–9. Traffic Advisory Practices of Airports Without Operating Control Towers

This change provides the procedural basis for carrying out CTAF practices in Alaska while operating in designated areas in addition to operations to/from airports without an airport traffic control tower.

#### f. 4–5–7. Automatic Dependent Surveillance – Broadcast (ADS–B) Services

This change updates the title of subparagraph c to include "procedures" to clarify the intent of the paragraph. In addition, this change explains that an aircraft's flight identification (FLT ID), also known as the registration number or airline flight number, is transmitted by the ADS–B Out avionics, and explains the pilot's responsibilities. This change also reflects a change in procedures for Mode S transponders.

#### g. 4–6–6. Guidance on Severe Turbulence and Mountain Wave Activity (MWA)

This change adds Graphical Turbulence Guidance (GTG) as a source to help pilots ascertain the possibility of severe weather turbulence or MWA.

h. 4–7–5. Provisions for Accommodation of NonRNP10 Aircraft (Aircraft Not Authorized RNP 10 or RNP 4)

4–7–8. Flight Planning Requirements

5-1-1. Preflight Preparation

5-1-9. International Flight Plan (FAA Form 7233-4)- IFR Flights (For Domestic or International Flights)

This change implements revised procedures for operators of NonRNP10 aircraft for flight plan filing. En Route Automation System (ERAS) modified procedures for flight planning requirements reference information which should be in Items 10 and 18. Tables 5-1-4 and 5-1-5 have also been updated as appropriate.

#### i. 5–4–15. Simultaneous Parallel ILS/RNAV/ GLS Approaches (Independent)

#### 5–4–16. Simultaneous Close Parallel ILS/ RNAV/GLS PRM Approaches (Independent) and Simultaneous Offset Instrument Approaches (SOIA)

This change clarifies the concepts depicted within the graphics and makes the language more consistent with the descriptions within the text.

#### j. 5–1–1. Preflight Preparation 7–1–2. FAA Weather Services 7–1–3. Use of Aviation Weather Products

This change adds Lockheed Martin Flight Services as a source of weather forecast services to pilots and updates their contact information.

#### k. 7–1–3. Use of Aviation Weather Products

This change removes subparagraph l, as it contains information deemed no longer necessary to pilots.

#### **l.** 7–2–3. Altimeter Errors

This change updates guidance on cold temperature altimetry operations. It also adds a note to emphasize how non-standard temperatures impact Baro-VNAV equipment.

#### m. 7-3-4. Vortex Behavior

This change fixes a discrepancy between Advisory Circular AC 90–23G, Aircraft Wake Turbulence, and the Aeronautical Information Manual.

#### n. 9-1-2. Obtaining Aeronautical Charts

This change reflects that chart sales are made through FAA chart agents.

#### o. 9–1–4. General Description of Each Chart Series

This change adds a description of the Helicopter Route Chart series and the U.S. VFR Wall Planning Chart. The name of the Sectional Raster Aeronautical Charts (SRAC) product was changed to digital-Visual Charts (d-VC) and the description was updated to reflect recent product enhancements and expansion of the compliment of charts included. Other minor editorial changes were made to clarify product descriptions and availability.

#### p. Entire publication.

Editorial/format changes were made where necessary. Revision bars were not used when changes are insignificant in nature.

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# Federal Aviation Administration (FAA)

The Federal Aviation Administration is responsible for insuring the safe, efficient, and secure use of the Nation's airspace, by military as well as civil aviation, for promoting safety in air commerce, for encouraging and developing civil aeronautics, including new aviation technology, and for supporting the requirements of national defense.

The activities required to carry out these responsibilities include: safety regulations; airspace management and the establishment, operation, and maintenance of a civil-military common system of air traffic control (ATC) and navigation facilities; research and development in support of the fostering of a national system of airports, promulgation of standards and specifications for civil airports, and administration of Federal grants-in-aid for developing public airports; various joint and cooperative activities with the Department of Defense; and technical assistance (under State Department auspices) to other countries.

# Aeronautical Information Manual (AIM) Basic Flight Information and ATC Procedures

This manual is designed to provide the aviation community with basic flight information and ATC procedures for use in the National Airspace System (NAS) of the United States. An international version called the Aeronautical Information Publication contains parallel information, as well as specific information on the international airports for use by the international community.

This manual contains the fundamentals required in order to fly in the United States NAS. It also contains items of interest to pilots concerning health and medical facts, factors affecting flight safety, a pilot/controller glossary of terms used in the ATC System, and information on safety, accident, and hazard reporting.

This manual is complemented by other operational publications which are available via separate subscriptions. These publications are:

Notices to Airmen publication - A publication containing current Notices to Airmen (NOTAMs) which are considered essential to the safety of flight as well as supplemental data affecting the other operational publications listed here. It also includes current Flight Data Center NOTAMs, which are regulatory in nature, issued to establish restrictions to flight or to amend charts or published Instrument Approach Procedures. This publication is issued every four weeks and is available through subscription from the Superintendent of Documents.

The Airport/Facility Directory, the Alaska Supplement, and the Pacific Chart Supplement – These publications contain information on airports, communications, navigation aids, instrument landing systems, VOR receiver check points, preferred routes, Flight Service Station/Weather Service telephone numbers, Air Route Traffic Control Center (ARTCC) frequencies, part–time surface areas, and various other pertinent special notices essential to air navigation. These publications are available through a network of FAA chart agents primarily located at or near major civil airports. A listing of products, dates of latest editions and agents is available on the AeroNav website at:

http://www.faa.gov/air\_traffic/flight\_info/aeronav.

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#### NOTE-

DO NOT attempt to fly a procedure that is NOTAMed out of service even if the identification is present. In certain cases, the identification may be transmitted for short periods as part of the testing.

#### 1-1-13. NAVAIDs with Voice

**a.** Voice equipped en route radio navigational aids are under the operational control of either a Flight Service Station (FSS) or an approach control facility. The voice communication is available on some facilities. Hazardous Inflight Weather Advisory Service (HIWAS) broadcast capability is available on selected VOR sites throughout the conterminous U.S. and does not provide two-way voice communication. The availability of two-way voice communication and HIWAS is indicated in the A/FD and aeronautical charts.

**b.** Unless otherwise noted on the chart, all radio navigation aids operate continuously except during shutdowns for maintenance. Hours of operation of facilities not operating continuously are annotated on charts and in the A/FD.

#### 1–1–14. User Reports Requested on NAVAID or Global Navigation Satellite System (GNSS) Performance or Interference

**a.** Users of the National Airspace System (NAS) can render valuable assistance in the early correction of NAVAID malfunctions or GNSS problems and are encouraged to report their observations of undesirable performance. Although NAVAIDs are monitored by electronic detectors, adverse effects of electronic interference, new obstructions, or changes in terrain near the NAVAID can exist without detection by the ground monitors. Some of the characteristics of malfunction or deteriorating performance which should be reported are: erratic course or bearing indications; intermittent, or full, flag alarm; garbled, missing or obviously improper coded identification; poor quality communications reception; or, in the case of frequency interference, an audible hum or tone accompanying radio communications or NAVAID identification. GNSS problems are often characterized by navigation degradation or service loss indications.

**b.** Reporters should identify the NAVAID (for example, VOR) malfunction or GNSS problem,

location of the aircraft (i.e., latitude, longitude or bearing/distance from a NAVAID), magnetic heading, altitude, date and time of the observation, type of aircraft (make/model/call sign), and description of the condition observed, and the type of receivers in use (i.e., make/model/software revision). For GNSS problems, if possible, please note the number of satellites being tracked at the time of the anomaly. Reports can be made in any of the following ways:

**1.** Immediately, by radio communication to the controlling Air Route Traffic Control Center (ARTCC), Control Tower, or FSS.

2. By telephone to the nearest FAA facility.

**3.** For GNSS problems, by internet via the GPS Anomaly Reporting Form at http://www.faa.gov/air\_traffic/nas/gps\_reports/.

**c.** In aircraft that have more than one receiver, there are many combinations of possible interference between units. This can cause either erroneous navigation indications or, complete or partial blanking out of the communications. Pilots should be familiar enough with the radio installation of the particular airplanes they fly to recognize this type of interference.

#### 1-1-15. LORAN

#### NOTE-

In accordance with the 2010 DHS Appropriations Act, the U.S. Coast Guard (USCG) terminated the transmission of all U.S. LORAN-C signals on 08 Feb 2010. The USCG also terminated the transmission of the Russian American signals on 01 Aug 2010, and the Canadian LORAN-C signals on 03 Aug 2010. For more information, visit http://www.navcen.uscg.gov. Operators should also note that TSO-C60b, AIRBORNE AREA NAVIGATION EQUIPMENT USING LORAN-C INPUTS, has been canceled by the FAA.

#### 1–1–16. Inertial Reference Unit (IRU), Inertial Navigation System (INS), and Attitude Heading Reference System (AHRS)

**a.** IRUs are self-contained systems comprised of gyros and accelerometers that provide aircraft attitude (pitch, roll, and heading), position, and velocity information in response to signals resulting from inertial effects on system components. Once aligned with a known position, IRUs continuously calculate position and velocity. IRU position

accuracy decays with time. This degradation is known as "drift."

**b.** INSs combine the components of an IRU with an internal navigation computer. By programming a series of waypoints, these systems will navigate along a predetermined track.

**c.** AHRSs are electronic devices that provide attitude information to aircraft systems such as weather radar and autopilot, but do not directly compute position information.

#### 1–1–17. Doppler Radar

Doppler Radar is a semiautomatic self-contained dead reckoning navigation system (radar sensor plus computer) which is not continuously dependent on information derived from ground based or external aids. The system employs radar signals to detect and measure ground speed and drift angle, using the aircraft compass system as its directional reference. Doppler is less accurate than INS, however, and the use of an external reference is required for periodic updates if acceptable position accuracy is to be achieved on long range flights.

#### 1–1–18. Global Positioning System (GPS)

#### a. System Overview

**1.** System Description. The Global Positioning System is a space-based radio navigation system used to determine precise position anywhere in the world. The 24 satellite constellation is designed to ensure at least five satellites are always visible to a user worldwide. A minimum of four satellites is necessary for receivers to establish an accurate three-dimensional position. The receiver uses data from satellites above the mask angle (the lowest angle above the horizon at which a receiver can use a satellite). The Department of Defense (DOD) is responsible for operating the GPS satellite constellation and monitors the GPS satellites to ensure proper operation. Each satellite's orbital parameters (ephemeris data) are sent to each satellite for broadcast as part of the data message embedded in the GPS signal. The GPS coordinate system is the Cartesian earth-centered, earth-fixed coordinates as specified in the World Geodetic System 1984 (WGS-84).

#### 2. System Availability and Reliability.

(a) The status of GPS satellites is broadcast as part of the data message transmitted by the GPS satellites. GPS status information is also available by means of the U.S. Coast Guard navigation information service: (703) 313–5907, Internet: http://www.navcen.uscg.gov/. Additionally, satellite status is available through the Notice to Airmen (NOTAM) system.

(b) GNSS operational status depends on the type of equipment being used. For GPS–only equipment TSO–C129 or TSO-C196(), the operational status of non–precision approach capability for flight planning purposes is provided through a prediction program that is embedded in the receiver or provided separately.

**3.** Receiver Autonomous Integrity Monitoring (RAIM). RAIM is the capability of a GPS receiver to perform integrity monitoring on itself by ensuring available satellite signals meet the integrity requirements for a given phase of flight. Without RAIM, the pilot has no assurance of the GPS position integrity. RAIM provides immediate feedback to the pilot. This fault detection is critical for performance-based navigation (PBN)(see Paragraph 1–2–1, Performance-Based Navigation (PBN) and Area Navigation (RNAV), for an introduction to PBN), because delays of up to two hours can occur before an erroneous satellite transmission is detected and corrected by the satellite control segment.

(a) In order for RAIM to determine if a satellite is providing corrupted information, at least one satellite, in addition to those required for navigation, must be in view for the receiver to perform the RAIM function. RAIM requires a minimum of 5 satellites, or 4 satellites and barometric altimeter input (baro-aiding), to detect an integrity anomaly. Baro-aiding is a method of augmenting the GPS integrity solution by using a non-satellite input source in lieu of the fifth satellite. Some GPS receivers also have a RAIM capability, called fault detection and exclusion (FDE), that excludes a failed satellite from the position solution; GPS receivers capable of FDE require 6 satellites or 5 satellites with baro-aiding. This allows the GPS receiver to isolate the corrupt satellite signal, remove it from the position solution, and still provide an integrity-assured position. To ensure that baro-aiding is available, enter the current altimeter setting into the receiver as described in the operating manual. Do not

use the GPS derived altitude due to the large GPS vertical errors that will make the integrity monitoring function invalid.

(b) There are generally two types of RAIM fault messages. The first type of message indicates that there are not enough satellites available to provide RAIM integrity monitoring. The GPS navigation solution may be acceptable, but the integrity of the solution cannot be determined. The second type indicates that the RAIM integrity monitor has detected a potential error and that there is an inconsistency in the navigation solution for the given phase of flight. Without RAIM capability, the pilot has no assurance of the accuracy of the GPS position.

**4.** Selective Availability. Selective Availability (SA) is a method by which the accuracy of GPS is intentionally degraded. This feature was designed to deny hostile use of precise GPS positioning data. SA was discontinued on May 1, 2000, but many GPS receivers are designed to assume that SA is still active. New receivers may take advantage of the discontinuance of SA based on the performance values in ICAO Annex 10.

**b.** Operational Use of GPS. U.S. civil operators may use approved GPS equipment in oceanic airspace, certain remote areas, the National Airspace System and other States as authorized (please consult the applicable Aeronautical Information Publication). Equipage other than GPS may be required for the desired operation. GPS navigation is used for both Visual Flight Rules (VFR) and Instrument Flight Rules (IFR) operations.

#### 1. VFR Operations

(a) GPS navigation has become an asset to VFR pilots by providing increased navigational capabilities and enhanced situational awareness. Although GPS has provided many benefits to the VFR pilot, care must be exercised to ensure that system capabilities are not exceeded. VFR pilots should integrate GPS navigation with electronic navigation (when possible), as well as pilotage and dead reckoning.

(b) GPS receivers used for VFR navigation vary from fully integrated IFR/VFR installation used to support VFR operations to hand-held devices. Pilots must understand the limitations of the receivers prior to using in flight to avoid misusing navigation information. (See TBL 1–1–6.) Most receivers are not intuitive. The pilot must learn the various keystrokes, knob functions, and displays that are used in the operation of the receiver. Some manufacturers provide computer–based tutorials or simulations of their receivers that pilots can use to become familiar with operating the equipment.

(c) When using GPS for VFR operations, RAIM capability, database currency, and antenna location are critical areas of concern.

(1) RAIM Capability. VFR GPS panel mount receivers and hand-held units have no RAIM alerting capability. This prevents the pilot from being alerted to the loss of the required number of satellites in view, or the detection of a position error. Pilots should use a systematic cross-check with other navigation techniques to verify position. Be suspicious of the GPS position if a disagreement exists between the two positions.

(2) Database Currency. Check the currency of the database. Databases must be updated for IFR operations and should be updated for all other operations. However, there is no requirement for databases to be updated for VFR navigation. It is not recommended to use a moving map with an outdated database in and around critical airspace. Pilots using an outdated database should verify waypoints using current aeronautical products; for example, Airport/Facility Directory, Sectional Chart, or En Route Chart.

(3) Antenna Location. The antenna location for GPS receivers used for IFR and VFR operations may differ. VFR antennae are typically placed for convenience more than performance, while IFR installations ensure a clear view is provided with the satellites. Antennae not providing a clear view have a greater opportunity to lose the satellite navigational signal. This is especially true in the case of hand-held GPS receivers. Typically, suction cups are used to place the GPS antennas on the inside of cockpit windows. While this method has great utility, the antenna location is limited to the cockpit or cabin which rarely provides a clear view of all available satellites. Consequently, signal losses may occur due to aircraft structure blocking satellite signals, causing a loss of navigation capability. These losses, coupled with a lack of RAIM capability, could present erroneous position and navigation information with no warning to the pilot. While the use of a hand-held GPS for VFR operations is not limited by regulation, modification of the aircraft, such as installing a panel– or yoke–mounted holder, is governed by 14 CFR Part 43. Consult with your mechanic to ensure compliance with the regulation and safe installation.

(d) Do not solely rely on GPS for VFR navigation. No design standard of accuracy or integrity is used for a VFR GPS receiver. VFR GPS receivers should be used in conjunction with other forms of navigation during VFR operations to ensure a correct route of flight is maintained. Minimize head-down time in the aircraft by being familiar with your GPS receiver's operation and by keeping eyes outside scanning for traffic, terrain, and obstacles.

#### (e) VFR Waypoints

(1) VFR waypoints provide VFR pilots with a supplementary tool to assist with position awareness while navigating visually in aircraft equipped with area navigation receivers. VFR waypoints should be used as a tool to supplement current navigation procedures. The uses of VFR waypoints include providing navigational aids for pilots unfamiliar with an area, waypoint definition of existing reporting points, enhanced navigation in and around Class B and Class C airspace, and enhanced navigation around Special Use Airspace. VFR pilots should rely on appropriate and current aeronautical charts published specifically for visual navigation. If operating in a terminal area, pilots should take advantage of the Terminal Area Chart available for that area, if published. The use of VFR waypoints does not relieve the pilot of any responsibility to comply with the operational requirements of 14 CFR Part 91.

(2) VFR waypoint names (for computerentry and flight plans) consist of five letters beginning with the letters "VP" and are retrievable from navigation databases. The VFR waypoint names are not intended to be pronounceable, and they are not for use in ATC communications. On VFR charts, stand-alone VFR waypoints will be portrayed using the same four-point star symbol used for IFR waypoints. VFR waypoints collocated with visual check points on the chart will be identified by small magenta flag symbols. VFR waypoints collocated with visual check points will be pronounceable based on the name of the visual check point and may be used for ATC communications. Each VFR waypoint name will appear in parentheses adjacent to the geographic location on the chart. Latitude/longitude data for all established VFR waypoints may be found in the appropriate regional Airport/Facility Directory (A/FD).

(3) VFR waypoints may not be used on IFR flight plans. VFR waypoints are not recognized by the IFR system and will be rejected for IFR routing purposes.

(4) Pilots may use the five-letter identifier as a waypoint in the route of flight section on a VFR flight plan. Pilots may use the VFR waypoints only when operating under VFR conditions. The point may represent an intended course change or describe the planned route of flight. This VFR filing would be similar to how a VOR would be used in a route of flight.

(5) VFR waypoints intended for use during flight should be loaded into the receiver while on the ground. Once airborne, pilots should avoid programming routes or VFR waypoint chains into their receivers.

(6) Pilots should be vigilant to see and avoid other traffic when near VFR waypoints. With the increased use of GPS navigation and accuracy, expect increased traffic near VFR waypoints. Regardless of the class of airspace, monitor the available ATC frequency for traffic information on other aircraft operating in the vicinity. See Paragraph 7–5–2, VFR in Congested Areas, for more information.

#### 2. IFR Use of GPS

(a) General Requirements. Authorization to conduct any GPS operation under IFR requires:

(1) GPS navigation equipment used for IFR operations must be approved in accordance with the requirements specified in Technical Standard Order (TSO) TSO-C129(), TSO-C196(), TSO-C145(), or TSO-C146(), and the installation must be done in accordance with Advisory Circular AC 20–138(), *Airworthiness Approval of Positioning and Navigation Systems*. Equipment approved in accordance with TSO-C115a does not meet the requirements of TSO-C129. Visual flight rules (VFR) and hand-held GPS systems are not authorized for IFR navigation, instrument approaches, or as a principal instrument flight reference.

(2) Aircraft using un-augmented GPS (TSO-C129() or TSO-C196()) for navigation under IFR must be equipped with an alternate approved and operational means of navigation suitable for navigating the proposed route of flight. (Examples of alternate navigation equipment include VOR or DME/DME/IRU capability). Active monitoring of alternative navigation equipment is not required when RAIM is available for integrity monitoring. Active monitoring of an alternate means of navigation is required when the GPS RAIM capability is lost.

(3) Procedures must be established for use in the event that the loss of RAIM capability is predicted to occur. In situations where RAIM is predicted to be unavailable, the flight must rely on other approved navigation equipment, re-route to where RAIM is available, delay departure, or cancel the flight.

(4) The GPS operation must be conducted in accordance with the FAA–approved aircraft flight manual (AFM) or flight manual supplement. Flight crew members must be thoroughly familiar with the particular GPS equipment installed in the aircraft, the receiver operation manual, and the AFM or flight manual supplement. Operation, receiver presentation and capabilities of GPS equipment vary. Due to these differences, operation of GPS receivers of different brands, or even models of the same brand, under IFR should not be attempted without thorough operational knowledge. Most receivers have a built–in simulator mode, which allows the pilot to become familiar with operation prior to attempting operation in the aircraft.

(5) Aircraft navigating by IFR–approved GPS are considered to be performance–based navigation (PBN) aircraft and have special equipment suffixes. File the appropriate equipment suffix in accordance with TBL 5–1–3 on the ATC flight plan. If GPS avionics become inoperative, the pilot should advise ATC and amend the equipment suffix.

(6) Prior to any GPS IFR operation, the pilot must review appropriate NOTAMs and aeronautical information. (See GPS NOTAMs/Aeronautical Information).

(b) **Database Requirements.** The onboard navigation data must be current and appropriate for the region of intended operation and should include

the navigation aids, waypoints, and relevant coded terminal airspace procedures for the departure, arrival, and alternate airfields.

(1) Further database guidance for terminal and en route requirements may be found in AC 90-100(), U.S. Terminal and En Route Area Navigation (RNAV) Operations.

(2) Further database guidance on Required Navigation Performance (RNP) instrument approach operations, RNP terminal, and RNP en route requirements may be found in AC 90-105(), *Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System.* 

(3) All approach procedures to be flown must be retrievable from the current airborne navigation database supplied by the equipment manufacturer or other FAA–approved source. The system must be able to retrieve the procedure by name from the aircraft navigation database, not just as a manually entered series of waypoints. Manual entry of waypoints using latitude/longitude or place/bearing is not permitted for approach procedures.

(4) Prior to using a procedure or waypoint retrieved from the airborne navigation database, the pilot should verify the validity of the database. This verification should include the following preflight and inflight steps:

#### [a] Preflight:

[1] Determine the date of database issuance, and verify that the date/time of proposed use is before the expiration date/time.

[2] Verify that the database provider has not published a notice limiting the use of the specific waypoint or procedure.

#### [b] Inflight:

[1] Determine that the waypoints and transition names coincide with names found on the procedure chart. Do not use waypoints which do not exactly match the spelling shown on published procedure charts.

[2] Determine that the waypoints are logical in location, in the correct order, and their orientation to each other is as found on the procedure chart, both laterally and vertically.

#### NOTE-

There is no specific requirement to check each waypoint

latitude and longitude, type of waypoint and/or altitude constraint, only the general relationship of waypoints in the procedure, or the logic of an individual waypoint's location.

[3] If the cursory check of procedure logic or individual waypoint location, specified in [b] above, indicates a potential error, do not use the retrieved procedure or waypoint until a verification of latitude and longitude, waypoint type, and altitude constraints indicate full conformity with the published data.

(5) Air carrier and commercial operators must meet the appropriate provisions of their approved operations specifications.

**[a]** During domestic operations for commerce or for hire, operators must have a second navigation system capable of reversion or contingency operations.

**[b]** Operators must have two independent navigation systems appropriate to the route to be flown, or one system that is suitable and a second, independent backup capability that allows the operator to proceed safely and land at a different airport, and the aircraft must have sufficient fuel (reference 14 CFR 121.349, 125.203, 129.17, and 135.165). These rules ensure the safety of the operation by preventing a single point of failure.

#### NOTE-

An aircraft approved for multi-sensor navigation and equipped with a single navigation system must maintain an ability to navigate or proceed safely in the event that any one component of the navigation system fails, including the flight management system (FMS). Retaining a FMS-independent VOR capability would satisfy this requirement.

[c] The requirements for a second system apply to the entire set of equipment needed to achieve the navigation capability, not just the individual components of the system such as the radio navigation receiver. For example, to use two RNAV systems (e.g., GPS and DME/DME/IRU) to comply with the requirements, the aircraft must be equipped with two independent radio navigation receivers and two independent navigation computers (e.g., flight management systems (FMS)). Alternatively, to comply with the requirements using a single RNAV system with an installed and operable VOR capability, the VOR capability must be independent of the FMS.

**[d]** To satisfy the requirement for two independent navigation systems, if the primary navigation system is GPS-based, the second system must be independent of GPS (for example, VOR or DME/DME/IRU). This allows continued navigation in case of failure of the GPS or WAAS services. Recognizing that GPS interference and test events resulting in the loss of GPS services have become more common, the FAA requires operators conducting IFR operations under 14 CFR 121.349, 125.203, 129.17 and 135.65 to retain a non-GPS navigation capability consisting of either DME/DME, IRU, or VOR for en route and terminal operations, and VOR and ILS for final approach. Since this system is to be used as a reversionary capability, single equipage is sufficient.

# **3.** Oceanic, Domestic, En Route, and Terminal Area Operations

(a) Conduct GPS IFR operations in oceanic areas only when approved avionics systems are installed. TSO-C196() users and TSO-C129() GPS users authorized for Class A1, A2, B1, B2, C1, or C2 operations may use GPS in place of another approved means of long-range navigation, such as dual INS. (See TBL 1–1–5 and TBL 1–1–6.) Aircraft with a single installation GPS, meeting the above specifications, are authorized to operate on short oceanic routes requiring one means of long-range navigation (reference AC 20-138(), Appendix 1).

(b) Conduct GPS domestic, en route, and terminal IFR operations only when approved avionics systems are installed. Pilots may use GPS via TSO-C129() authorized for Class A1, B1, B3, C1, or C3 operations GPS via TSO-C196(); or GPS/WAAS with either TSO-C145() or TSO-C146(). When using TSO-C129() or TSO-C196() receivers, the avionics necessary to receive all of the ground-based facilities appropriate for the route to the destination airport and any required alternate airport must be installed and operational. Ground-based facilities necessary for these routes must be operational.

(1) GPS en route IFR operations may be conducted in Alaska outside the operational service volume of ground-based navigation aids when a TSO-C145() or TSO-C146() GPS/wide area augmentation system (WAAS) system is installed and operating. WAAS is the U.S. version of a satellite-based augmentation system (SBAS). [a] In Alaska, aircraft may operate on GNSS Q-routes with GPS (TSO-C129 () or TSO-C196 ()) equipment while the aircraft remains in Air Traffic Control (ATC) radar surveillance or with GPS/WAAS (TSO-C145 () or TSO-C146 ()) which does not require ATC radar surveillance.

**[b]** In Alaska, aircraft may only operate on GNSS T-routes with GPS/WAAS (TSO-C145 () or TSO-C146 ()) equipment.

(2) Ground-based navigation equipment is not required to be installed and operating for en route IFR operations when using GPS/WAAS navigation systems. All operators should ensure that an alternate means of navigation is available in the unlikely event the GPS/WAAS navigation system becomes inoperative.

(3) Q-routes and T-routes outside Alaska. Q-routes require system performance currently met by GPS, GPS/WAAS, or DME/DME/IRU RNAV systems that satisfy the criteria discussed in AC 90–100(), U.S. Terminal and En Route Area Navigation (RNAV) Operations. T-routes require GPS or GPS/WAAS equipment.

#### REFERENCE-

AIM Paragraph 5-3-4 Airways and Route Systems

(c) GPS IFR approach/departure operations can be conducted when approved avionics systems are installed and the following requirements are met:

(1) The aircraft is TSO-C145() or TSO-C146() or TSO-C196() or TSO-C129() in Class A1, B1, B3, C1, or C3; and

(2) The approach/departure must be retrievable from the current airborne navigation database in the navigation computer. The system must be able to retrieve the procedure by name from the aircraft navigation database. Manual entry of waypoints using latitude/longitude or place/bearing is not permitted for approach procedures.

(3) The authorization to fly instrument approaches/departures with GPS is limited to U.S. airspace.

(4) The use of GPS in any other airspace must be expressly authorized by the FAA Administrator.

(5) GPS instrument approach/departure operations outside the U.S. must be authorized by the appropriate sovereign authority.

# 4. Departures and Instrument Departure Procedures (DPs)

The GPS receiver must be set to terminal  $(\pm 1 \text{ NM})$ CDI sensitivity and the navigation routes contained in the database in order to fly published IFR charted departures and DPs. Terminal RAIM should be automatically provided by the receiver. (Terminal RAIM for departure may not be available unless the waypoints are part of the active flight plan rather than proceeding direct to the first destination.) Certain segments of a DP may require some manual intervention by the pilot, especially when radar vectored to a course or required to intercept a specific course to a waypoint. The database may not contain all of the transitions or departures from all runways and some GPS receivers do not contain DPs in the database. It is necessary that helicopter procedures be flown at 70 knots or less since helicopter departure procedures and missed approaches use a 20:1 obstacle clearance surface (OCS), which is double the fixed-wing OCS, and turning areas are based on this speed as well.

#### 5. GPS Instrument Approach Procedures

(a) GPS overlay approaches are designated non-precision instrument approach procedures that pilots are authorized to fly using GPS avionics. Localizer (LOC), localizer type directional aid (LDA), and simplified directional facility (SDF) procedures are not authorized. Overlay procedures are identified by the "name of the procedure" and "or GPS" (e.g., VOR/DME or GPS RWY 15) in the title. Authorized procedures must be retrievable from a current onboard navigation database. The navigation database may also enhance position orientation by displaying a map containing information on conventional NAVAID approaches. This approach information should not be confused with a GPS overlay approach (see the receiver operating manual, AFM, or AFM Supplement for details on how to identify these approaches in the navigation database).

#### NOTE-

Overlay approaches do not adhere to the design criteria described in Paragraph 5–4–5m, Area Navigation (RNAV) Instrument Approach Charts, for stand–alone GPS approaches. Overlay approach criteria is based on the design criteria used for ground–based NAVAID approaches.

(b) Stand-alone approach procedures specifically designed for GPS systems have replaced

AIM

many of the original overlay approaches. All approaches that contain "GPS" in the title (e.g., "VOR or GPS RWY 24," "GPS RWY 24," or "RNAV (GPS) RWY 24") can be flown using GPS. GPS–equipped aircraft do not need underlying ground–based NAVAIDs or associated aircraft avionics to fly the approach. Monitoring the underlying approach with ground–based NAVAIDs is suggested when able. Existing overlay approaches may be requested using the GPS title; for example, the VOR or GPS RWY 24 may be requested as "GPS RWY 24." Some GPS procedures have a Terminal Arrival Area (TAA) with an underlining RNAV approach.

(c) For flight planning purposes, TSO-C129() and TSO-C196()-equipped users (GPS users) whose navigation systems have fault detection and exclusion (FDE) capability, who perform a preflight RAIM prediction for the approach integrity at the airport where the RNAV (GPS) approach will be flown, and have proper knowledge and any required training and/or approval to conduct a GPS-based IAP, may file based on a GPS-based IAP at either the destination or the alternate airport, but not at both locations. At the alternate airport, pilots may plan for:

(1) Lateral navigation (LNAV) or circling minimum descent altitude (MDA);

(2) LNAV/vertical navigation (LNAV/ VNAV) DA, if equipped with and using approved barometric vertical navigation (baro-VNAV) equipment;

(3) RNP 0.3 DA on an RNAV (RNP) IAP, if they are specifically authorized users using approved baro-VNAV equipment and the pilot has verified required navigation performance (RNP) availability through an approved prediction program.

(d) If the above conditions cannot be met, any required alternate airport must have an approved instrument approach procedure other than GPS-based that is anticipated to be operational and available at the estimated time of arrival, and which the aircraft is equipped to fly.

# (e) Procedures for Accomplishing GPS Approaches

(1) An RNAV (GPS) procedure may be associated with a Terminal Arrival Area (TAA). The

basic design of the RNAV procedure is the "T" design or a modification of the "T" (See Paragraph 5-4-5d, Terminal Arrival Area (TAA), for complete information).

(2) Pilots cleared by ATC for an RNAV (GPS) approach should fly the full approach from an Initial Approach Waypoint (IAWP) or feeder fix. Randomly joining an approach at an intermediate fix does not assure terrain clearance.

(3) When an approach has been loaded in the navigation system, GPS receivers will give an "arm" annunciation 30 NM straight line distance from the airport/heliport reference point. Pilots should arm the approach mode at this time if not already armed (some receivers arm automatically). Without arming, the receiver will not change from en route CDI and RAIM sensitivity of  $\pm 5$  NM either side of centerline to  $\pm 1$  NM terminal sensitivity. Where the IAWP is inside this 30 mile point, a CDI sensitivity change will occur once the approach mode is armed and the aircraft is inside 30 NM. Where the IAWP is beyond 30 NM from the airport/heliport reference point and the approach is armed, the CDI sensitivity will not change until the aircraft is within 30 miles of the airport/heliport reference point. Feeder route obstacle clearance is predicated on the receiver being in terminal  $(\pm 1 \text{ NM})$  CDI sensitivity and RAIM within 30 NM of the airport/heliport reference point; therefore, the receiver should always be armed (if required) not later than the 30 NM annunciation.

(4) The pilot must be aware of what bank angle/turn rate the particular receiver uses to compute turn anticipation, and whether wind and airspeed are included in the receiver's calculations. This information should be in the receiver operating manual. Over or under banking the turn onto the final approach course may significantly delay getting on course and may result in high descent rates to achieve the next segment altitude.

(5) When within 2 NM of the Final Approach Waypoint (FAWP) with the approach mode armed, the approach mode will switch to active, which results in RAIM and CDI changing to approach sensitivity. Beginning 2 NM prior to the FAWP, the full scale CDI sensitivity will smoothly change from  $\pm 1$  NM to  $\pm 0.3$  NM at the FAWP. As sensitivity changes from  $\pm 1$  NM to  $\pm 0.3$  NM approaching the FAWP, with the CDI not centered,

the corresponding increase in CDI displacement may give the impression that the aircraft is moving further away from the intended course even though it is on an acceptable intercept heading. Referencing the digital track displacement information (cross track error), if it is available in the approach mode, may help the pilot remain position oriented in this situation. Being established on the final approach course prior to the beginning of the sensitivity change at 2 NM will help prevent problems in interpreting the CDI display during ramp down. Therefore, requesting or accepting vectors which will cause the aircraft to intercept the final approach course within 2 NM of the FAWP is not recommended.

(6) When receiving vectors to final, most receiver operating manuals suggest placing the receiver in the non-sequencing mode on the FAWP and manually setting the course. This provides an extended final approach course in cases where the aircraft is vectored onto the final approach course outside of any existing segment which is aligned with the runway. Assigned altitudes must be maintained until established on a published segment of the approach. Required altitudes at waypoints outside the FAWP or stepdown fixes must be considered. Calculating the distance to the FAWP may be required in order to descend at the proper location.

(7) Overriding an automatically selected sensitivity during an approach will cancel the approach mode annunciation. If the approach mode is not armed by 2 NM prior to the FAWP, the approach mode will not become active at 2 NM prior to the FAWP, and the equipment will flag. In these conditions, the RAIM and CDI sensitivity will not ramp down, and the pilot should not descend to MDA, but fly to the MAWP and execute a missed approach. The approach active annunciator and/or the receiver should be checked to ensure the approach mode is active prior to the FAWP.

(8) Do not attempt to fly an approach unless the procedure in the onboard database is current and identified as "GPS" on the approach chart. The navigation database may contain information about non-overlay approach procedures that enhances position orientation generally by providing a map, while flying these approaches using conventional NAVAIDs. This approach information should not be confused with a GPS overlay approach (see the receiver operating manual, AFM, or AFM Supplement for details on how to identify these procedures in the navigation database). Flying point to point on the approach does not assure compliance with the published approach procedure. The proper RAIM sensitivity will not be available and the CDI sensitivity will not automatically change to  $\pm 0.3$ NM. Manually setting CDI sensitivity does not automatically change the RAIM sensitivity on some receivers. Some existing non-precision approach procedures cannot be coded for use with GPS and will not be available as overlays.

(9) Pilots should pay particular attention to the exact operation of their GPS receivers for performing holding patterns and in the case of overlay approaches, operations such as procedure turns. These procedures may require manual intervention by the pilot to stop the sequencing of waypoints by the receiver and to resume automatic GPS navigation sequencing once the maneuver is complete. The same waypoint may appear in the route of flight more than once consecutively (for example, IAWP, FAWP, MAHWP on a procedure turn). Care must be exercised to ensure that the receiver is sequenced to the appropriate waypoint for the segment of the procedure being flown, especially if one or more fly-overs are skipped (for example, FAWP rather than IAWP if the procedure turn is not flown). The pilot may have to sequence past one or more fly-overs of the same waypoint in order to start GPS automatic sequencing at the proper place in the sequence of waypoints.

(10) Incorrect inputs into the GPS receiver are especially critical during approaches. In some cases, an incorrect entry can cause the receiver to leave the approach mode.

(11) A fix on an overlay approach identified by a DME fix will not be in the waypoint sequence on the GPS receiver unless there is a published name assigned to it. When a name is assigned, the along track distance (ATD) to the waypoint may be zero rather than the DME stated on the approach chart. The pilot should be alert for this on any overlay procedure where the original approach used DME.

(12) If a visual descent point (VDP) is published, it will not be included in the sequence of waypoints. Pilots are expected to use normal piloting techniques for beginning the visual descent, such as ATD. (13) Unnamed stepdown fixes in the final approach segment may or may not be coded in the waypoint sequence of the aircraft's navigation database and must be identified using ATD. Stepdown fixes in the final approach segment of RNAV (GPS) approaches are being named, in addition to being identified by ATD. However, GPS avionics may or may not accommodate waypoints between the FAF and MAP. Pilots must know the capabilities of their GPS equipment and continue to identify stepdown fixes using ATD when necessary.

#### (f) Missed Approach

(1) A GPS missed approach requires pilot action to sequence the receiver past the MAWP to the missed approach portion of the procedure. The pilot must be thoroughly familiar with the activation procedure for the particular GPS receiver installed in the aircraft and must initiate appropriate action after the MAWP. Activating the missed approach prior to the MAWP will cause CDI sensitivity to immediately change to terminal  $(\pm 1NM)$  sensitivity and the receiver will continue to navigate to the MAWP. The receiver will not sequence past the MAWP. Turns should not begin prior to the MAWP. If the missed approach is not activated, the GPS receiver will display an extension of the inbound final approach course and the ATD will increase from the MAWP until it is manually sequenced after crossing the MAWP.

(2) Missed approach routings in which the first track is via a course rather than direct to the next waypoint require additional action by the pilot to set the course. Being familiar with all of the inputs required is especially critical during this phase of flight.

# (g) GPS NOTAMs/Aeronautical Information

(1) GPS satellite outages are issued as GPS NOTAMs both domestically and internationally. However, the effect of an outage on the intended operation cannot be determined unless the pilot has a RAIM availability prediction program which allows excluding a satellite which is predicted to be out of service based on the NOTAM information.

(2) The terms UNRELIABLE and MAY NOT BE AVAILABLE are used in conjunction with GPS NOTAMs. Both UNRELIABLE and MAY NOT BE AVAILABLE are advisories to pilots indicating

the expected level of service may not be available. UNRELIABLE does not mean there is a problem with GPS signal integrity. If GPS service is available, pilots may continue operations. If the LNAV or LNAV/VNAV service is available, pilots may use the displayed level of service to fly the approach. GPS operation may be NOTAMed UNRELIABLE or MAY NOT BE AVAILABLE due to testing or anomalies. (Pilots are encouraged to report GPS anomalies, including degraded operation and/or loss of service, as soon as possible, reference paragraph 1–1–14.) When GPS testing NOTAMS are published and testing is actually occurring, Air Traffic Control will advise pilots requesting or cleared for a GPS or RNAV (GPS) approach that GPS may not be available and request intentions. If pilots have reported GPS anomalies, Air Traffic Control will request the pilot's intentions and/or clear the pilot for an alternate approach, if available and operational.

#### EXAMPLE-

The following is an example of a GPS testing NOTAM: !GPS 06/001 ZAB NAV GPS (INCLUDING WAAS, GBAS, AND ADS-B) MAY NOT BE AVAILABLE WITHIN A 468NM RADIUS CENTERED AT 330702N1062540W (TCS 093044) FL400-UNL DECREASING IN AREA WITH A DECREASE IN ALTITUDE DEFINED AS: 425NM RADIUS AT FL250, 360NM RADIUS AT 10000FT, 354NM RADIUS AT 4000FT AGL, 327NM RADIUS AT 50FT AGL. 1406070300-1406071200.

(3) Civilian pilots may obtain GPS RAIM availability information for non-precision approach procedures by: using a manufacturer-supplied RAIM prediction tool; or using the generic tool at www.raimprediction.net. The FAA is developing a replacement prediction tool at www.sapt.faa.gov scheduled for transition in 2014. Pilots can also request GPS RAIM aeronautical information from a flight service station during preflight briefings. GPS RAIM aeronautical information can be obtained for a period of 3 hours (for example, if you are scheduled to arrive at 1215 hours, then the GPS RAIM information is available from 1100 to 1400 hours) or a 24-hour timeframe at a particular airport. FAA briefers will provide RAIM information for a period of 1 hour before to 1 hour after the ETA hour, unless a specific timeframe is requested by the pilot. If flying a published GPS departure, a RAIM prediction should also be requested for the departure airport.

(4) The military provides airfield specific GPS RAIM NOTAMs for non-precision approach procedures at military airfields. The RAIM outages
are issued as M-series NOTAMs and may be obtained for up to 24 hours from the time of request.

(5) Receiver manufacturers and/or database suppliers may supply "NOTAM" type information concerning database errors. Pilots should check these sources, when available, to ensure that they have the most current information concerning their electronic database.

# (h) Receiver Autonomous Integrity Monitoring (RAIM)

(1) RAIM outages may occur due to an insufficient number of satellites or due to unsuitable satellite geometry which causes the error in the position solution to become too large. Loss of satellite reception and RAIM warnings may occur due to aircraft dynamics (changes in pitch or bank angle). Antenna location on the aircraft, satellite position relative to the horizon, and aircraft attitude may affect reception of one or more satellites. Since the relative positions of the satellites are constantly changing, prior experience with the airport does not guarantee reception at all times, and RAIM availability should always be checked.

(2) If RAIM is not available, use another type of navigation and approach system, select another route or destination, or delay the trip until RAIM is predicted to be available on arrival. On longer flights, pilots should consider rechecking the RAIM prediction for the destination during the flight. This may provide an early indication that an unscheduled satellite outage has occurred since takeoff.

(3) If a RAIM failure/status annunciation occurs prior to the final approach waypoint (FAWP), the approach should not be completed since GPS no longer provides the required integrity. The receiver performs a RAIM prediction by 2 NM prior to the FAWP to ensure that RAIM is available as a condition for entering the approach mode. The pilot should ensure the receiver has sequenced from "Armed" to "Approach" prior to the FAWP (normally occurs 2 NM prior). Failure to sequence may be an indication of the detection of a satellite anomaly, failure to arm the receiver (if required), or other problems which preclude flying the approach.

(4) If the receiver does not sequence into the approach mode or a RAIM failure/status annunciation occurs prior to the FAWP, the pilot must not initiate the approach or descend, but instead proceed to the missed approach waypoint (MAWP) via the FAWP, perform a missed approach, and contact ATC as soon as practical. The GPS receiver may continue to operate after a RAIM flag/status annunciation appears, but the navigation information should be considered advisory only. Refer to the receiver operating manual for specific indications and instructions associated with loss of RAIM prior to the FAF.

(5) If the RAIM flag/status annunciation appears after the FAWP, the pilot should initiate a climb and execute the missed approach. The GPS receiver may continue to operate after a RAIM flag/status annunciation appears, but the navigation information should be considered advisory only. Refer to the receiver operating manual for operating mode information during a RAIM annunciation.

### (i) Waypoints

(1) GPS receivers navigate from one defined point to another retrieved from the aircraft's onboard navigational database. These points are waypoints (5-letter pronounceable name), existing VHF intersections, DME fixes with 5-letter pronounceable names and 3-letter NAVAID IDs. Each waypoint is a geographical location defined by a latitude/longitude geographic coordinate. These 5-letter waypoints, VHF intersections, 5-letter pronounceable DME fixes and 3-letter NAVAID IDs are published on various FAA aeronautical navigation products (IFR Enroute Charts, VFR Charts, Terminal Procedures Publications, etc.).

(2) A Computer Navigation Fix (CNF) is also a point defined by a latitude/longitude coordinate and is required to support Performance-Based Navigation (PBN) operations. The GPS receiver uses CNFs in conjunction with waypoints to navigate from point to point. However, CNFs are not recognized by ATC. ATC does not maintain CNFs in their database and they do not use CNFs for any air traffic control purpose. CNFs may or may not be charted on FAA aeronautical navigation products, are listed in the chart legends, and are for advisory purposes only. Pilots are not to use CNFs for point to point navigation (proceed direct), filing a flight plan, or in aircraft/ATC communications. CNFs that do appear on aeronautical charts allow pilots increased situational awareness by identifying points in the aircraft database route of flight with points on the aeronautical chart. CNFs are random five-letter identifiers, not pronounceable like waypoints and placed in parenthesis. Eventually, all CNFs will begin with the letters "CF" followed by three consonants (for example, CFWBG). This five-letter identifier will be found next to an "x" on enroute charts and possibly on an approach chart. On instrument approach procedures (charts) in the terminal procedures publication, CNFs may represent unnamed DME fixes, beginning and ending points of DME arcs, and sensor (ground-based signal i.e., VOR, NDB, ILS) final approach fixes on GPS overlay approaches. These CNFs provide the GPS with points on the procedure that allow the overlay approach to mirror the ground-based sensor approach. These points should only be used by the GPS system for navigation and should not be used by pilots for any other purpose on the approach. The CNF concept has not been adopted or recognized by the International Civil Aviation Organization (ICAO).

(3) GPS approaches use fly-over and fly-by waypoints to join route segments on an approach. Fly-by waypoints connect the two segments by allowing the aircraft to turn prior to the current waypoint in order to roll out on course to the next waypoint. This is known as turn anticipation and is compensated for in the airspace and terrain clearances. The MAWP and the missed approach holding waypoint (MAHWP) are normally the only two waypoints on the approach that are not fly-by waypoints. Fly-over waypoints are used when the aircraft must overfly the waypoint prior to starting a turn to the new course. The symbol for a fly-over waypoint is a circled waypoint. Some waypoints may have dual use; for example, as a fly-by waypoint when used as an IF for a NoPT route and as a fly-over waypoint when the same waypoint is also used as an IAF/IF hold-in-lieu of PT. When this occurs, the less restrictive (fly-by) symbology will be charted. Overlay approach charts and some early stand-alone GPS approach charts may not reflect this convention.

(4) Unnamed waypoints for each airport will be uniquely identified in the database. Although the identifier may be used at different airports (for example, RW36 will be the identifier at each airport with a runway 36), the actual point, at each airport, is defined by a specific latitude/longitude coordinate.

(5) The runway threshold waypoint, normally the MAWP, may have a five-letter identifier (for example, SNEEZ) or be coded as RW## (for example, RW36, RW36L). MAWPs located at the runway threshold are being changed to the RW## identifier, while MAWPs not located at the threshold will have a five–letter identifier. This may cause the approach chart to differ from the aircraft database until all changes are complete. The runway threshold waypoint is also used as the center of the Minimum Safe Altitude (MSA) on most GPS approaches.

### (j) Position Orientation.

Pilots should pay particular attention to position orientation while using GPS. Distance and track information are provided to the next active waypoint, not to a fixed navigation aid. Receivers may sequence when the pilot is not flying along an active route, such as when being vectored or deviating for weather, due to the proximity to another waypoint in the route. This can be prevented by placing the receiver in the non-sequencing mode. When the receiver is in the non-sequencing mode, bearing and distance are provided to the selected waypoint and the receiver will not sequence to the next waypoint in the route until placed back in the auto sequence mode or the pilot selects a different waypoint. The pilot may have to compute the ATD to stepdown fixes and other points on overlay approaches, due to the receiver showing ATD to the next waypoint rather than DME to the VOR or ILS ground station.

# (k) Impact of Magnetic Variation on PBN Systems

(1) Differences may exist between PBN systems and the charted magnetic courses on ground-based NAVAID instrument flight procedures (IFP), enroute charts, approach charts, and Standard Instrument Departure/Standard Terminal Arrival (SID/STAR) charts. These differences are due to the magnetic variance used to calculate the magnetic course. Every leg of an instrument procedure is first computed along a desired ground track with reference to true north. A magnetic variation correction is then applied to the true course in order to calculate a magnetic course for publication. The type of procedure will determine what magnetic variation value is added to the true course. A ground-based NAVAID IFP applies the facility magnetic variation of record to the true course to get the charted magnetic course. Magnetic courses on PBN procedures are calculated two different ways. SID/STAR procedures use the airport magnetic variation of record, while IFR enroute charts use magnetic reference bearing. PBN systems make a correction to true north by adding a magnetic variation calculated with an algorithm based on aircraft position, or by adding the magnetic variation coded in their navigational database. This may result in the PBN system and the procedure designer using a different magnetic variation, which causes the magnetic course displayed by the PBN system and the magnetic course *charted* on the IFP plate to be different. It is important to understand, however, that PBN systems, (with the exception of VOR/DME RNAV equipment) navigate by reference to true north and display magnetic course only for pilot reference. As such, a *properly* functioning PBN system, containing a current and accurate navigational database, should fly the correct ground track for any loaded instrument procedure, despite differences in displayed magnetic course that may be attributed to magnetic variation application. Should significant differences between the approach chart and the PBN system avionics' application of the navigation database arise, the published approach chart, supplemented by NOT-AMs, holds precedence.

(2) The course into a waypoint may not always be 180 degrees different from the course leaving the previous waypoint, due to the PBN system avionics' computation of geodesic paths, distance between waypoints, and differences in magnetic variation application. Variations in distances may also occur since PBN system distance-to-waypoint values are ATDs computed to the next waypoint and the DME values published on underlying procedures are slant-range distances measured to the station. This difference increases with aircraft altitude and proximity to the NAVAID.

#### (I) GPS Familiarization

Pilots should practice GPS approaches in visual meteorological conditions (VMC) until thoroughly proficient with all aspects of their equipment (receiver and installation) prior to attempting flight in instrument meteorological conditions (IMC). Pilots should be proficient in the following areas:

(1) Using the receiver autonomous integrity monitoring (RAIM) prediction function;

(2) Inserting a DP into the flight plan, including setting terminal CDI sensitivity, if required, and the conditions under which terminal RAIM is available for departure;

(3) Programming the destination airport;

(4) Programming and flying the approaches (especially procedure turns and arcs);

(5) Changing to another approach after selecting an approach;

(6) Programming and flying "direct" missed approaches;

(7) Programming and flying "routed" missed approaches;

(8) Entering, flying, and exiting holding patterns, particularly on approaches with a second waypoint in the holding pattern;

(9) Programming and flying a "route" from a holding pattern;

(10) Programming and flying an approach with radar vectors to the intermediate segment;

(11) Indication of the actions required for RAIM failure both before and after the FAWP; and

(12) Programming a radial and distance from a VOR (often used in departure instructions).

			TSO-C129			
Equipment Class	RAIM	Int. Nav. Sys. to Prov. RAIM Equiv.	Oceanic	En Route	Terminal	Non–precision Approach Capable
Class A – GPS se	nsor and navigation	n capability.				
A1	yes		yes	yes	yes	yes
A2	yes		yes	yes	yes	no
Class B – GPS set	nsor data to an inte	grated navigation sy	vstem (i.e., FMS, m	ulti–sensor navigat	ion system, etc.).	
B1	yes		yes	yes	yes	yes
B2	yes		yes	yes	yes	no
B3		yes	yes	yes	yes	yes
B4		yes	yes	yes	yes	no
Class C – GPS se flight director, to r	nsor data to an inte reduce flight tech. e	grated navigation sy errors. Limited to 14	vstem (as in Class I CFR Part 121 or e	<ol> <li>Which provides e quivalent criteria.</li> </ol>	enhanced guidance	to an autopilot, or
C1	yes		yes	yes	yes	yes
C2	yes		yes	yes	yes	no
C3		yes	yes	yes	yes	yes
C4		ves	ves	ves	ves	no

TBL 1-1-5 GPS IFR Equipment Classes/Categories

*TBL 1–1–6* GPS Approval Required/Authorized Use

Equipment Type <sup>1</sup>	Installation Approval Required	Operational Approval Required	IFR En Route <sup>2</sup>	IFR Terminal <sup>2</sup>	IFR Approach <sup>3</sup>	Oceanic Remote	In Lieu of ADF and/or DME <sup>3</sup>
Hand held <sup>4</sup>	X <sup>5</sup>						
VFR Panel Mount <sup>4</sup>	Х						
IFR En Route and Terminal	Х	X	Х	Х			X
IFR Oceanic/ Remote	Х	X	Х	Х		Х	X
IFR En Route, Terminal, and Approach	Х	Х	Х	Х	Х		X

#### NOTE-

<sup>1</sup>To determine equipment approvals and limitations, refer to the AFM, AFM supplements, or pilot guides.

<sup>2</sup>Requires verification of data for correctness if database is expired.

<sup>3</sup>*Requires current database or verification that the procedure has not been amended since the expiration of the database.* <sup>4</sup>*VFR and hand–held GPS systems are not authorized for IFR navigation, instrument approaches, or as a primary instrument flight reference. During IFR operations they may be considered only an aid to situational awareness.* 

<sup>5</sup>Hand-held receivers require no approval. However, any aircraft modification to support the hand-held receiver; *i.e., installation of an external antenna or a permanent mounting bracket, does require approval.* 

# 1–1–19. Wide Area Augmentation System (WAAS)

#### a. General

1. The FAA developed the WAAS to improve the accuracy, integrity and availability of GPS signals. WAAS will allow GPS to be used, as the aviation navigation system, from takeoff through approach when it is complete. WAAS is a critical component of the FAA's strategic objective for a seamless satellite navigation system for civil aviation, improving capacity and safety.

2. The International Civil Aviation Organization (ICAO) has defined Standards and Recommended Practices (SARPs) for satellite-based augmentation systems (SBAS) such as WAAS. Japan, India, and Europe are building similar systems: EGNOS, the European Geostationary Navigation Overlay System; India's GPS and Geo-Augmented Navigation (GAGAN) system; and Japan's Multi-functional Transport Satellite (MT-SAT)-based Satellite Augmentation System (MSAS). The merging of these systems will create an expansive navigation capability similar to GPS, but with greater accuracy, availability, and integrity.

3. Unlike traditional ground-based navigation aids, WAAS will cover a more extensive service area. Precisely surveyed wide-area reference stations (WRS) are linked to form the U.S. WAAS network. Signals from the GPS satellites are monitored by these WRSs to determine satellite clock and ephemeris corrections and to model the propagation effects of the ionosphere. Each station in the network relays the data to a wide-area master station (WMS) where the correction information is computed. A correction message is prepared and uplinked to a geostationary earth orbit satellite (GEO) via a GEO uplink subsystem (GUS) which is located at the ground earth station (GES). The message is then broadcast on the same frequency as GPS (L1, 1575.42 MHz) to WAAS receivers within the broadcast coverage area of the WAAS GEO.

4. In addition to providing the correction signal, the WAAS GEO provides an additional pseudorange measurement to the aircraft receiver, improving the availability of GPS by providing, in effect, an additional GPS satellite in view. The integrity of GPS is improved through real-time monitoring, and the accuracy is improved by providing differential corrections to reduce errors. The performance improvement is sufficient to enable approach procedures with GPS/WAAS glide paths (vertical guidance).

**5.** The FAA has completed installation of 3 GEO satellite links, 38 WRSs, 3 WMSs, 6 GES, and the required terrestrial communications to support the WAAS network including 2 operational control centers. Prior to the commissioning of the WAAS for public use, the FAA conducted a series of test and validation activities. Future dual frequency operations are planned.

6. GNSS navigation, including GPS and WAAS, is referenced to the WGS–84 coordinate system. It should only be used where the Aeronautical Information Publications (including electronic data and aeronautical charts) conform to WGS–84 or equivalent. Other countries' civil aviation authorities may impose additional limitations on the use of their SBAS systems.

#### b. Instrument Approach Capabilities

**1.** A class of approach procedures which provide vertical guidance, but which do not meet the ICAO Annex 10 requirements for precision approaches has been developed to support satellite navigation use for aviation applications worldwide. These procedures are not precision and are referred to as Approach with Vertical Guidance (APV), are defined in ICAO Annex 6, and include approaches such as the LNAV/VNAV and localizer performance with vertical guidance (LPV). These approaches provide vertical guidance, but do not meet the more stringent standards of a precision approach. Properly certified WAAS receivers will be able to fly will be able to fly to LPV minima and LNAV/VNAV minima, using a WAAS electronic glide path, which eliminates the errors that can be introduced by using Barometric altimetry.

2. LPV minima takes advantage of the high accuracy guidance and increased integrity provided by WAAS. This WAAS generated angular guidance allows the use of the same TERPS approach criteria used for ILS approaches. LPV minima may have a decision altitude as low as 200 feet height above touchdown with visibility minimums as low as  $1/_2$  mile, when the terrain and airport infrastructure support the lowest minima. LPV minima is published on the RNAV (GPS) approach charts (see Paragraph 5–4–5, Instrument Approach Procedure Charts).

**3.** A different WAAS-based line of minima, called Localizer Performance (LP) is being added in locations where the terrain or obstructions do not allow publication of vertically guided LPV minima. LP takes advantage of the angular lateral guidance and smaller position errors provided by WAAS to provide a lateral only procedure similar to an ILS Localizer. LP procedures may provide lower minima than a LNAV procedure due to the narrower obstacle clearance surface.

#### NOTE-

WAAS receivers certified prior to TSO-C145b and TSO-C146b, even if they have LPV capability, do not contain LP capability unless the receiver has been upgraded. Receivers capable of flying LP procedures must contain a statement in the Aircraft Flight Manual (AFM), AFM Supplement, or Approved Supplemental Flight Manual stating that the receiver has LP capability, as well as the capability for the other WAAS and GPS approach procedure types.

**4.** WAAS provides a level of service that supports all phases of flight, including RNAV (GPS) approaches to LNAV, LP, LNAV/VNAV, and LPV lines of minima, within system coverage. Some locations close to the edge of the coverage may have a lower availability of vertical guidance.

#### c. General Requirements

**1.** WAAS avionics must be certified in accordance with Technical Standard Order (TSO) TSO-C145(), Airborne Navigation Sensors Using the (GPS) Augmented by the Wide Area Augmentation System (WAAS); or TSO-C146(), Stand-Alone Airborne Navigation Equipment Using the Global Positioning System (GPS) Augmented by the Wide Area Augmentation System (WAAS), and installed in accordance with Advisory Circular (AC) 20–138(), *Airworthiness Approval of Positioning and Navigation Systems*.

2. GPS/WAAS operation must be conducted in accordance with the FAA–approved aircraft flight manual (AFM) and flight manual supplements. Flight manual supplements will state the level of approach procedure that the receiver supports. IFR approved WAAS receivers support all GPS only operations as long as lateral capability at the appropriate level is functional. WAAS monitors both GPS and WAAS satellites and provides integrity.

**3.** GPS/WAAS equipment is inherently capable of supporting oceanic and remote operations if the

operator obtains a fault detection and exclusion (FDE) prediction program.

**4.** Air carrier and commercial operators must meet the appropriate provisions of their approved operations specifications.

**5.** Prior to GPS/WAAS IFR operation, the pilot must review appropriate Notices to Airmen (NOT-AMs) and aeronautical information. This information is available on request from a Flight Service Station. The FAA will provide NOTAMs to advise pilots of the status of the WAAS and level of service available.

(a) The term MAY NOT BE AVBL is used in conjunction with WAAS NOTAMs and indicates that due to ionospheric conditions, lateral guidance may still be available when vertical guidance is unavailable. Under certain conditions, both lateral and vertical guidance may be unavailable. This NOTAM language is an advisory to pilots indicating the expected level of WAAS service (LNAV/VNAV, LPV, LP) may not be available.

#### EXAMPLE-

!FDC FDC NAV WAAS VNAV/LPV/LP MINIMA MAY NOT BE AVBL 1306111330-1306141930EST

!FDC FDC NAV WAAS VNAV/LPV MINIMA NOT AVBL, WAAS LP MINIMA MAY NOT BE AVBL 1306021200-1306031200EST

WAAS MAY NOT BE AVBL NOTAMs are predictive in nature and published for flight planning purposes. Upon commencing an approach at locations NOTAMed WAAS MAY NOT BE AVBL, if the WAAS avionics indicate LNAV/VNAV or LPV service is available, then vertical guidance may be used to complete the approach using the displayed level of service. Should an outage occur during the approach, reversion to LNAV minima or an alternate instrument approach procedure may be required. When GPS testing NOTAMS are published and testing is actually occurring, Air Traffic Control will advise pilots requesting or cleared for a GPS or RNAV (GPS) approach that GPS may not be available and request intentions. If pilots have reported GPS anomalies, Air Traffic Control will request the pilot's intentions and/or clear the pilot for an alternate approach, if available and operational.

(b) WAAS area-wide NOTAMs are originated when WAAS assets are out of service and impact the service area. Area-wide WAAS NOT AVAIL-ABLE (AVBL) NOTAMs indicate loss or malfunction of the WAAS system. In flight, Air Traffic Control will advise pilots requesting a GPS or RNAV (GPS) approach of WAAS NOT AVBL NOTAMs if not contained in the ATIS broadcast.

#### EXAMPLE-

For unscheduled loss of signal or service, an example NOTAM is: !FDC FDC NAV WAAS NOT AVBL 1311160600-1311191200EST.

For scheduled loss of signal or service, an example NOTAM is: !FDC FDC NAV WAAS NOT AVBL 1312041015- 1312082000EST.

(c) Site-specific WAAS MAY NOT BE AVBL NOTAMs indicate an expected level of service; for example, LNAV/VNAV, LP, or LPV may not be available. Pilots must request site-specific WAAS NOTAMs during flight planning. In flight, Air Traffic Control will not advise pilots of WAAS MAY NOT BE AVBL NOTAMs.

#### NOTE-

Though currently unavailable, the FAA is updating its prediction tool software to provide this site-service in the future.

(d) Most of North America has redundant coverage by two or more geostationary satellites. One exception is the northern slope of Alaska. If there is a problem with the satellite providing coverage to this area, a NOTAM similar to the following example will be issued:

#### EXAMPLE-

!FDC 4/3406 (PAZA A0173/14) ZAN NAV WAAS SIGNAL MAY NOT BE AVBL NORTH OF LINE FROM 7000N150000W TO 6400N16400W. RMK WAAS USERS SHOULD CONFIRM RAIM AVAILABILITY FOR IFR OPERATIONS IN THIS AREA. T-ROUTES IN THIS SECTOR NOT AVBL. ANY REQUIRED ALTERNATE AIRPORT IN THIS AREA MUST HAVE AN APPROVED INSTRUMENT APPROACH PROCEDURE OTHER THAN GPS THAT IS ANTICIPATED TO BE OPERATION-AL AND AVAILABLE AT THE ESTIMATED TIME OF ARRIVAL AND WHICH THE AIRCRAFT IS EQUIPPED TO FLY. 1406030812-1406050812EST.

6. When GPS-testing NOTAMS are published and testing is actually occurring, Air Traffic Control will advise pilots requesting or cleared for a GPS or RNAV (GPS) approach that GPS may not be available and request intentions. If pilots have reported GPS anomalies, Air Traffic Control will request the pilot's intentions and/or clear the pilot for an alternate approach, if available and operational.

#### EXAMPLE-

Here is an example of a GPS testing NOTAM: !GPS 06/001 ZAB NAV GPS (INCLUDING WAAS, GBAS, AND ADS-B) MAY NOT BE AVAILABLE WITHIN A 468NM RADIUS CENTERED AT 330702N1062540W (TCS 093044) FL400-UNL DECREASING IN AREA WITH A DECREASE IN ALTITUDE DEFINED AS: 425NM RADIUS AT FL250, 360NM RADIUS AT 10000FT, 354NM RADIUS AT 4000FT AGL, 327NM RADIUS AT 50FT AGL. 1406070300-1406071200.

7. When the approach chart is annotated with the ₩ symbol, site-specific WAAS MAY NOT BE AVBL NOTAMs or Air Traffic advisories are not provided for outages in WAAS LNAV/VNAV and LPV vertical service. Vertical outages may occur daily at these locations due to being close to the edge of WAAS system coverage. Use LNAV or circling minima for flight planning at these locations, whether as a destination or alternate. For flight operations at these locations, when the WAAS avionics indicate that LNAV/VNAV or LPV service is available, then the vertical guidance may be used to complete the approach using the displayed level of service. Should an outage occur during the procedure, reversion to LNAV minima may be required.

#### NOTE-

Area-wide WAAS NOT AVBL NOTAMs apply to all airports in the WAAS NOT AVBL area designated in the NOTAM, including approaches at airports where an approach chart is annotated with the  $\mathbb{W}$  symbol.

**8.** GPS/WAAS was developed to be used within GEO coverage over North America without the need for other radio navigation equipment appropriate to the route of flight to be flown. Outside the WAAS coverage or in the event of a WAAS failure, GPS/WAAS equipment reverts to GPS–only operation and satisfies the requirements for basic GPS equipment. (See paragraph 1–1–18 for these requirements).

**9.** Unlike TSO-C129 avionics, which were certified as a supplement to other means of navigation, WAAS avionics are evaluated without reliance on other navigation systems. As such, installation of WAAS avionics does not require the aircraft to have other equipment appropriate to the route to be flown. (See paragraph 1-1-18d for more information on equipment requirements.)

(a) Pilots with WAAS receivers may flight plan to use any instrument approach procedure authorized for use with their WAAS avionics as the planned approach at a required alternate, with the following restrictions. When using WAAS at an alternate airport, flight planning must be based on flying the RNAV (GPS) LNAV or circling minima line, or minima on a GPS approach procedure, or conventional approach procedure with "or GPS" in the title. Code of Federal Regulation (CFR) Part 91 non-precision weather requirements must be used for planning. Upon arrival at an alternate, when the WAAS navigation system indicates that LNAV/ VNAV or LPV service is available, then vertical guidance may be used to complete the approach using the displayed level of service. The FAA has begun removing the **A** NA (Alternate Minimums Not Authorized) symbol from select RNAV (GPS) and GPS approach procedures so they may be used by approach approved WAAS receivers at alternate airports. Some approach procedures will still require the  $\triangle$  NA for other reasons, such as no weather reporting, so it cannot be removed from all procedures. Since every procedure must be individually evaluated, removal of the **A** NA from RNAV (GPS) and GPS procedures will take some time.

#### NOTE-

Properly trained and approved, as required, TSO-C145() and TSO-C146() equipped users (WAAS users) with and using approved baro-VNAV equipment may plan for LNAV/VNAV DA at an alternate airport. Specifically authorized WAAS users with and using approved baro-VNAV equipment may also plan for RNP 0.3 DA at the alternate airport as long as the pilot has verified RNP availability through an approved prediction program.

#### d. Flying Procedures with WAAS

1. WAAS receivers support all basic GPS approach functions and provide additional capabilities. One of the major improvements is the ability to generate glide path guidance, independent of ground equipment or barometric aiding. This eliminates several problems such as hot and cold temperature effects, incorrect altimeter setting, or lack of a local altimeter source. It also allows approach procedures to be built without the cost of installing ground stations at each airport or runway. Some approach certified receivers may only generate a glide path with performance similar to Baro-VNAV and are only approved to fly the LNAV/VNAV line of minima on the RNAV (GPS) approach charts. Receivers with additional capability (including faster update rates and smaller integrity limits) are approved to fly the LPV line of minima. The lateral integrity changes dramatically from the 0.3 NM (556 meter) limit for GPS, LNAV, and LNAV/VNAV approach mode, to 40 meters for LPV. It also provides vertical integrity monitoring, which bounds the vertical error to 50 meters for LNAV/VNAV and LPVs with minima of 250' or above, and bounds the vertical error to 35 meters for LPVs with minima below 250'.

2. When an approach procedure is selected and active, the receiver will notify the pilot of the most accurate level of service supported by the combination of the WAAS signal, the receiver, and the selected approach, using the naming conventions on the minima lines of the selected approach procedure. For example, if an approach is published with LPV minima and the receiver is only certified for LNAV/VNAV, the equipment would indicate "LNAV/VNAV available," even though the WAAS signal would support LPV. If flying an existing LNAV/VNAV procedure with no LPV minima, the receiver will notify the pilot "LNAV/VNAV available," even if the receiver is certified for LPV and the signal supports LPV. If the signal does not support vertical guidance on procedures with LPV and/or LNAV/VNAV minima, the receiver annunciation will read "LNAV available." On lateral only procedures with LP and LNAV minima the receiver will indicate "LP available" or "LNAV available" based on the level of lateral service available. Once the level of service notification has been given, the receiver will operate in this mode for the duration of the approach procedure, unless that level of service becomes unavailable. The receiver cannot change back to a more accurate level of service until the next time an approach is activated.

#### NOTE-

Receivers do not "fail down" to lower levels of service once the approach has been activated. If only the vertical off flag appears, the pilot may elect to use the LNAV minima if the rules under which the flight is operating allow changing the type of approach being flown after commencing the procedure. If the lateral integrity limit is exceeded on an LP approach, a missed approach will be necessary since there is no way to reset the lateral alarm limit while the approach is active.

**3.** Another additional feature of WAAS receivers is the ability to exclude a bad GPS signal and continue operating normally. This is normally accomplished by the WAAS correction information. Outside WAAS coverage or when WAAS is not available, it is accomplished through a receiver algorithm called FDE. In most cases this operation will be invisible to the pilot since the receiver will

continue to operate with other available satellites after excluding the "bad" signal. This capability increases the reliability of navigation.

4. Both lateral and vertical scaling for the LNAV/VNAV and LPV approach procedures are different than the linear scaling of basic GPS. When the complete published procedure is flown,  $\pm 1$  NM linear scaling is provided until two (2) NM prior to the FAF, where the sensitivity increases to be similar to the angular scaling of an ILS. There are two differences in the WAAS scaling and ILS: 1) on long final approach segments, the initial scaling will be  $\pm 0.3$  NM to achieve equivalent performance to GPS (and better than ILS, which is less sensitive far from the runway); 2) close to the runway threshold, the scaling changes to linear instead of continuing to become more sensitive. The width of the final approach course is tailored so that the total width is usually 700 feet at the runway threshold. Since the origin point of the lateral splay for the angular portion of the final is not fixed due to antenna placement like localizer, the splay angle can remain fixed, making a consistent width of final for aircraft being vectored onto the final approach course on different length runways. When the complete published procedure is not flown, and instead the aircraft needs to capture the extended final approach course similar to ILS, the vector to final (VTF) mode is used. Under VTF, the scaling is linear at  $\pm$  NM until the point where the ILS angular splay reaches a width of  $\pm 1$  NM regardless of the distance from the FAWP.

**5.** The WAAS scaling is also different than GPS TSO-C129() in the initial portion of the missed approach. Two differences occur here. First, the scaling abruptly changes from the approach scaling to the missed approach scaling, at approximately the departure end of the runway or when the pilot selects missed approach guidance rather than ramping as GPS does. Second, when the first leg of the missed approach is a Track to Fix (TF) leg aligned within 3 degrees of the inbound course, the receiver will change to 0.3 NM linear sensitivity until the turn initiation point for the first waypoint in the missed approach procedure, at which time it will abruptly change to terminal  $(\pm 1 \text{ NM})$  sensitivity. This allows the elimination of close in obstacles in the early part of the missed approach that may otherwise cause the DA to be raised.

6. There are two ways to select the final approach segment of an instrument approach. Most receivers use menus where the pilot selects the airport, the runway, the specific approach procedure and finally the IAF, there is also a channel number selection method. The pilot enters a unique 5–digit number provided on the approach chart, and the receiver recalls the matching final approach segment from the aircraft database. A list of information including the available IAFs is displayed and the pilot selects the appropriate IAF. The pilot should confirm that the correct final approach segment was loaded by cross checking the Approach ID, which is also provided on the approach chart.

7. The Along–Track Distance (ATD) during the final approach segment of an LNAV procedure (with a minimum descent altitude) will be to the MAWP. On LNAV/VNAV and LPV approaches to a decision altitude, there is no missed approach waypoint so the along-track distance is displayed to a point normally located at the runway threshold. In most cases, the MAWP for the LNAV approach is located on the runway threshold at the centerline, so these distances will be the same. This distance will always vary slightly from any ILS DME that may be present, since the ILS DME is located further down the runway. Initiation of the missed approach on the LNAV/ VNAV and LPV approaches is still based on reaching the decision altitude without any of the items listed in 14 CFR Section 91.175 being visible, and must not be delayed while waiting for the ATD to reach zero. The WAAS receiver, unlike a GPS receiver, will automatically sequence past the MAWP if the missed approach procedure has been designed for RNAV. The pilot may also select missed approach prior to the MAWP; however, navigation will continue to the MAWP prior to waypoint sequencing taking place.

# 1–1–20. Ground Based Augmentation System (GBAS) Landing System (GLS)

#### a. General

1. The GLS provides precision navigation guidance for exact alignment and descent of aircraft on approach to a runway. It provides differential augmentation to the Global Navigation Satellite System (GNSS).

#### NOTE-

GBAS is the ICAO term for Local Area Augmentation System (LAAS).

**2.** LAAS was developed as an "ILS look–alike" system from the pilot perspective. LAAS is based on GPS signals augmented by ground equipment and has been developed to provide GLS precision approaches similar to ILS at airfields.

**3.** GLS provides guidance similar to ILS approaches for the final approach segment; portions of the GLS approach prior to and after the final approach segment will be based on Area Navigation (RNAV) or Required Navigation Performance (RNP).

**4.** The equipment consists of a GBAS Ground Facility (GGF), four reference stations, a VHF Data Broadcast (VDB) uplink antenna, and an aircraft GBAS receiver.

#### b. Procedure

**1.** Pilots will select the five digit GBAS channel number of the associated approach within the Flight Management System (FMS) menu or manually select the five digits (system dependent). Selection of the GBAS channel number also tunes the VDB.

2. Following procedure selection, confirmation that the correct LAAS procedure is loaded can be accomplished by cross checking the charted Reference Path Indicator (RPI) or approach ID with the cockpit displayed RPI or audio identification of the RPI with Morse Code (for some systems).

**3.** The pilot will fly the GLS approach using the same techniques as an ILS, once selected and identified.

# 1–1–21. Precision Approach Systems other than ILS and GLS

#### a. General

Approval and use of precision approach systems other than ILS and GLS require the issuance of special instrument approach procedures.

#### b. Special Instrument Approach Procedure

1. Special instrument approach procedures must be issued to the aircraft operator if pilot training, aircraft equipment, and/or aircraft performance is different than published procedures. Special instrument approach procedures are not distributed for general public use. These procedures are issued to an aircraft operator when the conditions for operations approval are satisfied. 2. General aviation operators requesting approval for special procedures should contact the local Flight Standards District Office to obtain a letter of authorization. Air carrier operators requesting approval for use of special procedures should contact their Certificate Holding District Office for authorization through their Operations Specification.

#### c. Transponder Landing System (TLS)

**1.** The TLS is designed to provide approach guidance utilizing existing airborne ILS localizer, glide slope, and transponder equipment.

2. Ground equipment consists of a transponder interrogator, sensor arrays to detect lateral and vertical position, and ILS frequency transmitters. The TLS detects the aircraft's position by interrogating its transponder. It then broadcasts ILS frequency signals to guide the aircraft along the desired approach path.

3. TLS instrument approach procedures are designated Special Instrument Approach Procedures. Special aircrew training is required. TLS ground equipment provides approach guidance for only one aircraft at a time. Even though the TLS signal is received using the ILS receiver, no fixed course or glidepath is generated. The concept of operation is very similar to an air traffic controller providing radar vectors, and just as with radar vectors, the guidance is valid only for the intended aircraft. The TLS ground equipment tracks one aircraft, based on its transponder code, and provides correction signals to course and glidepath based on the position of the tracked aircraft. Flying the TLS corrections computed for another aircraft will not provide guidance relative to the approach; therefore, aircrews must not use the TLS signal for navigation unless they have received approach clearance and completed the required coordination with the TLS ground equipment operator. Navigation fixes based on conventional NAVAIDs or GPS are provided in the special instrument approach procedure to allow aircrews to verify the TLS guidance.

# d. Special Category I Differential GPS (SCAT-I DGPS)

**1.** The SCAT–I DGPS is designed to provide approach guidance by broadcasting differential correction to GPS.

**2.** SCAT–I DGPS procedures require aircraft equipment and pilot training.

**3.** Ground equipment consists of GPS receivers and a VHF digital radio transmitter. The SCAT–I

DGPS detects the position of GPS satellites relative to GPS receiver equipment and broadcasts differential corrections over the VHF digital radio.

4. Category I Ground Based Augmentation

System (GBAS) will displace SCAT–I DGPS as the public use service.

#### REFERENCE-

AIM, Para 5-4-7f, Instrument Approach Procedures.

# Section 2. Performance–Based Navigation (PBN) and Area Navigation (RNAV)

# 1–2–1. Performance–Based Navigation (PBN) and Area Navigation (RNAV)

a. Introduction to PBN. As air travel has evolved, methods of navigation have improved to give operators more flexibility. Under the umbrella of area navigation, there are legacy and performancebased navigation (PBN) methods, see FIG 1-2-1. The legacy methods include operations incorporating systems approved under AC 90-45, Approval of Area Navigation Systems for Use in the U.S. National Airspace System, which allows two-dimensional area navigation (2D RNAV) within the U.S. National Airspace System (NAS). AC 90-45 describes 2D RNAV in terms of both VOR/DME dependent systems and self-contained systems such as Inertial Navigation Systems (INS). Many operators have upgraded their systems to obtain the benefits of PBN. Within PBN there are two main categories of navigation methods: area navigation (RNAV) and required navigation performance (RNP). For an aircraft to meet the requirements of RNAV, a specified RNAV accuracy must be met 95 percent of the flight time. RNP is an RNAV system that includes onboard performance monitoring and alerting capability (for example, Receiver Autonomous Integrity Monitoring (RAIM)). PBN also introduces the concept of navigation specifications (Nav Specs) which are a set of aircraft and aircrew requirements needed to support a navigation application within a defined airspace concept. For both RNP and RNAV designations, the numerical designation refers to the lateral navigation accuracy in nautical miles which is expected to be achieved at least 95 percent of the flight time by the population of aircraft operating within the airspace, route, or procedure. This information is introduced in International Civil Aviation Organization's (ICAO) Doc 9613, Performance-based Navigation (PBN) Manual (Fourth Edition, 2013) and the FAA Advisory Circular (AC) 90-105A, Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System and in Remote and Oceanic Airspace (expected publication date in late 2014) further develops this story.

FIG 1-2-1



#### b. Area Navigation (RNAV)

**1. General.** RNAV is a method of navigation that permits aircraft operation on any desired flight path within the coverage of ground– or space–based navigation aids or within the limits of the capability of self–contained aids, or a combination of these. In the future, there will be an increased dependence on the use of RNAV in lieu of routes defined by ground–based navigation aids. RNAV routes and terminal procedures, including departure procedures (DPs) and standard terminal arrivals (STARs), are designed with RNAV systems in mind. There are several potential advantages of RNAV routes and procedures:

(a) Time and fuel savings;

(b) Reduced dependence on radar vectoring, altitude, and speed assignments allowing a reduction in required ATC radio transmissions; and

(c) More efficient use of airspace. In addition to information found in this manual, guidance for domestic RNAV DPs, STARs, and routes may also be found in Advisory Circular 90–100(), U.S. Terminal and En Route Area Navigation (RNAV) Operations.

2. RNAV Operations. RNAV procedures, such as DPs and STARs, demand strict pilot awareness and maintenance of the procedure centerline. Pilots should possess a working knowledge of their aircraft navigation system to ensure RNAV procedures are flown in an appropriate manner. In addition, pilots should have an understanding of the various waypoint and leg types used in RNAV procedures; these are discussed in more detail below.

(a) Waypoints. A waypoint is a predetermined geographical position that is defined in terms of latitude/longitude coordinates. Waypoints may be a simple named point in space or associated with existing navaids, intersections, or fixes. A waypoint is most often used to indicate a change in direction, speed, or altitude along the desired path. RNAV procedures make use of both fly–over and fly–by waypoints.

(1) Fly-by waypoints. Fly-by waypoints are used when an aircraft should begin a turn to the next course prior to reaching the waypoint separating the two route segments. This is known as turn anticipation.

(2) Fly–over waypoints. Fly–over waypoints are used when the aircraft must fly over the point prior to starting a turn.

### NOTE-

FIG 1–2–2 illustrates several differences between a fly–by and a fly–over waypoint.

(b) **RNAV Leg Types.** A leg type describes the desired path proceeding, following, or between waypoints on an RNAV procedure. Leg types are identified by a two–letter code that describes the path (e.g., heading, course, track, etc.) and the termination point (e.g., the path terminates at an altitude, distance, fix, etc.). Leg types used for procedure design are included in the aircraft navigation database, but not normally provided on the procedure chart. The narrative depiction of the RNAV chart describes how a procedure is flown. The "path and terminator concept" defines that every leg of a procedure has a termination point and some kind of path into that termination point. Some of the available leg types are described below.

(1) Track to Fix. A Track to Fix (TF) leg is intercepted and acquired as the flight track to the following waypoint. Track to a Fix legs are sometimes called point-to-point legs for this reason. *Narrative:* "*direct ALPHA, then on course to BRAVO WP.*" See FIG 1–2–3.

(2) Direct to Fix. A Direct to Fix (DF) leg is a path described by an aircraft's track from an initial area direct to the next waypoint. *Narrative: "turn right direct BRAVO WP."* See FIG 1–2–4.



*FIG 1–2–2* Fly–by and Fly–over Waypoints

*FIG 1–2–3* **Track to Fix Leg Type** 



*FIG 1–2–4* Direct to Fix Leg Type



(3) Course to Fix. A Course to Fix (CF) leg is a path that terminates at a fix with a specified course at that fix. *Narrative:* "on course 150 to ALPHA WP." See FIG 1–2–5.

FIG 1-2-5 Course to Fix Leg Type



(4) **Radius to Fix.** A Radius to Fix (RF) leg is defined as a constant radius circular path around a defined turn center that terminates at a fix. See FIG 1–2–6.



(5) Heading. A Heading leg may be defined as, but not limited to, a Heading to Altitude (VA), Heading to DME range (VD), and Heading to Manual Termination, i.e., Vector (VM). Narrative: "climb heading 350 to 1500", "heading 265, at 9 DME west of PXR VORTAC, right turn heading 360", "fly heading 090, expect radar vectors to DRYHT INT."

(c) Navigation Issues. Pilots should be aware of their navigation system inputs, alerts, and annunciations in order to make better–informed decisions. In addition, the availability and suitability of particular sensors/systems should be considered.

(1) GPS/WAAS. Operators using TSO–C129(), TSO–C196(), TSO–C145() or TSO–C146() systems should ensure departure and arrival airports are entered to ensure proper RAIM availability and CDI sensitivity.

(2) **DME/DME.** Operators should be aware that DME/DME position updating is dependent on navigation system logic and DME facility proximity, availability, geometry, and signal masking.

(3) VOR/DME. Unique VOR characteristics may result in less accurate values from VOR/DME position updating than from GPS or DME/DME position updating.

(4) Inertial Navigation. Inertial reference units and inertial navigation systems are often coupled with other types of navigation inputs, e.g., DME/DME or GPS, to improve overall navigation system performance.

### NOTE-

Specific inertial position updating requirements may apply.

(d) Flight Management System (FMS). An FMS is an integrated suite of sensors, receivers, and computers, coupled with a navigation database. These systems generally provide performance and RNAV guidance to displays and automatic flight control systems.

Inputs can be accepted from multiple sources such as GPS, DME, VOR, LOC and IRU. These inputs may be applied to a navigation solution one at a time or in combination. Some FMSs provide for the detection and isolation of faulty navigation information.

When appropriate navigation signals are available, FMSs will normally rely on GPS and/or DME/DME (that is, the use of distance information from two or more DME stations) for position updates. Other inputs may also be incorporated based on FMS system architecture and navigation source geometry.

#### NOTE-

DME/DME inputs coupled with one or more IRU(s) are often abbreviated as DME/DME/IRU or D/D/I.

# (e) RNAV Navigation Specifications (Nav Specs)

Nav Specs are a set of aircraft and aircrew requirements needed to support a navigation application within a defined airspace concept. For both RNP and RNAV designations, the numerical designation refers to the lateral navigation accuracy in nautical miles which is expected to be achieved at least 95 percent of the flight time by the population of aircraft operating within the airspace, route, or procedure. (See FIG 1–2–1.)

(1) **RNAV 1.** Typically RNAV 1 is used for DPs and STARs and appears on the charts. Aircraft must maintain a total system error of not more than 1 NM for 95 percent of the total flight time.

(2) **RNAV 2.** Typically RNAV 2 is used for en route operations unless otherwise specified. T-routes and Q-routes are examples of this Nav Spec. Aircraft must maintain a total system error of not more than 2 NM for 95 percent of the total flight time.

(3) **RNAV 10.** Typically RNAV 10 is used in oceanic operations. See paragraph 4–7–1 for specifics and explanation of the relationship between RNP 10 and RNAV 10 terminology.

# 1–2–2. Required Navigation Performance (RNP)

a. General. RNP is RNAV with onboard navigation monitoring and alerting. RNP is also a statement of navigation performance necessary for operation within a defined airspace. A critical component of RNP is the *ability of the aircraft navigation system to* monitor its achieved navigation performance, and to identify for the pilot whether the operational requirement is, or is not, being met during an operation. This onboard performance monitoring and alerting capability therefore allows a lessened reliance on air traffic control intervention (via radar monitoring, automatic dependent surveillance (ADS), multilateration, communications), and/or route separation to achieve the overall safety of the operation. RNP capability of the aircraft is a major component in determining the separation criteria to ensure that the overall containment of the operation is met.

The RNP capability of an aircraft will vary depending upon the aircraft equipment and the navigation infrastructure. For example, an aircraft may be equipped and certified for RNP 1.0, but may not be capable of RNP 1.0 operations due to limited NAVAID coverage.

#### b. RNP Operations.

**1. Lateral Accuracy Values.** Lateral Accuracy values are applicable to a selected airspace, route, or procedure. The lateral accuracy value is a value typically expressed as a distance in nautical miles from the intended centerline of a procedure, route, or path. RNP applications also account for potential errors at some multiple of lateral accuracy value (for example, twice the RNP lateral accuracy values).

(a) Nav Specs and Standard Lateral Accuracy Values. U.S. standard values supporting typical RNP airspace are as specified below. Other lateral accuracy values as identified by ICAO, other states, and the FAA may also be used. (See FIG 1–2–1.)

(1) **RNP Approach (APCH).** RNP APCH procedures are titled RNAV (GPS) and offer several lines of minima to accommodate varying levels of aircraft equipage: either lateral navigation (LNAV), LNAV/vertical navigation (LNAV/VNAV), and Localizer Performance with Vertical Guidance (LPV), or LNAV, and Localizer Performance (LP). GPS or WAAS can provide the lateral information to

support LNAV minima. LNAV/VNAV incorporates LNAV lateral with vertical path guidance for systems and operators capable of either barometric or WAAS vertical. Pilots are required to use WAAS to fly to the LPV or LP minima. RNP APCH has a lateral accuracy value of 1 in the terminal and missed approach segments and essentially scales to RNP 0.3 in the final approach. (See paragraph 1–1–19.)

(2) **RNP AR APCH.** RNP AR APCH procedures are titled RNAV (RNP). RNP AR APCH vertical navigation performance is based upon barometric VNAV or WAAS. RNP AR is intended to provide specific benefits at specific locations. It is not intended for every operator or aircraft. RNP AR capability requires specific aircraft performance, design, operational processes, training, and specific procedure design criteria to achieve the required target level of safety. RNP AR APCH has lateral accuracy values that can range below 1 in the terminal and missed approach segments and essentially scale to RNP 0.3 or lower in the final approach. Operators conducting these approaches should refer to AC 90-101A, Approval Guidance for RNP Procedures with AR. (See paragraph 5-4-18.)

(3) Advanced RNP (A-RNP). Advanced RNP includes a lateral accuracy value of 2 for oceanic and remote operations but not planned for U.S. implementation and may have a 2 or 1 lateral accuracy value for domestic enroute segments. Except for the final approach, A-RNP allows for scalable RNP lateral navigation accuracies. Its applications in the U.S. are still in progress.

(4) **RNP 1.** RNP 1 requires a lateral accuracy value of 1 for arrival and departure in the terminal area and the initial and intermediate approach phase.

(5) **RNP 2.** RNP 2 will apply to both domestic and oceanic/remote operations with a lateral accuracy value of 2.

(6) **RNP 4.** RNP 4 will apply to oceanic and remote operations only with a lateral accuracy value of 4.

(7) **RNP 0.3.** RNP 0.3 will apply to rotorcraft only. This Nav Spec requires a lateral accuracy value of 0.3 for all phases of flight except for oceanic and remote and the final approach segment.

(b) Application of Standard Lateral Accuracy Values. U.S. standard lateral accuracy values typically used for various routes and procedures supporting RNAV operations may be based on use of a specific navigational system or sensor such as GPS, or on multi–sensor RNAV systems having suitable performance.

(c) **Depiction of Lateral Accuracy Values.** The applicable lateral accuracy values will be depicted on affected charts and procedures.

c. Other RNP Applications Outside the U.S. The FAA and ICAO member states have led initiatives in implementing the RNP concept to oceanic operations. For example, RNP–10 routes have been established in the northern Pacific (NOPAC) which has increased capacity and efficiency by reducing the distance between tracks to 50 NM. See paragraph 4-7-1.)

d. Aircraft and Airborne Equipment Eligibility for RNP Operations. Aircraft meeting RNP criteria will have an appropriate entry including special conditions and limitations in its Aircraft Flight Manual (AFM), or supplement. Operators of aircraft not having specific AFM–RNP certification may be issued operational approval including special conditions and limitations for specific RNP lateral accuracy values.

#### NOTE-

Some airborne systems use Estimated Position Uncertainty (EPU) as a measure of the current estimated navigational performance. EPU may also be referred to as Actual Navigation Performance (ANP) or Estimated Position Error (EPE).

RNP Level	Typical Application	Primary Route Width (NM) – Centerline to Boundary
0.1 to 1.0	RNP AR Approach Segments	0.1 to 1.0
0.3 to 1.0	RNP Approach Segments	0.3 to 1.0
1	Terminal and En Route	1.0
2	En Route	2.0
4	Projected for oceanic/remote areas where 30 NM horizontal separation is applied.	4.0
10	Oceanic/remote areas where 50 NM lateral separation is applied.	10.0

*TBL 1–2–1* U.S. Standard RNP Levels

### 1–2–3. Use of Suitable Area Navigation (RNAV) Systems on Conventional Procedures and Routes

**a. Discussion.** This paragraph sets forth policy, while providing operational and airworthiness guidance regarding the suitability and use of RNAV systems when operating on, or transitioning to, conventional, non–RNAV routes and procedures within the U.S. National Airspace System (NAS):

1. Use of a suitable RNAV system as a Substitute Means of Navigation when a Very–High Frequency (VHF) Omni–directional Range (VOR), Distance Measuring Equipment (DME), Tactical Air Navigation (TACAN), VOR/TACAN (VORTAC), VOR/DME, Non–directional Beacon (NDB), or compass locator facility including locator outer marker and locator middle marker is out–of–service (that is, the navigation aid (NAVAID) information is not available); an aircraft is not equipped with an Automatic Direction Finder (ADF) or DME; or the installed ADF or DME on an aircraft is not operational. For example, if equipped with a suitable RNAV system, a pilot may hold over an out–of– service NDB.

2. Use of a suitable RNAV system as an Alternate Means of Navigation when a VOR, DME, VORTAC, VOR/DME, TACAN, NDB, or compass locator facility including locator outer marker and locator middle marker is operational and the respective aircraft is equipped with operational navigation equipment that is compatible with conventional navaids. For example, if equipped with a suitable RNAV system, a pilot may fly a procedure

or route based on operational VOR using that RNAV system without monitoring the VOR.

### NOTE-

**1.** Additional information and associated requirements are available in Advisory Circular 90-108 titled "Use of Suitable RNAV Systems on Conventional Routes and Procedures."

**2.** Good planning and knowledge of your RNAV system are critical for safe and successful operations.

**3.** Pilots planning to use their RNAV system as a substitute means of navigation guidance in lieu of an out-of-service NAVAID may need to advise ATC of this intent and capability.

4. The navigation database should be current for the duration of the flight. If the AIRAC cycle will change during flight, operators and pilots should establish procedures to ensure the accuracy of navigation data, including suitability of navigation facilities used to define the routes and procedures for flight. To facilitate validating database currency, the FAA has developed procedures for publishing the amendment date that instrument approach procedures were last revised. The amendment date follows the amendment number, e.g., Amdt 4 14Jan10. Currency of graphic departure procedures and STARs may be ascertained by the numerical designation in the procedure title. If an amended chart is published for the procedure, or the procedure amendment date shown on the chart is on or after the expiration date of the database, the operator must not use the database to conduct the operation.

**b.** Types of RNAV Systems that Qualify as a Suitable RNAV System. When installed in accordance with appropriate airworthiness installation requirements and operated in accordance with applicable operational guidance (e.g., aircraft flight manual and Advisory Circular material), the

following systems qualify as a suitable RNAV system:

**1.** An RNAV system with TSO-C129/ -C145/-C146 equipment, installed in accordance with AC 20-138, Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for Use as a VFR and IFR Supplemental Navigation System, or AC 20-130A, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, and authorized for instrument flight rules (IFR) en route and terminal operations (including those systems previously qualified for "GPS in lieu of ADF or DME" operations), or

2. An RNAV system with DME/DME/IRU inputs that is compliant with the equipment provisions of AC 90–100A, U.S. Terminal and En Route Area Navigation (RNAV) Operations, for RNAV routes. A table of compliant equipment is available at the following website:

http://www.faa.gov/about/office\_org/ headquarters\_offices/avs/offices/afs/afs400/afs47 0/policy\_guidance/

#### NOTE-

Approved RNAV systems using DME/DME/IRU, without GPS/WAAS position input, may only be used as a substitute means of navigation when specifically authorized by a Notice to Airmen (NOTAM) or other FAA guidance for a specific procedure. The NOTAM or other FAA guidance authorizing the use of DME/DME/IRU systems will also identify any required DME facilities based on an FAA assessment of the DME navigation infrastructure.

**c.** Uses of Suitable RNAV Systems. Subject to the operating requirements, operators may use a suitable RNAV system in the following ways.

**1.** Determine aircraft position relative to, or distance from a VOR (see NOTE 5 below), TACAN, NDB, compass locator, DME fix; or a named fix defined by a VOR radial, TACAN course, NDB bearing, or compass locator bearing intersecting a VOR or localizer course.

**2.** Navigate to or from a VOR, TACAN, NDB, or compass locator.

**3.** Hold over a VOR, TACAN, NDB, compass locator, or DME fix.

4. Fly an arc based upon DME.

#### NOTE-

**1.** The allowances described in this section apply even

when a facility is identified as required on a procedure (for example, "Note ADF required").

**2.** These operations do not include lateral navigation on localizer–basedcourses (including localizer back–course guidance) without reference to raw localizer data.

**3.** Unless otherwise specified, a suitable RNAV system cannot be used for navigation on procedures that are identified as not authorized ("NA") without exception by a NOTAM. For example, an operator may not use a RNAV system to navigate on a procedure affected by an expired or unsatisfactory flight inspection, or a procedure that is based upon a recently decommissioned NAVAID.

**4.** Pilots may not substitute for the NAVAID (for example, a VOR or NDB) providing lateral guidance for the final approach segment. This restriction does not refer to instrument approach procedures with "or GPS" in the title when using GPS or WAAS. These allowances do not apply to procedures that are identified as not authorized (NA) without exception by a NOTAM, as other conditions may still exist and result in a procedure not being available. For example, these allowances do not apply to a procedure associated with an expired or unsatisfactory flight inspection, or is based upon a recently decommissioned NAVAID.

**5.** For the purpose of paragraph c, "VOR" includes VOR, VOR/DME, and VORTAC facilities and "compass locator" includes locator outer marker and locator middle marker.

d. Alternate Airport Considerations. For the purposes of flight planning, any required alternate airport must have an available instrument approach procedure that does not require the use of GPS. This restriction includes conducting a conventional approach at the alternate airport using a substitute means of navigation that is based upon the use of GPS. For example, these restrictions would apply when planning to use GPS equipment as a substitute means of navigation for an out-of-service VOR that supports an ILS missed approach procedure at an alternate airport. In this case, some other approach not reliant upon the use of GPS must be available. This restriction does not apply to RNAV systems using TSO-C145/-C146 WAAS equipment. For further WAAS guidance, see paragraph 1-1-19.

**1.** For flight planning purposes, TSO-C129() and TSO-C196() equipped users (GPS users) whose navigation systems have fault detection and exclusion (FDE) capability, who perform a preflight RAIM prediction at the airport where the RNAV (GPS) approach will be flown, and have proper knowledge and any required training and/or approval

to conduct a GPS-based IAP, may file based on a GPS-based IAP at either the destination or the alternate airport, but not at both locations. At the alternate airport, pilots may plan for applicable alternate airport weather minimums using:

(a) Lateral navigation (LNAV) or circling minimum descent altitude (MDA);

(b) LNAV/vertical navigation (LNAV/ VNAV) DA, if equipped with and using approved barometric vertical navigation (baro-VNAV) equipment;

(c) RNP 0.3 DA on an RNAV (RNP) IAP, if they are specifically authorized users using approved

baro-VNAV equipment and the pilot has verified required navigation performance (RNP) availability through an approved prediction program.

2. If the above conditions cannot be met, any required alternate airport must have an approved instrument approach procedure other than GPS that is anticipated to be operational and available at the estimated time of arrival, and which the aircraft is equipped to fly.

**3.** This restriction does not apply to TSO-C145() and TSO-C146() equipped users (WAAS users). For further WAAS guidance, see paragraph 1-1-19.

TBL 4–1–1 Summary of Recommended Communication Procedures

			Communication/Broadcast Procedures		
	Facility at Airport	Frequency Use	Outbound	Inbound	Practice Instrument Approach
1.	UNICOM (No Tower or FSS)	Communicate with UNICOM station on published CTAF frequency (122.7; 122.8; 122.725; 122.975; or 123.0). If unable to contact UNICOM station, use self-announce procedures on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
2.	No Tower, FSS, or UNICOM	Self-announce on MULTICOM frequency 122.9.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Departing final approach fix (name) or on final approach segment inbound.
3.	No Tower in operation, FSS open	Communicate with FSS on CTAF frequency.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	Approach com- pleted/terminated.
4.	FSS Closed (No Tower)	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
5.	Tower or FSS not in operation	Self-announce on CTAF.	Before taxiing and before taxiing on the runway for departure.	10 miles out. Entering downwind, base, and final. Leaving the runway.	
6.	Designated CTAF Area (Alaska Only)	Self-announce on CTAF designated on chart or Alaska Supplement (A/FD).	Before taxiing and before taxiing on the runway for departure until leaving designated area.	When entering designated CTAF area.	

**2. CTAF** (Alaska Only). In Alaska, a CTAF may also be designated for the purpose of carrying out advisory practices while operating in designated areas with a high volume of VFR traffic.

**3.** The CTAF frequency for a particular airport or area is contained in the A/FD, Alaska Supplement, Alaska Terminal Publication, Instrument Approach Procedure Charts, and Instrument Departure Procedure (DP) Charts. Also, the CTAF frequency can be obtained by contacting any FSS. Use of the appropriate CTAF, combined with a visual alertness and application of the following recommended good operating practices, will enhance safety of flight into and out of all uncontrolled airports.

#### c. Recommended Traffic Advisory Practices

**1.** Pilots of inbound traffic should monitor and communicate as appropriate on the designated CTAF from 10 miles to landing. Pilots of departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 10 miles from the airport unless the CFRs or local procedures require otherwise.

2. Pilots of aircraft conducting other than arriving or departing operations at altitudes normally used by arriving and departing aircraft should monitor/communicate on the appropriate frequency while within 10 miles of the airport unless required to do otherwise by the CFRs or local procedures. Such operations include parachute jumping/dropping, en route, practicing maneuvers, etc.

**3.** In Alaska, pilots of aircraft conducting other than arriving or departing operations in designated CTAF areas should monitor/communicate on the appropriate frequency while within the designated area, unless required to do otherwise by CFRs or local procedures. Such operations include parachute jumping/dropping, en route, practicing maneuvers, etc.

#### REFERENCE-

AIM, Parachute Jump Aircraft Operations, Paragraph 3-5-4

#### d. Airport Advisory/Information Services Provided by a FSS

**1.** There are three advisory type services provided at selected airports.

(a) Local Airport Advisory (LAA) is provided at airports that have a FSS physically located on the airport, which does not have a control tower or where the tower is operated on a part–time basis. The CTAF for LAA airports is disseminated in the appropriate aeronautical publications.

(b) Remote Airport Advisory (RAA) is provided at selected very busy GA airports, which do not have an operating control tower. The CTAF for RAA airports is disseminated in the appropriate aeronautical publications.

(c) Remote Airport Information Service (RAIS) is provided in support of special events at nontowered airports by request from the airport authority.

2. In communicating with a CTAF FSS, check the airport's automated weather and establish two-way communications before transmitting outbound/inbound intentions or information. An inbound aircraft should initiate contact approximately 10 miles from the airport, reporting aircraft identification and type, altitude, location relative to the airport, intentions (landing or over flight), possession of the automated weather, and request airport advisory or airport information service. A departing aircraft should initiate contact before taxiing, reporting aircraft identification and type, VFR or IFR, location on the airport, intentions, direction of take-off, possession of the automated weather, and request airport advisory or information service. Also, report intentions before taxiing onto the active runway for departure. If you must change frequencies for other service after initial report to FSS, return to FSS frequency for traffic update.

(a) Inbound

#### EXAMPLE-

Vero Beach radio, Centurion Six Niner Delta Delta is ten miles south, two thousand, landing Vero Beach. I have the automated weather, request airport advisory.

#### (b) Outbound

#### EXAMPLE-

Vero Beach radio, Centurion Six Niner Delta Delta, ready to taxi to runway 22, VFR, departing to the southwest. I have the automated weather, request airport advisory.

**3.** Airport advisory service includes wind direction and velocity, favored or designated runway, altimeter setting, known airborne and ground traffic, NOTAMs, airport taxi routes, airport traffic pattern information, and instrument approach procedures. These elements are varied so as to best serve the current traffic situation. Some airport managers have specified that under certain wind or other conditions designated runways be used. Pilots should advise the FSS of the runway they intend to use.

# CAUTION-

# All aircraft in the vicinity of an airport may not be in communication with the FSS.

# e. Information Provided by Aeronautical Advisory Stations (UNICOM)

**1.** UNICOM is a nongovernment air/ground radio communication station which may provide airport information at public use airports where there is no tower or FSS.

2. On pilot request, UNICOM stations may provide pilots with weather information, wind direction, the recommended runway, or other necessary information. If the UNICOM frequency is designated as the CTAF, it will be identified in appropriate aeronautical publications.

# f. Unavailability of Information from FSS or UNICOM

Should LAA by an FSS or Aeronautical Advisory Station UNICOM be unavailable, wind and weather information may be obtainable from nearby controlled airports via Automatic Terminal Information Service (ATIS) or Automated Weather Observing System (AWOS) frequency.

#### g. Self-Announce Position and/or Intentions

**1. General.** Self-announce is a procedure whereby pilots broadcast their position or intended

flight activity or ground operation on the designated CTAF. This procedure is used primarily at airports which do not have an FSS on the airport. The self-announce procedure should also be used if a pilot is unable to communicate with the FSS on the designated CTAF. Pilots stating, "*Traffic in the area, please advise*" is not a recognized Self–Announce Position and/or Intention phrase and should not be used under any condition.

**2.** If an airport has a tower and it is temporarily closed, or operated on a part-time basis and there is no FSS on the airport or the FSS is closed, use the CTAF to self-announce your position or intentions.

**3.** Where there is no tower, FSS, or UNICOM station on the airport, use MULTICOM frequency 122.9 for self-announce procedures. Such airports will be identified in appropriate aeronautical information publications.

**4. Practice Approaches.** Pilots conducting practice instrument approaches should be particularly alert for other aircraft that may be departing in the opposite direction. When conducting any practice approach, regardless of its direction relative to other airport operations, pilots should make announcements on the CTAF as follows:

(a) Departing the final approach fix, inbound (nonprecision approach) or departing the outer marker or fix used in lieu of the outer marker, inbound (precision approach);

(**b**) Established on the final approach segment or immediately upon being released by ATC;

(c) Upon completion or termination of the approach; and

(d) Upon executing the missed approach procedure.

**5.** Departing aircraft should always be alert for arrival aircraft coming from the opposite direction.

**6.** Recommended self-announce phraseologies: It should be noted that aircraft operating to or from another nearby airport may be making self-announce broadcasts on the same UNICOM or MULTICOM frequency. To help identify one airport from another, the airport name should be spoken at the beginning and end of each self-announce transmission.

(a) Inbound

#### EXAMPLE-

Strawn traffic, Apache Two Two Five Zulu, (position), (altitude), (descending) or entering downwind/base/final (as appropriate) runway one seven full stop, touch-and-go, Strawn.

Strawn traffic Apache Two Two Five Zulu clear of runway one seven Strawn.

#### (b) Outbound

#### EXAMPLE-

Strawn traffic, Queen Air Seven One Five Five Bravo (location on airport) taxiing to runway two six Strawn. Strawn traffic, Queen Air Seven One Five Five Bravo departing runway two six. Departing the pattern to the (direction), climbing to (altitude) Strawn.

#### (c) Practice Instrument Approach

#### EXAMPLE-

Strawn traffic, Cessna Two One Four Three Quebec (position from airport) inbound descending through (altitude) practice (name of approach) approach runway three five Strawn.

Strawn traffic, Cessna Two One Four Three Quebec practice (type) approach completed or terminated runway three five Strawn.

#### h. UNICOM Communications Procedures

**1.** In communicating with a UNICOM station, the following practices will help reduce frequency congestion, facilitate a better understanding of pilot intentions, help identify the location of aircraft in the traffic pattern, and enhance safety of flight:

(a) Select the correct UNICOM frequency.

(b) State the identification of the UNICOM station you are calling in each transmission.

(c) Speak slowly and distinctly.

(d) Report approximately 10 miles from the airport, reporting altitude, and state your aircraft type, aircraft identification, location relative to the airport, state whether landing or overflight, and request wind information and runway in use.

(e) Report on downwind, base, and final approach.

(f) Report leaving the runway.

2. Recommended UNICOM phraseologies:

(a) Inbound

### PHRASEOLOGY-

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT 10 MILES SOUTHEAST DESCENDING THROUGH (altitude) LANDING FREDERICK, REQUEST WIND AND RUNWAY INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT ENTERING DOWNWIND/BASE/ FINAL (as appropriate) FOR RUNWAY ONE NINER (full stop/touch-and-go)FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT CLEAR OF RUNWAY ONE NINER FREDERICK.

(b) Outbound

#### PHRASEOLOGY-

FREDERICK UNICOM CESSNA EIGHT ZERO ONE TANGO FOXTROT (location on airport) TAXIING TO RUNWAY ONE NINER, REQUEST WIND AND TRAFFIC INFORMATION FREDERICK.

FREDERICK TRAFFIC CESSNA EIGHT ZERO ONE TANGO FOXTROT DEPARTING RUNWAY ONE NINER. "REMAINING IN THE PATTERN" OR "DEPARTING THE PATTERN TO THE (direction) (as appropriate)" FREDERICK.

# 4–1–10. IFR Approaches/Ground Vehicle Operations

**a. IFR Approaches.** When operating in accordance with an IFR clearance and ATC approves a change to the advisory frequency, make an expeditious change to the CTAF and employ the recommended traffic advisory procedures.

**b. Ground Vehicle Operation.** Airport ground vehicles equipped with radios should monitor the CTAF frequency when operating on the airport movement area and remain clear of runways/taxiways being used by aircraft. Radio transmissions from ground vehicles should be confined to safety-related matters.

c. Radio Control of Airport Lighting Systems. Whenever possible, the CTAF will be used to control airport lighting systems at airports without operating control towers. This eliminates the need for pilots to change frequencies to turn the lights on and allows a continuous listening watch on a single frequency. The CTAF is published on the instrument approach chart and in other appropriate aeronautical information publications. For further details concerning radio controlled lights, see AC 150/5340–27, Air–to–Ground Radio Control of Airport Lighting Systems.

# 4–1–11. Designated UNICOM/MULTICOM Frequencies

#### **Frequency use**

**a.** The following listing depicts UNICOM and MULTICOM frequency uses as designated by the Federal Communications Commission (FCC). (See TBL 4–1–2.)

TBL 4–1–2	
<b>Unicom/Multicom Frequency</b>	Usage

Use	Frequency
Airports without an operating	122.700
control tower.	122.725
	122.800
	122.975
	123.000
	123.050
	123.075
(MULTICOM FREQUENCY)	122.900
Activities of a temporary, seasonal,	
emergency nature or search and	
rescue, as well as, airports with no	
tower, FSS, or UNICOM.	
(MULTICOM FREQUENCY)	122.925
Forestry management and fire	
suppression, fish and game	
management and protection, and	
environmental monitoring and	
protection.	
Airports with a control tower or	122.950
FSS on airport.	

#### NOTE-

**1.** In some areas of the country, frequency interference may be encountered from nearby airports using the same UNICOM frequency. Where there is a problem, UNICOM operators are encouraged to develop a "least interference" frequency assignment plan for airports concerned using the frequencies designated for airports without operating control towers. UNICOM licensees are encouraged to apply for UNICOM 25 kHz spaced channel frequencies. Due to the extremely limited number of frequencies with 50 kHz channel spacing, 25 kHz channel spacing should be implemented. UNICOM licensees may then request FCC to assign frequencies in accordance with the plan, which FCC will review and consider for approval.

**2.** Wind direction and runway information may not be available on UNICOM frequency 122.950.

**b.** The following listing depicts other frequency uses as designated by the Federal Communications Commission (FCC). (See TBL 4-1-3.)



*FIG 4–5–7* ADS–B, TIS–B, and FIS–B: Broadcast Services Architecture

**3.** ADS B avionics can have the ability to both transmit and receive information. The transmission of ADS–B information from an aircraft is known as ADS–B Out. The receipt of ADS–B information by an aircraft is known as ADS–B In. On January 1, 2020, all aircraft operating within the airspace defined in 14 CFR part 91, § 91.225 will be required to transmit the information defined in § 91.227 using ADS–B Out avionics.

**4.** In general, operators flying at 18,000 feet and above will require equipment which uses 1090 ES. Those that do not fly above 18,000 may use either UAT or 1090ES equipment. (Refer to 14 CFR 91.225 and 91.227.) While the regulation will not require it, operators equipped with ADS–B In will realize additional benefits from ADS–B broadcast services: Traffic Information Service – Broadcast (TIS–B) (paragraph 4–5–8) and Flight Information Service – Broadcast (FIS–B) (paragraph 4–5–9).

# **b.** ADS-B Certification and Performance Requirements

ADS-B equipment may be certified as a surveillance source for air traffic separation services using

ADS-B Out. ADS-B equipment may also be certified for use with ADS-B In advisory services that enable appropriately equipped aircraft to display traffic and flight information. Refer to the aircraft's flight manual supplement or Pilot Operating Handbook for the capabilities of a specific aircraft installation.

#### c. ADS-B Capabilities and Procedures

**1.** ADS–B enables improved surveillance services, both air–to–air and air–to–ground, especially in areas where radar is ineffective due to terrain or where it is impractical or cost prohibitive. Initial NAS applications of air–to–air ADS–B are for "advisory" use only, enhancing a pilot's visual acquisition of other nearby equipped aircraft either when airborne or on the airport surface. Additionally, ADS–B will enable ATC and fleet operators to monitor aircraft throughout the available ground station coverage area.

**2.** An aircraft's Flight Identification (FLT ID), also known as registration number or airline flight number, is transmitted by the ADS-B Out avionics. The FLT ID is comprised of a maximum of seven alphanumeric characters and also corresponds to the

aircraft identification annotated on the ATC flight plan. The FLT ID for airline and commuter aircraft is associated with the company name and flight number (for example, AAL3342). The FLT ID is typically entered by the flightcrew during preflight through either a Flight Management System (FMS) interface (Control Display Unit/CDU) or transponder control panel. The FLT ID for General Aviation (GA) aircraft is associated with the aircraft's registration number. The aircraft owner can preset the FLT ID to the aircraft's registration number (for example, N235RA), since it is a fixed value, or the pilot can enter it into the ADS-B Out system prior to flight.

ATC systems use transmitted FLT IDs to uniquely identify each aircraft within a given airspace and correlate them to a filed flight plan for the provision of surveillance and separation services. If the FLT ID is not entered correctly, ATC automation systems may not associate surveillance tracks for the aircraft to its filed flight plan. Therefore, Air Traffic services may be delayed or unavailable until this is corrected. Consequently, it is imperative that flightcrews and GA pilots ensure the FLT ID entry correctly matches the aircraft identification annotated in the filed ATC flight plan.

3. ADS-B systems integrated with the transponder will automatically set the applicable emergency status when 7500, 7600, or 7700 are entered into the transponder. ADS B systems not integrated with the transponder, or systems with optional emergency codes, will require that the appropriate emergency code is entered through a pilot interface. ADS-B is intended for in-flight and airport surface use. ADS-B systems should be turned "on" -- and remain "on" -- whenever operating in the air and moving on the airport surface. Civil and military Mode A/C transponders and ADS-B systems should be adjusted to the "on" or normal operating position as soon as practical, unless the change to "standby" has been accomplished previously at the request of ATC.

### d. ATC Surveillance Services using ADS–B – Procedures and Recommended Phraseology – For Use In Alaska Only

Radar procedures, with the exceptions found in this paragraph, are identical to those procedures prescribed for radar in AIM Chapter 4 and Chapter 5.

# 1. Preflight:

If a request for ATC services is predicated on ADS–B and such services are anticipated when either a VFR or IFR flight plan is filed, the aircraft's "N" number or call–sign as filed in "Block 2" of the Flight Plan must be entered in the ADS–B avionics as the aircraft's flight ID.

2. Inflight:

When requesting ADS–B services while airborne, pilots should ensure that their ADS–B equipment is transmitting their aircraft's "N" number or call sign prior to contacting ATC. To accomplish this, the pilot must select the ADS–B "broadcast flight ID" function.

# NOTE-

The broadcast "VFR" or "Standby" mode built into some ADS–B systems will not provide ATC with the appropriate aircraft identification information. This function should first be disabled before contacting ATC.

**3.** Aircraft with an Inoperative/Malfunctioning ADS–B Transmitter or in the Event of an Inoperative Ground Broadcast Transceiver (GBT).

(a) ATC will inform the flight crew when the aircraft's ADS–B transmitter appears to be inoperative or malfunctioning:

#### PHRASEOLOGY-

YOUR ADS-B TRANSMITTER APPEARS TO BE INOPERATIVE/MALFUNCTIONING. STOP ADS-B TRANSMISSIONS.

(**b**) ATC will inform the flight crew when the GBT transceiver becomes inoperative or malfunctioning, as follows:

#### PHRASEOLOGY-

(Name of facility) GROUND BASED TRANSCEIVER INOPERATIVE/MALFUNCTIONING. (And if appropriate) RADAR CONTACT LOST.

#### NOTE-

An inoperative or malfunctioning GBT may also cause a loss of ATC surveillance services.

(c) ATC will inform the flight crew if it becomes necessary to turn off the aircraft's ADS-B transmitter.

# PHRASEOLOGY-

STOP ADS-B TRANSMISSIONS.

(d) Other malfunctions and considerations:

Loss of automatic altitude reporting capabilities (encoder failure) will result in loss of ATC altitude advisory services.

#### e. ADS-B Limitations

1. The ADS–B cockpit display of traffic is <u>NOT</u> intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" other aircraft. (See paragraph 5–5–8, See and Avoid). ADS–B must not be used for avoidance maneuvers during IMC or other times when there is no visual contact with the intruder aircraft. ADS–B is intended only to assist in visual acquisition of other aircraft. <u>No avoidance maneuvers are provided nor authorized, as a direct result of an ADS–B target being displayed in the cockpit.</u>

**2.** Use of ADS–B radar services is limited to the service volume of the GBT.

#### NOTE-

The coverage volume of GBTs are limited to line-of-sight.

#### f. Reports of ADS-B Malfunctions

Users of ADS–B can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. Reports should identify the time of observation, location, type and identity of aircraft, and describe the condition observed; the type of avionics system and its software version in use should also be included. Since ADS–B performance is monitored by maintenance personnel rather than ATC, it is suggested that malfunctions be reported in any one of the following ways:

**1.** By radio or telephone to the nearest Flight Service Station (FSS) facility.

**2.** By reporting the failure directly to the FAA Safe Flight 21 program at 1–877–FLYADSB or **http://www.adsb.gov**.

### 4–5–8. Traffic Information Service– Broadcast (TIS–B)

TIS-B is the broadcast of ATC derived traffic information to ADS-B equipped (1090ES or UAT) aircraft from ground radio stations. The source of this traffic information is derived from ground-based air traffic surveillance radar sensors. TIS-B service will be available throughout the NAS where there are both adequate surveillance coverage (radar) from ground sensors and adequate broadcast coverage from ADS-B ground radio stations. The quality level of traffic information provided by TIS-B is dependent upon the number and type of ground sensors available as TIS-B sources and the timeliness of the reported data.

#### a. TIS-B Requirements.

In order to receive TIS–B service, the following conditions must exist:

**1.** Aircraft must be equipped with an ADS–B transmitter/receiver or transceiver, and a cockpit display of traffic information (CDTI).

2. Aircraft must fly within the coverage volume of a compatible ground radio station that is configured for TIS–B uplinks. (Not all ground radio stations provide TIS–B due to a lack of radar coverage or because a radar feed is not available).

**3.** Aircraft must be within the coverage of and detected by at least one ATC radar serving the ground radio station in use.

#### b. TIS-B Capabilities.

**1.** TIS–B is intended to provide ADS–B equipped aircraft with a more complete traffic picture in situations where not all nearby aircraft are equipped with ADS–B Out. This advisory–only application is intended to enhance a pilot's visual acquisition of other traffic.

2. Only transponder-equipped targets (i.e., Mode A/C or Mode S transponders) are transmitted through the ATC ground system architecture. Current radar siting may result in limited radar surveillance coverage at lower altitudes near some airports, with subsequently limited TIS-B service volume coverage. If there is no radar coverage in a given area, then there will be no TIS-B coverage in that area.

#### c. TIS-B Limitations.

**1.** TIS–B is <u>NOT</u> intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" other aircraft, in accordance with 14CFR §91.113b. TIS–B must not be used for avoidance maneuvers during times when there is no visual contact with the intruder aircraft. TIS–B is intended only to assist in the visual acquisition of other aircraft.

#### NOTE-

No aircraft avoidance maneuvers are authorized as a direct result of a TIS-B target being displayed in the cockpit.

**2.** While TIS–B is a useful aid to visual traffic avoidance, its inherent system limitations must be understood to ensure proper use.

(a) A pilot may receive an intermittent TIS–B target of themselves, typically when maneuvering (e.g., climbing turns) due to the radar not tracking the aircraft as quickly as ADS–B.

(b) The ADS-B-to-radar association process within the ground system may at times have difficulty correlating an ADS-B report with corresponding radar returns from the same aircraft. When this happens the pilot may see duplicate traffic symbols (i.e., "TIS-B shadows") on the cockpit display.

(c) Updates of TIS–B traffic reports will occur less often than ADS–B traffic updates. TIS–B position updates will occur approximately once every 3–13 seconds depending on the type of radar system in use within the coverage area. In comparison, the update rate for ADS–B is nominally once per second.

(d) The TIS-B system only uplinks data pertaining to transponder-equipped aircraft. Aircraft without a transponder will not be displayed as TIS-B traffic.

(e) There is no indication provided when any aircraft is operating inside or outside the TIS–B service volume, therefore it is difficult to know if one is receiving uplinked TIS–B traffic information.

**3.** Pilots and operators are reminded that the airborne equipment that displays TIS–B targets is for pilot situational awareness only and is not approved as a collision avoidance tool. Unless there is an imminent emergency requiring immediate action, any deviation from an air traffic control clearance in response to perceived converging traffic appearing on a TIS–B display must be approved by the controlling ATC facility before commencing the maneuver, except as permitted under certain conditions in 14CFR §91.123. Uncoordinated deviations may place an aircraft in close proximity to other aircraft under ATC control not seen on the airborne equipment and may result in a pilot deviation or other incident.

#### d. Reports of TIS-B Malfunctions

Users of TIS-B can provide valuable assistance in the correction of malfunctions by reporting instances of

undesirable system performance. Reporters should identify the time of observation, location, type and identity of the aircraft, and describe the condition observed; the type of avionics system and its software version used. Since TIS–B performance is monitored by maintenance personnel rather than ATC, it is suggested that malfunctions be reported in anyone of the following ways:

**1.** By radio or telephone to the nearest Flight Service Station (FSS) facility.

**2.** By reporting the failure directly to the FAA Surveillance and Broadcast Services Program Office at 1–877–FLYADSB or **http://www.adsb.gov**.

### 4–5–9. Flight Information Service– Broadcast (FIS–B)

**a.** FIS–B is a ground broadcast service provided through the ADS–B Services network over the 978 MHz UAT data link. The FAA FIS–B system provides pilots and flight crews of properly equipped aircraft with a cockpit display of certain aviation weather and aeronautical information. FIS–B service availability is expected across the NAS in 2013 and is currently available within certain regions.

**b.** The weather products provided by FIS–B are for information only. Therefore, these products do not meet the safety and regulatory requirements of official weather products. The weather products displayed on FIS–B should not be used as primary weather products, i.e., aviation weather to meet operational and safety requirements. Official weather products (primary products) can be obtained from a variety of sources including ATC, FSSs, and, if applicable, AOCC VHF/HF voice, which can transmit aviation weather, NOTAMS, and other operational aeronautical information to aircraft in flight. FIS-B augments the traditional ATC/FSS/ AOCC services by providing additional information and, for some products, offers the advantage of being displayed graphically. By using FIS-B for orientation and information, the usefulness of information received from official sources may be enhanced, but the user should be alert and understand any limitations associated with individual products. FIS-B provides the initial basic products listed below at no-charge to the user. Additional products are envisioned, but may incur subscription charges to the user. FIS-B reception is line-of-sight within the service volume of the ground infrastructure.

AIM

# Section 6. Operational Policy/Procedures for Reduced Vertical Separation Minimum (RVSM) in the Domestic U.S., Alaska, Offshore Airspace and the San Juan FIR

# 4–6–1. Applicability and RVSM Mandate (Date/Time and Area)

**a. Applicability.** The policies, guidance and direction in this section apply to RVSM operations in the airspace over the lower 48 states, Alaska, Atlantic and Gulf of Mexico High Offshore Airspace and airspace in the San Juan FIR where VHF or UHF voice direct controller–pilot communication (DCPC) is normally available. Policies, guidance and direction for RVSM operations in oceanic airspace where VHF or UHF voice DCPC is not available and the airspace of other countries are posted on the FAA "RVSM Documentation" Webpage described in Paragraph 4–6–3, Aircraft and Operator Approval Policy/Procedures, RVSM Monitoring and Databases for Aircraft and Operator Approval.

**b.** Mandate. At 0901 UTC on January 20, 2005, the FAA implemented RVSM between flight level (FL) 290–410 (inclusive) in the following airspace: the airspace of the lower 48 states of the United States, Alaska, Atlantic and Gulf of Mexico High Offshore Airspace and the San Juan FIR. (A chart showing the location of offshore airspace is posted on the Domestic U.S. RVSM (DRVSM) Webpage. See paragraph 4–6–3.) On the same time and date, RVSM was also introduced into the adjoining airspace of Canada and Mexico to provide a seamless environment for aircraft traversing those borders. In addition, RVSM was implemented on the same date in the Caribbean and South American regions.

**c. RVSM Authorization.** In accordance with 14 CFR Section 91.180, with only limited exceptions, prior to operating in RVSM airspace, operators and aircraft must have received RVSM authorization from the responsible civil aviation authority. (See Paragraph 4–6–10, Procedures for Accommodation of Non–RVSM Aircraft.) If the operator or aircraft or both have not been authorized for RVSM operations, the aircraft will be referred to as a "non–RVSM" aircraft. Paragraph 4–6–10 discusses ATC policies for accommodation of non–RVSM aircraft flown by the Department of Defense, Air Ambulance

(MEDEVAC) operators, foreign State governments and aircraft flown for certification and development. Paragraph 4–6–11, Non–RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off, contains policies for non–RVSM aircraft climbing and descending through RVSM airspace to/from flight levels above RVSM airspace.

**d. Benefits.** RVSM enhances ATC flexibility, mitigates conflict points, enhances sector throughput, reduces controller workload and enables crossing traffic. Operators gain fuel savings and operating efficiency benefits by flying at more fuel efficient flight levels and on more user preferred routings.

# 4-6-2. Flight Level Orientation Scheme

Altitude assignments for direction of flight follow a scheme of odd altitude assignment for magnetic courses 000–179 degrees and even altitudes for magnetic courses 180–359 degrees for flights up to and including FL 410, as indicated in FIG 4–6–1.



FIG 4–6–1 Flight Level Orientation Scheme

#### NOTE-

*Odd Flight Levels: Magnetic Course 000–179 Degrees Even Flight Levels: Magnetic Course 180–359 Degrees.* 

# 4–6–3. Aircraft and Operator Approval Policy/Procedures, RVSM Monitoring and Databases for Aircraft and Operator Approval

**a. RVSM Authority**. 14 CFR Section 91.180 applies to RVSM operations within the U.S. 14 CFR Section 91.706 applies to RVSM operations outside the U.S. Both sections require that the operator obtain authorization prior to operating in RVSM airspace. 14 CFR Section 91.180 requires that, prior to conducting RVSM operations within the U.S., the operator obtain authorization from the FAA or from the responsible authority, as appropriate. In addition, it requires that the operator and the operator's aircraft comply with the standards of 14 CFR Part 91 Appendix G (Operations in RVSM Airspace).

**b.** Sources of Information. The FAA RVSM Website Homepage can be accessed at: http://www.faa.gov/about/office\_org/headquarters\_offices/ato/service\_units/enroute/rvsm/. The "RVSM Documentation" and "Domestic RVSM" webpages are linked to the RVSM Homepage. "RVSM Documentation" contains guidance and direction for an operator to obtain aircraft and operator approval to conduct RVSM operations. It provides information for DRVSM and oceanic and international RVSM airspace. It is recommended that operators planning to operate in Domestic U.S. RVSM airspace first review the following documents to orient themselves to the approval process.

1. Under "Area of Operations Specific Information," the document, "Basic Operator Information on DRVSM Programs," provides an overview of the DRVSM program and the related aircraft and operator approval programs.

2. In the "Getting Started" section, review the "RVSM Approval Checklist – U.S. Operators" or "RVSM Approval Checklist – Non–U.S. Operators" (as applicable). These are job aids or checklists that show aircraft/operator approval process events with references to related RVSM documents published on the website.

**3.** Under "Documents Applicable to All RVSM Approvals," review "RVSM Area New to the Operator." This document provides a guide for operators that are conducting RVSM operations in one or more areas of operation, but are planning to

conduct RVSM operations in an area where they have not previously conducted RVSM operations, such as the U.S.

**c. TCAS Equipage.** TCAS equipage requirements are contained in 14 CFR Sections 121.356, 125.224, 129.18 and 135.189. Part 91 Appendix G does not contain TCAS equipage requirements specific to RVSM, however, Appendix G does require that aircraft equipped with TCAS II and flown in RVSM airspace be modified to incorporate TCAS II Version 7.0 or a later version.

**d.** Aircraft Monitoring. Operators are required to participate in the RVSM aircraft monitoring program. The "Monitoring Requirements and Procedures" section of the RVSM Documentation Webpage contains policies and procedures for participation in the monitoring program. Ground–based and GPS–based monitoring systems are available for the Domestic RVSM program. Monitoring is a quality control program that enables the FAA and other civil aviation authorities to assess the in–service altitude–keeping performance of aircraft and operators.

e. Registration on RVSM Approvals Databases. The "Registration on RVSM Approvals Database" section of the RVSM Documentation Webpage provides policies/procedures for operator and aircraft registration on RVSM approvals databases.

**1. Purpose of RVSM Approvals Databases.** ATC does not use RVSM approvals databases to determine whether or not a clearance can be issued into RVSM airspace. RVSM program managers do regularly review the operators and aircraft that operate in RVSM airspace to identify and investigate those aircraft and operators flying in RVSM airspace, but not listed on the RVSM approvals databases.

2. Registration of U.S. Operators. When U.S. operators and aircraft are granted RVSM authority, the FAA Flight Standards office makes an input to the FAA Program Tracking and Reporting Subsystem (PTRS). The Separation Standards Group at the FAA Technical Center obtains PTRS operator and aircraft information to update the FAA maintained U.S. Operator/Aircraft RVSM Approvals Database. Basic database operator and aircraft information can be viewed on the RVSM Documentation Webpage by clicking on the appropriate database icon.

**3. Registration of Non–U.S. Operators.** Non–U.S. operators can find policy/procedures for registration on the North American Approvals Registry and Monitoring Organization (NAARMO) database in the "Registration on RVSM Approvals Database" section of RVSM Documentation.

# 4-6-4. Flight Planning into RVSM Airspace

**a.** Operators that do not file the correct aircraft equipment suffix on the FAA or ICAO Flight Plan may be denied clearance into RVSM airspace. Policies for the FAA Flight Plan are detailed in subparagraph c below. Policies for the ICAO Flight Plan are detailed in subparagraph d.

**b.** The operator will annotate the equipment block of the FAA or ICAO Flight Plan with an aircraft equipment suffix indicating RVSM capability only after the responsible civil aviation authority has determined that both the operator and its aircraft are RVSM–compliant and has issued RVSM authorization to the operator.

**c.** General Policies for FAA Flight Plan Equipment Suffix. TBL 5–1–3, Aircraft Suffixes, allows operators to indicate that the aircraft has both RVSM and Advanced Area Navigation (RNAV) capabilities or has only RVSM capability.

**1.** The operator will annotate the equipment block of the FAA Flight Plan with the appropriate aircraft equipment suffix from TBL 5-1-3.

2. Operators can only file one equipment suffix in block 3 of the FAA Flight Plan. Only this equipment suffix is displayed directly to the controller.

**3.** Aircraft with RNAV Capability. For flight in RVSM airspace, aircraft with RNAV capability, but not Advanced RNAV capability, will file "/W". Filing "/W" will not preclude such aircraft from filing and flying direct routes in en route airspace.

**d.** Policy for ICAO Flight Plan Equipment Suffixes.

**1.** Operators/aircraft that are RVSM-compliant and that file ICAO flight plans will file "/W" in block 10 (Equipment) to indicate RVSM authorization and will also file the appropriate ICAO Flight Plan suffixes to indicate navigation and communication capabilities. The equipment suffixes in TBL 5–1–3 are for use only in an FAA Flight Plan (FAA Form 7233–1).

**2.** Operators/aircraft that file ICAO flight plans that include flight in Domestic U.S. RVSM airspace must file "/W" in block 10 to indicate RVSM authorization.

**e.** Importance of Flight Plan Equipment Suffixes. The operator must file the appropriate equipment suffix in the equipment block of the FAA Flight Plan (FAA Form 7233–1) or the ICAO Flight Plan. The equipment suffix informs ATC:

**1.** Whether or not the operator and aircraft are authorized to fly in RVSM airspace.

**2.** The navigation and/or transponder capability of the aircraft (e.g., advanced RNAV, transponder with Mode C).

**f.** Significant ATC uses of the flight plan equipment suffix information are:

**1.** To issue or deny clearance into RVSM airspace.

2. To apply a 2,000 foot vertical separation minimum in RVSM airspace to aircraft that are not authorized for RVSM, but are in one of the limited categories that the FAA has agreed to accommodate. (See Paragraphs 4–6–10, Procedures for Accommodation of Non–RVSM Aircraft, and 4–6–11, Non–RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off, for policy on limited operation of unapproved aircraft in RVSM airspace).

**3.** To determine if the aircraft has "Advanced RNAV" capabilities and can be cleared to fly procedures for which that capability is required.

# 4–6–5. Pilot RVSM Operating Practices and Procedures

**a. RVSM Mandate.** If either the operator or the aircraft or both have not received RVSM authorization (non–RVSM aircraft), the pilot will neither request nor accept a clearance into RVSM airspace unless:

**1.** The flight is conducted by a non–RVSM DOD, MEDEVAC, certification/development or foreign State (government) aircraft in accordance with Paragraph 4–6–10, Procedures for Accommodation of Non–RVSM Aircraft.

AIM

2. The pilot intends to climb to or descend from FL 430 or above in accordance with Paragraph 4–6–11, Non–RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off.

**3.** An emergency situation exists.

**b. Basic RVSM Operating Practices and Procedures.** Appendix 4 of AC 91–85, Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum Airspace contains pilot practices and procedures for RVSM. Operators must incorporate Appendix 4 practices and procedures, as supplemented by the applicable paragraphs of this section, into operator training or pilot knowledge programs and operator documents containing RVSM operational policies.

**c.** Appendix 4 contains practices and procedures for flight planning, preflight procedures at the aircraft, procedures prior to RVSM airspace entry, inflight (en route) procedures, contingency procedures and post flight.

**d.** The following paragraphs either clarify or supplement Appendix 4 practices and procedures.

### 4–6–6. Guidance on Severe Turbulence and Mountain Wave Activity (MWA)

# a. Introduction/Explanation

**1.** The information and practices in this paragraph are provided to emphasize to pilots and controllers the importance of taking appropriate action in RVSM airspace when aircraft experience severe turbulence and/or MWA that is of sufficient magnitude to significantly affect altitude–keeping.

**2. Severe Turbulence.** Severe turbulence causes large, abrupt changes in altitude and/or attitude usually accompanied by large variations in indicated airspeed. Aircraft may be momentarily out of control. Encounters with severe turbulence must be remedied immediately in any phase of flight. Severe turbulence may be associated with MWA.

# 3. Mountain Wave Activity (MWA)

(a) Significant MWA occurs both below and above the floor of RVSM airspace, FL 290. MWA often occurs in western states in the vicinity of mountain ranges. It may occur when strong winds blow perpendicular to mountain ranges resulting in up and down or wave motions in the atmosphere. Wave action can produce altitude excursions and airspeed fluctuations accompanied by only light turbulence. With sufficient amplitude, however, wave action can induce altitude and airspeed fluctuations accompanied by severe turbulence. MWA is difficult to forecast and can be highly localized and short lived.

(b) Wave activity is not necessarily limited to the vicinity of mountain ranges. Pilots experiencing wave activity anywhere that significantly affects altitude-keeping can follow the guidance provided below.

(c) Inflight MWA Indicators (Including Turbulence). Indicators that the aircraft is being subjected to MWA are:

(1) Altitude excursions and/or airspeed fluctuations with or without associated turbulence.

(2) Pitch and trim changes required to maintain altitude with accompanying airspeed fluctuations.

(3) Light to severe turbulence depending on the magnitude of the MWA.

# 4. Priority for Controller Application of Merging Target Procedures

(a) Explanation of Merging Target Procedures. As described in subparagraph c3 below, ATC will use "merging target procedures" to mitigate the effects of both severe turbulence and MWA. The procedures in subparagraph c3 have been adapted from existing procedures published in FAA Order JO 7110.65, Air Traffic Control, Paragraph 5–1–8, Merging Target Procedures. Paragraph 5–1–8 calls for en route controllers to advise pilots of potential traffic that they perceive may fly directly above or below his/her aircraft at minimum vertical separation. In response, pilots are given the option of requesting a radar vector to ensure their radar target will not merge or overlap with the traffic's radar target.

(b) The provision of "merging target procedures" to mitigate the effects of severe turbulence and/or MWA is not optional for the controller, but rather is a priority responsibility. Pilot requests for vectors for traffic avoidance when encountering MWA or pilot reports of "Unable RVSM due turbulence or MWA" are considered first priority aircraft separation and sequencing responsibilities. (FAA Order JO 7110.65, Paragraph 2–1–2, Duty Priority, states that the controller's first priority is to separate aircraft and issue safety alerts).

(c) Explanation of the term "traffic permitting." The contingency actions for MWA and severe turbulence detailed in Paragraph 4–6–9, Contingency Actions: Weather Encounters and Aircraft System Failures that Occur After Entry into RVSM Airspace, state that the controller will "vector aircraft to avoid merging targets with traffic at adjacent flight levels, traffic permitting." The term "traffic permitting" is not intended to imply that merging target procedures are not a priority duty. The term is intended to recognize that, as stated in FAA Order JO 7110.65, Paragraph 2–1–2, Duty Priority, there are circumstances when the controller is required to perform more than one action and must "exercise their best judgment based on the facts and circumstances known to them" to prioritize their actions. Further direction given is: "That action which is most critical from a safety standpoint is performed first."

**5. TCAS Sensitivity.** For both MWA and severe turbulence encounters in RVSM airspace, an additional concern is the sensitivity of collision avoidance systems when one or both aircraft operating in close proximity receive TCAS advisories in response to disruptions in altitude hold capability.

**b. Pre-flight tools.** Sources of observed and forecast information that can help the pilot ascertain the possibility of MWA or severe turbulence are: Forecast Winds and Temperatures Aloft (FD), Area Forecast (FA), Graphical Turbulence Guidance (GTG), SIGMETs and PIREPs.

c. Pilot Actions When Encountering Weather (e.g., Severe Turbulence or MWA)

**1. Weather Encounters Inducing Altitude Deviations of Approximately 200 feet.** When the pilot experiences weather induced altitude deviations of approximately 200 feet, the pilot will contact ATC and state "Unable RVSM Due (state reason)" (e.g., turbulence, mountain wave). See contingency actions in paragraph 4–6–9.

2. Severe Turbulence (including that associated with MWA). When pilots encounter severe turbulence, they should contact ATC and report the situation. Until the pilot reports clear of severe turbulence, the controller will apply merging target

vectors to one or both passing aircraft to prevent their targets from merging:

#### EXAMPLE-

"Yankee 123, FL 310, unable RVSM due severe turbulence."

"Yankee 123, fly heading 290; traffic twelve o'clock, 10 miles, opposite direction; eastbound MD-80 at FL 320" (or the controller may issue a vector to the MD-80traffic to avoid Yankee 123).

**3. MWA.** When pilots encounter MWA, they should contact ATC and report the magnitude and location of the wave activity. When a controller makes a merging targets traffic call, the pilot may request a vector to avoid flying directly over or under the traffic. In situations where the pilot is experiencing altitude deviations of 200 feet or greater, the pilot will request a vector to avoid traffic. Until the pilot reports clear of MWA, the controller will apply merging target vectors to one or both passing aircraft to prevent their targets from merging:

#### EXAMPLE-

"Yankee 123, FL 310, unable RVSM due mountain wave."

"Yankee 123, fly heading 290; traffic twelve o'clock, 10 miles, opposite direction; eastbound MD-80 at FL 320" (or the controller may issue a vector to the MD-80traffic to avoid Yankee 123).

**4. FL Change or Re-route.** To leave airspace where MWA or severe turbulence is being encountered, the pilot may request a FL change and/or re-route, if necessary.

#### 4-6-7. Guidance on Wake Turbulence

**a.** Pilots should be aware of the potential for wake turbulence encounters in RVSM airspace. Experience gained since 1997 has shown that such encounters in RVSM airspace are generally moderate or less in magnitude.

**b.** Prior to DRVSM implementation, the FAA established provisions for pilots to report wake turbulence events in RVSM airspace using the NASA Aviation Safety Reporting System (ASRS). A "Safety Reporting" section established on the FAA RVSM Documentation webpage provides contacts, forms, and reporting procedures.

**c.** To date, wake turbulence has not been reported as a significant factor in DRVSM operations. European authorities also found that reports of wake turbulence encounters did not increase significantly after RVSM implementation (eight versus seven reports in a ten-month period). In addition, they found that reported wake turbulence was generally similar to moderate clear air turbulence.

**d.** Pilot Action to Mitigate Wake Turbulence Encounters

**1.** Pilots should be alert for wake turbulence when operating:

(a) In the vicinity of aircraft climbing or descending through their altitude.

(**b**) Approximately 10–30 miles after passing 1,000 feet below opposite–direction traffic.

(c) Approximately 10–30 miles behind and 1,000 feet below same–direction traffic.

**2.** Pilots encountering or anticipating wake turbulence in DRVSM airspace have the option of requesting a vector, FL change, or if capable, a lateral offset.

# NOTE-

**1.** Offsets of approximately a wing span upwind generally can move the aircraft out of the immediate vicinity of another aircraft's wake vortex.

**2.** In domestic U.S. airspace, pilots must request clearance to fly a lateral offset. Strategic lateral offsets flown in oceanic airspace do not apply.

e. The FAA will track wake turbulence events as an element of its post implementation program. The FAA will advertise wake turbulence reporting procedures to the operator community and publish reporting procedures on the RVSM Documentation Webpage (See address in Paragraph 4–6–3, Aircraft and Operator Approval Policy/Procedures, RVSM Monitoring and Databases for Aircraft and Operator Approval.

# 4-6-8. Pilot/Controller Phraseology

TBL 4–6–1 shows standard phraseology that pilots and controllers will use to communicate in DRVSM operations.

*TBL 4–6–1* **Pilot/Controller Phraseology** 

Message	Phraseology
For a controller to ascertain the RVSM approval status of an aircraft:	(call sign) confirm RVSM approved
Pilot indication that flight is RVSM approved	Affirm RVSM
Pilot report of lack of RVSM approval (non–RVSM status). Pilot will report non–RVSM status, as follows:	Negative RVSM, (supplementary information, e.g., "Certification flight").
<ul> <li>a. On the initial call on any frequency in the RVSM airspace and</li> <li>b. In all requests for flight level changes pertaining to flight levels within the RVSM airspace and</li> <li>c. In all read backs to flight level clearances pertaining to flight levels within the RVSM airspace and</li> <li>d. In read back of flight level clearances involving climb and descent through RVSM airspace (FL 290 – 410).</li> </ul>	
Pilot report of one of the following after entry into RVSM airspace: all primary altimeters, automatic altitude control systems or altitude alerters have failed. (See Paragraph 4–6–9, Contingency Actions: Weather Encounters and Aircraft System Failures that Occur After Entry into RVSM Airspace.)	Unable RVSM Due Equipment
<b>NOTE</b> – This phrase is to be used to convey both the initial indication of RVSM aircraft system failure and on initial contact on all frequencies in RVSM airspace until the problem ceases to exist or the aircraft has exited RVSM airspace.	
ATC denial of clearance into RVSM airspace	Unable issue clearance into RVSM airspace, maintain FL
*Pilot reporting inability to maintain cleared flight level due to weather encounter. (See Paragraph 4–6–9, Contingency Actions: Weather Encounters and Aircraft System Failures that Occur After Entry into RVSM Airspace.).	*Unable RVSM due (state reason) (e.g., turbulence, mountain wave)
ATC requesting pilot to confirm that an aircraft has regained RVSM–approved status or a pilot is ready to resume RVSM	Confirm able to resume RVSM
Pilot ready to resume RVSM after aircraft system or weather contingency	Ready to resume RVSM

# 4–6–9. Contingency Actions: Weather Encounters and Aircraft System Failures that Occur After Entry into RVSM Airspace

TBL 4–6–2 provides pilot guidance on actions to take under certain conditions of aircraft system

failure that occur after entry into RVSM airspace and weather encounters. It also describes the expected ATC controller actions in these situations. It is recognized that the pilot and controller will use judgment to determine the action most appropriate to any given situation.

#### TBL 4–6–2 Contingency Actions: Weather Encounters and Aircraft System Failures that Occur After Entry into RVSM Airspace

Initial Pilot Actions in	Contingency Situations	
Initial pilot actions when unable to maintain flight leve capability:	el (FL) or unsure of aircraft altitude-keeping	
•Notify ATC and request assistance as detailed below	ow.	
•Maintain cleared flight level, to the extent possibl	e, while evaluating the situation.	
•Watch for conflicting traffic both visually and by	reference to TCAS, if equipped.	
•Alert nearby aircraft by illuminating exterior light	ts (commensurate with aircraft limitations).	
Severe Turbulence and/or Mounta	in Wave Activity (MWA) Induced	
Altitude Deviations of	Approximately 200 feet	
Pilot will:	Controller will:	
•When experiencing severe turbulence and/or MWA induced altitude deviations of approximately 200 feet or greater, pilot will contact ATC and state "Unable RVSM Due (state reason)" (e.g., turbulence, mountain wave)	<ul> <li>Vector aircraft to avoid merging target with traffic at adjacent flight levels, traffic permitting</li> <li>Advise pilot of conflicting traffic</li> </ul>	
•If not issued by the controller, request vector	•Issue FL change or re–route, traffic permitting	
clear of traffic at adjacent FLs	•Issue PIREP to other aircraft	
•If desired, request FL change or re-route		
•Report location and magnitude of turbulence or MWA to ATC		
See Paragraph 4–6–6, Guidance on Severe	Paragraph 4–6–6 explains "traffic permitting."	
Mountain Wave Activity (MWA) Encounters – General		
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Pilot actions:	Controller actions:	
•Contact ATC and report experiencing MWA	•Advise pilot of conflicting traffic at adjacent FL	
•If so desired, pilot may request a FL change or re-route	•If pilot requests, vector aircraft to avoid merging target with traffic at adjacent RVSM flight levels traffic permitting	
•Report location and magnitude of MWA to ATC	•Issue FL change or re–route, traffic permitting	
	•Issue PIREP to other aircraft	
See paragraph 4–6–6 for guidance on MWA.	Paragraph 4–6–6 explains "traffic permitting."	

MWA encounters do not necessarily result in altitude deviations on the order of 200 feet. The guidance below is intended to address less significant MWA encounters.

Wake Turbulence Encounters		
Pilot should:	Controller should:	
•Contact ATC and request vector, FL change or, if capable, a lateral offset	•Issue vector, FL change or lateral offset clearance, traffic permitting	
See Paragraph 4–6–7, Guidance on Wake Turbulence.	Paragraph 4–6–6 explains "traffic permitting."	

"Unable RVSM Due Equipment" Failure of Automatic Altitude Control System, Altitude Alerter or All Primary Altimeters	
Pilot will:	Controller will:
•Contact ATC and state "Unable RVSM Due Equipment"	•Provide 2,000 feet vertical separation or appropriate horizontal separation
•Request clearance out of RVSM airspace unless operational situation dictates otherwise	•Clear aircraft out of RVSM airspace unless operational situation dictates otherwise

One Primary Altimeter Remains Operational		
Pilot will:	Controller will:	
•Cross check stand-by altimeter	•Acknowledge operation with single primary altimeter	
•Notify ATC of operation with single primary altimeter		
•If unable to confirm primary altimeter accuracy, follow actions for failure of all primary altimeters		

Transponder Failure		
Pilot will:	Controller will:	
•Contact ATC and request authority to continue to operate at cleared flight level	•Consider request to continue to operate at cleared flight level	
•Comply with revised ATC clearance, if issued	•Issue revised clearance, if necessary	
NOTE-		
14 CFR Section 91.215 (ATC transponder and altitude reporting equipment and use) regulates operation with the transponder inoperative.		

# 4–6–10. Procedures for Accommodation of Non–RVSM Aircraft

# a. General Policies for Accommodation of Non–RVSM Aircraft

**1.** The RVSM mandate calls for only RVSM authorized aircraft/operators to fly in designated RVSM airspace with limited exceptions. The policies detailed below are intended exclusively for use by aircraft that the FAA has agreed to accommodate. They are not intended to provide other operators a means to circumvent the normal RVSM approval process.

2. If either the operator or aircraft or both have not been authorized to conduct RVSM operations, the aircraft will be referred to as a "non–RVSM" aircraft. 14 CFR Section 91.180 and Part 91 Appendix G enable the FAA to authorize a deviation to operate a non–RVSM aircraft in RVSM airspace.

**3.** Non-RVSM aircraft flights will be handled on a workload permitting basis. The vertical separation standard applied between aircraft not approved for RVSM and all other aircraft must be 2,000 feet.

**4. Required Pilot Calls.** The pilot of non–RVSM aircraft will inform the controller of the lack of RVSM approval in accordance with the direction provided in Paragraph 4–6–8, Pilot/Controller Phraseology.

# b. Categories of Non–RVSM Aircraft that may be Accommodated

Subject to FAA approval and clearance, the following categories of non–RVSM aircraft may operate in domestic U.S. RVSM airspace provided they have an operational transponder.

1. Department of Defense (DOD) aircraft.

**2.** Flights conducted for aircraft certification and development purposes.

**3.** Active air ambulance flights utilizing a "MEDEVAC" call sign.

**4.** Aircraft climbing/descending through RVSM flight levels (without intermediate level off) to/from FLs above RVSM airspace (Policies for these flights are detailed in Paragraph 4–6–11, Non–RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off.

5. Foreign State (government) aircraft.

**c.** Methods for operators of non–RVSM aircraft to request access to RVSM Airspace. Operators may:

**1. LOA/MOU.** Enter into a Letter of Agreement (LOA)/Memorandum of Understanding (MOU) with the RVSM facility (the Air Traffic facility that provides air traffic services in RVSM airspace). Operators must comply with LOA/MOU.

AIM

**2. File–and–Fly.** File a flight plan to notify the FAA of their intention to request access to RVSM airspace.

#### NOTE-

# Priority for access to RVSM airspace will be afforded to RVSM compliant aircraft, then File-and-Fly flights.

**d.** Center Phone Numbers. Center phone numbers are posted on the RVSM Documentation Webpage, North American RVSM, Domestic U.S. RVSM section. This address provides direct access to the phone number listing:

http://www.faa.gov/ats/ato/150\_docs/ Center\_Phone\_No.\_Non-RVSM\_Acft.doc

### 4–6–11. Non–RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off

**a. File–and–Fly.** Operators of Non–RVSM aircraft climbing to and descending from RVSM flight levels should just file a flight plan.

**b.** Non–RVSM aircraft climbing to and descending from flight levels above RVSM airspace will be handled on a workload permitting basis. The vertical separation standard applied in RVSM airspace between non–RVSM aircraft and all other aircraft must be 2,000 feet.

**c.** Non–RVSM aircraft climbing to/descending from RVSM airspace can only be considered for accommodation provided:

**1.** Aircraft is capable of a continuous climb/ descent and does not need to level off at an intermediate altitude for any operational considerations and

**2.** Aircraft is capable of climb/descent at the normal rate for the aircraft.

**d. Required Pilot Calls.** The pilot of non–RVSM aircraft will inform the controller of the lack of RVSM approval in accordance with the direction provided in Paragraph 4–6–8, Pilot/Controller Phraseology.

# Section 7. Operational Policy/Procedures for the Gulf of Mexico 50 NM Lateral Separation Initiative

### 4-7-1. Introduction and Background

**a. Introduction.** On 20 October 2011 at 0900 UTC, the Federal Aviation Administration (FAA), Serviciós a la Navegacion en el Espacio Aéreo Mexicano (SENEAM) and the Direccion General de Aeronautica Civil (DGAC) Mexico implemented 50 Nautical Mile (NM) lateral separation between aircraft authorized Required Navigation Performance 10 (RNP 10) or RNP 4 operating in the Gulf of Mexico (GoMex) Oceanic Control Areas (CTA). Existing Air Traffic Services (ATS) routes and route operating policies did not change for this implementation.

**b. RNP 10 Versus RNAV 10 Terminology.** "RNP 10" has the same meaning and application as "RNAV 10". The ICAO Performance-based Navigation (PBN) Manual (ICAO Doc 9613), Volume II, Part B, Chapter 1 (Implementing RNAV 10, Designated and Authorized as RNP 10) explains that the term "RNP 10" was in use before the publication of the ICAO PBN Manual and the manual has "grandfathered in" its continued use when implementing an "RNAV 10" navigation specification.

**c. Background.** 50 NM lateral separation was first applied between aircraft authorized for RNP 10 operations on the North Pacific Route System in April 1998. Since that time, 50 NM lateral separation has been expanded throughout the Pacific Flight Information Regions (FIRs) and is currently applied in other airspaces, including, starting in June 2008, the West Atlantic Route System. GoMex 50 NM lateral separation implementation will apply the experience gained in those operations.

**d. Project Objectives.** The project objectives were to:

**1.** Reduce lateral separation to 50 NM between aircraft authorized RNP 10 or RNP 4.

**2.** Leave existing ATS routes and operating policies in place.

**3.** Have approximately 90% of flights conducted by operators/aircraft over the Gulf of Mexico authorized for RNP 10 or RNP 4 operations by the appropriate State authority.

**4.** Accommodate the operation of the small percentage of flights not authorized RNP 10.

**5.** Establish a policy that aircraft equipped with a Single Long-Range Navigation System (S-LRNS) can qualify for RNP 10 operations in the Gulf of Mexico in accordance with the ICAO PBN Manual and the appropriate FAA and DGAC documents. (See paragraph 4-7-7 e.)

e. Control Areas (CTA) Affected. 50 NM lateral separation is implemented in the following CTAs/ FIRs/Upper Control Areas (UTA).

1 The Houston Oceanic CTA/FIR and the Gulf of Mexico portion of the Miami Oceanic CTA/FIR.

(a) The Monterrey CTA and Merida High CTA within the Mexico FIR/UTA

**f.** Policy and Procedures Coordination with SENEAM and the DGAC. The policies and procedures were coordinated with SENEAM and the Mexico DGAC. They are applied in the GoMex CTA's where the FAA and SENEAM provide Air Traffic Control.

#### 4–7–2. Gulf of Mexico 50 NM Lateral Separation Initiative Web Page: Policy, Procedures and Guidance for Operators and Regulators

Information on plans, policies and procedures for 50 NM lateral separation is posted on the "Gulf of Mexico 50 NM Lateral Separation Web Page":

http://www.faa.gov/about/office\_org/headquarters\_offices/ato/service\_units/enroute/oceanic/gome x/

The web page contains detailed guidance on operator and aircraft authorization for RNP 10 or RNP 4 and includes Job Aids with FAA and ICAO document references.

#### 4-7-3. Lateral Separation Minima Applied

**a.** 50 NM lateral separation is applied in the GoMex CTA's between aircraft authorized RNP 10 or RNP 4 at all altitudes above the floor of controlled airspace.

**b.** The current lateral separation minima of 100 NM in the Houston, Monterrey and Merida CTAs, and 90 NM in the Miami Oceanic CTA will continues to be applied between aircraft not authorized RNP 10 or RNP 4.

# 4–7–4. Operation on Routes on the periphery of the Gulf of Mexico CTAs

Operations on certain routes that fall within the boundaries of affected CTAs are not affected by the introduction of 50 NM lateral separation. Operation on the following routes is not affected:

**a.** Routes that are flown by reference to ICAO standard ground-based navigation aids (VOR, VOR/DME, NDB).

**b.** Special Area Navigation (RNAV) routes Q100, Q102 and Q105 in the Houston, Jacksonville and Miami CTAs.

#### 4–7–5. Provisions for Accommodation of NonRNP10 Aircraft (Aircraft Not Authorized RNP 10 or RNP 4)

**a.** Operators of NonRNP10 aircraft must annotate ICAO flight plan Item 18 as follows:

"STS/NONRNP10" (no space between letters and numbers).

**b.** Pilots of NonRNP10 aircraft that operate in GoMex CTA's must report the lack of authorization by stating "Negative RNP 10":

1. On initial call to ATC in a GoMex CTA:

**2.** In read back of a clearance to climb to or descend from cruise altitude. (See paragraph 4-7-5e); and

**3.** When approval status is requested by the controller. (See paragraph 4-7-9e.)

**c.** Operators of NonRNP10 aircraft must not annotate ICAO flight plan Item 18 (Other Information) with "PBN/A1" or "PBN/L1" if they have not obtained RNP 10 or RNP 4 authorization.

**d.** NonRNP10 operators/aircraft may file any route at any altitude in a GoMex CTA. They will be cleared to operate on their preferred routes and altitudes as traffic permits. 50 NM lateral separation will not be applied to NonRNP10 aircraft.

**e.** NonRNP10 aircraft are encouraged to operate at altitudes above those where traffic is most dense (i.e., at/above FL 380), if possible. NonRNP10 aircraft

### 4-7-6. Operator Action

In order to maximize operational flexibility provided by 50 NM lateral separation, operators capable of meeting RNP 10 or RNP 4 that operate on oceanic routes or areas in the GoMex CTA's should obtain authorization for RNP 10 or RNP 4 and annotate the ICAO flight plan accordingly.

should plan on completing their climb to or descent

from higher FLs within radar coverage, if possible.

#### NOTE-

**1.** *RNP* 10 is the minimum "Navigation Specification (NavSpec)" required for the application of 50 NM lateral separation. RNP 4 is an operator option. Operators/aircraft authorized RNP 4 are not required to also obtain RNP 10 authorization.

**2.** "RNP navigation specification" (e.g., RNP 10) is the term adopted in the ICAO Performance-based Navigation (PBN) Manual (Doc 9613). It replaces the term "RNP type".

### 4–7–7. RNP 10 or RNP 4 Authorization: Policy and Procedures for Aircraft and Operators

**a.** RNP NavSpecs Applicable To Oceanic Operations. In accordance with ICAO guidance, RNP 10 and RNP 4 are the only NavSpecs applicable to oceanic and remote area operations. Other RNAV and RNP NavSpecs are applicable to continental en route, terminal area and approach operations.

**b.** FAA Documents. The guidance and direction of FAA Order 8400.12 (as amended) (RNP 10 Operational Authorization) is used to grant RNP 10 authorization to operators and aircraft for which the FAA is responsible. FAA Order 8400.33 (as amended) (Procedures for Obtaining Authorization for RNP 4 Oceanic/Remote Area Operations) is used to authorize RNP 4. The FAA RNP 10 and RNP 4 orders are consistent with the ICAO PBN Manual guidance discussed below. FAA and ICAO documents are posted on the FAA Gulf of Mexico 50 NM Lateral Separation Initiative Web Page.

**c.** ICAO Performance-based Navigation (PBN) Manual (ICAO Doc 9613). Guidance for authorization of RNP 10 and RNP 4 is provided in ICAO Doc 9613. RNP 10 is addressed in Volume II, Part B; Chapter 1. RNP 4 is addressed in Volume II, Part C; Chapter 1.

**d.** RNP 10 and RNP 4 Job Aids. Operators and authorities are encouraged to use the RNP 10 or RNP 4 Job Aids posted on the FAA Gulf of Mexico 50 NM Lateral Separation Initiative Web Page. For U.S. operators, one set of RNP 10 and RNP 4 Job Aids provides references to FAA documents. For international operators, a second set of Job Aids provide references to the ICAO PBN Manual. These Job Aids address the operational and airworthiness elements of aircraft and operator authorization and provide references to track the operators to develop and authorities to track the operator/aircraft program elements required for RNP 10 or RNP 4 authorization.

**e.** Qualification of Aircraft Equipped With a Single Long-Range Navigation System (S-LRNS) For RNP 10 Operations In GoMex CTA's.

**1.** Background. S-LRNS operations in the Gulf of Mexico, the Caribbean Sea and the other designated areas have been conducted for at least 25 years. Provisions allowing aircraft equipage with a S-LRNS for operations in specified oceanic and off-shore areas are contained in the following sections of 14 Code of Federal Regulations (CFR): 91.511, 121.351, 125.203 and 135.165.

**2.** ICAO PBN Manual Reference. In reference to RNP 10 authorization, the ICAO PBN Manual, Volume II, Part B, Chapter 1, paragraph 1.3.6.2 states that: "A State authority may approve the use of a single LRNS in specific circumstances (e.g., North Atlantic MNPS and 14 CFR 121.351 (c) refer). An RNP 10 approval is still required."

**3.** Policy Development. The FAA worked with the ICAO NACC Office (North American, Central American and Caribbean), State regulators and ATS providers in the GoMex and Caribbean areas to implement a policy for S-LRNS equipped aircraft to qualify for RNP 10 for GoMex operations. Allowing S-LRNS equipped aircraft to qualify for RNP 10 enables more operator aircraft to be authorized RNP 10, thereby creating a more uniform operating environment for the application of 50 NM lateral separation. The factors considered were: the shortness of the legs outside the range of ground navigation aids, the availability of radar and VHF coverage in a large portion of GoMex airspace and the absence of events attributed to S-LRNS in GoMex operations.

**4.** Document Revision. The following documents were revised or created to enable implementation of the S-LRNS/RNP 10 qualification policy:

(a) FAA Order 8400.12

(**b**) FAA Order 8900.1 (Flight Standards Information Management System (FSIMS))

(c) Paragraph B054 of FAA Operations Specifications and Management Specifications (Class II Navigation Using Single Long-Range Navigation System)

(d) LOA B054 (Class II Navigation Using Single Long-Range Navigation System (S-LRNS) Equipped Airplane Authorized RNP 10) (LOA's are applicable to International General Aviation operators.)

(e) FAA RNP 10 Job Aid with FAA Order 8400.12 references

(f) RNP 10 Job Aid with ICAO PBN Manual references

**5.** S-LRNS/RNP 10 Authorization Limited To GoMex. At this time, S-LRNS qualification for RNP 10 only applies to GoMex operations. Any expansion of this provision will require assessment and agreement by the appropriate State authorities.

f. RNP 10 Time Limit for INS or IRU Only Equipped Aircraft. Operators should review their Airplane Flight Manual (AFM), AFM Supplement or other appropriate documents and/or contact the airplane or avionics manufacturer to determine the RNP 10 time limit applicable to their aircraft. They will then need to determine its effect, if any, on their operation. Unless otherwise approved, the basic RNP 10 time limit is 6.2 hours between position updates for aircraft on which Inertial Navigation Systems (INS) or Inertial Reference Units (IRU) provide the only source of long range navigation. Extended RNP 10 time limits of 10 hours and greater are already approved for many IRU systems. FAA Order 8400.12 contains provisions for extending RNP 10 time limits.

### 4-7-8. Flight Planning Requirements

Operators must make ICAO flight plan annotations in accordance with this paragraph and, if applicable, Paragraph 4–7–5, Provisions for Accommodation of NonRNP10 Aircraft (Aircraft Not Authorized RNP 10 or RNP 4).

**a.** ICAO Flight Plan Requirement. ICAO flight plans must be filed for operation on oceanic routes and areas in the Houston Oceanic CTA/FIR, the Gulf of Mexico portion of the Miami CTA/FIR, the Monterrey CTA and Merida High CTA.

**b.** To inform ATC that they have obtained RNP 10 or RNP 4 authorization and are eligible for 50 NM lateral separation, operators must:

**1.** Annotate ICAO Flight Plan Item 10 (Equipment) with the letters "R" and

**2.** Annotate Item 18 (Other Information) with, as appropriate, "PBN/A1" (for RNP10) or "PBN/L1" (for RNP4).

#### NOTE-

**1.** See paragraph 4–7–8e. It provides recommended filing practices for domestic U.S. RNAV operations and filing with EUROCONTROL.

**2.** On the ICAO Flight Plan, the letter "R" in Item 10 indicates that the flight is authorized for PBN operations. Item 18 PBN/ indicates the types of PBN capabilities that are authorized.

**c.** 50 NM lateral separation will only be applied to operators/aircraft that annotate the ICAO flight plan in accordance with this policy. (See 4-7-8 b.)

**d.** Operators that have not obtained RNP 10 or RNP 4 authorization must not annotate ICAO flight plan Item 18 (Other information) with "PBN/A1" or "PBN/L1", but must follow the practices detailed in paragraph 4–7–5.

**e.** Recommendation for Filing to Show Domestic U.S. RNAV and Oceanic RNP Capabilities.

1. Explanation. The FAA program that allows operators to communicate their domestic U.S. RNAV capabilities to ATC. It is explained in paragraph 5-1-9b 8 items 18 (c) and 18 (d).

**2. Recommendation.** It is recommended that operators provide their PBN capability for oceanic operations by filing: "PBN/A1" (for RNP10) or "PBN/L1" (for RNP4). For domestic operations,

operators should indicate their PBN capability per paragraph 5-1-9b 8 items 18 (c) and 18 (d).

**3. Multiple NAV/ Entries.** Operators should be aware that if they make multiple "NAV/" entries in a flight plan filed with EUROCONTROL, only the last "NAV/" entry will be forwarded to the next ATC facility. For example, if "NAV/RNVD1E2A1" and "NAV/RNP10" are entered, only "NAV/RNP10" will be forwarded. Multiple "NAV/" entries should, therefore, be consolidated following a single "NAV/" indicator.

**4. Recommendation.** Item 18 entries made in accordance with paragraph 4-7-8 e 2. above will limit the number of characters needed to show domestic U.S. RNAV and oceanic RNP capabilities and mitigate the chance that one or the other will not be forwarded for use by FAA domestic and oceanic automation systems.

f. Implementation of ICAO Doc 4444, Revised Appendix 2 (Flight Plan). ICAO Doc 4444, Amendment 1 revises Appendix 2 (Flight Plan). Specifically, Amendment 1 revises the flight plan annotations in Item 10 (Equipment) and Item 18 (Other Information) that show aircraft communications, navigation and surveillance capabilities. The new Appendix 2 flight plan annotations will be required on 15 November 2012. The following Websites provide information on implementation planning:

**1.** FAA Website: http://www.faa.gov/go/fpl2012.

2. ICAO Flight Plan Implementation Tracking System (FITS): http://www2.icao.int/en/FITS/ Pages/home.aspx.

#### 4–7–9. Pilot and Dispatcher Procedures: Basic and In-flight Contingency Procedures

**a. Basic Pilot Procedures.** The RNP 10 and RNP 4 Job Aids contain references to pilot and, if applicable, dispatcher procedures contained in:

**1.** FAA Order 8400.12C (RNP 10), Appendix D (Training Programs and Operating Practices and Procedures)

**2.** FAA Order 8400.33 (RNP 4): Paragraph 9 (Operational Requirements) and Paragraph 10 (Training Programs, Operating Practices and Procedures)

**3.** ICAO PBN Manual, Volume II, Part B, Chapter 1 (RNP 10)

**4.** ICAO PBN Manual, Volume II, Part C, Chapter 1 (RNP 4)

**b. ICAO Doc 4444, Chapter 15, In-flight Contingency Procedures.** Doc 4444 Chapter 15 contains important guidance for pilot training programs. For ease of reference, significant Chapter 15 paragraphs are posted on the Gulf of Mexico 50 NM Lateral Separation Web Page. Chapter 15 paragraphs posted on the website include:

**1.** Paragraph 15.2 (Special Procedures for In-Flight Contingencies in Oceanic Airspace). Paragraph 15.2.2 (General Procedures) provides guidance for in-flight diversions, turn-backs and for loss of, or significant reduction in, required navigation capability when operating in an airspace where the navigation performance accuracy is a prerequisite to the safe conduct of flight operations.

**2.** Paragraph 15.2.3 (Weather Deviation Procedures). Paragraph 15.2.3 provides guidance for events where the pilot is able to obtain a clearance prior to deviating from track to avoid convective weather and for events where the pilot is unable to obtain clearance prior to deviating.

c. Strategic Lateral Offset Procedures (SLOP). Pilots should use SLOP procedures in the course of regular oceanic operations. SLOP procedures are published in ICAO Document 4444, 15th Edition, Amendment 2, paragraph 16.5 and FAA Notices. They are posted on the Gulf of Mexico 50 NM Lateral Separation Web Page and are addressed in the RNP 10 and RNP 4 Job Aids. **d. Pilot Report of NonRNP10 Status.** The pilot must report the lack of RNP 10 or RNP 4 status in accordance with the following:

**1.** When the operator/aircraft is not authorized RNP 10 or RNP 4. See paragraph 4-7-5.

**2.** If approval status is requested by the controller in accordance with paragraph 4-7-9e.

e. Pilot Statement of RNP 10 or RNP 4 Approval Status, If Requested. If requested by the controller, the pilot must communicate approval status using the following phraseology:

(Call sign) confirm RNP 10 or 4 approved

#### Pilot Response:

"Affirm RNP 10 approved" or "Affirm RNP 4 approved," as appropriate, or

"Negative RNP 10" (See paragraph 4–7–5 for NonRNP10 aircraft procedures.)

**f.** Pilot action when navigation system malfunctions. In addition to the actions suggested in ICAO Doc. 4444, Chapter 15, when pilots suspect a navigation system malfunction, the following actions should be taken:

**1.** Immediately inform ATC of navigation system malfunction or failure.

**2.** Accounting for wind drift, fly magnetic compass heading to maintain track.

**3.** Request radar vectors from ATC, when available.

# **Chapter 5. Air Traffic Procedures**

# Section 1. Preflight

#### 5-1-1. Preflight Preparation

**a.** Every pilot is urged to receive a preflight briefing and to file a flight plan. This briefing should consist of the latest or most current weather, airport, and en route NAVAID information. Briefing service may be obtained from an FSS either by telephone, by radio when airborne, or by a personal visit to the station. Pilots with a current medical certificate in the 48 contiguous States may access Lockheed Martin Flight Services or the Direct User Access Terminal System (DUATS) via the internet. Lockheed Martin Flight Services and DUATS will provide preflight weather data and allow pilots to file domestic VFR or IFR flight plans.

REFERENCE-

AIM, FAA Weather Services, Paragraph 7–1–2, lists DUATS vendors.

#### NOTE-

Pilots filing flight plans via "fast file" who desire to have their briefing recorded, should include a statement at the end of the recording as to the source of their weather briefing.

**b.** The information required by the FAA to process flight plans is contained on FAA Form 7233–1, Flight Plan, or FAA Form 7233–4, International Flight Plan. The forms are available at all flight service stations. Additional copies will be provided on request.

#### REFERENCE-

AIM, Flight Plan– VFR Flights, Paragraph 5–1–4 AIM, Flight Plan– IFR Flights, Paragraph 5–1–8 AIM, International Flight Plan– IFR Flights, Paragraph 5–1–9

**c.** Consult an FSS, Lockheed Martin Flight Services, or DUATS for preflight weather briefing.

**d.** FSSs are required to advise of pertinent NOTAMs if a *standard* briefing is requested, but if they are overlooked, don't hesitate to remind the specialist that you have not received NOTAM information.

#### NOTE-

NOTAMs which are known in sufficient time for publication and are of 7 days duration or longer are normally incorporated into the Notices to Airmen Publication and carried there until cancellation time. FDC NOTAMs, which apply to instrument flight procedures, are also included in the Notices to Airmen Publication up to and including the number indicated in the FDC NOTAM legend. Printed NOTAMs are not provided during a briefing unless specifically requested by the pilot since the FSS specialist has no way of knowing whether the pilot has already checked the Notices to Airmen Publication prior to calling. Remember to ask for NOTAMs in the Notices to Airmen Publication. This information is not normally furnished during your briefing.

#### REFERENCE-

AIM, Notice to Airmen (NOTAM) System, Paragraph 5-1-3

e. Pilots are urged to use only the latest issue of aeronautical charts in planning and conducting flight operations. Aeronautical charts are revised and reissued on a regular scheduled basis to ensure that depicted data are current and reliable. In the conterminous U.S., Sectional Charts are updated every 6 months, IFR En Route Charts every 56 days, and amendments to civil IFR Approach Charts are accomplished on a 56–day cycle with a change notice volume issued on the 28–day midcycle. Charts that have been superseded by those of a more recent date may contain obsolete or incomplete flight information.

#### REFERENCE-

AIM, General Description of Each Chart Series, Paragraph 9-1-4

**f.** When requesting a preflight briefing, identify yourself as a pilot and provide the following:

- 1. Type of flight planned; e.g., VFR or IFR.
- 2. Aircraft's number or pilot's name.
- 3. Aircraft type.
- 4. Departure Airport.
- 5. Route of flight.
- 6. Destination.
- 7. Flight altitude(s).
- 8. ETD and ETE.

**g.** Prior to conducting a briefing, briefers are required to have the background information listed above so that they may tailor the briefing to the needs of the proposed flight. The objective is to communicate a "picture" of meteorological and aeronautical information necessary for the conduct of a safe and efficient flight. Briefers use all available weather and aeronautical information to summarize data applicable to the proposed flight. They do not read weather reports and forecasts verbatim unless specifically requested by the pilot. FSS briefers do not provide FDC NOTAM information for special instrument approach procedures unless specifically asked. Pilots authorized by the FAA to use special instrument approach procedures must specifically request FDC NOTAM information for these procedures. Pilots who receive the information electronically will receive NOTAMs for special IAPs automatically.

#### REFERENCE-

AIM, Preflight Briefings, Paragraph 7-1-4, contains those items of a weather briefing that should be expected or requested.

**h.** FAA by 14 CFR Part 93, Subpart K, has designated High Density Traffic Airports (HDTAs) and has prescribed air traffic rules and requirements for operating aircraft (excluding helicopter operations) to and from these airports.

#### REFERENCE-

Airport/Facility Directory, Special Notices Section. AIM, Airport Reservation Operations and Special Traffic Management Programs, Paragraph 4–1–22

**i.** In addition to the filing of a flight plan, if the flight will traverse or land in one or more foreign countries, it is particularly important that pilots leave a complete itinerary with someone directly concerned and keep that person advised of the flight's progress. If serious doubt arises as to the safety of the flight, that person should first contact the FSS.

#### REFERENCE-

AIM, Flights Outside the U.S. and U.S. Territories, Paragraph 5-1-1 1

**j.** Pilots operating under provisions of 14 CFR Part 135 on a domestic flight and not having an FAA assigned 3–letter designator, are urged to prefix the normal registration (N) number with the letter "T" on flight plan filing; e.g., TN1234B.

**REFERENCE**– AIM, Aircraft Call Signs, Paragraph 4–2–4

# 5–1–2. Follow IFR Procedures Even When Operating VFR

**a.** To maintain IFR proficiency, pilots are urged to practice IFR procedures whenever possible, even when operating VFR. Some suggested practices include:

**1.** Obtain a complete preflight and weather briefing. Check the NOTAMs.

2. File a flight plan. This is an excellent low cost insurance policy. The cost is the time it takes to fill it out. The insurance includes the knowledge that someone will be looking for you if you become overdue at your destination.

**3.** Use current charts.

**4.** Use the navigation aids. Practice maintaining a good course–keep the needle centered.

**5.** Maintain a constant altitude which is appropriate for the direction of flight.

6. Estimate en route position times.

7. Make accurate and frequent position reports to the FSSs along your route of flight.

**b.** Simulated IFR flight is recommended (under the hood); however, pilots are cautioned to review and adhere to the requirements specified in 14 CFR Section 91.109 before and during such flight.

**c.** When flying VFR at night, in addition to the altitude appropriate for the direction of flight, pilots should maintain an altitude which is at or above the minimum en route altitude as shown on charts. This is especially true in mountainous terrain, where there is usually very little ground reference. Do not depend on your eyes alone to avoid rising unlighted terrain, or even lighted obstructions such as TV towers.

#### 5–1–3. Notice to Airmen (NOTAM) System

**a.** Time-critical aeronautical information which is of either a temporary nature or not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications receives immediate dissemination via the National NOTAM System.

#### NOTE-

**1.** NOTAM information is that aeronautical information that could affect a pilot's decision to make a flight. It includes such information as airport or aerodrome primary runway closures, taxiways, ramps, obstructions, communications, airspace, changes in the status of navigational aids, ILSs, radar service availability, and other information essential to planned en route, terminal, or landing operations.

**2.** NOTAM information is transmitted using standard contractions to reduce transmission time. See TBL 5–1–2 for a listing of the most commonly used contractions. For a complete listing, see FAA Order 7340.2, Contractions.

**b.** NOTAM information is classified into five categories. These are NOTAM (D) or distant, Flight

Data Center (FDC) NOTAMs, Pointer NOTAMs, Special Activity Airspace (SAA) NOTAMs, and Military NOTAMs.

1. NOTAM (D) information is disseminated for all navigational facilities that are part of the National Airspace System (NAS), all public use airports, seaplane bases, and heliports listed in the Airport/ Facility Directory (A/FD). The complete file of all NOTAM (D) information is maintained in a computer database at the Weather Message Switching Center (WMSC), located in Atlanta, Georgia. This category of information is distributed automatically via Service A telecommunications system. Air traffic facilities, primarily FSSs, with Service A capability have access to the entire WMSC database of NOTAMs. These NOTAMs remain available via Service A for the duration of their validity or until published. Once published, the NOTAM data is deleted from the system. NOTAM (D) information includes such data as taxiway closures, personnel and equipment near or crossing runways, and airport lighting aids that do not affect instrument approach criteria, such as VASI.

All NOTAM Ds must have one of the keywords listed in TBL 5-1-1 as the first part of the text after the location identifier.

2. FDC NOTAMs. On those occasions when it becomes necessary to disseminate information which is regulatory in nature, the National Flight Data Center (NFDC), in Washington, DC, will issue an FDC NOTAM. FDC NOTAMs contain such things as amendments to published IAPs and other current aeronautical charts. They are also used to advertise temporary flight restrictions caused by such things as natural disasters or large-scale public events that may generate a congestion of air traffic over a site.

#### NOTE-

**1.** DUATS vendors will provide FDC NOTAMs only upon site-specific requests using a location identifier.

**2.** NOTAM data may not always be current due to the changeable nature of national airspace system components, delays inherent in processing information, and occasional temporary outages of the U.S. NOTAM system. While en route, pilots should contact FSSs and obtain updated information for their route of flight and destination.

**3. Pointer NOTAMs.** NOTAMs issued by a flight service station to highlight or point out another

NOTAM, such as an FDC or NOTAM (D) NOTAM. This type of NOTAM will assist users in cross-referencing important information that may not be found under an airport or NAVAID identifier. Keywords in pointer NOTAMs must match the keywords in the NOTAM that is being pointed out. The keyword in pointer NOTAMs related to Temporary Flight Restrictions (TFR) must be AIRSPACE.

**4. SAA NOTAMs.** These NOTAMs are issued when Special Activity Airspace will be active outside the published schedule times and when required by the published schedule. Pilots and other users are still responsible to check published schedule times for Special Activity Airspace as well as any NOTAMs for that airspace.

**5.** Military NOTAMs. NOTAMs pertaining to U.S. Air Force, Army, Marine, and Navy navigational aids/airports that are part of the NAS.

**c.** Notices to Airmen Publication (NTAP). The NTAP is published by Mission Support Services, ATC Products and Publications, every 28 days. Data of a permanent nature can be published in the NTAP as an interim step between publication cycles of the A/FD and aeronautical charts. The NTAP is divided into four parts:

**1.** Notices in part 1 are provided by ATC Products and Publications. This part contains selected FDC NOTAMs that are expected to be in effect on the effective date of the publication. This part is divided into three sections:

(a) Section 1, Airway NOTAMs, reflects airway changes that fall within an ARTCC's airspace.

(b) Section 2, Procedural NOTAMs.

(c) Section 3, General NOTAMs, contains NOTAMs that are general in nature and not tied to a specific airport/facility (for example, flight advisories and restrictions, open duration special security instructions, and special flight rules area).

**2.** Part 2, provided by NFDC, contains Part 95 Revisions, Revisions to Minimum En Route IFR Altitudes and Changeover Points.

**3.** Part 3, International NOTAMs, is divided into two sections:

(a) Section 1, International Flight Prohibitions, Potential Hostile Situations, and Foreign Notices.

(**b**) Section 2, International Oceanic Airspace Notices.

**4.** Part 4, Graphic Notices, compiled by ATC Products and Publications from data provided by FAA service area offices and other lines of business,

contains special notices and graphics pertaining to almost every aspect of aviation such as: military training areas, large scale sporting events, air show information, Special Traffic Management Programs (STMP), and airport-specific information. This part is comprised of 6 sections: General, Special Military Operations, Airport and Facility Notices, Major Sporting and Entertainment Events, Airshows, and Special Notices.

TBL 5-1-1 NOTAM Keywords

Keyword	Definition
RWY	Runway
Example	!BNA BNA RWY 36 CLSD 1309131300–1309132000EST
TWY	<b>Taxiway</b>
Example	!BTV BTV TWY C EDGE LGT OBSC 1310131300–1310141300EST
APRON	Apron/Ramp
Example	!BNA BNA APRON NORTH APRON EAST SIDE CLSD 13111221500-1312220700
AD	Aerodrome
Example	!BET BET AD ELK NEAR MVMT AREAS 1309251300-1309262200EST
OBST Example	Obstruction !SJT SJT OBST MOORED BALLOON WITHIN AREA DEFINED AS 1NM RADIUS OF SJT 2430FT (510FT AGL) FLAGGED 1309251400–1309261400EST
NAV	Navigation Aids
Example	!SHV SHV NAV ILS RWY 32 110.3 COMMISSIONED 1311251600-PERM
COM	Communications
Example	!INW INW COM REMOTE COM OUTLET 122.6 OUT OF SERVICE 1307121330-1307151930EST
SVC	Services
Example	!ROA ROA SVC TWR COMMISSIONED 1301050001-PERM
AIRSPACE Example	Airspace !MIV MIV AIRSPACE AIRSHOW ACFT WITHIN AREA DEFINED AS 5NM RADIUS OF MIV SFC-10000FT AVOIDANCE ADVISED 1308122100-1308122300
OPD Example	Obstacle Departure Procedure !FDC 2/9700 DIK ODP DICKINSON - THEODORE ROOSEVELT RGNL, DICKINSON, ND. TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES AMDT 1 DEPARTURE PROCEDURE: RWY 25, CLIMB HEADING 250 TO 3500 BEFORE TURNING LEFT. ALL OTHER DATA REMAINS AS PUBLISHED. THIS IS TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES, AMDT 1A. 1305011200-PERM
SID Example	Standard Instrument Departure !FDC x/xxxx DFW SID DALLAS/FORT WORTH INTL, DALLAS, TX. PODDE THREE DEPARTURE CHANGE NOTES TO READ: RWYS 17C/R, 18L/R: DO NOT EXCEED 240KT UNTIL LARRN. RWYS 35L/C, 36L/R: DONOT EXCEED 240KT UNTIL KMART 1305011200-1312111200EST
STAR Example	Standard Terminal Arrival !FDC x/xxxx DCA STAR RONALD REAGAN WASHINGTON NATIONAL,WASHINGTON, DC. WZRRD TWO ARRIVAL SHAAR TRANSITION: ROUTE FROM DRUZZ INT TO WZRRD INT NOT AUTHORIZED. AFTER DRUZZ INT EXPECT RADAR VECTORS TO AML VORTAC 1305011200-1312111200ES

**11. Block 11.** Enter only those remarks pertinent to ATC or to the clarification of other flight plan information, such as the appropriate radiotelephony (call sign) associated with the FAA-assigned three-letter company designator filed in Block 2, if the radiotelephony is new or has changed within the last 60 days. In cases where there is no three-letter designator but only an assigned radiotelephony or an assigned three-letter designator is used in a medical emergency, the radiotelephony must be included in the remarks field. Items of a personal nature are not accepted.

#### NOTE-

**1.** The pilot is responsible for knowing when it is appropriate to file the radiotelephony in remarks under the 60-day rule or when using FAA special radiotelephony assignments.

**2.** "DVRSN" should be placed in Block 11 only if the pilot/company is requesting priority handling to their original destination from ATC as a result of a diversion as defined in the Pilot/Controller Glossary.

**3.** Do not assume that remarks will be automatically transmitted to every controller. Specific ATC or en route requests should be made directly to the appropriate controller.

**12. Block 12.** Specify the fuel on board, computed from the departure point.

**13.** Block 13. Specify an alternate airport if desired or required, but do not include routing to the alternate airport.

14. Block 14. Enter the complete name, address, and telephone number of pilot-in-command, or in the case of a formation flight, the formation commander. Enter sufficient information to identify home base, airport, or operator.

#### NOTE-

This information would be essential in the event of search and rescue operation.

**15.** Block 15. Enter the total number of persons on board including crew.

16. Block 16. Enter the predominant colors.

#### NOTE-

Close IFR flight plans with tower, approach control, or ARTCC, or if unable, with FSS. When landing at an airport with a functioning control tower, IFR flight plans are automatically canceled. **g.** The information transmitted to the ARTCC for IFR flight plans will consist of only flight plan blocks 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

**h.** A description of the International Flight Plan Form is contained in the International Flight Information Manual (IFIM).

#### 5–1–9. International Flight Plan (FAA Form 7233–4)– IFR Flights (For Domestic or International Flights)

#### a. General

Use of FAA Form 7233-4 is:

**1.** Mandatory for assignment of RNAV SIDs and STARs or other PBN routing,

**2.** Mandatory for all IFR flights that will depart U.S. domestic airspace, and

**3.** Recommended for domestic IFR flights.

#### NOTE-

**1.** An abbreviated description of FAA Form 7233–4 (International Flight Plan) may be found in this section. A detailed description of FAA Form 7233–4 may be found on the FAA website at:

http://www.faa.gov/about/office\_org/ headquarters\_offices/ato/service\_units/enroute/flight\_pl an\_filing/

**2.** Filers utilizing FAA Form 7233–1 (Flight Plan) may not be eligible for assignment of RNAV SIDs and STARs. Filers desiring assignment of these procedures should file using FAA Form 7233–4, as described in this section.

**3.** When filing an IFR flight plan using FAA Form 7233-4, it is recommended that filers include all operable navigation, communication, and surveillance equipment capabilities by adding appropriate equipment qualifiers as shown in Tables 5-1-3 and 5-1-4. These equipment qualifiers should be filed in Item 10 of FAA Form 7233-4.

**4.** ATC issues clearances based on aircraft capabilities filed in Items 10 and 18 of FAA Form 7233–4. Operators should file all capabilities for which the aircraft and crew is certified, capable, and authorized. PBN/ capability should be filed as per paragraph 5-1-9 b 8 Items 18 (c) and (d).

# b. Explanation of Items Filed in FAA Form 7233–4

Procedures and other information provided in this section are designed to assist operators using FAA Form 7233–4 to file IFR flight plans for flights that will be conducted entirely within U.S. domestic airspace. Requirements and procedures for operating

outside U.S. domestic airspace may vary significantly from country to country. It is, therefore, recommended that operators planning flights outside U.S. domestic airspace become familiar with applicable international documents, including Aeronautical Information Publications (AIP); International Flight Information Manuals (IFIM); and ICAO Document 4444, Procedures for Air Navigation Services/Air Traffic Management, Appendix 2.

#### NOTE-

FAA Form 7233-4 is shown in FIG 5-1-3. The filer is normally responsible for providing the information required in Items 3 through 19.

**1. Item 7. Aircraft Identification.** Insert the full registration number of the aircraft, or the approved FAA/ICAO company or organizational designator, followed by the flight number.

#### EXAMPLE-

N235RA, AAL3342, BONGO33

#### NOTE-

Callsigns filed in this item must begin with a letter followed by 1-6 additional alphanumeric characters.

#### 2. Item 8. Flight Rules and Type of Flight.

(a) Flight Rules. Insert the character "I" to indicate IFR

(b) **Type of Flight.** Insert one of the following letters to denote the type of flight:

(1) S if scheduled air service

(2) N if non-scheduled air transport operation

- (3) G if general aviation
- (4) M if military

(5) X if other than any of the defined categories above.

#### NOTE-

*Type of flight is optional for flights that will be conducted entirely within U.S. domestic airspace.* 

# **3.** Item **9.** Number, Type of Aircraft, and Wake Turbulence Category.

(a) Number. Insert the number of aircraft, if more than 1 (maximum 99).

(b) Type of Aircraft.

(1) Insert the appropriate designator as specified in ICAO Doc 8643, Aircraft Type Designators;

(2) Or, if no such designator has been assigned, or in the case of formation flights consisting of more than one type;

(3) Insert ZZZZ, and specify in Item 18, the (numbers and) type(s) of aircraft preceded by TYP/.

(c) Wake Turbulence Category. Insert an oblique stroke followed by one of the following letters to indicate the wake turbulence category of the aircraft:

(1) H — HEAVY, to indicate an aircraft type with a maximum certificated takeoff weight of 300,000 pounds (136 000 kg), or more;

(2) M — MEDIUM, to indicate an aircraft type with a maximum certificated takeoff weight of less than 300,000 pounds (136,000 kg), but more than 15,500 pounds (7,000 kg);

(3) L — LIGHT, to indicate an aircraft type with a maximum certificated takeoff weight of 15,500 pounds (7,000 kg) or less.

#### 4. Item 10. Equipment

TBL 5–1–4	
Aircraft COM, NAV, and Approach Equipment Qua	alifiers

INSERT one letter as follows:			
N if no COM/NAV/approach aid equipment for the route to be flown is carried, or the equipment			
is unserviceable,			
(OR)			
	S if standard COM/NAV/approach aid equipment for the route to be flown is carried and		
(AN	D/OR)		
(AND/OK) INSERT one or more of the following letters to indicate the COM/NAV/approach aid equipment available			
and serviceable:			
NOT	<i>E</i> -		
The	capabilities described below comprise the following eleme	nts:	
a	Presence of relevant serviceable equipment on board the a	ircraft.	
<i>D</i> .	Equipment and capabilities commensurate with flight crew Where applicable, authorization from the appropriate auth	' qualific ority	canons.
A	GBAS landing system	J'/	CPDLC FANS I/A SATCOM (Iridium)
В	LPV (APV with SBAS)	K	MLS
С	LORAN C	L	ILS
D	DME	M1	ATC RTF SATCOM (INMARSAT)
E1	FMC WPR ACARS	M2	ATC RTF (MTSAT)
E2	D-FIS ACARS	M3	ATC RTF (Iridium)
E3	PDC ACARS	0	VOR
F	ADF	P1-	Reserved for RCP
		P9	
G	(GNSS) – see Note 2	R	PBN approved - <i>see Note 4</i>
Η	HF RTF	Т	TACAN
Ι	Inertial navigation	U	UHF RTF
J1	CPDLC ATN VDL Mode 2 – see Note 3	V	VHF RTF
J2	CPDLC FANS 1/A HFDL	W	RVSM approved
J3	CPDLC FANS 1/A VDL Mode 4	Х	MNPS approved
J4	CPDLC FANS 1/A VDL Mode 2	Y	VHF with 8.33 kHz channel spacing capability
J5	CPDLC FANS 1/A SATCOM (INMARSAT)	Z	Other equipment carried or other capabilities - see Note 5
J6	CPDLC FANS 1/A SATCOM (MTSAT)	1	

NOTE-

1. If the letter S is used, standard equipment is considered to be VHF RTF, VOR, and ILS within U.S. domestic airspace.

**2.** If the letter G is used, the types of external GNSS augmentation, if any, are specified in Item 18 following the indicator NAV/ and separated by a space.

**3.** See RTCA/EUROCAE Interoperability Requirements Standard For ATN Baseline 1 (ATN B1 INTEROP Standard – DO-280B/ED-110B) for data link services air traffic control clearance and information/air traffic control communications management/air traffic control microphone check.

**4.** If the letter R is used, the performance-based navigation levels that are authorized must be specified in Item 18 following the indicator PBN/. For further details, see Paragraph 5-1-9b 8, Item 18 (c) and (d).

**5.** If the letter Z is used, specify in Item 18 the other equipment carried, preceded by COM/, DAT/, and/or NAV/, as appropriate.

6. Information on navigation capability is provided to ATC for clearance and routing purposes.

### TBL 5-1-5

### Aircraft Surveillance Equipment, Including Designators for Transponder, ADS–B, ADS–C, and Capabilities

INSI OR	<i>INSERT</i> N if no surveillance equipment for the route to be flown is carried, or the equipment is unserviceable, OR			
INS	<i>INSERT</i> one or more of the following descriptors, to a maximum of 20 characters, to describe the serviceable surveillance equip-			
men	ment and/or capabilities on board:			
SSR	SSR Modes A and C			
А	Transponder - Mode A (4 digits – 4096 codes)			
С	Transponder - Mode A (4 digits – 4096 codes) and Mode C			
SSR	R Mode S			
Е	Transponder - Mode S, including aircraft identification, pressure-altitude and extended squitter (ADS-B) capability			
Н	Transponder - Mode S, including aircraft identification, pressure-altitude and enhanced surveillance capability			
Ι	Transponder - Mode S, including aircraft identification, but no pressure-altitude capability			
L	Transponder - Mode S, including aircraft identification, pressure-altitude, extended squitter (ADS B) and enhanced surveil- lance canability			
D	Transponder - Mode S, including pressure altitude, but no aircraft identification canability			
r c	Transponder - Mode S, including pressure-antitude, out no anerant identification capability			
3	Transponder - Mode S, including both pressure-antitude and ancrart identification capability			
Х	Transponder - Mode S with neither aircraft identification nor pressure-altitude capability			
NO1 Enh	FE– anced surveillance capability is the ability of the aircraft to down-link aircraft derived data via a Mode S transponder.			
Foll	owed by one or more of the following codes if the aircraft has ADS-B capability:			
B1	ADS-B with dedicated 1090 MHz ADS-B "out" capability			
B2	ADS-B with dedicated 1090 MHz ADS-B "out" and "in" capability			
U1	ADS-B "out" capability using UAT			
U2	ADS-B "out" and "in" capability using UAT			
V1	ADS-B "out" capability using VDL Mode 4			
V2	ADS-B "out" and "in" capability using VDL Mode 4			
NOTE-				
File	no more than one code for each type of capability; for example, file B1 or B2, but not both.			
Foll	owed by one or more of the following codes if the aircraft has ADS-C capability:			
D1	ADS-C with FANS 1/A capabilities			
G1	ADS-C with ATN capabilities			

### EXAMPLE-

**1.** SDGW/SB1U1 {VOR, ILS, VHF, DME, GNSS, RVSM, Mode S transponder, ADS-B 1090 Extended Squitter out, ADS-B UAT out}

2. S/C {VOR, ILS, VHF, Mode C transponder}

	RNP SPECIFICATIONS
L1	RNP 4
O1	Basic RNP 1 all permitted sensors
O2	Basic RNP 1 GNSS
O3	Basic RNP 1 DME/DME
O4	Basic RNP 1 DME/DME/IRU
S1	RNP APCH
S2	RNP APCH with BARO-VNAV
T1	RNP AR APCH with RF (special authorization required)
T2	RNP AR APCH without RF (special authorization required)

#### NOTE-

Combinations of alphanumeric characters not indicated above are reserved.

(d) NAV/ Significant data related to navigation equipment, other than as specified in PBN/.

(1) When Performance Based Navigation Capability has been filed in PBN/, if PBN routing is desired for only some segment(s) of the flight then that information can be conveyed by inserting the character "Z" in Item 10 and "NAV/RNV" in field 18 followed by the appropriate RNAV accuracy value(s) per the following:

[a] To be assigned an RNAV 1 SID, insert the characters "D1".

**[b]** To be assigned an RNAV 1 STAR, insert the characters "A1".

[c] To be assigned en route extensions and/or RNAV PTP, insert the characters "E2".

[d] To prevent assignment of an RNAV route or procedure, insert a numeric value of "0" for the segment of the flight. Alternatively, you may simply remove the segment of the flight indicator and numeric value from the character string.

### EXAMPLE-

- 1. NAV/RNVD1 or NAV/RNVD1E0A0 (Same meaning)
- 2. NAV/RNVA1 or NAV/RNVD0E0A1 (Same meaning)
- 3. NAV/RNVE2 or NAV/RNVD0E2A0 (Same meaning)
- 4. NAV/RNVD1A1 or NAV/RNVD1E0A1 (Same meaning)

#### 5. NAV/RNVD1E2A1

#### NOTE-

**1.** Route assignments are predicated on NAV/ data over PBN/ data in ERAS.

**2.** Aircraft certification requirements for RNAV operations within U.S. airspace are defined in AC 90-45A, Approval of Area Navigation Systems for Use in the U.S. National Airspace System, and AC 90–100A, U.S. Terminal and En Route Area Navigation (RNAV) Operations, as amended.

(2) Operators should file their maximum capabilities in order to qualify for the most advanced procedures.

(e) COM/ Indicate communications capabilities not specified in Item 10a, when requested by an air navigation service provider.

(f) DAT/ Indicate data applications or capabilities not specified in Item 10a, when requested by an Air Navigation Service Provider.

(g) SUR/ Indicate surveillance capabilities not specified in Item 10b, when requested by an Air Navigation Service Provider. If ADS-B capability filed in Item 10 is compliant with RTCA DO-260B, include the item "260B" in SUR/. If ADS-B capability filed in Item 10 is compliant with RTCA DO-282B, include the item "282B" in SUR/.

#### EXAMPLE-

- **1.** SUR/260B
- 2. SUR/260B 282B

(h) DEP/ Insert the non–ICAO identifier, or fix/radial/distance from navaid, or latitude/longitude, if ZZZZ is inserted in Item 13. Optionally, append the name of the departure point.

#### EXAMPLE-

- 1. DEP/T23 ALBANY MUNI
- **2.** *DEP/T23*
- 3. DEP/UKW197011 TICK HOLLR RANCH
- **4.** *DEP*/4620N07805W

(i) DEST/ Insert the non–ICAO identifier, or fix/radial/distance from navaid, or latitude/longitude, if ZZZZ is inserted in Item 16. Optionally, append the name of the destination point.

#### EXAMPLE-

- 1. DEST/T23 ALBANY MUNI
- 2. DEST/PIE335033 LEXI DUNES
- 3. DEST/4620N07805W

(j) DOF/ The date of flight departure in a six figure format (YYMMDD, where YY equals the year, MM equals the month, and DD equals the day). The FAA will not accept flight plans filed with Date of Flight resulting in more than a day in advance.

(k) REG/ The registration markings of the aircraft, if different from the aircraft identification in Item 7. Note that the FAA uses this information in monitoring of RVSM and ADS-B performance.

(1) EET/ Significant points or FIR boundary designators and accumulated estimated elapsed times to such points or FIR boundaries.

#### EXAMPLE-

EET/KZLA0745 KZAB0830

(m) SEL/ SELCAL code.

(n) TYP/ Insert the type of aircraft if ZZZZ was entered in Item 9. If necessary, insert the number and type(s) of aircraft in a formation.

#### EXAMPLE-

1. TYP/Homebuilt

#### 2. TYP/2 P51 B17 B24

(o) CODE/ Aircraft address (expressed in the form of an alphanumerical code of six hexadecimal characters) when required by the appropriate ATS authority. Include CODE/ when ADS-B capability is filed in Item 10.

#### EXAMPLE-

"F00001" is the lowest aircraft address contained in the specific block administered by ICAO.

(**p**) DLE/ En route delay or holding, insert the significant point(s) on the route where a delay is planned to occur, followed by the length of delay using four figure time in hours and minutes (hhmm).

#### EXAMPLE-

#### DLE/MDG0030

(q) OPR/ Name of the operator, if not obvious from the aircraft identification in Item 7.

(r) ORGN/ The originator's 8-letter AFTN address or other appropriate contact details, in cases where the originator of the flight plan may not be readily identified, as required by the appropriate ATS authority. The FAA does not require ORGN/ information.

#### NOTE-

In some areas, flight plan reception centers may insert the ORGN/ identifier and originator's AFTN address automatically.

(s) PER/ Aircraft performance data, indicated by a single letter as specified in the Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS, Doc 8168), Volume I - Flight Procedures, if so prescribed by the appropriate ATS authority. Note that the FAA does not require PER/ information.

(t) ALTN/ Name of destination alternate aerodrome(s), if ZZZZ is inserted in Item 16.

#### EXAMPLE-

#### **1.** *ALTN/F35 POSSUM KINGDOM*

#### 2. ALTN/TCC233016 LAZY S RANCH

(u) RALT/ ICAO 4-letter indicator(s) for en-route alternate(s), as specified in Doc 7910, Location Indicators, or name(s) of en-route alternate aerodrome(s), if no indicator is allocated. For aerodromes not listed in the relevant Aeronautical Information Publication, indicate location in LAT/ LONG or bearing and distance from the nearest significant point, as described in DEP/ above.

(v) TALT/ ICAO 4-letter indicator(s) for take-off alternate, as specified in Doc 7910, Location Indicators, or name of take-off alternate aerodrome, if no indicator is allocated. For aerodromes not listed in the relevant Aeronautical Information Publication, indicate location in LAT/LONG or bearing and distance from the nearest significant point, as described in DEP/ above.

(w) RIF/ The route details to the revised destination aerodrome, followed by the ICAO four-letter location indicator of the aerodrome. The revised route is subject to reclearance in flight.

#### EXAMPLE-

1. RIF/DTA HEC KLAX

#### 2. RIF/ESP G94 CLA YPPH

(x) RMK/ Any other plain-language remarks when required by the ATC or deemed necessary.

### EXAMPLE-

1. RMK/NRP

#### 2. RMK/DRVSN

(y) RVR/ The minimum RVR requirement of the flight in meters. This item is defined by

**7.** TAAs may be modified from the standard size and shape to accommodate operational or ATC requirements. Some areas may be eliminated, while the other areas are expanded. The "T" design may be modified by the procedure designers where required by terrain or ATC considerations. For instance, the "T" design may appear more like a regularly or irregularly shaped "Y," upside down "L," or an "I." (a) FIG 5-4-6 depicts a TAA without a left base leg and right base leg. In this generalized example, pilots approaching on a bearing TO the IF/IAF from 271 clockwise to 089 are expected to execute a course reversal because the amount of turn required at the IF/IAF exceeds 90 degrees. The term "NoPT" will be annotated on the boundary of the TAA icon for the other portion of the TAA.



FIG 5–4–6 TAA with Left and Right Base Areas Eliminated

(b) FIG 5–4–7 depicts another TAA modification that pilots may encounter. In this generalized example, the left base area and part of the straight-in area have been eliminated. Pilots operating within the TAA between 210 clockwise to 360 bearing TO the IF/IAF are expected to proceed direct to the IF/IAF and then execute the course reversal in order to properly align the aircraft for entry onto the intermediate segment or to avoid an excessive descent rate. Aircraft operating in areas from 001 clockwise to 090 bearing TO the IF/IAF are expected to proceed direct to the right base IAF and not execute course reversal maneuver. Aircraft cleared direct the IF/IAF by ATC in this sector will be expected to accomplish HILTP. Aircraft operating in areas 091 clockwise to 209 bearing TO the IF/IAF are expected to proceed direct to the IF/IAF and not execute the course reversal. These two areas are annotated "NoPT" at the TAA boundary of the icon in these areas when displayed on the approach chart's plan view.

FIG 5-4-7 TAA with Left Base and Part of Straight–In Area Eliminated



(c) Fig 5-4-8 depicts a TAA with right base leg and part of the straight-in area eliminated.



FIG 5–4–8 TAA with Right Base Eliminated

e. At certain airports, simultaneous (parallel) dependent approaches are permitted to runways spaced less than 2500 feet apart. In this case, ATC will stagger aircraft on the parallel approaches with the leaders always arriving on the same runway. The trailing aircraft is permitted diagonal separation of not less than 1.5 NM, instead of the single runway separation normally utilized for runways spaced less than 2500 feet apart. For wake turbulence mitigation reasons: a) 1.5 NM spacing is only permitted when the leader is either in the large or small wake turbulence category, and b) all aircraft must descend on the glideslope from the altitude at which they were cleared for the approach during these operations. When 1.5 NM reduced separation is authorized, the

IAP briefing strip which indicates that simultaneous operations require the use of vertical guidance and that the pilot should maintain last assigned altitude until intercepting the glideslope. No special pilot training is required to participate in these operations.

### NOTE-

Either simultaneous dependent ILS approaches or SOIA LDA PRM and ILS PRM approaches may be conducted to these runways depending on weather conditions and traffic volume. Pilots should use caution so as not to confuse these operations. Use SOIA procedures only when the ATIS advertises PRM approaches are in use, refer to AIM paragraph 5-4-16. SFO is the only airport where both procedures are presently conducted.

## 5-4-15. Simultaneous (Parallel) Independent ILS/RNAV/GLS Approaches

(See FIG 5–4–20.)



a. System. An approach system permitting simultaneous ILS/RNAV/GLS approaches to parallel runways with centerlines separated by 4,300 to 9,000 feet (9,200' for airports above 5,000') utilizing NTZ final monitor controllers. Simultaneous (parallel) independent approaches require NTZ radar monitoring to ensure separation between aircraft on the adjacent parallel approach course. Aircraft position is tracked by final monitor controllers who will issue instructions to aircraft observed deviating from the assigned final approach course. Staggered radar separation procedures are not utilized. Integral parts of a total system are ILS, radar, communications, ATC procedures, and required airborne equipment. The Approach Procedure Chart permitting simultaneous approaches will contain a note identifying the other runways or approaches that may be used simultaneously. When advised that simultaneous approaches are in progress, pilots must advise approach control immediately of malfunctioning or inoperative receivers, or if a simultaneous approach is not desired.

### NOTE-

ATC does not use the word independent or parallel when advertising these operations on the ATIS.

### EXAMPLE-

Simultaneous ILS 24L and ILS 24R approaches in progress.

**b.** Radar Services. These services are is provided for each simultaneous (parallel) independent approach.

**1.** During turn on to parallel final approach, aircraft will be provided 3 miles radar separation or a minimum of 1,000 feet vertical separation. The assigned altitude must be maintained until intercepting the glide path, unless cleared otherwise by ATC. Aircraft will not be vectored to intercept the final approach course at an angle greater than thirty degrees.

5 - 4 - 40

**2.** The final monitor controller will have the capability of overriding the tower controller on the tower frequency.

**3.** Pilots will be instructed to contact the tower frequency prior to the point where NTZ monitoring begins.

**4.** Aircraft observed to overshoot the turn–on or to continue on a track which will penetrate the NTZ will be instructed to return to the correct final approach course immediately. The final monitor controller may cancel the approach clearance, and issue missed approach or other instructions to the deviating aircraft.

#### PHRASEOLOGY-

"(Aircraft call sign) YOU HAVE CROSSED THE FINAL APPROACH COURSE. TURN (left/right) IMMEDIATELY AND RETURN TO THE FINAL APPROACH COURSE,"

or

"(aircraft call sign) TURN (left/right) AND RETURN TO THE FINAL APPROACH COURSE." **5.** If a deviating aircraft fails to respond to such instructions or is observed penetrating the NTZ, the aircraft on the adjacent final approach course (if threatened), will be issued a breakout instruction.

#### PHRASEOLOGY-

"TRAFFIC ALERT (aircraft call sign) TURN (left/right) IMMEDIATELY HEADING (degrees), (climb/descend) AND MAINTAIN (altitude)."

6. Radar monitoring will automatically be terminated when visual separation is applied, the aircraft reports the approach lights or runway in sight, or the aircraft is 1 mile or less from the runway threshold. Final monitor controllers will not advise pilots when radar monitoring is terminated.

### NOTE-

Simultaneous independent approaches conducted to runways spaced greater than 9,000 feet (or 9,200' at airports above 5,000') do not require an NTZ. However, from a pilot's perspective, the same alerts relative to deviating aircraft will be provided by ATC as are provided when an NTZ is being monitored. Pilots may not be aware as to whether or not an NTZ is being monitored.

# 5–4–16. Simultaneous Close Parallel ILS PRM/RNAV PRM/GLS PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA)

FIG 5-4-21

(See FIG 5–4–21.)



#### a. System.

**1.** PRM is an acronym for the high update rate Precision Runway Monitor surveillance system which is required to monitor the No Transgression Zone (NTZ) for specific parallel runway separations used to conduct simultaneous close parallel approaches. PRM is also published in the title as part of the approach name for IAPs used to conduct Simultaneous Close Parallel approaches. "PRM" alerts pilots that specific airborne equipment, training, and procedures are applicable.

Because Simultaneous Close Parallel PRM approaches are independent, the NTZ and normal operating zone (NOZ) airspace between the final approach courses is monitored by two monitor controllers, one for each approach course. The NTZ monitoring system consists of high resolution ATC radar displays, automated tracking software which provides monitor controllers with aircraft identification, position, speed and a ten-second projected position, as well as visual and aural NTZ penetration alerts. A PRM high update rate surveillance sensor is a component of this system only for specific runway spacing. Additional procedures for simultaneous independent approaches are described in Paragraph 5-4-15, Simultaneous (Parallel) Independent ILS/ RNAV/GLS Approaches. Simultaneous Close Parallel PRM approaches, whether conducted utilizing a high update rate PRM surveillance sensor or not, must meet all of the following requirements: pilot training, PRM in the approach title, NTZ monitoring utilizing a final monitor aid, publication on an AAUP, and use of a secondary PRM communication frequency.

Simultaneous close parallel ILS PRM approaches are depicted on a separate Approach Procedure Chart

titled ILS PRM Rwy XXX (Simultaneous Close Parallel).

#### NOTE-

ATC does not use the word "independent" when advertising these operations on the ATIS.

#### EXAMPLE-

Simultaneous ILS PRM 33L and ILS PRM 33R approaches in progress.

(a) In the discussion below, RNAV PRM and GLS PRM approaches may be substituted for one or both of the ILS PRM approaches in a simultaneous close parallel operation, or, in the case of SOIA, may be substituted for an ILS PRM and/or LDA PRM approach. RNAV PRM or GLS PRM approaches utilize the same applicable chart notations and the same fixes, crossing altitudes, and missed approach procedures as the ILS PRM or LDA PRM approach it overlays. Vertical guidance for an RNAV PRM or GLS PRM approach it of GLS PRM approach must be used when substituting for an ILS PRM or LDA PRM approach.

(**b**) RNAV PRM and GLS PRM approaches may be substituted for:

(1) one or both of the ILS PRM approaches in a simultaneous close parallel operation, or

(2) the ILS PRM and/or LDA PRM approach in a Simultaneous Offset Instrument Approach (SOIA) operation.

(c) The pilot may request to fly the RNAV PRM or GLS PRM approach in lieu of either the ILS PRM and LDA PRM approaches. ATIS may advertise RNAV or GLS PRM approaches to the affected runway or runways in the event of the loss of ground based NAVAIDS. The Attention All Users Page will address ILS PRM, LDA PRM, RNAV PRM, or GLS PRM approaches as applicable. In the remainder of this section:

(1) The RNAV PRM or GLS PRM approaches may be substituted when reference is made to an ILS, LOC, or SOIA offset LDA PRM approach.

(2) The RNAV PRM or GLS PRM Missed Approach Point (MAP) in SOIA operations may be substituted when reference is made to the LDA PRM MAP.

2. Flight Management System (FMS) coding of the offset RNAV PRM and GLS PRM approaches in a SOIA operation is different than other RNAV and GLS approach coding in that it does not match the initial procedure published on the charted IAP. In the SOIA design of the offset approach, the lateral course terminates at the fictitious threshold point (FTP), which is an extension of the final approach course to a point near the runway threshold. The FTP is designated in the approach coding as the MAP so that vertical guidance is available to the pilot to the runway threshold, just as vertical guidance is provided by the LDA glideslope. RNAV and GLS lateral guidance, in contrast, is discontinued at the charted MAP and replaced by visual maneuvering to accomplish runway alignment in the same manner as LDA course guidance is discontinued at the MAP.

As a result of this RNAV and GLS approach coding, when executing a missed approach at and after passing the charted MAP, a heading must initially be flown, either hand-flown or using autopilot "heading mode," before engaging LNAV. If the pilot engages LNAV immediately, the aircraft will continue to track toward the FTP instead of commencing a turn toward the missed approach holding fix. Notes on the charted IAP and in the AAUP make specific reference to this procedure.

Because the SOIA LDA approach is coded in the FMS in same manner as the RNAV GPS approach, this same procedure should be utilized when conducting the LDA PRM missed approach at or inside of the LDA MAP.

Some FMSs do not code waypoints inside of the FAF as part of the approach. Therefore, the depicted MAP on the charted IAP may not be included in the offset approach coding. Pilots utilizing those FMSs may identify the location of the waypoint by noting its distance from the FTP as published on the charted IAP. In those same FMSs, the straight-in SOIA approach will not display a waypoint inside the PFAF. The same procedures may be utilized to identify the uncoded waypoint. In this case, the location is determined by noting its distance from the runway waypoint as published on the charted IAP.

Because the FTP is coded as the MAP, the FMS map display will depict the initial missed approach course as beginning at the FTP. This depiction does not match the charted initial missed approach procedure on the IAP. Pilots are reminded that charted IAP guidance is to be followed, not the map display. Once the aircraft completes the initial turn when commencing a missed approach, the remainder of the procedure coding is standard and can be utilized as with any other IAP.

# b. Simultaneous Offset Instrument Approach (SOIA).

1. SOIA is an acronym for Simultaneous Offset Instrument Approach, a procedure used to conduct simultaneous approaches to runways spaced less than 3,000 feet, but at least 750 feet apart. The SOIA procedure utilizes an ILS PRM approach to one runway and an offset Localizer Type Directional Aid (LDA) PRM approach with glide slope to the adjacent runway. In SOIA operations, aircraft are paired, with the aircraft conducting the ILS PRM approach always positioned slightly ahead of the aircraft conducting the LDA PRM approach.

2. The ILS PRM approach plates used in SOIA operations are identical to other ILS PRM approach plates, with an additional note, which provides the separation between the two runways used for simultaneous approaches. The LDA PRM approach plate displays the required notations for closely spaced approaches as well as depicting the visual segment of the approach.

**3.** Controllers monitor the SOIA ILS PRM and LDA PRM approaches in exactly the same manner as is done for ILS PRM approaches. The procedures and system requirements for SOIA ILS PRM and LDA PRM approaches are identical with those used for simultaneous close parallel ILS PRM approaches until near the LDA PRM approach missed approach point (MAP) — where visual acquisition of the ILS aircraft by the aircraft conducting the LDA PRM approaches are identical except for the visual segment in the SOIA concept, an understanding of the procedures for conducting ILS PRM approaches is essential before conducting a SOIA ILS PRM or LDA PRM operation.

**4.** In SOIA, the approach course separation (instead of the runway separation) meets established close parallel approach criteria. Refer to FIG 5–4–22 for the generic SOIA approach geometry. A visual segment of the LDA PRM approach is established between the LDA MAP and the runway threshold. Aircraft transition in visual conditions from the LDA course, beginning at the LDA MAP, to align with the runway and can be stabilized by 500

feet above ground level (AGL) on the extended runway centerline. Aircraft will be "paired" in SOIA operations, with the ILS aircraft ahead of the LDA aircraft prior to the LDA aircraft reaching the LDA MAP. A cloud ceiling for the approach is established so that the LDA aircraft has nominally 30 seconds to acquire the leading ILS aircraft prior to the LDA aircraft reaching the LDA MAP. If visual acquisition is not accomplished, a missed approach must be executed at the LDA MAP.

### c. Requirements and Procedures.

Besides system requirements and pilot procedures as identified in subparagraph a1 above, all pilots must have completed special training before accepting a clearance to conduct ILS PRM or LDA PRM Simultaneous Close Parallel Approaches.

**1. Pilot Training Requirement.** Pilots must complete **special pilot training**, as outlined below, before accepting a clearance for a simultaneous close parallel ILS PRM or LDA PRM approach.

(a) For operations under 14 CFR Parts 121, 129, and 135, pilots must comply with FAA-approved company training as identified in their Operations Specifications. Training, at a minimum, must require pilots to view the FAA video "ILS PRM AND SOIA APPROACHES: INFORM-ATION FOR AIR CARRIER PILOTS." Refer to <u>https://www.faa.gov/training\_testing/training/</u>prm/ or search key words FAA PRM for additional information and to view or download the video.

(**b**) For operations under Part 91:

(1) Pilots operating **transport category** aircraft must be familiar with PRM operations as contained in this section of the AIM. In addition, **pilots operating transport category aircraft** must view the FAA video "ILS PRM AND SOIA APPROACHES: INFORMATION FOR AIR CARRIER PILOTS." Refer to <u>https://www.faa.gov/</u> **training\_testing/training/prm/** or search key words **FAA PRM** for additional information and to view or download the video.

(2) Pilots *not* operating **transport cat**egory aircraft must be familiar with PRM and SOIA operations as contained in this section of the AIM. The FAA strongly recommends that pilots *not* involved in **transport category** aircraft operations view the FAA video, "ILS PRM AND SOIA AP-

#### PROACHES: INFORMATION FOR GENERAL AVIATION PILOTS." Refer to <u>https://www.faa.gov/training\_testing/training/</u> prm/ or search key words FAA PRM for additional information and to view or download the video.

#### NOTE-

Either simultaneous dependent ILS approaches, or SOIA LDA PRM and ILS PRM approaches may be conducted depending on weather conditions and traffic volume. Pilots should use caution so as not to confuse these operations. Use SOIA procedures only when the ATIS advertises PRM approaches are in use. For simultaneous (parallel) dependent approaches see paragraph 5-4-14 SFO is the only airport where both procedures are presently conducted.

**2. ATC Directed Breakout.** An ATC directed "breakout" is defined as a vector off the ILS or LDA approach course of a threatened aircraft in response to another aircraft penetrating the NTZ.

**3. Dual Communications.** The aircraft flying the ILS PRM or LDA PRM approach must have the capability of enabling the pilot/s to listen to two communications frequencies simultaneously.

#### 4. Radar Services.

(a) During turn on to parallel final approach, aircraft will be provided 3 miles radar separation or a minimum of 1,000 feet vertical separation. The assigned altitude must be maintained until intercepting the glide path, unless cleared otherwise by ATC. Aircraft will not be vectored to intercept the final approach course at an angle greater than thirty degrees.

(b) The final monitor controller will have the capability of overriding the tower controller on the tower frequency.

(c) Pilots will be instructed to contact the tower frequency prior to the point where NTZ monitoring begins. Pilots will begin monitoring the secondary PRM frequency at that time (see Dual VHF Communications Required below).

(d) To ensure separation is maintained, and in order to avoid an imminent situation during simultaneous close parallel ILS PRM or SOIA ILS PRM and LDA PRM approaches, pilots must immediately comply with PRM monitor controller instructions.

(e) Aircraft observed to overshoot the turn or to continue on a track which will penetrate the NTZ will be instructed to return to the correct final approach course immediately. The final monitor controller may cancel the approach clearance, and issue missed approach or other instructions to the deviating aircraft.

#### PHRASEOLOGY-

"(Aircraft call sign) YOU HAVE CROSSED THE FINAL APPROACH COURSE. TURN (left/right) IMMEDI-ATELY AND RETURN TO THE LOCALIZER FINAL APPROACH COURSE," or

"(aircraft call sign) TURN (left/right) AND RETURN TO THE LOCALIZER FINAL APPROACH COURSE."

(f) If a deviating aircraft fails to respond to such instructions or is observed penetrating the NTZ, the aircraft on the adjacent final approach course (if threatened) will be issued a breakout instruction.

#### PHRASEOLOGY-

"TRAFFIC ALERT (aircraft call sign) TURN (left/right) IMMEDIATELY HEADING (degrees), (climb/descend) AND MAINTAIN (altitude)."

(g) Radar monitoring will automatically be terminated when visual separation is applied or the aircraft reports the approach lights or runway in sight. Otherwise, monitoring continues to at least .5 NM beyond the furthest DER. Final monitor controllers will **not** advise pilots when radar monitoring is terminated.

**5.** At airports that conduct PRM operations, (ILS PRM, and the case of airports where SOIAs are conducted, ILS PRM and LDA PRM approaches) the Attention All Users Page (AAUP) informs pilots who are unable to participate that they will be afforded appropriate arrival services as operational conditions permit and must notify the controlling ARTCC as soon as practical, but at least 100 miles from destination.

*FIG 5–4–22* SOIA Approach Geometry



### NOTE-

AIM

SAP	The stabilized approach point is a design point along the extended centerline of the intended land- ing runway on the glide slope/glide path at 500 feet above the runway threshold elevation. It is used to verify a sufficient distance is provided for the visual maneuver after the offset course ap- proach DA to permit the pilots to conform to approved, stabilized approach criteria. The SAP is not published on the IAP.
Offset Course DA	The point along the LDA, or other offset course, where the course separation with the adjacent ILS, or other straight-in course, reaches the minimum distance permitted to conduct closely spaced approaches. Typically that minimum distance will be 3,000 feet without the use of high update radar; with high update radar, course separation of less than 3,000 ft may be used when validated by a safety study. The altitude of the glide slope/glide path at that point determines the offset course approach decision altitude and is where the NTZ terminates. Maneuvering inside the DA is done in visual conditions.
Visual Segment Angle	Angle, as determined by the SOIA design tool, formed by the extension of the straight segment of the calculated flight track (between the offset course MAP/DA and the SAP) and the extended runway centerline. The size of the angle is dependent on the aircraft approach categories (Cat- egory D or only selected categories/speeds) that are authorized to use the offset course approach and the spacing between the runways.

*Visibility* Distance from the offset course approach DA to runway threshold in statute mile.

- **Procedure** The aircraft on the offset course approach must see the runway-landing environment and, if ATC has advised that traffic on the straight-in approach is a factor, the offset course approach aircraft must visually acquire the straight-in approach aircraft and report it in sight to ATC prior to reaching the DA for the offset course approach.
- **CC** The Clear of Clouds point is the position on the offset final approach course where aircraft first operate in visual meteorological conditions below the ceiling, when the actual weather conditions are at, or near, the minimum ceiling for SOIA operations. Ceiling is defined by the Aeronautical Information Manual.

**d.** Attention All Users Page (AAUP). Multiple PRM approach charts at the same airport have a single AAUP associated with them that must be referred to in preparation for conducting the approach.

Bullet points are published which summarize the PRM procedures which apply to each approach and must be briefed before conducting a PRM approach. The following information may be summarized in the bullet points or published in more detail in the Expanded Procedures section of the AAUP. Briefing on the Expanded Procedures is optional.

**1. ATIS.** When the ATIS broadcast advises ILS PRM approaches are in progress (or ILS PRM and LDA PRM approaches in the case of SOIA), pilots should brief to fly the ILS PRM or LDA PRM approach. If later advised to expect the ILS or LDA approach (should one be published), the ILS PRM or LDA PRM chart may be used after completing the following briefing items. The pilot may also request to fly the RNAV (GPS) PRM in lieu of either the ILS PRM or LDAPRM approach. In the event of the loss of ground based NAVAIDS, the ATIS may advertise RNAV (GPS) PRM approaches to the effected runway or runways.

(a) Minimums and missed approach procedures are unchanged.

(b) PRM Monitor frequency no longer required.

(c) ATC may assign a lower altitude for glide slope intercept.

#### NOTE-

In the case of the LDA PRM approach, this briefing procedure only applies if an LDA-DME approach is also published.

In the case of the SOIA ILS PRM and LDA PRM procedure, the AAUP describes the weather conditions in which simultaneous approaches are authorized: Simultaneous approach weather minimums are X,XXX feet (ceiling), x miles (visibility).

2. Dual VHF Communications Required. To avoid blocked transmissions, each runway will have two frequencies, a primary and a PRM monitor frequency. The tower controller will transmit on both frequencies. The monitor controller's transmissions, if needed, will override both frequencies. Pilots will ONLY transmit on the tower controller's frequency, but will listen to both frequencies. Select the PRM monitor frequency audio only when instructed by ATC to contact the tower. The volume levels should be set about the same on both radios so that the pilots will be able to hear transmissions on at least one frequency if the other is blocked. Site specific procedures take precedence over the general information presented in this paragraph. Refer to the AAUP for applicable procedures at specific airports.

### NOTE-

At SFO, pilots conducting SOIA operations select the monitor frequency audio when communicating with the final radar controller. In this special case, the monitor controller's transmissions, if required, override the final controller's frequency.

**3. Breakouts.** Breakouts differ from other types of abandoned approaches in that they can happen anywhere and unexpectedly. Pilots directed by ATC to break off an approach must assume that an aircraft is blundering toward them and a breakout must be initiated **immediately**.

(a) Hand-fly breakouts. All breakouts are to be hand-flown to ensure the maneuver is accomplished in the shortest amount of time.

(b) ATC Directed "Breakouts." ATC directed breakouts will consist of a turn and a climb or descent. Pilots must always initiate the breakout in response to an air traffic controller's instruction. Controllers will give a descending breakout only when there are no other reasonable options available, but in no case will the descent be below the minimum

vectoring altitude (MVA) which provides at least 1,000 feet required obstruction clearance. The AAUP may provide the MVA in the final approach segment as X,XXX feet at (Name) Airport.

#### NOTE-

"TRAFFIC ALERT." If an aircraft enters the "NO TRANS-GRESSION ZONE (NTZ)," the controller will breakout the threatened aircraft on the adjacent approach. The phraseology for the breakout will be:

#### PHRASEOLOGY-

TRAFFIC ALERT, (aircraft call sign) TURN (left/right) IMMEDIATELY, HEADING (degrees), CLIMB/ DES-CEND AND MAINTAIN (altitude).

**4. ILS PRM Glideslope Navigation.** The pilot may find crossing altitudes published along the final approach course. If the approach geometry warrants it, the pilot is advised on the AAUP that descending on the ILS or LDA glideslope ensures complying with any charted crossing restrictions.

# 5. SOIA and ILS PRM differences as noted on the AAUP.

(a) ILS PRM, LDA Traffic (only published on the AAUP when the ILS PRM approach is used in conjunction with an LDA PRM approach to the adjacent runway). To provide better situational awareness, and because traffic on the LDA may be visible on the ILS aircraft's TCAS, pilots are reminded of the fact that aircraft will be maneuvering behind them to align with the adjacent runway. While conducting the ILS PRM approach to Runway XXX, other aircraft may be conducting the offset LDA PRM approach to Runway XXX. These aircraft will approach from the (left/right) rear and will realign with Runway XXX after making visual contact with the ILS traffic. Under normal circumstances, these aircraft will not pass the ILS traffic.

(b) SOIA LDA PRM Items. The AAUP section for the SOIA LDA PRM approach contains most information found in the ILS PRM section. It replaces certain information as seen below and provides pilots with the procedures to be used in the visual segment of the LDA PRM approach from the LDA MAP until landing.

(c) SOIA LDA PRM Navigation (replaces ILS PRM (4) and (a) above). The pilot may find crossing altitudes published along the final approach course. The pilot is advised that descending on the LDA glideslope ensures complying with any charted crossing restrictions. Remain on the LDA course un-

til passing XXXXX (LDA MAP name) intersection prior to maneuvering to align with the centerline of Runway XXX.

(d) SOIA (Name) Airport Visual Segment (replaces ILS PRM (4) above). Pilot procedures for navigating beyond the LDA MAP are spelled out. If ATC advises that there is traffic on the adjacent ILS, pilots are authorized to continue past the LDA MAP to align with runway centerline when:

(1) the ILS traffic is in sight and is expected to remain in sight,

(2) ATC has been advised that "traffic is in sight." (ATC is not required to acknowledge this transmission),

(3) the runway environment is in sight. Otherwise, a missed approach must be executed. Between the LDA MAP and the runway threshold, pilots conducting the LDA PRM approach are responsible for separating themselves visually from traffic conducting the ILS PRM approach to the adjacent runway, which means maneuvering the aircraft as necessary to avoid that traffic until landing, and providing wake turbulence avoidance, if applicable. Pilots maintaining visual separation should advise ATC, as soon as practical, if visual contact with the aircraft conducting the ILS PRM approach is lost and execute a missed approach unless otherwise instructed by ATC.

# e. Differences between Simultaneous ILS and ILS PRM or LDA PRM approaches of importance to the pilot.

1. Runway Spacing. Prior to simultaneous close parallel approaches, most ATC directed breakouts were the result of two aircraft in-trail on the same final approach course getting too close together. Two aircraft going in the same direction did not mandate quick reaction times. With PRM closely spaced approaches, two aircraft could be alongside each other, navigating on courses that are separated by less than 4,300 feet. In the unlikely event that an aircraft "blunders" off its course and makes a worst case turn of 30 degrees toward the adjacent final approach course, closing speeds of 135 feet per second could occur that constitute the need for quick reaction. A blunder has to be recognized by the monitor controller, and breakout instructions issued to the endangered aircraft. The pilot will not have any warning that a breakout is imminent because the blundering aircraft will be on another frequency. It is important that, when a pilot receives breakout instructions, he/ she assumes that a blundering aircraft is about to or has penetrated the NTZ and is heading toward his/her approach course. The pilot must initiate a breakout as soon as safety allows. While conducting PRM approaches, pilots must maintain an increased sense of awareness in order to immediately react to an ATC instruction (**breakout**) and maneuver as instructed by ATC, away from a blundering aircraft.

2. Communications. To help in avoiding communication problems caused by stuck microphones and two parties talking at the same time, two frequencies for each runway will be in use during ILS PRM and LDA PRM approach operations, the primary tower frequency and the PRM monitor frequency. The tower controller transmits and receive in a normal fashion on the primary frequency and also transmits on the PRM monitor frequency. The monitor controller's transmissions override on both frequencies. The pilots flying the approach will listen to both frequencies but only transmit on the primary tower frequency. If the PRM monitor controller initiates a breakout and the primary frequency is blocked by another transmission, the breakout instruction will still be heard on the PRM monitor frequency.

#### NOTE-

At some airports, the override capability may be on other than the tower frequency (KSFO overrides the final radar controller frequency). Pilots should carefully review the dual communications requirements on the AAUP prior to accepting a PRM approach.

**3. Breakouts.** The probability is extremely low that an aircraft will "blunder" from its assigned approach course and enter the NTZ, causing ATC to "breakout" the aircraft approaching on the adjacent ILS or LDA course. However, because of the close proximity of the final approach courses, it is essential that pilots follow the ATC breakout instructions precisely and expeditiously. The controller's "breakout" instructions provide conflict resolution for the threatened aircraft, with the turn portion of the "breakout" being the single most important element in achieving maximum protection. A descending breakout will only be issued when it is the only controller option. In no case will the controller descend an aircraft below the MVA, which will provide at least 1,000 feet clearance above obstacles. The pilot is not expected to exceed 1,000 feet per minute rate of descent in the event a descending breakout is issued.

**4. Hand-flown Breakouts.** The use of the autopilot is encouraged while flying an ILS PRM or LDA PRM approach, but the autopilot must be disengaged in the rare event that a breakout is issued. Simulation studies of breakouts have shown that a hand-flown breakout can be initiated consistently faster than a breakout performed using the autopilot.

**5.** TCAS. The ATC breakout instruction is the primary means of conflict resolution. TCAS, if installed, provides another form of conflict resolution in the unlikely event other separation standards would fail. TCAS is not required to conduct a closely spaced approach.

The TCAS provides only vertical resolution of aircraft conflicts, while the ATC breakout instruction provides both vertical and horizontal guidance for conflict resolutions. Pilots should always immediately follow the TCAS Resolution Advisory (RA), whenever it is received. Should a TCAS RA be received before, during, or after an ATC breakout instruction is issued, the pilot should follow the RA, even if it conflicts with the climb/descent portion of the breakout maneuver. If following an RA requires deviating from an ATC clearance, the pilot must advise ATC as soon as practical. While following an RA, it is extremely important that the pilot also comply with the turn portion of the ATC breakout instruction unless the pilot determines safety to be factor. Adhering to these procedures assures the pilot that acceptable "breakout" separation margins will always be provided, even in the face of a normal procedural or system failure.

# 5–4–17. Simultaneous Converging Instrument Approaches

**a.** ATC may conduct instrument approaches simultaneously to converging runways; i.e., runways having an included angle from 15 to 100 degrees, at airports where a program has been specifically approved to do so.

**b.** The basic concept requires that dedicated, separate standard instrument approach procedures be developed for each converging runway included. Missed Approach Points must be at least 3 miles apart and missed approach procedures ensure that missed approach protected airspace does not overlap.

**c.** Other requirements are: radar availability, nonintersecting final approach courses, precision approach capability for each runway and, if runways

intersect, controllers must be able to apply visual separation as well as intersecting runway separation criteria. Intersecting runways also require minimums of at least 700 foot ceilings and 2 miles visibility. Straight in approaches and landings must be made.

**d.** Whenever simultaneous converging approaches are in progress, aircraft will be informed by the controller as soon as feasible after initial contact or via ATIS. Additionally, the radar controller will have direct communications capability with the tower controller where separation responsibility has not been delegated to the tower.

# 5–4–18. RNP AR Instrument Approach Procedures

These procedures require authorization analogous to the special authorization required for Category II or III ILS procedures. Authorization required (AR) procedures are to be conducted by aircrews meeting special training requirements in aircraft that meet the specified performance and functional requirements.

# a. Unique characteristics of RNP AR Approaches

**1. RNP value.** Each published line of minima has an associated RNP value. The indicated value defines the lateral and vertical performance requirements. A minimum RNP type is documented as part of the RNP AR authorization for each operator and may vary depending on aircraft configuration or operational procedures (e.g., GPS inoperative, use of flight director vice autopilot).

**2.** Curved path procedures. Some RNP approaches have a curved path, also called a radius-to-a-fix (RF) leg. Since not all aircraft have the capability to fly these arcs, pilots are responsible for knowing if they can conduct an RNP approach with an arc or not. Aircraft speeds, winds and bank

angles have been taken into consideration in the development of the procedures.

**3. RNP required for extraction or not.** Where required, the missed approach procedure may use RNP values less than RNP–1. The reliability of the navigation system has to be very high in order to conduct these approaches. Operation on these procedures generally requires redundant equipment, as no single point of failure can cause loss of both approach and missed approach navigation.

**4.** Non-standard speeds or climb gradients. RNP AR approaches are developed based on standard approach speeds and a 200 ft/NM climb gradient in the missed approach. Any exceptions to these standards will be indicated on the approach procedure, and the operator should ensure they can comply with any published restrictions before conducting the operation.

**5. Temperature Limits.** For aircraft using barometric vertical navigation (without temperature compensation) to conduct the approach, low and high-temperature limits are identified on the procedure. Cold temperatures reduce the glidepath angle while high temperatures increase the glidepath angle. Aircraft using baro VNAV with temperature compensation or aircraft using an alternate means for vertical guidance (e.g., SBAS) may disregard the temperature restrictions. The charted temperature limits are evaluated for the final approach segment only. Regardless of charted temperature limits or temperature compensation by the FMS, the pilot may need to manually compensate for cold temperature on minimum altitudes and the decision altitude.

6. Aircraft size. The achieved minimums may be dependent on aircraft size. Large aircraft may require higher minimums due to gear height and/or wingspan. Approach procedure charts will be annotated with applicable aircraft size restrictions.

#### c. Other Sources of Weather Information

**1.** Telephone Information Briefing Service (TIBS) (FSS); and in Alaska, Transcribed Weather Broadcast (TWEB) locations, and telephone access to the TWEB (TEL–TWEB) provide continuously updated recorded weather information for short or local flights. Separate paragraphs in this section give additional information regarding these services.

#### REFERENCE-

AIM, Telephone Information Briefing Service (TIBS), Paragraph 7–1–8 AIM, Transcribed Weather Broadcast (TWEB) (Alaska Only), Paragraph 7–1–9

2. Weather and aeronautical information are also available from numerous private industry sources on an individual or contract pay basis. Information on how to obtain this service should be available from local pilot organizations.

**3.** Pilots can access the Direct User Access Terminal System (DUATS) and Lockheed Martin Flight Services with a current medical certificate via the internet. Pilots can receive preflight weather data and file domestic VFR and IFR flight plans. The following are the contract DUATS vendors:

Computer Sciences Corporation (CSC) Internet Access: http://www.duats.com For customer service: (800) 345–3828

Data Transformation Corporation (DTC) Internet Access: http://www.duat.com For customer service: (800) 243–3828

Lockheed Martin Flight Services Internet Access: http://www.lmfsweb.afss.com/ Website/.com For customer service: (866) 936–6826

**d.** Inflight weather information is available from any FSS within radio range. The common frequency for all FSSs is 122.2. Discrete frequencies for individual stations are listed in the A/FD.

1. Information on In-Flight Weather broadcasts.

#### REFERENCE-

AIM, Inflight Weather Broadcasts, Paragraph 7-1-10

**2.** En Route Flight Advisory Service (EFAS) is provided to serve the nonroutine weather needs of pilots in flight.

#### REFERENCE-

AIM, En Route Flight Advisory Service (EFAS), Paragraph 7-1-5 gives details on this service.

#### 7–1–3. Use of Aviation Weather Products

**a.** Air carriers and operators certificated under the provisions of 14 CFR Part 119 are required to use the aeronautical weather information systems defined in the Operations Specifications issued to that certificate holder by the FAA. These systems may utilize basic FAA/National Weather Service (NWS) weather services, contractor– or operator–proprietary weather services and/or Enhanced Weather Information System (EWINS) when approved in the Operations Specifications. As an integral part of this system approval, the procedures for collecting, producing and disseminating aeronautical weather information, as well as the crew member and dispatcher training to support the use of system weather products, must be accepted or approved.

**b.** Operators not certificated under the provisions of 14 CFR Part 119 are encouraged to use FAA/NWS products through Flight Service Stations, Direct User Access Terminal System (DUATS), Lockheed Martin Flight Services, and/or Flight Information Services–Broadcast (FIS–B).

c. The suite of available aviation weather product types is expanding, with the development of new sensor systems, algorithms and forecast models. The FAA and NWS, supported by various weather research laboratories and corporations under contract to the Government, develop and implement new aviation weather product types. The FAA's NextGen Aviation Weather Research Program (AWRP) facilitates collaboration between the NWS, the FAA, and various industry and research representatives. This collaboration ensures that user needs and technical readiness requirements are met before experimental products mature to operational application.

**d.** The AWRP manages the transfer of aviation weather R&D to operational use through technical review panels and conducting safety assessments to ensure that newly developed aviation weather products meet regulatory requirements and enhance safety.

e. The AWRP review and decision-making process applies criteria to weather products at various stages . The stages are composed of the following:

1. Sponsorship of user needs.

- 2. R & D and controlled testing.
- **3.** Experimental application.
- 4. Operational application.

**f.** Pilots and operators should be aware that weather services provided by entities other than FAA, NWS or their contractors (such as the DUAT/DUATS and Lockheed Martin Flight Services) may not meet FAA/NWS quality control standards. Hence, operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (e.g., current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar products, or products not supported by FAA/NWS technical specifications.

#### NOTE-

# When in doubt, consult with a FAA Flight Service Station Specialist.

g. In addition, pilots and operators should be aware there are weather services and products available from government organizations beyond the scope of the AWRP process mentioned earlier in this section. For example, governmental agencies such as the NWS and the Aviation Weather Center (AWC), or research organizations such as the National Center for Atmospheric Research (NCAR) display weather "model data" and "experimental" products which require training and/or expertise to properly interpret and use. These products are developmental prototypes that are subject to ongoing research and can change without notice. Therefore, some data on display by government organizations, or government data on display by independent organizations may be unsuitable for flight planning purposes. Operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar weather products.

#### NOTE-

When in doubt, consult with a FAA Flight Service Station Specialist.

h. With increased access to weather products via the public Internet, the aviation community has access to an over whelming amount of weather information and data that support self-briefing. FAA AC 00-45 (current edition) describes the weather products distributed by the NWS. Pilots and operators using the public Internet to access weather from a third party vendor should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar weather products and when in doubt, consult with a Flight Service Specialist.

**i.** The development of new weather products, coupled with the termination of some legacy textual and graphical products may create confusion between regulatory requirements and the new products. All flight–related, aviation weather decisions must be based on all available pertinent weather products. As every flight is unique and the weather conditions for that flight vary hour by hour, day to day, multiple weather products may be necessary to meet aviation weather regulatory requirements. Many new weather products now have a Precautionary Use Statement that details the proper use or application of the specific product.

**j.** The FAA has identified three distinct types of weather information available to pilots and operators.

**1. Observations**. Raw weather data collected by some type of sensor suite including surface and airborne observations, radar, lightning, satellite imagery, and profilers.

**2.** Analysis. Enhanced depiction and/or interpretation of observed weather data.

**3.** Forecasts. Predictions of the development and/or movement of weather phenomena based on meteorological observations and various mathematical models.

**k.** Not all sources of aviation weather information are able to provide all three types of weather information. The FAA has determined that operators and pilots may utilize the following approved sources of aviation weather information:

**1. Federal Government.** The FAA and NWS collect raw weather data, analyze the observations,
and produce forecasts. The FAA and NWS disseminate meteorological observations, analyses, and forecasts through a variety of systems. In addition, the Federal Government is the only approval authority for sources of weather observations; for example, contract towers and airport operators may be approved by the Federal Government to provide weather observations.

2. Enhanced Weather Information System (EWINS). An EWINS is an FAA authorized, proprietary system for tracking, evaluating, reporting, and forecasting the presence or lack of adverse weather phenomena. The FAA authorizes a certificate holder to use an EWINS to produce flight movement forecasts, adverse weather phenomena forecasts, and other meteorological advisories. For more detailed information regarding EWINS, see the Aviation Weather Services Advisory Circular 00–45 and the Flight Standards Information Management System 8900.1.

3. Commercial Weather Information **Providers.** In general, commercial providers produce proprietary weather products based on NWS/FAA products with formatting and layout modifications but no material changes to the weather information itself. This is also referred to as "repackaging." In addition, commercial providers may produce analyses, forecasts, and other proprietary weather products that substantially alter the information contained in government-produced products. However, those proprietary weather products that substantially alter governmentproduced weather products or information, may only be approved for use by 14 CFR Part 121 and Part 135 certificate holders if the commercial provider is EWINS qualified.

### NOTE-

Commercial weather information providers contracted by FAA to provide weather observations, analyses, and forecasts (e.g., contract towers) are included in the Federal Government category of approved sources by virtue of maintaining required technical and quality assurance standards under Federal Government oversight.

### 7–1–4. Preflight Briefing

**a.** Flight Service Stations (FSSs) are the primary source for obtaining preflight briefings and inflight weather information. Flight Service Specialists are

qualified and certificated by the NWS as Pilot Weather Briefers. They are not authorized to make original forecasts, but are authorized to translate and interpret available forecasts and reports directly into terms describing the weather conditions which you can expect along your flight route and at your destination. Available aviation weather reports, forecasts and aviation weather charts are displayed at each FSS, for pilot use. Pilots should feel free to use these self briefing displays where available, or to ask for a briefing or assistance from the specialist on duty. Three basic types of preflight briefings are available to serve your specific needs. These are: Standard Briefing, Abbreviated Briefing, and Outlook Briefing. You should specify to the briefer the type of briefing you want, along with your appropriate background information. This will enable the briefer to tailor the information to your intended flight. The following paragraphs describe the types of briefings available and the information provided in each briefing.

#### REFERENCE-

AIM, Preflight Preparation, Paragraph 5-1-1, for items that are required.

**b. Standard Briefing.** You should request a Standard Briefing any time you are planning a flight and you have not received a previous briefing or have not received preliminary information through mass dissemination media; e.g., TIBS, TWEB (Alaska only), etc. International data may be inaccurate or incomplete. If you are planning a flight outside of U.S. controlled airspace, the briefer will advise you to check data as soon as practical after entering foreign airspace, unless you advise that you have the international cautionary advisory. The briefer will automatically provide the following information in the sequence listed, except as noted, when it is applicable to your proposed flight.

**1.** Adverse Conditions. Significant meteorological and/or aeronautical information that might influence the pilot to alter or cancel the proposed flight; for example, hazardous weather conditions, airport closures, air traffic delays, etc. Pilots should be especially alert for current or forecast weather that could reduce flight minimums below VFR or IFR conditions. Pilots should also be alert for any reported or forecast icing if the aircraft is not certified for operating in icing conditions. Flying into areas of icing or weather below minimums could have disastrous results.

2. VFR Flight Not Recommended. When VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that, in the briefer's judgment, would make flight under VFR doubtful, the briefer will describe the conditions, describe the affected locations, and use the phrase "VFR flight not recommended." This recommendation is advisory in nature. The final decision as to whether the flight can be conducted safely rests solely with the pilot. Upon receiving a "VFR flight not recommended" statement, the non-IFR rated pilot will need to make a "go or no go" decision. This decision should be based on weighing the current and forecast weather conditions against the pilot's experience and ratings. The aircraft's equipment, capabilities and limitations should also be considered.

### NOTE-

Pilots flying into areas of minimal VFR weather could encounter unforecasted lowering conditions that place the aircraft outside the pilot's ratings and experience level. This could result in spatial disorientation and/or loss of control of the aircraft.

**3.** Synopsis. A brief statement describing the type, location and movement of weather systems and/or air masses which might affect the proposed flight.

### NOTE-

These first 3 elements of a briefing may be combined in any order when the briefer believes it will help to more clearly describe conditions.

4. Current Conditions. Reported weather conditions applicable to the flight will be summarized from all available sources; e.g., METARs/ SPECIs, PIREPs, RAREPs. This element will be omitted if the proposed time of departure is beyond 2 hours, unless the information is specifically requested by the pilot.

**5.** En Route Forecast. Forecast en route conditions for the proposed route are summarized in logical order; i.e., departure/climbout, en route, and descent. (Heights are MSL, unless the contractions "AGL" or "CIG" are denoted indicating that heights are above ground.)

**6. Destination Forecast.** The destination forecast for the planned ETA. Any significant changes within 1 hour before and after the planned arrival are included.

**7. Winds Aloft.** Forecast winds aloft will be provided using degrees of the compass. The briefer

will interpolate wind directions and speeds between levels and stations as necessary to provide expected conditions at planned altitudes. (Heights are MSL.) Temperature information will be provided on request.

### 8. Notices to Airmen (NOTAMs).

(a) Available NOTAM (D) information pertinent to the proposed flight, including special use airspace (SUA) NOTAMs for restricted areas, aerial refueling, and night vision goggles (NVG).

### NOTE-

Other SUA NOTAMs (D), such as military operations area (MOA), military training route (MTR), and warning area NOTAMs, are considered "upon request" briefing items as indicated in paragraph 7-1-4b10(a).

(**b**) Prohibited Areas P-40, P-49, P-56, and the special flight rules area (SFRA) for Washington, DC.

(c) FSS briefers do not provide FDC NOTAM information for special instrument approach procedures unless specifically asked. Pilots authorized by the FAA to use special instrument approach procedures must specifically request FDC NOTAM information for these procedures.

### NOTE-

**1.** *NOTAM information may be combined with current conditions when the briefer believes it is logical to do so*.

**2.** NOTAM (D) information and FDC NOTAMs which have been published in the Notices to Airmen Publication are not included in pilot briefings unless a review of this publication is specifically requested by the pilot. For complete flight information you are urged to review the printed NOTAMs in the Notices to Airmen Publication and the A/FD in addition to obtaining a briefing.

**9. ATC Delays.** Any known ATC delays and flow control advisories which might affect the proposed flight.

### 10. Pilots may obtain the following from flight service station briefers upon request:

(a) Information on SUA and SUA-related airspace, except those listed in paragraph 7–1–4b8. *NOTE*–

**1.** For the purpose of this paragraph, SUA and related airspace includes the following types of airspace: alert area, military operations area (MOA), warning area, and air traffic control assigned airspace (ATCAA). MTR data includes the following types of airspace: IFR training routes (IR), VFR training routes (VR), and slow training routes (SR).

**2.** *Pilots are encouraged to request updated information from ATC facilities while in flight.* 

(c) Approximate density altitude data.

(d) Information regarding such items as air traffic services and rules, customs/immigration procedures, ADIZ rules, search and rescue, etc.

(e) GPS RAIM availability for 1 hour before to 1 hour after ETA or a time specified by the pilot.

(f) Other assistance as required.

c. Abbreviated Briefing. Request an Abbreviated Briefing when you need information to supplement mass disseminated data, update a previous briefing, or when you need only one or two specific items. Provide the briefer with appropriate background information, the time you received the previous information, and/or the specific items needed. You should indicate the source of the information already received so that the briefer can limit the briefing to the information that you have not received, and/or appreciable changes in meteorological/aeronautical conditions since your previous briefing. To the extent possible, the briefer will provide the information in the sequence shown for a Standard Briefing. If you request only one or two specific items, the briefer will advise you if adverse conditions are present or forecast. (Adverse conditions contain both meteorological and/or aeronautical information.) Details on these conditions will be provided at your request. International data may be inaccurate or incomplete. If you are planning a flight outside of U.S. controlled airspace, the briefer will advise you to check data as soon as practical after entering foreign airspace, unless you advise that you have the international cautionary advisory.

**d.** Outlook Briefing. You should request an Outlook Briefing whenever your proposed time of departure is six or more hours from the time of the briefing. The briefer will provide available forecast data applicable to the proposed flight. This type of briefing is provided for planning purposes only. You should obtain a Standard or Abbreviated Briefing prior to departure in order to obtain such items as adverse conditions, current conditions, updated forecasts, winds aloft and NOTAMs, etc.

e. <u>When filing a flight plan only</u>, you will be asked if you require the latest information on adverse conditions pertinent to the route of flight.

f. Inflight Briefing. You are encouraged to obtain your preflight briefing by telephone or in person before departure. In those cases where you need to obtain a preflight briefing or an update to a previous briefing by radio, you should contact the nearest FSS to obtain this information. After communications have been established, advise the specialist of the type briefing you require and provide appropriate background information. You will be provided information as specified in the above paragraphs, depending on the type of briefing requested. In addition, the specialist will recommend shifting to the Flight Watch frequency when conditions along the intended route indicate that it would be advantageous to do so. Remember that weather conditions can change rapidly and that a "go or no go" decision, as mentioned in paragraph 7–1–4b2, should be assessed at all phases of flight.

**g.** Following any briefing, feel free to ask for any information that you or the briefer may have missed or are not understood. This way, the briefer is able to present the information in a logical sequence, and lessens the chance of important items being overlooked.

# 7–1–5. En Route Flight Advisory Service (EFAS)

a. EFAS (radio call "Flight Watch") is a service specifically designed to provide en route aircraft with timely and meaningful weather advisories pertinent to the type of flight intended, route of flight, and altitude. In conjunction with this service, EFAS is also a central collection and distribution point for pilot reported weather information. EFAS is provided by specially trained FSS specialists controlling multiple Remote Communications Outlets covering a large geographical area and is normally available throughout the conterminous U.S. and Puerto Rico from 6 a.m. to 10 p.m. EFAS provides communications capabilities for aircraft flying at 5,000 feet above ground level to 17,500 feet MSL on a common frequency of 122.0 MHz. Discrete EFAS frequencies have been established to ensure communications coverage from 18,000 through 45,000 MSL serving in each specific ARTCC area. These discrete frequencies may be used below 18,000 feet when coverage permits reliable communication.

### NOTE-

When an EFAS outlet is located in a time zone different from the zone in which the flight watch control station is located, the availability of service may be plus or minus one hour from the normal operating hours.

**b.** In some regions of the contiguous U.S., especially those that are mountainous, it is necessary to be above 5000 feet AGL in order to be at an altitude where the EFAS frequency, 122.0 MHz, is available. Pilots should take this into account when flight planning. Other FSS communication frequencies may be available at lower altitudes. See FIG 7-1-2.

**c.** Contact flight watch by using the name of the ARTCC facility identification serving the area of your location, followed by your aircraft identification, and the name of the nearest VOR to your position. The specialist needs to know this approximate location to select the most appropriate transmitter/receiver outlet for communications coverage.

### EXAMPLE-

Cleveland Flight Watch, Cessna One Two Three Four Kilo, Mansfield V–O–R, over.

**d.** Charts depicting the location of the flight watch control stations (parent facility) and the outlets they use are contained in the A/FD. If you do not know in which flight watch area you are flying, initiate contact by using the words "Flight Watch," your aircraft identification, and the name of the nearest VOR. The facility will respond using the name of the flight watch facility.

### EXAMPLE-

Flight Watch, Cessna One Two Three Four Kilo, Mansfield V-O-R,over.

**e.** Radio outlets that provide En Route Flight Advisory Service are listed regionally in the A/FDs.

**f.** EFAS is not intended to be used for filing or closing flight plans, position reporting, getting complete preflight briefings, or obtaining random weather reports and forecasts. En route flight advisories are tailored to the phase of flight that begins after climb-out and ends with descent to land. Immediate destination weather and terminal aerodrome forecasts will be provided on request. Pilots requesting information not within the scope of flight watch will be advised of the appropriate FSS frequency to obtain the information. Pilot participation is essential to the success of EFAS by providing a continuous exchange of information on weather,

winds, turbulence, flight visibility, icing, etc., between pilots and flight watch specialists. Pilots are encouraged to report good weather as well as bad, and to confirm expected conditions as well as unexpected to EFAS facilities.

### 7–1–6. Inflight Aviation Weather Advisories

### a. Background

1. Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. All inflight aviation weather advisories in the conterminous U.S. are issued by the Aviation Weather Center (AWC) in Kansas City, Missouri. The Weather Forecast Office (WFO) in Honolulu issues advisories for the Hawaiian Islands. In Alaska, the Alaska Aviation Weather Unit (AAWU) issues inflight aviation weather advisories. All heights are referenced MSL, except in the case of ceilings (CIG) which indicate AGL.

2. There are three types of inflight aviation weather advisories: the SIGMET, the Convective SIGMET, and the AIRMET (text or graphical product). All of these advisories use the same location identifiers (either VORs, airports, or well-known geographic areas) to describe the hazardous weather areas. See FIG 7–1–3 and FIG 7–1–4. Graphics with improved clarity can be found in the latest version of Advisory Circular AC 00–45 series, Aviation Weather Services, which is available on the following Web site: http://www.faa.gov.

**3.** Two other weather products supplement these Inflight Aviation Weather Advisories:

(a) The Severe Weather Watch Bulletins (WWs), (with associated Alert Messages) (AWW), and

(b) The Center Weather Advisories (CWAs).

## b. SIGMET (WS)/AIRMET (WA or G-AIRMET)

SIGMETs/AIRMET text (WA) products are issued corresponding to the Area Forecast (FA) areas described in FIG 7–1–5, FIG 7–1–6 and FIG 7–1–7. The maximum forecast period is 4 hours for SIGMETs and 6 hours for AIRMETs. The G–AIRMET is issued over the CONUS every 6 hours, valid at 3–hour increments through 12 hours with optional forecasts possible during the first 6 hours. The first 6 hours of the G–AIRMET correspond to the 6-hour period of the AIRMET. SIGMETs and AIRMETs are considered "wide-spread" because they must be either affecting or be forecasted to affect an area of at least 3,000 square miles at any one time. However, if the total area to be affected during the forecast period is very large, it could be that in actuality only a small portion of this total area would be affected at any one time.

### c. SIGMET (WS)

1. A SIGMET advises of non-convective weather that is potentially hazardous to all aircraft. SIGMETs are unscheduled products that are valid for 4 hours. However, conditions that are associated with hurricanes are valid for 6 hours. Unscheduled updates and corrections are issued as necessary. In the conterminous U.S., SIGMETs are issued when the following phenomena occur or are expected to occur:

(a) Severe icing not associated with thunderstorms.

(b) Severe or extreme turbulence or clear air turbulence (CAT) not associated with thunderstorms.

(c) Widespread dust storms or sandstorms lowering surface visibilities to below 3 miles.

(d) Volcanic ash.

**2.** In Alaska and Hawaii, SIGMETs are also issued for:

(a) Tornadoes.

(b) Lines of thunderstorms.

(c) Embedded thunderstorms.

(d) Hail greater than or equal to 3/4 inch in diameter.

**3.** SIGMETs are identified by an alphabetic designator from November through Yankee excluding Sierra and Tango. (Sierra, Tango, and Zulu are reserved for AIRMET text [WA] products; G-AIRMETS do not use the Sierra, Tango, or Zulu designators.) The first issuance of a SIGMET will be labeled as UWS (Urgent Weather SIGMET).

Subsequent issuances are at the forecaster's discretion. Issuance for the same phenomenon will be sequentially numbered, using the original designator until the phenomenon ends. For example, the first issuance in the Chicago (CHI) FA area for phenomenon moving from the Salt Lake City (SLC) FA area will be SIGMET Papa 3, if the previous two issuances, Papa 1 and Papa 2, had been in the SLC FA area. Note that no two different phenomena across the country can have the same alphabetic designator at the same time.

EXAMPLE-

Example of a SIGMET: BOSR WS 050600 SIGMET ROMEO 2 VALID UNTIL 051000 ME NH VT FROM CAR TO YSJ TO CON TO MPV TO CAR OCNL SEV TURB BLW 080 EXP DUE TO STG NWLY FLOW. CONDS CONTG BYD 1000Z.

#### d. Convective SIGMET (WST)

**1.** Convective SIGMETs are issued in the conterminous U.S. for any of the following:

(a) Severe thunderstorm due to:

(1) Surface winds greater than or equal to 50 knots.

(2) Hail at the surface greater than or equal to 3/4 inches in diameter.

(3) Tornadoes.

(b) Embedded thunderstorms.

(c) A line of thunderstorms.

(d) Thunderstorms producing precipitation greater than or equal to heavy precipitation affecting 40 percent or more of an area at least 3,000 square miles.

2. Any convective SIGMET implies severe or greater turbulence, severe icing, and low-level wind shear. A convective SIGMET may be issued for any convective situation that the forecaster feels is hazardous to all categories of aircraft.

FIG 7-1-2 EFAS Radio Coverage Areas



### NOTE-

*EFAS radio coverage at 5000 feet AGL. The shaded areas depict limited coverage areas in which altitudes above 5000 feet AGL would be required to contact EFAS.* 

# 7–1–19. Estimating Intensity of Snow or Drizzle (Based on Visibility)

**a. Light.** Visibility more than 1/2 statute mile.

**b. Moderate.** Visibility from more than 1/4 statute mile to 1/2 statute mile.

c. Heavy. Visibility 1/4 statute mile or less.

### 7-1-20. Pilot Weather Reports (PIREPs)

**a.** FAA air traffic facilities are required to solicit PIREPs when the following conditions are reported or forecast: ceilings at or below 5,000 feet; visibility at or below 5 miles (surface or aloft); thunderstorms and related phenomena; icing of light degree or greater; turbulence of moderate degree or greater; wind shear and reported or forecast volcanic ash clouds.

**b.** Pilots are urged to cooperate and promptly volunteer reports of these conditions and other atmospheric data such as: cloud bases, tops and layers; flight visibility; precipitation; visibility restrictions such as haze, smoke and dust; wind at altitude; and temperature aloft.

**c.** PIREPs should be given to the ground facility with which communications are established; i.e., EFAS, FSS, ARTCC, or terminal ATC. One of the primary duties of EFAS facilities, radio call "FLIGHT WATCH," is to serve as a collection point for the exchange of PIREPs with en route aircraft.

**d.** If pilots are not able to make PIREPs by radio, reporting upon landing of the inflight conditions encountered to the nearest FSS or Weather Forecast Office will be helpful. Some of the uses made of the reports are:

**1.** The ATCT uses the reports to expedite the flow of air traffic in the vicinity of the field and for hazardous weather avoidance procedures.

**2.** The FSS uses the reports to brief other pilots, to provide inflight advisories, and weather avoidance information to en route aircraft.

**3.** The ARTCC uses the reports to expedite the flow of en route traffic, to determine most favorable altitudes, and to issue hazardous weather information within the center's area.

4. The NWS uses the reports to verify or amend conditions contained in aviation forecast and advisories. In some cases, pilot reports of hazardous conditions are the triggering mechanism for the issuance of advisories. They also use the reports for pilot weather briefings.

**5.** The NWS, other government organizations, the military, and private industry groups use PIREPs for research activities in the study of meteorological phenomena.

**6.** All air traffic facilities and the NWS forward the reports received from pilots into the weather distribution system to assure the information is made available to all pilots and other interested parties.

e. The FAA, NWS, and other organizations that enter PIREPs into the weather reporting system use the format listed in TBL 7–1–7. Items 1 through 6 are included in all transmitted PIREPs along with one or more of items 7 through 13. Although the PIREP should be as complete and concise as possible, pilots should not be overly concerned with strict format or phraseology. The important thing is that the information is relayed so other pilots may benefit from your observation. If a portion of the report needs clarification, the ground station will request the information. Completed PIREPs will be transmitted to weather circuits as in the following examples:

AIM

	PIREP ELEMENT	PIREP CODE	CONTENTS					
1.	3-letter station identifier	XXX	Nearest weather reporting location to the reported phenomenon					
2.	Report type	UA or UUA	Routine or Urgent PIREP					
3.	Location	/OV	In relation to a VOR					
4.	Time	/TM	Coordinated Universal Time					
5.	Altitude	/FL	Essential for turbulence and icing reports					
6.	Type Aircraft	/TP	Essential for turbulence and icing reports					
7.	Sky cover	/SK	Cloud height and coverage (sky clear, few, scattered, broken, or overcast)					
8.	Weather	/WX	Flight visibility, precipitation, restrictions to visibility, etc.					
9.	Temperature	/TA	Degrees Celsius					
10.	Wind	/WV	Direction in degrees magnetic north and speed in knots					
11.	Turbulence	/TB	See AIM paragraph 7–1–23					
12.	Icing	/IC	See AIM paragraph 7–1–21					
13.	Remarks	/RM	For reporting elements not included or to clarify previously reported items					

*TBL 7–1–7* **PIREP Element Code Chart** 

### EXAMPLE-

**1.** *KCMH UA /OV APE 230010/TM 1516/FL085/TP BE20/SK BKN065/WX FV03SM HZ FU/TA 20/TB LGT* 

### NOTE-

**1.** One zero miles southwest of Appleton VOR; time 1516 UTC; altitude eight thousand five hundred; aircraft type BE200; bases of the broken cloud layer is six thousand five hundred; flight visibility 3 miles with haze and smoke; air temperature 20 degrees Celsius; light turbulence.

### EXAMPLE-

2. KCRW UV /OV KBKW 360015-KCRW/TM 1815/FL120//TP BE99/SK IMC/WX RA/TA M08 /WV 290030/TB LGT-MDT/IC LGT RIME/RM MDT MXD ICG DURC KROA NWBND FL080-100 1750Z

### NOTE-

**2.** From 15 miles north of Beckley VOR to Charleston VOR; time 1815 UTC; altitude 12,000 feet; type aircraft, BE–99; in clouds; rain; temperature minus 8 Celsius; wind 290 degrees magnetic at 30 knots; light to moderate turbulence; light rime icing during climb northwestbound from Roanoke, VA, between 8,000 and 10,000 feet at 1750 UTC.

### 7–1–21. PIREPs Relating to Airframe Icing

**a.** The effects of ice on aircraft are cumulativethrust is reduced, drag increases, lift lessens, and weight increases. The results are an increase in stall speed and a deterioration of aircraft performance. In extreme cases, 2 to 3 inches of ice can form on the leading edge of the airfoil in less than 5 minutes. It takes but 1/2 inch of ice to reduce the lifting power of some aircraft by 50 percent and increases the frictional drag by an equal percentage.

**b.** A pilot can expect icing when flying in visible precipitation, such as rain or cloud droplets, and the temperature is between +02 and -10 degrees Celsius. When icing is detected, a pilot should do one of two things, particularly if the aircraft is not equipped with deicing equipment; get out of the area of precipitation; or go to an altitude where the temperature is above freezing. This "warmer" altitude may not always be a lower altitude. Proper preflight action includes obtaining information on the freezing level and the above freezing levels in precipitation areas. Report icing to ATC, and if operating IFR, request new routing or altitude if icing will be a hazard. Be sure to give the type of aircraft to ATC when reporting icing. The following describes how to report icing conditions.

**1. Trace.** Ice becomes perceptible. Rate of accumulation slightly greater than sublimation. Deicing/anti-icing equipment is not utilized unless encountered for an extended period of time (over 1 hour).

### 7–2–3. Altimeter Errors

**a.** Most pressure altimeters are subject to mechanical, elastic, temperature, and installation errors. (Detailed information regarding the use of pressure altimeters is found in the Instrument Flying Handbook, Chapter IV.) Although manufacturing and installation specifications, as well as the periodic test and inspections required by regulations (14 CFR Part 43, Appendix E), act to reduce these errors, any scale error may be observed in the following manner:

**1.** Set the current reported altimeter setting on the altimeter setting scale.

**2.** Altimeter should now read field elevation if you are located on the same reference level used to establish the altimeter setting.

**3.** Note the variation between the known field elevation and the altimeter indication. If this variation is in the order of plus or minus 75 feet, the accuracy of the altimeter is questionable and the problem should be referred to an appropriately rated repair station for evaluation and possible correction.

**b.** Once in flight, it is very important to obtain frequently current altimeter settings en route. If you do not reset your altimeter when flying *from* an area of high pressure into an area of low pressure, *your aircraft will be closer to the surface than your altimeter indicates.* An inch error in the altimeter setting equals 1,000 feet of altitude. To quote an old saying: "GOING FROM A HIGH TO A LOW, LOOK OUT BELOW."

**c.** Temperature also has an effect on the accuracy of altimeters and your altitude. The crucial values to consider are standard temperature versus the ambient (at altitude) temperature and the elevation above the altitude setting reporting source. It is these "differences" that cause the error in indicated altitude. When the column of air is warmer than standard, you are higher than your altimeter indicates. Subsequently, when the column of air is colder than standard, you are lower than indicated. It is the magnitude of these "differences" that determine the magnitude of the error. When flying into a cooler air mass while maintaining a constant indicated altitude, you are losing true altitude. However, flying into a cooler air mass does not necessarily mean you will be lower than indicated if the *difference* is still on the plus side. For example, while flying at 10,000 feet (where STANDARD temperature is +5 degrees

Celsius (C)), the outside air temperature cools from +5 degrees C to 0 degrees C, the temperature error will nevertheless cause the aircraft to be **HIGHER** than indicated. It is the extreme "cold" difference that normally would be of concern to the pilot. Also, when flying in cold conditions over mountainous terrain, the pilot should exercise caution in flight planning both in regard to route and altitude to ensure adequate en route and terminal area terrain clearance.

#### NOTE-

Non-standard temperatures can result in a change to effective vertical paths and actual descent rates while using aircraft Baro-VNAV equipment for vertical guidance on final approach segments. A higher than standard temperature will result in a steeper gradient and increased actual descent rate. Indications of these differences are often not directly related to vertical speed indications. Conversely, a lower than standard temperature will result in a shallower descent gradient and reduced actual descent rate. Pilots should consider potential consequences of these effects on approach minimums, power settings, sight picture, visual cues, etc., especially for high-altitude or terrain-challenged locations and during low-visibility conditions.

**d.** TBL 7–2–3, derived from ICAO formulas, indicates how much error can exist when operating in cold temperatures. To use the table, find the reported temperature in the left column, read across the top row to locate the height above the airport/reporting station (i.e., subtract the airport/ reporting elevation from the intended flight altitude). The intersection of the column and row is how much *lower* the aircraft may actually be as a result of the possible cold temperature induced error.

e. Pilots are responsible to compensate for cold temperature altimetry errors when operating into an airport with any published cold temperature restriction and a reported airport temperature at or below the published temperature restriction. Pilots must ensure compensating aircraft are correcting on the proper segment or segments of the approach. Manually correct if compensating aircraft system is inoperable. Pilots manually correcting, are responsible to calculate and apply a cold temperature altitude correction derived from TBL 7-2-3 to the affected approach segment or segments. Pilots must advise the cold temperature altitude correction to Air Traffic Control (ATC). Pilots are not required to advise ATC of a cold temperature altitude correction inside of the final approach fix.

	Height Above Airport in Feet														
		200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
keported Temp $^\circ \mathrm{C}$	+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90
	0	20	20	30	30	40	40	50	50	60	90	120	170	230	280
	-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	420	570	710
	-30	40	60	80	100	120	140	150	170	190	280	380	570	760	950
	-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
F	-50	60	90	120	150	180	210	240	270	300	450	590	890	1190	1500

*TBL 7–2–3* ICAO Cold Temperature Error Table Height Above Airport in Feet

### EXAMPLE-

*Temperature–10 degrees Celsius, and the aircraft altitude is 1,000 feet above the airport elevation. The chart shows that the reported current altimeter setting may place the aircraft as much as 100 feet below the altitude indicated by the altimeter.* 

### 7-2-4. High Barometric Pressure

**a.** Cold, dry air masses may produce barometric pressures in excess of 31.00 inches of Mercury, and many altimeters do not have an accurate means of being adjusted for settings of these levels. When the altimeter cannot be set to the higher pressure setting, the aircraft actual altitude will be higher than the altimeter indicates.

#### REFERENCE-

#### AIM, Paragraph 7–2–3 Altimeter Errors.

**b.** When the barometric pressure exceeds 31.00 inches, air traffic controllers will issue the actual altimeter setting, and:

**1. En Route/Arrivals.** Advise pilots to remain set on 31.00 inches until reaching the final approach segment.

**2. Departures.** Advise pilots to set 31.00 inches prior to reaching any mandatory/crossing altitude or 1,500 feet, whichever is lower.

**c.** The altimeter error caused by the high pressure will be in the opposite direction to the error caused by the cold temperature.

### 7-2-5. Low Barometric Pressure

When abnormally low barometric pressure conditions occur (below 28.00), flight operations by aircraft unable to set the actual altimeter setting are not recommended.

### NOTE-

The true altitude of the aircraft is **lower** than the indicated altitude if the pilot is unable to set the actual altimeter setting.

### Section 3. Wake Turbulence

### 7-3-1. General

**a.** Every aircraft generates a wake while in flight. Initially, when pilots encountered this wake in flight, the disturbance was attributed to "prop wash." It is known, however, that this disturbance is caused by a pair of counter–rotating vortices trailing from the wing tips. The vortices from larger aircraft pose problems to encountering aircraft. For instance, the wake of these aircraft can impose rolling moments exceeding the roll–control authority of the encountering aircraft. Further, turbulence generated within the vortices can damage aircraft components and equipment if encountered at close range. The pilot must learn to envision the location of the vortex wake generated by larger (transport category) aircraft and adjust the flight path accordingly.

**b.** During ground operations and during takeoff, jet engine blast (thrust stream turbulence) can cause damage and upsets if encountered at close range. Exhaust velocity versus distance studies at various thrust levels have shown a need for light aircraft to maintain an adequate separation behind large turbojet aircraft. Pilots of larger aircraft should be particularly careful to consider the effects of their "jet blast" on other aircraft, vehicles, and maintenance equipment during ground operations.

### 7-3-2. Vortex Generation

Lift is generated by the creation of a pressure differential over the wing surface. The lowest pressure occurs over the upper wing surface and the highest pressure under the wing. This pressure differential triggers the roll up of the airflow aft of the wing resulting in swirling air masses trailing downstream of the wing tips. After the roll up is completed, the wake consists of two counter–rotating cylindrical vortices. (See FIG 7–3–1.) Most of the energy is within a few feet of the center of each vortex, but pilots should avoid a region within about 100 feet of the vortex core.

FIG 7–3–1 Wake Vortex Generation



#### 7-3-3. Vortex Strength

**a.** The strength of the vortex is governed by the weight, speed, and shape of the wing of the generating aircraft. The vortex characteristics of any given aircraft can also be changed by extension of flaps or other wing configuring devices as well as by change in speed. However, as the basic factor is weight, the vortex strength increases proportionately. Peak vortex tangential speeds exceeding 300 feet per second have been recorded. The greatest vortex strength occurs when the generating aircraft is HEAVY, CLEAN, and SLOW.

#### b. Induced Roll

1. In rare instances a wake encounter could cause inflight structural damage of catastrophic proportions. However, the usual hazard is associated with induced rolling moments which can exceed the roll–control authority of the encountering aircraft. In flight experiments, aircraft have been intentionally flown directly up trailing vortex cores of larger aircraft. It was shown that the capability of an aircraft to counteract the roll imposed by the wake vortex primarily depends on the wingspan and counter– control responsiveness of the encountering aircraft. **2.** Counter control is usually effective and induced roll minimal in cases where the wingspan and ailerons of the encountering aircraft extend beyond the rotational flow field of the vortex. It is more difficult for aircraft with short wingspan (relative to the generating aircraft) to counter the imposed roll induced by vortex flow. Pilots of short span aircraft, even of the high performance type, must be especially alert to vortex encounters. (See FIG 7–3–2.)

#### FIG 7–3–2 Wake Encounter Counter Control



**3.** The wake of larger aircraft requires the respect of all pilots.

### 7-3-4. Vortex Behavior

**a.** Trailing vortices have certain behavioral characteristics which can help a pilot visualize the

wake location and thereby take avoidance precautions.

1. An aircraft generates vortices from the moment it rotates on takeoff to touchdown, since trailing vortices are a by-product of wing lift. Prior to takeoff or touchdown pilots should note the rotation or touchdown point of the preceding aircraft. (See FIG 7-3-3.)

2. The vortex circulation is outward, upward and around the wing tips when viewed from either ahead or behind the aircraft. Tests with large aircraft have shown that the vortices remain spaced a bit less than a wingspan apart, drifting with the wind, at altitudes greater than a wingspan from the ground. In view of this, if persistent vortex turbulence is encountered, a slight change of altitude and lateral position (preferably upwind) will provide a flight path clear of the turbulence.

**3.** Flight tests have shown that the vortices from larger (transport category) aircraft sink at a rate of several hundred feet per minute, slowing their descent and diminishing in strength with time and distance behind the generating aircraft. Atmospheric turbulence hastens breakup. Pilots should fly at or above the preceding aircraft's flight path, altering course as necessary to avoid the area behind and below the generating aircraft. (See FIG 7–3–4.) However, vertical separation of 1,000 feet may be considered safe.

**4.** When the vortices of larger aircraft sink close to the ground (within 100 to 200 feet), they tend to move laterally over the ground at a speed of 2 or 3 knots. (See FIG 7-3-5.)



*FIG 7–3–3* Wake Ends/Wake Begins

### Chapter 9. Aeronautical Charts and Related Publications

### Section 1. Types of Charts Available

### 9-1-1. General

Civil aeronautical charts for the U.S. and its territories, and possessions are produced by Aeronautical Navigation Products (AeroNav), http://www.faa.gov/air\_traffic/flight\_info/ aeronav which is part of FAA's Air Traffic Organization, Mission Support Services.

### 9-1-2. Obtaining Aeronautical Charts

Public sales of charts and publications are available through a network of FAA chart agents primarily located at or near major civil airports. A listing of products, dates of latest editions and agents is available on the AeroNav website at: http://www.faa.gov/air\_traffic/flight\_info/ aeronav.

### 9–1–3. Selected Charts and Products Available

VFR Navigation Charts IFR Navigation Charts Planning Charts Supplementary Charts and Publications Digital Products

### 9–1–4. General Description of Each Chart Series

### a. VFR Navigation Charts.

**1. Sectional Aeronautical Charts.** Sectional Charts are designed for visual navigation of slow to medium speed aircraft. The topographic information consists of contour lines, shaded relief, drainage patterns, and an extensive selection of visual checkpoints and landmarks used for flight under VFR. Cultural features include cities and towns, roads, railroads, and other distinct landmarks. The aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, special–use airspace, obstructions, and related data. Scale 1 inch = 6.86nm/1:500,000. 60 x 20 inches folded to 5 x 10 inches. Revised biannually, except most Alaskan charts are revised annually. (See FIG 9–1–1 and FIG 9–1–13.)

2. VFR Terminal Area Charts (TAC). TACs depict the airspace designated as Class B airspace. While similar to sectional charts, TACs have more detail because the scale is larger. The TAC should be used by pilots intending to operate to or from airfields within or near Class B or Class C airspace. Areas with TAC coverage are indicated by a • on the Sectional Chart indexes. Scale 1 inch = 3.43nm/1:250,000. Charts are revised biannually, except Puerto Rico–Virgin Islands which is revised annually. (See FIG 9–1–1 and FIG 9–1–13.)

**3.** World Aeronautical Chart (WAC). WACs cover land areas for navigation by moderate speed aircraft operating at high altitudes. Included are city tints, principal roads, railroads, distinctive landmarks, drainage patterns, and relief. Aeronautical information includes visual and radio aids to navigation, airports, airways, special–use airspace, and obstructions. Because of a smaller scale, WACs do not show as much detail as sectional or TACs, and; therefore, are not recommended for exclusive use by pilots of low speed, low altitude aircraft. Scale 1 inch = 13.7nm/1:1,000,000. 60 x 20 inches folded to 5 x 10 inches. WACs are revised annually, except for a few in Alaska, Mexico, and the Caribbean, which are revised biennially.

(See FIG 9–1–14 and FIG 9–1–15.)

AIM



FIG 9–1–1 Sectional and VFR Terminal Area Charts for the Conterminous U.S., Hawaii, Puerto Rico, and Virgin Islands

4. U.S. Gulf Coast VFR Aeronautical Chart. The Gulf Coast Chart is designed primarily for helicopter operation in the Gulf of Mexico area. Information depicted includes offshore mineral leasing areas and blocks, oil drilling platforms, and high density helicopter activity areas. Scale 1 inch = 13.7nm/1:1,000,000. 55 x 27 inches folded to 5 x 10 inches. Revised annually.

**5. Grand Canyon VFR Aeronautical Chart.** Covers the Grand Canyon National Park area and is designed to promote aviation safety, flight free zones, and facilitate VFR navigation in this popular area. The chart contains aeronautical information for general aviation VFR pilots on one side and commercial VFR air tour operators on the other side.

6. Helicopter Route Charts. A three-color chart series which shows current aeronautical information useful to helicopter pilots navigating in areas with high concentrations of helicopter activity. Information depicted includes helicopter routes, four classes of heliports with associated frequency and lighting capabilities, NAVAIDs, and obstructions. In addition, pictorial symbols, roads, and easily identified geographical features are portrayed.

Helicopter charts have a longer life span than other chart products and may be current for several years. Helicopter Route Charts are updated as requested by the FAA. Scale 1 inch = 1.71nm/1:125,000. 34 x 30 inches folded to 5 x 10 inches. (See FIG 9–1–2.)

### b. IFR Navigation Charts.

1. IFR Enroute Low Altitude Charts (Conterminous U.S. and Alaska). Enroute low altitude charts provide aeronautical information for navigation under IFR conditions below 18,000 feet MSL. This four-color chart series includes airways; limits of controlled airspace; VHF NAVAIDs with frequency, identification, channel, geographic coordinates; airports with terminal air/ground communications; minimum en route and obstruction clearance altitudes; airway distances; reporting points; special use airspace; and military training routes. Scales vary from 1 inch = 5nm to 1 inch = 20nm. 50 x 20 inches folded to 5 x 10 inches. Charts revised every 56 days. Area charts show congested terminal areas at a large scale. They are included with subscriptions to any conterminous U.S. Set Low (Full set, East or West sets).

(See FIG 9–1–3 and FIG 9–1–5.)

*FIG 9–1–2* Helicopter Route Charts



*FIG 9–1–3* Enroute Low Altitude Instrument Charts for the Conterminous U.S. (Includes Area Charts)



205 2 Seattle Great Falls H-11 HΨ H-2 Portland Fargo Minneapolis Rapid City wauke New Yor H-3 Salt Lake City Chicac H-10 Philadelphia H-5 Reno Des Moines San Francisco Vashington Denve • Kansas City ouisville Charlotte 分 os Angele Nashville Santa Fe H-4 Oklahoma City H-9 Atlanta Phoenix Tucson H-6 Dallas Mob Jacksonville New Orlean Houston H-7 Corpus Christi H-8

2. IFR Enroute High Altitude Charts (Conterminous U.S. and Alaska). Enroute high altitude charts are designed for navigation at or above 18,000 feet MSL. This four-color chart series includes the jet route structure; VHF NAVAIDs with

frequency, identification, channel, geographic coordinates; selected airports; reporting points. Scales vary from 1 inch = 45nm to 1 inch = 18nm.  $55 \times 20$ inches folded to 5 x 10 inches. Revised every 56 days. (See FIG 9–1–4 and FIG 9–1–6.)



FIG 9-1-5 Alaska Enroute Low Altitude Chart

FIG 9-1-4 Enroute High Altitude Charts for the Conterminous U.S.



3. U.S. Terminal Procedures Publication (TPP). TPPs are published in 24 loose-leaf or perfect bound volumes covering the conterminous U.S., Puerto Rico and the Virgin Islands. A Change Notice is published at the midpoint between revisions in bound volume format and is available on the internet for free download at the AeroNav web site. (See FIG 9–1–11.) The TPPs include:

(a) Instrument Approach Procedure (IAP) Charts. IAP charts portray the aeronautical data that is required to execute instrument approaches to airports. Each chart depicts the IAP, all related navigation data, communications information, and an airport sketch. Each procedure is designated for use with a specific electronic navigational aid, such as ILS, VOR, NDB, RNAV, etc.

(b) Instrument Departure Procedure (DP) Charts. DP charts are designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. They furnish pilots' departure routing clearance information in graphic and textual form.

(c) Standard Terminal Arrival (STAR) Charts. STAR charts are designed to expedite ATC arrival procedures and to facilitate transition between en route and instrument approach operations. They depict preplanned IFR ATC arrival procedures in graphic and textual form. Each STAR procedure is presented as a separate chart and may serve either a single airport or more than one airport in a given geographic area.

(d) Airport Diagrams. Full page airport diagrams are designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations and provide information for updating geodetic position navigational systems aboard aircraft. Airport diagrams are available for free download at the AeroNav website.

4. Alaska Terminal Procedures Publication. This publication contains all terminal flight procedures for civil and military aviation in Alaska. Included are IAP charts, DP charts, STAR charts, airport diagrams, radar minimums, and supplementary support data such as IFR alternate minimums, take–off minimums, rate of descent tables, rate of climb tables and inoperative components tables. Volume is  $5-3/8 \ge 8-1/4$  inch top bound. Publication revised every 56 days with provisions for a Terminal Change Notice, as required.

### c. Planning Charts.

**1. U.S. IFR/VFR Low Altitude Planning Chart.** This chart is designed for prefight and en route flight planning for IFR/VFR flights. Depiction includes low altitude airways and mileage, NAVAIDs, airports, special use airspace, cities, times zones, major drainage, a directory of airports with their airspace classification, and a mileage table showing great circle distances between major airports. Scale 1 inch = 47nm/1:3,400,000. Chart revised annually, and is available either folded or unfolded for wall mounting. (See FIG 9-1-7.)

2. Gulf of Mexico and Caribbean Planning Chart. This is a VFR planning chart on the reverse side of the *Puerto Rico – Virgin Islands VFR Terminal Area Chart*. Information shown includes mileage between airports of entry, a selection of special use airspace and a directory of airports with their available services. Scale 1 inch = 85nm/1:6,192,178. 60 x 20 inches folded to 5 x 10 inches. Chart revised annually. (See FIG 9–1–7.)



FIG 9-1-7 Planning Charts

**3.** U.S. VFR Wall Planning Chart. This chart is designed for VFR preflight planning and provides aeronautical and topographic information of the conterminous U.S. The aeronautical information includes airports, radio aids to navigation, Class B airspace and special use airspace. The topographic information includes city tint, populated places, principal roads, drainage patterns, and shaded relief. Scale 1 inch = 43 nm/ 1:3,100,000. The one-sided chart is 59 x 36 inches and ships unfolded for wall mounting. Chart is revised biennially. (See FIG 9–1–8.)

FIG 9-1-8 U.S.VFR Wall Planning Chart



**4.** Charted VFR Flyway Planning Charts. This chart is printed on the reverse side of selected TAC charts. The coverage is the same as the associated TAC. Flyway planning charts depict flight paths and altitudes recommended for use to bypass high traffic areas. Ground references are provided as a guide for visual orientation. Flyway planning charts are designed for use in conjunction with TACs and sectional charts and are not to be used for navigation. Chart scale 1 inch = 3.43nm/1:250,000.

#### d. Supplementary Charts and Publications.

1. Airport/Facility Directory (A/FD). This 7-volume booklet series contains data on airports, seaplane bases, heliports, NAVAIDs, communications data, weather data sources, airspace, special notices, and operational procedures. Coverage includes the conterminous U.S., Puerto Rico, and the Virgin Islands. The A/FD shows data that cannot be readily depicted in graphic form; e.g., airport hours of operations, types of fuel available, runway widths, lighting codes, etc. The A/FD also provides a means for pilots to update visual charts between edition dates (A/FD is published every 56 days while Sectional Aeronautical and VFR Terminal Area Charts are generally revised every six months). The Aeronautical Chart Bulletins (VFR Chart Update Bulletins) are available for free download from the AeroNav web site. Volumes are side-bound 5-3/8 x 8-1/4 inches. (See FIG 9-1-12.)

**2. Supplement Alaska.** This is a civil/military flight information publication issued by FAA every 56 days. It is a single volume booklet designed for use with appropriate IFR or VFR charts. The Supplement Alaska contains an A/FD, airport sketches, communications data, weather data sources, airspace, listing of navigational facilities, and special notices and

procedures. Volume is side-bound  $5-3/8 \times 8-1/4$  inches.

3. Chart Supplement Pacific. This supplement is designed for use with appropriate VFR or IFR enroute charts. Included in this one-volume booklet are the A/FD, communications data, weather data sources, airspace, navigational facilities, special notices, and Pacific area procedures. IAP charts, DP charts, STAR charts, airport diagrams, radar minimums, and supporting data for the Hawaiian and Pacific Islands are included. The manual is published every 56 days. Volume is side-bound  $5-3/8 \times 8-1/4$  inches.

**4.** North Pacific Route Charts. These charts are designed for FAA controllers to monitor transoceanic flights. They show established intercontinental air routes, including reporting points with geographic positions. Composite Chart: Scale 1 inch = 164nm/1:12,000,000. 48 x 41–1/2 inches. Area Charts: Scale 1 inch = 95.9nm/1:7,000,000. 52 x 40–1/2 inches. All charts shipped unfolded. Charts revised every 56 days. (See FIG 9–1–10.)

5. North Atlantic Route Chart. Designed for FAA controllers to monitor transatlantic flights, this 5–color chart shows oceanic control areas, coastal navigation aids, oceanic reporting points, and NAVAID geographic coordinates. Full Size Chart: Scale 1 inch = 113.1nm/1:8,250,000. Chart is shipped flat only. Half Size Chart: Scale 1 inch = 150.8nm/1:11,000,000. Chart is  $29-3/4 \times 20-1/2$  inches, shipped folded to 5 x 10 inches only. Chart revised every 56 weeks. (See FIG 9–1–9.)

**6.** Airport Obstruction Charts (OC). The OC is a 1:12,000 scale graphic depicting 14 CFR Part 77, Objects Affecting Navigable Airspace, surfaces, a representation of objects that penetrate these surfaces, aircraft movement and apron areas, navigational aids, prominent airport buildings, and a selection of roads and other planimetric detail in the airport vicinity. Also included are tabulations of runway and other operational data.





FIG 9-1-10 North Pacific Oceanic Route Charts



**7. FAA Aeronautical Chart User's Guide.** A booklet designed to be used as a teaching aid and reference document. It describes the substantial amount of information provided on FAA's aeronautical charts and publications. It includes explanations and illustrations of chart terms and symbols

organized by chart type. The users guide is available for free download at the AeroNav web site.

### e. Digital Products.

**1. The Digital Aeronautical Information CD** (**DAICD**). The DAICD is a combination of the NAVAID Digital Data File, the Digital Chart Supplement, and the Digital Obstacle File on one Compact Disk. These three digital products are no longer sold separately. The files are updated every 56 days and are available by subscription only.

(a) The NAVAID Digital Data File. This file contains a current listing of NAVAIDs that are compatible with the National Airspace System. This file contains all NAVAIDs including ILS and its components, in the U.S., Puerto Rico, and the Virgin Islands plus bordering facilities in Canada, Mexico, and the Atlantic and Pacific areas.

(b) The Digital Obstacle File. This file describes all obstacles of interest to aviation users in the U.S., with limited coverage of the Pacific, Caribbean, Canada, and Mexico. The obstacles are assigned unique numerical identifiers, accuracy codes, and listed in order of ascending latitude within each state or area.

(c) The Digital Aeronautical Chart Supplement (DACS). The DACS is specifically designed to provide digital airspace data not otherwise readily available. The supplement includes a *Change Notice* for IAPFIX.dat at the mid–point between revisions. The *Change Notice* is available only by free download from the AeroNav website.

The DACS individual data files are:

ENHIGH.DAT: High altitude airways (conterminous U.S.)

ENLOW.DAT: Low altitude airways (conterminous U.S.)

IAPFIX.DAT: Selected instrument approach procedure NAVAID and fix data.

MTRFIX.DAT: Military training routes data.

ALHIGH.DAT: Alaska high altitude airways data.

ALLOW.DAT: Alaska low altitude airways data.

PR.DAT: Puerto Rico airways data.

HAWAII.DAT: Hawaii airways data.

BAHAMA.DAT: Bahamas routes data.

OCEANIC.DAT: Oceanic routes data.

STARS.DAT: Standard terminal arrivals data.

DP.DAT: Instrument departure procedures data.

LOPREF.DAT: Preferred low altitude IFR routes data.

HIPREF.DAT: Preferred high altitude IFR routes data.

ARF.DAT: Air route radar facilities data.

ASR.DAT: Airport surveillance radar facilities data.

2. The National Flight Database (NFD) (ARINC 424 [Ver 13 & 15]). The NFD is a basic digital dataset, modeled to an international standard, which can be used as a basis to support GPS navigation. Initial data elements included are: Airport and Helicopter Records, VHF and NDB Navigation aids, en route waypoints and airways. Additional data elements will be added in subsequent releases to include: departure procedures, standard terminal arrivals, and GPS/RNAV instrument approach procedures. The database is updated every 28 days. The data is available by subscription only and is distributed on CD–ROM or by ftp download.

3. digital-Visual Charts (d-VC). These digital VFR charts are geo-referenced images of FAA Sectional Aeronautical, TAC, WAC, and Helicopter Route charts. Additional digital data may easily be overlaid on the raster image using commonly available Geographic Information System software. Data such as weather, temporary flight restrictions, obstacles, or other geospatial data can be combined with d–VC data to support a variety of needs. The file resolution is 300 dots per inch and the data is 8-bit color. The data is provided as a GeoTIFF and distributed on DVD-R media and on the AeroNav Products website. The root mean square error of the transformation will not exceed two pixels. D-VC DVDs are updated every 28 days and are available by subscription only.

*FIG 9–1–11* U.S. Terminal Publication Volumes





FIG 9–1–13 Sectional and VFR Terminal Area Charts for Alaska



FIG 9–1–14 World Aeronautical Charts for Alaska



FIG 9–1–15 World Aeronautical Charts for the Conterminous U.S. Mexico, and the Caribbean Areas



## 9–1–5. Where and How to Get Charts of Foreign Areas

a. National Geospatial-Intelligence Agency (NGA) Products. For the latest information regarding publication availability visit the NGA Web site: https://www.nga.mil/ProductsServices/ Aeronautical/Pages/default.aspx

### **1. Flight Information Publication (FLIP) Planning Documents.**

General Planning (GP) Area Planning Area Planning – Special Use Airspace – Planning Charts

### 2. FLIP Enroute Charts and Chart Supplements.

Pacific, Australasia, and Antarctica U.S. – IFR and VFR Supplements Flight Information Handbook Caribbean and South America – Low Altitude Caribbean and South America – High Altitude Europe, North Africa, and Middle East – Low Altitude Europe, North Africa, and Middle East – High Altitude Africa Eastern Europe and Asia Area Arrival Charts

## **3. FLIP Instrument Approach Procedures** (IAPs).

Africa Canada and North Atlantic Caribbean and South America Eastern Europe and Asia Europe, North Africa, and Middle East Pacific, Australasia, and Antarctica VFR Arrival/Departure Routes – Europe and Korea U.S.

### 4. Miscellaneous DOD Charts and Products.

Aeronautical Chart Updating Manual (CHUM) DOD Weather Plotting Charts (WPC) Tactical Pilotage Charts (TPC) Operational Navigation Charts (ONC) Global Navigation and Planning Charts (GNC) Jet Navigation Charts (JNC) and Universal Jet Navigation Charts (JNU) Jet Navigation Charts (JNCA) Aerospace Planning Charts (ASC) Oceanic Planning Charts (OPC) Joint Operations Graphics – Air (JOG–A) Standard Index Charts (SIC) Universal Plotting Sheet (VP–OS) Sight Reduction Tables for Air Navigation (PUB249) Plotting Sheets (VP–30) Dial–Up Electronic CHUM

**b.** Canadian Charts. Information on available Canadian charts and publications may be obtained from designated FAA chart agents or by contacting the:

NAV CANADA Aeronautical Publications Sales and Distribution Unit P.O. Box 9840, Station T Ottawa, Ontario K1G 6S8 Canada Telephone: 613–744–6393 or 1–866–731–7827 Fax: 613–744–7120 or 1–866–740–9992

**c. Mexican Charts.** Information on available Mexican charts and publications may be obtained by contacting:

Dirección de Navigacion Aereo Blvd. Puerto Aereo 485 Zona Federal Del Aeropuerto Int'l 15620 Mexico D.F. Mexico

**d.** International Civil Aviation Organization (ICAO). A free *ICAO Publications and Audio–Visual Training Aids Catalogue* is available from:

International Civil Aviation Organization ATTN: Document Sales Unit 999 University Street Montreal, Quebec H3C 5H7, Canada Telephone: (514) 954–8022 Fax: (514) 954–6769 E-mail: sales\_unit@icao.org Internet: http://www.icao.org/cgi/goto.pl?icao/en/ sales.htm Sitatex: YULCAYA Telex: 05–24513

# PILOT/CONTROLLER GLOSSARY

### PURPOSE

**a.** This Glossary was compiled to promote a common understanding of the terms used in the Air Traffic Control system. It includes those terms which are intended for pilot/controller communications. Those terms most frequently used in pilot/controller communications are printed in *bold italics*. The definitions are primarily defined in an operational sense applicable to both users and operators of the National Airspace System. Use of the Glossary will preclude any misunderstandings concerning the system's design, function, and purpose.

**b.** Because of the international nature of flying, terms used in the Lexicon, published by the International Civil Aviation Organization (ICAO), are included when they differ from FAA definitions. These terms are followed by "[ICAO]." For the reader's convenience, there are also cross references to related terms in other parts of the Glossary and to other documents, such as the Code of Federal Regulations (CFR) and the Aeronautical Information Manual (AIM).

c. This Glossary will be revised, as necessary, to maintain a common understanding of the system.

### **EXPLANATION OF CHANGES**

- d. Terms Added: APPROACH WITH VERTICAL GUIDANCE (APV) DESIGNATED COMMON TRAFFIC ADVISORY FREQUENCY (CTAF) AREA
- e. Terms Modified: COMMON TRAFFIC ADVISORY FREQUENCY (CTAF)

**f.** Editorial/format changes were made where necessary. Revision bars were not used due to the insignificant nature of the changes.

### APD-

(See AUTOMATED PROBLEM DETECTION.)

APDIA-

(See AUTOMATED PROBLEM DETECTION INHIBITED AREA.)

APPROACH CLEARANCE– Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a clearance and other pertinent information is provided in the approach clearance when required.

(See CLEARED APPROACH.) (See INSTRUMENT APPROACH PROCEDURE.) (Refer to AIM.) (Refer to 14 CFR Part 91.)

APPROACH CONTROL FACILITY- A terminal ATC facility that provides approach control service in a terminal area.

(See APPROACH CONTROL SERVICE.) (See RADAR APPROACH CONTROL FACILITY.)

APPROACH CONTROL SERVICE- Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service.

(See ICAO term APPROACH CONTROL SERVICE.) (Refer to AIM.)

APPROACH CONTROL SERVICE [ICAO]– Air traffic control service for arriving or departing controlled flights.

APPROACH GATE- An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course. The gate will be established along the final approach course 1 mile from the final approach fix on the side away from the airport and will be no closer than 5 miles from the landing threshold.

APPROACH HOLD AREA- The locations on taxiways in the approach or departure areas of a runway designated to protect landing or departing aircraft. These locations are identified by signs and markings.

APPROACH LIGHT SYSTEM-(See AIRPORT LIGHTING.) APPROACH SEQUENCE– The order in which aircraft are positioned while on approach or awaiting approach clearance.

(See LANDING SEQUENCE.) (See ICAO term APPROACH SEQUENCE.)

APPROACH SEQUENCE [ICAO] – The order in which two or more aircraft are cleared to approach to land at the aerodrome.

**APPROACH SPEED**- The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

APPROACH WITH VERTICAL GUIDANCE (APV)– A term used to describe RNAV approach procedures that provide lateral and vertical guidance but do not meet the requirements to be considered a precision approach.

APPROPRIATE ATS AUTHORITY [ICAO] – The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned. In the United States, the "appropriate ATS authority" is the Program Director for Air Traffic Planning and Procedures, ATP-1.

### APPROPRIATE AUTHORITY-

**a.** Regarding flight over the high seas: the relevant authority is the State of Registry.

**b.** Regarding flight over other than the high seas: the relevant authority is the State having sovereignty over the territory being overflown.

APPROPRIATE OBSTACLE CLEARANCE MINIMUM ALTITUDE – Any of the following: (See MINIMUM EN ROUTE IFR ALTITUDE.) (See MINIMUM IFR ALTITUDE.) (See MINIMUM OBSTRUCTION CLEARANCE ALTITUDE.) (See MINIMUM VECTORING ALTITUDE.)

APPROPRIATE TERRAIN CLEARANCE MINIMUM ALTITUDE – Any of the following: (See MINIMUM EN ROUTE IFR ALTITUDE.) (See MINIMUM IFR ALTITUDE.) (See MINIMUM OBSTRUCTION CLEARANCE ALTITUDE.) (See MINIMUM VECTORING ALTITUDE.)

APRON- A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

(See ICAO term APRON.)

APRON [ICAO] – A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, refueling, parking or maintenance.

ARC- The track over the ground of an aircraft flying at a constant distance from a navigational aid by reference to distance measuring equipment (DME).

AREA CONTROL CENTER [ICAO] – An air traffic control facility primarily responsible for ATC services being provided IFR aircraft during the en route phase of flight. The U.S. equivalent facility is an air route traffic control center (ARTCC).

AREA NAVIGATION (RNAV) – A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground – or space–based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

Note: Area navigation includes performancebased navigation as well as other operations that do not meet the definition of performance-based navigation.

### AREA NAVIGATION (RNAV) APPROACH CONFIGURATION:

**a.** STANDARD T– An RNAV approach whose design allows direct flight to any one of three initial approach fixes (IAF) and eliminates the need for procedure turns. The standard design is to align the procedure on the extended centerline with the missed approach point (MAP) at the runway threshold, the final approach fix (FAF), and the initial approach/ intermediate fix (IAF/IF). The other two IAFs will be established perpendicular to the IF.

**b.** MODIFIED T- An RNAV approach design for single or multiple runways where terrain or operational constraints do not allow for the standard T. The "T" may be modified by increasing or decreasing the angle from the corner IAF(s) to the IF or by eliminating one or both corner IAFs.

**c.** STANDARD I– An RNAV approach design for a single runway with both corner IAFs eliminated. Course reversal or radar vectoring may be required at busy terminals with multiple runways.

**d.** TERMINAL ARRIVAL AREA (TAA)– The TAA is controlled airspace established in conjunction with the Standard or Modified T and I RNAV approach configurations. In the standard TAA, there are three areas: straight-in, left base, and right base. The arc boundaries of the three areas of the TAA are published portions of the approach and allow aircraft to transition from the en route structure direct to the nearest IAF. TAAs will also eliminate or reduce feeder routes, departure extensions, and procedure turns or course reversal.

**1.** STRAIGHT-IN AREA- A 30NM arc centered on the IF bounded by a straight line extending through the IF perpendicular to the intermediate course.

2. LEFT BASE AREA- A 30NM arc centered on the right corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

**3.** RIGHT BASE AREA- A 30NM arc centered on the left corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

AREA NAVIGATION (RNAV) GLOBAL POSITIONING SYSTEM (GPS) PRECISION RUNWAY MONITORING (PRM) APPROACH – A GPS approach, which requires vertical guidance, used in lieu of an ILS PRM approach to conduct approaches to parallel runways whose extended centerlines are separated by less than 4,300 feet and at least 3,000 feet, where simultaneous close parallel approaches are permitted. Also used in lieu of an ILS PRM and/or LDA PRM approach to conduct Simultaneous Offset Instrument Approach (SOIA) operations.

ARINC- An acronym for Aeronautical Radio, Inc., a corporation largely owned by a group of airlines. ARINC is licensed by the FCC as an aeronautical station and contracted by the FAA to provide communications support for air traffic control and meteorological services in portions of international airspace.

ARMY AVIATION FLIGHT INFORMATION BULLETIN- A bulletin that provides air operation

data covering Army, National Guard, and Army Reserve aviation activities.

### ARO-

(See AIRPORT RESERVATION OFFICE.)

ARRESTING SYSTEM- A safety device consisting of two major components, namely, engaging or catching devices and energy absorption devices for the purpose of arresting both tailhook and/or nontailhook-equipped aircraft. It is used to prevent aircraft from overrunning runways when the aircraft cannot be stopped after landing or during aborted takeoff. Arresting systems have various names; e.g., arresting gear, hook device, wire barrier cable.

(See ABORT.)

(Refer to AIM.)

ARRIVAL AIRCRAFT INTERVAL– An internally generated program in hundredths of minutes based upon the AAR. AAI is the desired optimum interval between successive arrival aircraft over the vertex.

ARRIVAL CENTER- The ARTCC having jurisdiction for the impacted airport.

ARRIVAL DELAY- A parameter which specifies a period of time in which no aircraft will be metered for arrival at the specified airport.

ARRIVAL SECTOR- An operational control sector containing one or more meter fixes.

ARRIVAL SECTOR ADVISORY LIST- An ordered list of data on arrivals displayed at the PVD/MDM of the sector which controls the meter fix.

ARRIVAL SEQUENCING PROGRAM- The automated program designed to assist in sequencing aircraft destined for the same airport.

ARRIVAL TIME- The time an aircraft touches down on arrival.

### ARSR-

(See AIR ROUTE SURVEILLANCE RADAR.)

### ARTCC-

(See AIR ROUTE TRAFFIC CONTROL CENTER.)

### ARTS-

(See AUTOMATED RADAR TERMINAL SYSTEMS.)

ASDA-

(See ACCELERATE-STOP DISTANCE AVAILABLE.)

ASDA [ICAO]– (See ICAO Term ACCELERATE-STOP DISTANCE AVAILABLE.)

### ASDE-

(See AIRPORT SURFACE DETECTION EQUIPMENT.)

ASF-

(See AIRPORT STREAM FILTER.)

ASLAR-

(See AIRCRAFT SURGE LAUNCH AND RECOVERY.)

ASP-

(See ARRIVAL SEQUENCING PROGRAM.)

ASR-

(See AIRPORT SURVEILLANCE RADAR.)

ASR APPROACH-

(See SURVEILLANCE APPROACH.)

ASSOCIATED- A radar target displaying a data block with flight identification and altitude information.

(See UNASSOCIATED.)

ATC-

(See AIR TRAFFIC CONTROL.)

ATC ADVISES – Used to prefix a message of noncontrol information when it is relayed to an aircraft by other than an air traffic controller.

(See ADVISORY.)

ATC ASSIGNED AIRSPACE– Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic.

(See SPECIAL USE AIRSPACE.)

ATC CLEARANCE-(See AIR TRAFFIC CLEARANCE.)

ATC CLEARS– Used to prefix an ATC clearance when it is relayed to an aircraft by other than an air traffic controller.

ATC INSTRUCTIONS- Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions; e.g., "Turn left heading two five zero," "Go around," "Clear the runway."

(Refer to 14 CFR Part 91.)

ATC PREFERRED ROUTE NOTIFICATION– URET notification to the appropriate controller of the need to determine if an ATC preferred route needs to be applied, based on destination airport.

(See ROUTE ACTION NOTIFICATION.) (See USER REQUEST EVALUATION TOOL.)

ATC PREFERRED ROUTES – Preferred routes that are not automatically applied by Host.

ATC REQUESTS- Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

ATC SECURITY SERVICES – Communications and security tracking provided by an ATC facility in support of the DHS, the DOD, or other Federal security elements in the interest of national security. Such security services are only applicable within designated areas. ATC security services do not include ATC basic radar services or flight following.

ATC SECURITY SERVICES POSITION – The position responsible for providing ATC security services as defined. This position does not provide ATC, IFR separation, or VFR flight following services, but is responsible for providing security services in an area comprising airspace assigned to one or more ATC operating sectors. This position may be combined with control positions.

ATC SECURITY TRACKING – The continuous tracking of aircraft movement by an ATC facility in support of the DHS, the DOD, or other security elements for national security using radar (i.e., radar tracking) or other means (e.g., manual tracking) without providing basic radar services (including traffic advisories) or other ATC services not defined in this section.

### ATCAA-

(See ATC ASSIGNED AIRSPACE.)

### ATCRBS-

(See RADAR.)

### ATCSCC-

(See AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER.)

### ATCT-

(See TOWER.)

### ATD-

(See ALONG-TRACK DISTANCE.)

### ATIS-

### (See AUTOMATIC TERMINAL INFORMATION SERVICE.)

ATIS [ICAO]-

(See ICAO Term AUTOMATIC TERMINAL INFORMATION SERVICE.)

ATS ROUTE [ICAO]– A specified route designed for channeling the flow of traffic as necessary for the provision of air traffic services.

Note: The term "ATS Route" is used to mean variously, airway, advisory route, controlled or uncontrolled route, arrival or departure, etc.

ATTENTION ALL USERS PAGE (AAUP)- The AAUP provides the pilot with additional information relative to conducting a specific operation, for example, PRM approaches and RNAV departures.

AUTOLAND APPROACH-An autoland system aids by providing control of aircraft systems during a precision instrument approach to at least decision altitude and possibly all the way to touchdown, as well as in some cases, through the landing rollout. The autoland system is a sub-system of the autopilot system from which control surface management occurs. The aircraft autopilot sends instructions to the autoland system and monitors the autoland system performance and integrity during its execution.

AUTOMATED INFORMATION TRANSFER- A precoordinated process, specifically defined in facility directives, during which a transfer of altitude control and/or radar identification is accomplished without verbal coordination between controllers using information communicated in a full data block.

AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM– A facility which can deliver, in a matter of minutes, a surface picture (SURPIC) of vessels in the area of a potential or actual search and rescue incident, including their predicted positions and their characteristics.

(See FAAO JO 7110.65, Para 10-6-4, INFLIGHT CONTINGENCIES.)

AUTOMATED PROBLEM DETECTION (APD)– An Automation Processing capability that compares trajectories in order to predict conflicts.

AUTOMATED PROBLEM DETECTION BOUNDARY (APB)– The adapted distance beyond a facilities boundary defining the airspace within which URET performs conflict detection.

(See USER REQUEST EVALUATION TOOL.)

AUTOMATED PROBLEM DETECTION IN-HIBITED AREA (APDIA) – Airspace surrounding a terminal area within which APD is inhibited for all flights within that airspace.

AUTOMATED RADAR TERMINAL SYSTEMS (ARTS)– A generic term for several tracking systems included in the Terminal Automation Systems (TAS). ARTS plus a suffix roman numeral denotes a major modification to that system.

**a.** ARTS IIIA. The Radar Tracking and Beacon Tracking Level (RT&BTL) of the modular, programmable automated radar terminal system. ARTS IIIA detects, tracks, and predicts primary as well as secondary radar-derived aircraft targets. This more sophisticated computer-driven system upgrades the existing ARTS III system by providing improved tracking, continuous data recording, and fail-soft capabilities.

**b.** Common ARTS. Includes ARTS IIE, ARTS IIIE; and ARTS IIIE with ACD (see DTAS) which combines functionalities of the previous ARTS systems.

c. Programmable Indicator Data Processor (PIDP). The PIDP is a modification to the AN/TPX-42 interrogator system currently installed in fixed RAPCONs. The PIDP detects, tracks, and predicts secondary radar aircraft targets. These are displayed by means of computer–generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although primary radar targets are not tracked, they are displayed coincident with the secondary radar targets as well as with the other symbols and alphanumerics. The system has the capability of interfacing with ARTCCs.

AUTOMATED WEATHER SYSTEM- Any of the automated weather sensor platforms that collect weather data at airports and disseminate the weather information via radio and/or landline. The systems currently consist of the Automated Surface Observing System (ASOS), Automated Weather Sensor System (AWSS) and Automated Weather Observation System (AWOS).

AUTOMATED UNICOM- Provides completely automated weather, radio check capability and airport advisory information on an Automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the UNICOM frequency. Availability will be published in the Airport/Facility Directory and approach charts.

### AUTOMATIC ALTITUDE REPORT-(See ALTITUDE READOUT.)

AUTOMATIC ALTITUDE REPORTING– That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

AUTOMATIC CARRIER LANDING SYSTEM– U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

AUTOMATIC DEPENDENT SURVEILLANCE (ADS) [ICAO]– A surveillance technique in which aircraft automatically provide, via a data link, data derived from on–board navigation and position fixing systems, including aircraft identification, four dimensional position and additional data as appropriate.

AUTOMATIC DEPENDENT SURVEILLANCE– BROADCAST (ADS-B)– A surveillance system in which an aircraft or vehicle to be detected is fitted with cooperative equipment in the form of a data link transmitter. The aircraft or vehicle periodically broadcasts its GPS–derived position and other information such as velocity over the data link, which is received by a ground–based transmitter/receiver (transceiver) for processing and display at an air traffic control facility.

(See GLOBAL POSITIONING SYSTEM.) (See GROUND-BASED TRANSCEIVER.)

AUTOMATIC DEPENDENT SURVEILLANCE-CONTRACT (ADS-C)- A data link position reporting system, controlled by a ground station, that establishes contracts with an aircraft's avionics that occur automatically whenever specific events occur, or specific time intervals are reached.

AUTOMATIC DIRECTION FINDER– An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum.

(See BEARING.) (See NONDIRECTIONAL BEACON.)

AUTOMATIC FLIGHT INFORMATION SERVICE (AFIS) – ALASKA FSSs ONLY– The continuous broadcast of recorded non–control information at airports in Alaska where a FSS provides local airport advisory service. The AFIS broadcast automates the repetitive transmission of essential but routine information such as weather, wind, altimeter, favored runway, breaking action, airport NOTAMs, and other applicable information. The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS/ AWSS/AWOS frequency.)

AUTOMATIC TERMINAL INFORMATION SERVICE- The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g., "Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa."

(See ICAO term AUTOMATIC TERMINAL INFORMATION SERVICE.) (Refer to AIM.)

AUTOMATIC TERMINAL INFORMATION SERVICE [ICAO] – The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

AUTOROTATION– A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

**a.** Autorotative Landing/Touchdown Autorotation. Used by a pilot to indicate that the landing will be made without applying power to the rotor.

**b.** Low Level Autorotation. Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.

**c.** 180 degrees Autorotation. Initiated from a downwind heading and is commenced well inside the normal traffic pattern. "Go around" may not be possible during the latter part of this maneuver.

AVAILABLE LANDING DISTANCE (ALD)– The portion of a runway available for landing and roll-out for aircraft cleared for LAHSO. This distance is measured from the landing threshold to the hold-short point.

AVIATION WEATHER SERVICE- A service provided by the National Weather Service (NWS) and FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS.

(See EN ROUTE FLIGHT ADVISORY SERVICE.) (See TRANSCRIBED WEATHER BROADCAST.) (See WEATHER ADVISORY.) (Refer to AIM.)

### AWW-

(See SEVERE WEATHER FORECAST ALERTS.)

aircraft are held short of the applicable runway holding position marking.

**b.** A pilot or controller may consider an aircraft, which is exiting or crossing a runway, to be clear of the runway when all parts of the aircraft are beyond the runway edge and there are no restrictions to its continued movement beyond the applicable runway holding position marking.

c. Pilots and controllers shall exercise good judgement to ensure that adequate separation exists between all aircraft on runways and taxiways at airports with inadequate runway edge lines or holding position markings.

### CLEARANCE-

(See AIR TRAFFIC CLEARANCE.)

CLEARANCE LIMIT- The fix, point, or location to which an aircraft is cleared when issued an air traffic clearance.

(See ICAO term CLEARANCE LIMIT.)

CLEARANCE LIMIT [ICAO] – The point to which an aircraft is granted an air traffic control clearance.

**CLEARANCE VOID IF NOT OFF BY (TIME)**– Used by ATC to advise an aircraft that the departure clearance is automatically canceled if takeoff is not made prior to a specified time. The pilot must obtain a new clearance or cancel his/her IFR flight plan if not off by the specified time.

(See ICAO term CLEARANCE VOID TIME.)

CLEARANCE VOID TIME [ICAO] – A time specified by an air traffic control unit at which a clearance ceases to be valid unless the aircraft concerned has already taken action to comply therewith.

**CLEARED APPROACH-** ATC authorization for an aircraft to execute any standard or special instrument approach procedure for that airport. Normally, an aircraft will be cleared for a specific instrument approach procedure.

(See CLEARED (Type of) APPROACH.) (See INSTRUMENT APPROACH PROCEDURE.) (Refer to 14 CFR Part 91.) (Refer to AIM.)

CLEARED (Type of) APPROACH- ATC authorization for an aircraft to execute a specific instrument approach procedure to an airport; e.g., "Cleared ILS Runway Three Six Approach."

(See APPROACH CLEARANCE.) (See INSTRUMENT APPROACH PROCEDURE.) (Refer to 14 CFR Part 91.) (Refer to AIM.)

**CLEARED AS FILED**– Means the aircraft is cleared to proceed in accordance with the route of flight filed in the flight plan. This clearance does not include the altitude, DP, or DP Transition.

(See REQUEST FULL ROUTE CLEARANCE.) (Refer to AIM.)

**CLEARED FOR TAKEOFF** – ATC authorization for an aircraft to depart. It is predicated on known traffic and known physical airport conditions.

**CLEARED FOR THE OPTION**– ATC authorization for an aircraft to make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student's performance under changing situations.

(See OPTION APPROACH.) (Refer to AIM.)

**CLEARED THROUGH**– ATC authorization for an aircraft to make intermediate stops at specified airports without refiling a flight plan while en route to the clearance limit.

**CLEARED TO LAND**- ATC authorization for an aircraft to land. It is predicated on known traffic and known physical airport conditions.

CLEARWAY- An area beyond the takeoff runway under the control of airport authorities within which terrain or fixed obstacles may not extend above specified limits. These areas may be required for certain turbine-powered operations and the size and upward slope of the clearway will differ depending on when the aircraft was certificated.

(Refer to 14 CFR Part 1.)

**CLIMB TO VFR**- ATC authorization for an aircraft to climb to VFR conditions within Class B, C, D, and E surface areas when the only weather limitation is restricted visibility. The aircraft must remain clear of clouds while climbing to VFR.

(See SPECIAL VFR CONDITIONS.) (Refer to AIM.)

CLIMBOUT- That portion of flight operation between takeoff and the initial cruising altitude.

CLIMB VIA– An abbreviated ATC clearance that requires compliance with the procedure lateral path, associated speed restrictions, and altitude restrictions along the cleared route or procedure.

CLOSE PARALLEL RUNWAYS- Two parallel runways whose extended centerlines are separated by less than 4,300 feet and at least 3000 feet (750 feet for SOIA operations) that are authorized to conduct simultaneous independent approach operations. PRM and simultaneous close parallel appear in approach title. Dual communications, special pilot training, an Attention All Users Page (AAUP), NTZ monitoring by displays that have aural and visual alerting algorithms are required. A high update rate surveillance sensor is required for certain runway or approach course spacing.

CLOSED RUNWAY- A runway that is unusable for aircraft operations. Only the airport management/ military operations office can close a runway.

CLOSED TRAFFIC- Successive operations involving takeoffs and landings or low approaches where the aircraft does not exit the traffic pattern.

CLOUD- A cloud is a visible accumulation of minute water droplets and/or ice particles in the atmosphere above the Earth's surface. Cloud differs from ground fog, fog, or ice fog only in that the latter are, by definition, in contact with the Earth's surface.

CLT-

(See CALCULATED LANDING TIME.)

CLUTTER– In radar operations, clutter refers to the reception and visual display of radar returns caused by precipitation, chaff, terrain, numerous aircraft targets, or other phenomena. Such returns may limit or preclude ATC from providing services based on radar.

(See CHAFF.) (See GROUND CLUTTER.) (See PRECIPITATION.) (See TARGET.) (See ICAO term RADAR CLUTTER.)

### CMNPS-

### (See CANADIAN MINIMUM NAVIGATION PERFORMANCE SPECIFICATION AIRSPACE.)

COASTAL FIX- A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure. CODES- The number assigned to a particular multiple pulse reply signal transmitted by a transponder.

(See DISCRETE CODE.)

COMBINED CENTER-RAPCON– An air traffic facility which combines the functions of an ARTCC and a radar approach control facility.

(See AIR ROUTE TRAFFIC CONTROL CENTER.) (See RADAR APPROACH CONTROL FACILITY.)

COMMON POINT- A significant point over which two or more aircraft will report passing or have reported passing before proceeding on the same or diverging tracks. To establish/maintain longitudinal separation, a controller may determine a common point not originally in the aircraft's flight plan and then clear the aircraft to fly over the point.

(See SIGNIFICANT POINT.)

COMMON PORTION-(See COMMON ROUTE.)

COMMON ROUTE- That segment of a North American Route between the inland navigation facility and the coastal fix.

### OR

COMMON ROUTE- Typically the portion of a RNAV STAR between the en route transition end point and the runway transition start point; however, the common route may only consist of a single point that joins the en route and runway transitions.

COMMON TRAFFIC ADVISORY FREQUENCY (CTAF)- A frequency designed for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, Multicom, FSS, or tower frequency and is identified in appropriate aeronautical publications.

(See DESIGNATED COMMON TRAFFIC ADVISORY FREQUENCY (CTAF) AREA.) (Refer to AC 90-42, Traffic Advisory Practices at Airports Without Operating Control Towers.)

COMPASS LOCATOR- A low power, low or medium frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as authorized in the approach procedure. **a.** Outer Compass Locator (LOM)– A compass locator installed at the site of the outer marker of an instrument landing system.

(See OUTER MARKER.)

**b.** Middle Compass Locator (LMM)– A compass locator installed at the site of the middle marker of an instrument landing system.

(See MIDDLE MARKER.) (See ICAO term LOCATOR.)

COMPASS ROSE– A circle, graduated in degrees, printed on some charts or marked on the ground at an airport. It is used as a reference to either true or magnetic direction.

COMPLY WITH RESTRICTIONS- An ATC instruction that requires an aircraft being vectored back onto an arrival or departure procedure to comply with all altitude and/or speed restrictions depicted on the procedure. This term may be used in lieu of repeating each remaining restriction that appears on the procedure.

COMPOSITE FLIGHT PLAN– A flight plan which specifies VFR operation for one portion of flight and IFR for another portion. It is used primarily in military operations.

(Refer to AIM.)

COMPOSITE ROUTE SYSTEM– An organized oceanic route structure, incorporating reduced lateral spacing between routes, in which composite separation is authorized.

COMPOSITE SEPARATION– A method of separating aircraft in a composite route system where, by management of route and altitude assignments, a combination of half the lateral minimum specified for the area concerned and half the vertical minimum is applied.

COMPULSORY REPORTING POINTS- Reporting points which must be reported to ATC. They are designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes. These points are geographical locations which are defined by navigation aids/fixes. Pilots should discontinue position reporting over compulsory reporting points when informed by ATC that their aircraft is in "radar contact."

CONFIDENCE MANEUVER- A confidence maneuver consists of one or more turns, a climb or descent, or other maneuver to determine if the pilot in command (PIC) is able to receive and comply with ATC instructions.

CONFLICT ALERT- A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations between tracked targets (known IFR or VFR aircraft) that require his/her immediate attention/action.

(See MODE C INTRUDER ALERT.)

CONFLICT RESOLUTION- The resolution of potential conflictions between aircraft that are radar identified and in communication with ATC by ensuring that radar targets do not touch. Pertinent traffic advisories shall be issued when this procedure is applied.

Note: This procedure shall not be provided utilizing mosaic radar systems.

CONFORMANCE– The condition established when an aircraft's actual position is within the conformance region constructed around that aircraft at its position, according to the trajectory associated with the aircraft's Current Plan.

CONFORMANCE REGION– A volume, bounded laterally, vertically, and longitudinally, within which an aircraft must be at a given time in order to be in conformance with the Current Plan Trajectory for that aircraft. At a given time, the conformance region is determined by the simultaneous application of the lateral, vertical, and longitudinal conformance bounds for the aircraft at the position defined by time and aircraft's trajectory.

CONSOLAN- A low frequency, long-distance NAVAID used principally for transoceanic navigations.

### CONTACT-

**a.** Establish communication with (followed by the name of the facility and, if appropriate, the frequency to be used).

**b.** A flight condition wherein the pilot ascertains the attitude of his/her aircraft and navigates by visual reference to the surface.

(See CONTACT APPROACH.) (See RADAR CONTACT.)

**CONTACT APPROACH-** An approach wherein an aircraft on an IFR flight plan, having an air traffic control authorization, operating clear of clouds with at least 1 mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, may deviate from the instrument

approach procedure and proceed to the destination airport by visual reference to the surface. This approach will only be authorized when requested by the pilot and the reported ground visibility at the destination airport is at least 1 statute mile.

(Refer to AIM.)

CONTAMINATED RUNWAY- A runway is considered contaminated whenever standing water, ice, snow, slush, frost in any form, heavy rubber, or other substances are present. A runway is contaminated with respect to rubber deposits or other friction-degrading substances when the average friction value for any 500-foot segment of the runway within the ALD fails below the recommended minimum friction level and the average friction value in the adjacent 500-foot segments falls below the maintenance planning friction level.

CONTERMINOUS U.S.- The 48 adjoining States and the District of Columbia.

CONTINENTAL UNITED STATES– The 49 States located on the continent of North America and the District of Columbia.

CONTINUE- When used as a control instruction should be followed by another word or words clarifying what is expected of the pilot. Example: "continue taxi," "continue descent," "continue inbound," etc.

CONTROL AREA [ICAO] – A controlled airspace extending upwards from a specified limit above the earth.

CONTROL SECTOR- An airspace area of defined horizontal and vertical dimensions for which a controller or group of controllers has air traffic control responsibility, normally within an air route traffic control center or an approach control facility. Sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-communications during operations within a sector are normally maintained on discrete frequencies assigned to the sector.

### (See DISCRETE FREQUENCY.)

CONTROL SLASH– A radar beacon slash representing the actual position of the associated aircraft. Normally, the control slash is the one closest to the interrogating radar beacon site. When ARTCC radar is operating in narrowband (digitized) mode, the control slash is converted to a target symbol. CONTROLLED AIRSPACE- An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

**a.** Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace.

**b.** Controlled airspace is also that airspace within which all aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements in 14 CFR Part 91 (for specific operating requirements, please refer to 14 CFR Part 91). For IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan and receive an appropriate ATC clearance. Each Class B, Class C, and Class D airspace area designated for an airport contains at least one primary airport around which the airspace is designated (for specific designations and descriptions of the airspace classes, please refer to 14 CFR Part 71).

**c.** Controlled airspace in the United States is designated as follows:

**1.** CLASS A– Generally, that airspace from 18,000 feet MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under IFR.

2. CLASS B– Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspaces areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."

**3.** CLASS C- Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually
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consists of a surface area with a 5 nautical mile (NM) radius, a circle with a 10NM radius that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation and an outer area that is not charted. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace.

(See OUTER AREA.)

4. CLASS D– Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.

5. CLASS E- Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or en route environment, en route domestic, and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska, up to, but not including 18,000 feet MSL, and the airspace above FL 600.

CONTROLLED AIRSPACE [ICAO] – An airspace of defined dimensions within which air traffic control

service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

Note: Controlled airspace is a generic term which covers ATS airspace Classes A, B, C, D, and E.

CONTROLLED TIME OF ARRIVAL- Arrival time assigned during a Traffic Management Program. This time may be modified due to adjustments or user options.

#### CONTROLLER-

(See AIR TRAFFIC CONTROL SPECIALIST.)

CONTROLLER [ICAO] – A person authorized to provide air traffic control services.

CONTROLLER PILOT DATA LINK COMMUNICATIONS (CPDLC)- A two-way digital communications system that conveys textual air traffic control messages between controllers and pilots using ground or satellite-based radio relay stations.

**CONVECTIVE SIGMET-** A weather advisory concerning convective weather significant to the safety of all aircraft. Convective SIGMETs are issued for tornadoes, lines of thunderstorms, embedded thunderstorms of any intensity level, areas of thunderstorms greater than or equal to VIP level 4 with an area coverage of  $\frac{4}{10}$  (40%) or more, and hail  $\frac{3}{4}$  inch or greater.

(See AIRMET.) (See AWW.) (See CWA.) (See SIGMET.) (Refer to AIM.)

CONVECTIVE SIGNIFICANT METEOROLOG-ICAL INFORMATION-

(See CONVECTIVE SIGMET.)

COORDINATES- The intersection of lines of reference, usually expressed in degrees/minutes/ seconds of latitude and longitude, used to determine position or location.

COORDINATION FIX– The fix in relation to which facilities will handoff, transfer control of an aircraft, or coordinate flight progress data. For terminal facilities, it may also serve as a clearance for arriving aircraft.

COPTER-

(See HELICOPTER.)

CORRECTION- An error has been made in the transmission and the correct version follows.

COUPLED APPROACH– An instrument approach performed by the aircraft autopilot, and/or visually depicted on the flight director, which is receiving position information and/or steering commands from onboard navigational equipment. In general, coupled non-precision approaches must be flown manually (autopilot disengaged) at altitudes lower than 50 feet AGL below the minimum descent altitude, and coupled precision approaches must be flown manually (autopilot disengaged) below 50 feet AGL unless authorized to conduct autoland operations. Coupled instrument approaches are commonly flown to the allowable IFR weather minima established by the operator or PIC, or flown VFR for training and safety.

#### COURSE-

**a.** The intended direction of flight in the horizontal plane measured in degrees from north.

**b.** The ILS localizer signal pattern usually specified as the front course or the back course.

**c.** The intended track along a straight, curved, or segmented MLS path.

(See BEARING.)

(See INSTRUMENT LANDING SYSTEM.) (See MICROWAVE LANDING SYSTEM.) (See RADIAL.)

#### CPDLC-

(See CONTROLLER PILOT DATA LINK COMMUNICATIONS.)

#### CPL [ICAO]-

(See ICAO term CURRENT FLIGHT PLAN.)

CRITICAL ENGINE- The engine which, upon failure, would most adversely affect the performance or handling qualities of an aircraft.

**CROSS** (FIX) AT (ALTITUDE) – Used by ATC when a specific altitude restriction at a specified fix is required.

**CROSS (FIX) AT OR ABOVE (ALTITUDE)** – Used by ATC when an altitude restriction at a specified fix is required. It does not prohibit the aircraft from crossing the fix at a higher altitude than specified; however, the higher altitude may not be one that will violate a succeeding altitude restriction or altitude assignment.

(See ALTITUDE RESTRICTION.) (Refer to AIM.)

#### **CROSS (FIX) AT OR BELOW (ALTITUDE)**– Used by ATC when a maximum crossing altitude at a specific fix is required. It does not prohibit the aircraft from crossing the fix at a lower altitude:

aircraft from crossing the fix at a lower altitude; however, it must be at or above the minimum IFR altitude.

(See ALTITUDE RESTRICTION.) (See MINIMUM IFR ALTITUDES.) (Refer to 14 CFR Part 91.)

#### CROSSWIND-

**a.** When used concerning the traffic pattern, the word means "crosswind leg."

(See TRAFFIC PATTERN.)

**b.** When used concerning wind conditions, the word means a wind not parallel to the runway or the path of an aircraft.

(See CROSSWIND COMPONENT.)

CROSSWIND COMPONENT- The wind component measured in knots at 90 degrees to the longitudinal axis of the runway.

**CRUISE** – Used in an ATC clearance to authorize a pilot to conduct flight at any altitude from the minimum IFR altitude up to and including the altitude specified in the clearance. The pilot may level off at any intermediate altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot. However, once the pilot starts descent and verbally reports leaving an altitude without additional ATC clearance. Further, it is approval for the pilot to proceed to and make an approach at destination airport and can be used in conjunction with:

**a.** An airport clearance limit at locations with a standard/special instrument approach procedure. The CFRs require that if an instrument letdown to an airport is necessary, the pilot shall make the letdown in accordance with a standard/special instrument approach procedure for that airport, or

**b.** An airport clearance limit at locations that are within/below/outside controlled airspace and without a standard/special instrument approach procedure. Such a clearance is NOT AUTHORIZA-TION for the pilot to descend under IFR conditions below the applicable minimum IFR altitude nor does it imply that ATC is exercising control over aircraft in Class G airspace; however, it provides a means for the aircraft to proceed to destination airport, descend, and land in accordance with applicable CFRs

governing VFR flight operations. Also, this provides search and rescue protection until such time as the IFR flight plan is closed.

(See INSTRUMENT APPROACH PROCEDURE.)

CRUISE CLIMB- A climb technique employed by aircraft, usually at a constant power setting, resulting in an increase of altitude as the aircraft weight decreases.

CRUISING ALTITUDE– An altitude or flight level maintained during en route level flight. This is a constant altitude and should not be confused with a cruise clearance.

(See ALTITUDE.) (See ICAO term CRUISING LEVEL.)

CRUISING LEVEL-(See CRUISING ALTITUDE.)

CRUISING LEVEL [ICAO]– A level maintained during a significant portion of a flight.

CT MESSAGE– An EDCT time generated by the ATCSCC to regulate traffic at arrival airports. Normally, a CT message is automatically transferred from the traffic management system computer to the NAS en route computer and appears as an EDCT. In the event of a communication failure between the traffic management system computer and the NAS,

the CT message can be manually entered by the TMC at the en route facility.

CTA-

(See CONTROLLED TIME OF ARRIVAL.) (See ICAO term CONTROL AREA.)

CTAF-

(See COMMON TRAFFIC ADVISORY FREQUENCY.)

CTAS-

(See CENTER TRACON AUTOMATION SYSTEM.)

CTRD-

(See CERTIFIED TOWER RADAR DISPLAY.)

CURRENT FLIGHT PLAN [ICAO]– The flight plan, including changes, if any, brought about by subsequent clearances.

CURRENT PLAN- The ATC clearance the aircraft has received and is expected to fly.

CVFP APPROACH-

(See CHARTED VISUAL FLIGHT PROCEDURE APPROACH.)

CWA-

(See CENTER WEATHER ADVISORY and WEATHER ADVISORY.)

# D

#### D-ATIS-

(See DIGITAL-AUTOMATIC TERMINAL INFORMATION SERVICE.)

#### DA [ICAO]-

(See ICAO Term DECISION ALTITUDE/DECISION HEIGHT.)

### DAIR-

(See DIRECT ALTITUDE AND IDENTITY READOUT.)

DANGER AREA [ICAO] – An airspace of defined dimensions within which activities dangerous to the flight of aircraft may exist at specified times.

Note: The term "Danger Area" is not used in reference to areas within the United States or any of its possessions or territories.

DAS-

(See DELAY ASSIGNMENT.)

DATA BLOCK-(See ALPHANUMERIC DISPLAY.)

DEAD RECKONING- Dead reckoning, as applied to flying, is the navigation of an airplane solely by means of computations based on airspeed, course, heading, wind direction, and speed, groundspeed, and elapsed time.

DECISION ALTITUDE/DECISION HEIGHT [ICAO Annex 6]- A specified altitude or height (A/H) 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.

1. Decision altitude (DA) is referenced to mean sea level and decision height (DH) is referenced to the threshold elevation.

2. Category II and III minima are expressed as a DH and not a DA. Minima is assessed by reference to a radio altimeter and not a barometric altimeter, which makes the minima a DH.

3. The required visual reference means that section of the visual aids or of the approach area which should have been in view for sufficient time for the pilot to have made an assessment of the aircraft position and rate of change of position, in relation to the desired flight path.

Decision altitude (DA) - A specified altitude (mean

sea level (MSL)) on an instrument approach procedure (ILS, GLS, vertically guided RNAV) at which the pilot must decide whether to continue the approach or initiate an immediate missed approach if the pilot does not see the required visual references.

DECISION HEIGHT– With respect to the operation of aircraft, means the height at which a decision must be made during an ILS, MLS, or PAR instrument approach to either continue the approach or to execute a missed approach.

(See ICAO term DECISION ALTITUDE/DECISION HEIGHT.)

DECODER- The device used to decipher signals received from ATCRBS transponders to effect their display as select codes.

(See CODES.) (See RADAR.)

DEFENSE AREA- Any airspace of the contiguous United States that is not an ADIZ in which the control of aircraft is required for reasons of national security.

DEFENSE VISUAL FLIGHT RULES – Rules applicable to flights within an ADIZ conducted under the visual flight rules in 14 CFR Part 91.

(See AIR DEFENSE IDENTIFICATION ZONE.) (Refer to 14 CFR Part 91.) (Refer to 14 CFR Part 99.)

DELAY ASSIGNMENT (DAS)- Delays are distributed to aircraft based on the traffic management program parameters. The delay assignment is calculated in 15-minute increments and appears as a table in Traffic Flow Management System (TFMS).

DELAY INDEFINITE (REASON IF KNOWN) EXPECT FURTHER CLEARANCE (TIME)– Used by ATC to inform a pilot when an accurate estimate of the delay time and the reason for the delay cannot immediately be determined; e.g., a disabled aircraft on the runway, terminal or center area saturation, weather below landing minimums, etc.

(See EXPECT FURTHER CLEARANCE (TIME).)

DELAY TIME– The amount of time that the arrival must lose to cross the meter fix at the assigned meter fix time. This is the difference between ACLT and VTA.

DEPARTURE CENTER- The ARTCC having jurisdiction for the airspace that generates a flight to the impacted airport.

DEPARTURE CONTROL- A function of an approach control facility providing air traffic control service for departing IFR and, under certain conditions, VFR aircraft.

(See APPROACH CONTROL FACILITY.) (Refer to AIM.)

DEPARTURE SEQUENCING PROGRAM- A program designed to assist in achieving a specified interval over a common point for departures.

DEPARTURE TIME– The time an aircraft becomes airborne.

DESCEND VIA– An abbreviated ATC clearance that requires compliance with a published procedure lateral path and associated speed restrictions and provides a pilot-discretion descent to comply with published altitude restrictions.

DESCENT SPEED ADJUSTMENTS- Speed deceleration calculations made to determine an accurate VTA. These calculations start at the transition point and use arrival speed segments to the vertex.

DESIGNATED COMMON TRAFFIC ADVISORY FREQUENCY (CTAF) AREA- In Alaska, in addition to being designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating airport traffic control tower, a CTAF may also be designated for the purpose of carrying out advisory practices for operations in and through areas with a high volume of VFR traffic.

#### DESIRED COURSE-

**a.** True– A predetermined desired course direction to be followed (measured in degrees from true north).

**b.** Magnetic- A predetermined desired course direction to be followed (measured in degrees from local magnetic north).

DESIRED TRACK- The planned or intended track between two waypoints. It is measured in degrees from either magnetic or true north. The instantaneous angle may change from point to point along the great circle track between waypoints.

DETRESFA (DISTRESS PHASE) [ICAO]– The code word used to designate an emergency phase wherein there is reasonable certainty that an aircraft

and its occupants are threatened by grave and imminent danger or require immediate assistance.

#### DEVIATIONS-

**a.** A departure from a current clearance, such as an off course maneuver to avoid weather or turbulence.

**b.** Where specifically authorized in the CFRs and requested by the pilot, ATC may permit pilots to deviate from certain regulations.

DH-

(See DECISION HEIGHT.)

DH [ICAO]-

(See ICAO Term DECISION ALTITUDE/ DECISION HEIGHT.)

DIGITAL-AUTOMATIC TERMINAL INFORMA-TION SERVICE (D-ATIS)– The service provides text messages to aircraft, airlines, and other users outside the standard reception range of conventional ATIS via landline and data link communications to the cockpit. Also, the service provides a computer– synthesized voice message that can be transmitted to all aircraft within range of existing transmitters. The Terminal Data Link System (TDLS) D-ATIS application uses weather inputs from local automated weather sources or manually entered meteorological data together with preprogrammed menus to provide standard information to users. Airports with D-ATIS capability are listed in the Airport/Facility Directory.

DIGITAL TARGET- A computer-generated symbol representing an aircraft's position, based on a primary return or radar beacon reply, shown on a digital display.

DIGITAL TERMINAL AUTOMATION SYSTEM (DTAS)- A system where digital radar and beacon data is presented on digital displays and the operational program monitors the system performance on a real-time basis.

DIGITIZED TARGET- A computer-generated indication shown on an analog radar display resulting from a primary radar return or a radar beacon reply.

**DIRECT**- Straight line flight between two navigational aids, fixes, points, or any combination thereof. When used by pilots in describing off-airway routes, points defining direct route segments become compulsory reporting points unless the aircraft is under radar contact.

DIRECT ALTITUDE AND IDENTITY READ-OUT- The DAIR System is a modification to the AN/TPX-42 Interrogator System. The Navy has two adaptations of the DAIR System-Carrier Air Traffic Control Direct Altitude and Identification Readout System for Aircraft Carriers and Radar Air Traffic Control Facility Direct Altitude and Identity Readout System for land-based terminal operations. The DAIR detects, tracks, and predicts secondary radar aircraft targets. Targets are displayed by means of computer-generated symbols and alphanumeric characters depicting flight identification, altitude, ground speed, and flight plan data. The DAIR System is capable of interfacing with ARTCCs.

DIRECTLY BEHIND- An aircraft is considered to be operating directly behind when it is following the actual flight path of the lead aircraft over the surface of the earth except when applying wake turbulence separation criteria.

DISCRETE BEACON CODE-(See DISCRETE CODE.)

DISCRETE CODE– As used in the Air Traffic Control Radar Beacon System (ATCRBS), any one of the 4096 selectable Mode 3/A aircraft transponder codes except those ending in zero zero; e.g., discrete codes: 0010, 1201, 2317, 7777; nondiscrete codes: 0100, 1200, 7700. Nondiscrete codes are normally reserved for radar facilities that are not equipped with discrete decoding capability and for other purposes such as emergencies (7700), VFR aircraft (1200), etc.

(See RADAR.)

(Refer to AIM.)

DISCRETE FREQUENCY- A separate radio frequency for use in direct pilot-controller communications in air traffic control which reduces frequency congestion by controlling the number of aircraft operating on a particular frequency at one time. Discrete frequencies are normally designated for each control sector in en route/terminal ATC facilities. Discrete frequencies are listed in the Airport/Facility Directory and the DOD FLIP IFR En Route Supplement.

(See CONTROL SECTOR.)

DISPLACED THRESHOLD- A threshold that is located at a point on the runway other than the designated beginning of the runway.

(See THRESHOLD.)

(Refer to AIM.)

DISTANCE MEASURING EQUIPMENT- Equipment (airborne and ground) used to measure, in nautical miles, the slant range distance of an aircraft from the DME navigational aid.

(See MICROWAVE LANDING SYSTEM.) (See TACAN.) (See VORTAC.)

DISTRESS- A condition of being threatened by serious and/or imminent danger and of requiring immediate assistance.

DIVE BRAKES-

(See SPEED BRAKES.)

DIVERSE VECTOR AREA- In a radar environment, that area in which a prescribed departure route is not required as the only suitable route to avoid obstacles. The area in which random radar vectors below the MVA/MIA, established in accordance with the TERPS criteria for diverse departures, obstacles and terrain avoidance, may be issued to departing aircraft.

DIVERSION (DVRSN)– Flights that are required to land at other than their original destination for reasons beyond the control of the pilot/company, e.g. periods of significant weather.

#### DME-

(See DISTANCE MEASURING EQUIPMENT.)

DME FIX- A geographical position determined by reference to a navigational aid which provides distance and azimuth information. It is defined by a specific distance in nautical miles and a radial, azimuth, or course (i.e., localizer) in degrees magnetic from that aid.

(See DISTANCE MEASURING EQUIPMENT.) (See FIX.)

(See MICROWAVE LANDING SYSTEM.)

DME SEPARATION– Spacing of aircraft in terms of distances (nautical miles) determined by reference to distance measuring equipment (DME).

(See DISTANCE MEASURING EQUIPMENT.)

DOD FLIP– Department of Defense Flight Information Publications used for flight planning, en route, and terminal operations. FLIP is produced by the National Geospatial–Intelligence Agency (NGA) for world-wide use. United States Government Flight Information Publications (en route charts and instrument approach procedure charts) are incorporated in DOD FLIP for use in the National Airspace System (NAS).

DOMESTIC AIRSPACE- Airspace which overlies the continental land mass of the United States plus

Hawaii and U.S. possessions. Domestic airspace extends to 12 miles offshore.

DOWNBURST- A strong downdraft which induces an outburst of damaging winds on or near the ground. Damaging winds, either straight or curved, are highly divergent. The sizes of downbursts vary from 1/2 mile or less to more than 10 miles. An intense downburst often causes widespread damage. Damaging winds, lasting 5 to 30 minutes, could reach speeds as high as 120 knots.

#### DOWNWIND LEG-

(See TRAFFIC PATTERN.)

DP-

(See INSTRUMENT DEPARTURE PROCEDURE.)

DRAG CHUTE- A parachute device installed on certain aircraft which is deployed on landing roll to assist in deceleration of the aircraft.

DSP-

(See DEPARTURE SEQUENCING PROGRAM.)

DT–

(See DELAY TIME.)

DTAS-

(See DIGITAL TERMINAL AUTOMATION SYSTEM.)

DUE REGARD- A phase of flight wherein an aircraft commander of a State-operated aircraft assumes responsibility to separate his/her aircraft from all other aircraft.

(See also FAAO JO 7110.65, Para 1-2-1, WORD MEANINGS.)

DUTY RUNWAY-

(See RUNWAY IN USE/ACTIVE RUNWAY/DUTY RUNWAY.)

DVA-

(See DIVERSE VECTOR AREA.)

DVFR-

(See DEFENSE VISUAL FLIGHT RULES.)

DVFR FLIGHT PLAN– A flight plan filed for a VFR aircraft which intends to operate in airspace within which the ready identification, location, and control of aircraft are required in the interest of national security.

DVRSN-

(See DIVERSION.)

DYNAMIC- Continuous review, evaluation, and change to meet demands.

DYNAMIC RESTRICTIONS- Those restrictions imposed by the local facility on an "as needed" basis to manage unpredictable fluctuations in traffic demands.

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