

U.S. Department of Transportation

Federal Aviation Administration

Aeronautical Information Manual

Change 3 November 3, 2022

DO NOT DESTROY BASIC DATED JUNE 17, 2021

Aeronautical Information Manual

Explanation of Changes

Effective: November 3, 2022

a. General Information—Aeronautical Information Manual (AIM) Code of Federal Regulations and Advisory Circulars

This change removes the reference to the canceled Advisory Circular (AC) 00–2 in the Aeronautical Information Manual (AIM), General Information– Code of Federal Regulations and Advisory Circulars section. It also adds a note, with a link, that sends users where current AC information can be found.

b. 1–1–9. INSTRUMENT LANDING SYS-TEM (ILS)

This change amends the Aeronautical Information Manual (AIM), 1–1–9 Instrument Landing System (ILS), subparagraph k, ILS Course Distortion, correcting deficiencies in the paragraph and better aligning content with that published in FAA Order JO 7110.65, paragraph 3–7–5. This change also adds controller observation and PIREPs to the sources contributing to the official weather observation.

c. 1–1–17. GLOBAL POSITIONING SYS-TEM (GPS)

7-6-7. MOUNTAIN FLYING

This change provides pilots guidance on the use of visual flight rules (VFR) waypoints for mountain pass entry points.

d. 3–2–3. CLASS B AIRSPACE 3–2–4. CLASS C AIRSPACE 4–1–8. APPROACH CONTROL SERVICE FOR VFR ARRIVING AIRCRAFT 4–1–18. TERMINAL RADAR SERVICES FOR VFR AIRCRAFT 4–4–11. IFR SEPARATION STANDARDS 4–5–3. SURVEILLANCE RADAR 5–4–11. RADAR APPROACHES

This change will eliminate the reference to Center Radar Presentation (CENRAP) in several paragraphs in the AIM.

e. 3–5–2. MILITARY TRAINING ROUTES

This change to subparagraph 3–5–2e clarifies that Military Training Route (MTR) information from the Flight Information Publication (FLIP) is available through Flight Service. This change also adds a new subparagraph f that provides specific information for accessing MTR route information from the FAA. In addition, the former subparagraph f was re-lettered g and "while inflight" was added for clarification.

f. 4–1–9. TRAFFIC ADVISORY PRACTICES AT AIRPORTS WITHOUT OPERATING CONTROL

This change updates the AIM to incorporate the changes to the FAA Advisory Circular, AC90–66B, that address pilot recommended self–announce broadcasts along with recommendations for pilots conducting straight–in landings to non–towered airports. This change also adds the reference to the AC 90–66, Non–Towered Airport Flight Operations.

g. 4–1–18. TERMINAL RADAR SERVICES FOR VFR AIRCRAFT

This change adds the word "participating" and "and other participating VFR" in subparagraph 4–1–18b6 to clarify that the guidance only applies to participating visual flight rules (VFR) aircraft.

h. 4–1–20. TRANSPONDER AND ADS-B OUT OPERATION

4–4–15. USE OF VISUAL CLEARING PROCEDURES

This change expands the language in AIM paragraphs 4-1-20 and 4-4-15 to include the limitations inherent in visual scans for traffic and the benefits and best practices of using cockpit displays of traffic information to supplement visual scans to help overcome these limitations.

i. 4–5–1. RADAR

This change adds information to raise awareness regarding potential limitations on Air Traffic Control (ATC) radar for aircraft flying in the vicinity of wind turbine farms and expands the knowledge of pilots regarding the effects on aviation safety.

j. 4–7–1. INTRODUCTION AND GENERAL POLICIES

This change replaces "West Atlantic Route System" with "West Atlantic" in the title of the referenced Resource Guide for U.S. Operators.

k. 5–4–5. INSTRUMENT APPROACH PRO-CEDURE (IAP) CHARTS

5-4-9. PROCEDURE TURN AND HOLD-IN-LIEU OF PROCEDURE TURN 7-3-6. EXAMPLES FOR CALCULATING ALTITUDE CORRECTIONS ON CTAS

This change has updated the referenced instrument approach procedures (IAPs) due to the FAA Order 8260.19 update to remove the requirement to those references from the profile notes, and to add explanatory language that altitude restrictions at stepdown fixes in the final approach segment are not applicable to instrument landing system (ILS), Localizer Performance with Vertical Guidance (LPV), or LNAV/Vertical Navigation (VNAV) approaches.

I. 5-4-23. VISUAL APPROACH 5-5-11. VISUAL APPROACH

This change adds content to address go-around responsibilities after conducting a visual approach for aircraft either instructed to remain within the traffic pattern or proceed as otherwise directed by air traffic control (ATC). This change also addresses the difference in approach clearances for locations with or without an operating control tower.

m. 7–1–10. WEATHER OBSERVING PRO-GRAMS

This change clarifies that wind direction is reported relative to magnetic north in the Automatic Terminal Information Service (ATIS) as well as the Automated Surface Observation System (ASOS) and the Automated Weather Observation System (AWOS) broadcasts.

n. APPENDIX 4. FAA FORM 7233–4. INTER-NATIONAL FLIGHT PLAN

This change removes existing instructions allowing alternate use of NAV/ to indicate Area Navigation (RNAV) capability to resolve incompatibility with required navigation performance (RNP) routing. Adds instructions for RNP Standard Instrument Departures (SIDs) and Standard Terminal Arrival Routes (STARs), which are being added to the NAS (for example, see the KSNA STAYY SID). Removes the legacy use of NAV/ for RNAV capability to avoid the NAV/ information overriding RNP capability filed in PBN/. Because ICAO guidance is moving towards use of standardized, unambiguous codes M1 and M2 for the two variations of RNP 2, the information relating to Australia's practice is removed from the table.

o. Editorial Changes

Editorial changes include defining PIREP consistently as Pilot Weather Report and fixing incorrect references in paragraph 5–6–6.

p. Entire Publication

Additional editorial/format changes were made where necessary. Revision bars were not used because of the insignificant nature of these changes.

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Aeronautical Information Manual (AIM) Code of Federal Regulations and Advisory Circulars

Code of Federal Regulations - The FAA publishes the Code of Federal Regulations (CFR) to make readily available to the aviation community the regulatory requirements placed upon them. These regulations are sold as individual parts by the Superintendent of Documents.

The more frequently amended parts are sold on subscription service with subscribers receiving changes automatically as issued. Less active parts are sold on a single-sale basis. Changes to single-sale parts will be sold separately as issued. Information concerning these changes will be furnished by the FAA through its Status of Federal Aviation Regulations, AC 00-44.

Advisory Circulars - The FAA issues Advisory Circulars (AC) to inform the aviation public in a systematic way of nonregulatory material. Unless incorporated into a regulation by reference, the contents of an advisory circular are not binding on the public. Advisory Circulars are issued in a numbered subject system corresponding to the subject areas of the Code of Federal Regulations (CFR) (Title 14, Chapter 1, FAA).

NOTE-

Current AC information can be found at: https://www.faa.gov/regulations_policies/advisory_circulars/.

External References - All references to Advisory Circulars and other FAA publications in the Aeronautical Information Manual include the FAA Advisory Circular or Order identification numbers (when available). However, due to varied publication dates, the basic publication letter is not included.

EXAMPLE-

FAA Order JO 7110.65X, Air Traffic Control, is referenced as FAA Order JO 7110.65.

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maneuvering will be required compared to an ILS approach.

d. Glide Slope/Glide Path

1. The UHF glide slope transmitter, operating on one of the 40 ILS channels within the frequency range 329.15 MHz, to 335.00 MHz radiates its signals in the direction of the localizer front course. The term "glide path" means that portion of the glide slope that intersects the localizer.

CAUTION-

False glide slope signals may exist in the area of the localizer back course approach which can cause the glide slope flag alarm to disappear and present unreliable glide slope information. Disregard all glide slope signal indications when making a localizer back course approach unless a glide slope is specified on the approach and landing chart.

2. The glide slope transmitter is located between 750 feet and 1,250 feet from the approach end of the runway (down the runway) and offset 250 to 650 feet from the runway centerline. It transmits a glide path beam 1.4 degrees wide (vertically). The signal provides descent information for navigation down to the lowest authorized decision height (DH) specified in the approved ILS approach procedure. The glidepath may not be suitable for navigation below the lowest authorized DH and any reference to glidepath indications below that height must be supplemented by visual reference to the runway environment. Glidepaths with no published DH are usable to runway threshold.

3. The glide path projection angle is normally adjusted to 3 degrees above horizontal so that it intersects the MM at about 200 feet and the OM at about 1,400 feet above the runway elevation. The glide slope is normally usable to the distance of 10 NM. However, at some locations, the glide slope has been certified for an extended service volume which exceeds 10 NM.

4. Pilots must be alert when approaching the glidepath interception. False courses and reverse sensing will occur at angles considerably greater than the published path.

5. Make every effort to remain on the indicated glide path.

CAUTION-

Avoid flying below the glide path to assure obstacle/terrain clearance is maintained.

6. The published glide slope threshold crossing height (TCH) DOES NOT represent the height of the actual glide path on-course indication above the runway threshold. It is used as a reference for planning purposes which represents the height above the runway threshold that an aircraft's glide slope antenna should be, if that aircraft remains on a trajectory formed by the four-mile-to-middle marker glidepath segment.

7. Pilots must be aware of the vertical height between the aircraft's glide slope antenna and the main gear in the landing configuration and, at the DH, plan to adjust the descent angle accordingly if the published TCH indicates the wheel crossing height over the runway threshold may not be satisfactory. Tests indicate a comfortable wheel crossing height is approximately 20 to 30 feet, depending on the type of aircraft.

NOTE-

The TCH for a runway is established based on several factors including the largest aircraft category that normally uses the runway, how airport layout affects the glide slope antenna placement, and terrain. A higher than optimum TCH, with the same glide path angle, may cause the aircraft to touch down further from the threshold if the trajectory of the approach is maintained until the flare. Pilots should consider the effect of a high TCH on the runway available for stopping the aircraft.

e. Distance Measuring Equipment (DME)

1. When installed with the ILS and specified in the approach procedure, DME may be used:

(a) In lieu of the OM;

(**b**) As a back course (BC) final approach fix (FAF); and

(c) To establish other fixes on the localizer course.

2. In some cases, DME from a separate facility may be used within Terminal Instrument Procedures (TERPS) limitations:

(a) To provide ARC initial approach segments;

(b) As a FAF for BC approaches; and

(c) As a substitute for the OM.

f. Marker Beacon

1. ILS marker beacons have a rated power output of 3 watts or less and an antenna array designed to produce an elliptical pattern with

dimensions, at 1,000 feet above the antenna, of approximately 2,400 feet in width and 4,200 feet in length. Airborne marker beacon receivers with a selective sensitivity feature should always be operated in the "low" sensitivity position for proper reception of ILS marker beacons.

2. ILS systems may have an associated OM. An MM is no longer required. Locations with a Category II ILS also have an Inner Marker (IM). Due to advances in both ground navigation equipment and airborne avionics, as well as the numerous means that may be used as a substitute for a marker beacon, the current requirements for the use of marker beacons are:

(a) An OM or suitable substitute identifies the Final Approach Fix (FAF) for nonprecision approach (NPA) operations (for example, localizer only); and

(b) The MM indicates a position approximately 3,500 feet from the landing threshold. This is also the position where an aircraft on the glide path will be at an altitude of approximately 200 feet above the elevation of the touchdown zone. A MM is no longer operationally required. There are some MMs still in use, but there are no MMs being installed at new ILS sites by the FAA; and

(c) An IM, where installed, indicates the point at which an aircraft is at decision height on the glide path during a Category II ILS approach. An IM is only required for CAT II operations that do not have a published radio altitude (RA) minimum.

TBL 1-1-3 Marker Passage Indications

Marker	Code	Light
OM		BLUE
MM	• - • -	AMBER
IM	• • • •	WHITE
BC	• • • •	WHITE

3. A back course marker normally indicates the ILS back course final approach fix where approach descent is commenced.

g. Compass Locator

1. Compass locator transmitters are often situated at the MM and OM sites. The transmitters have a power of less than 25 watts, a range of at least 15 miles and operate between 190 and 535 kHz. At

some locations, higher powered radio beacons, up to 400 watts, are used as OM compass locators.

2. Compass locators transmit two letter identification groups. The outer locator transmits the first two letters of the localizer identification group, and the middle locator transmits the last two letters of the localizer identification group.

h. ILS Frequency (See TBL 1–1–4.)

TBL 1–1–4
Frequency Pairs Allocated for ILS

Localizer MHz	Glide Slope
108.10	334.70
108.15	334.55
108.3	334.10
108.35	333.95
108.5	329.90
108.55	329.75
108.7	330.50
108.75	330.35
108.9	329.30
108.95	329.15
109.1	331.40
109.15	331.25
109.3	332.00
109.35	331.85
109.50	332.60
109.55	332.45
109.70	333.20
109.75	333.05
109.90	333.80
109.95	333.65
110.1	334.40
110.15	334.25
110.3	335.00
110.35	334.85
110.5	329.60
110.55	329.45
110.70	330.20
110.75	330.05
110.90	330.80
110.95	330.65
111.10	331.70
111.15	331.55
111.30	332.30
111.35	332.15
111.50	332.9
111.55	332.75
111.70	333.5
111.75	333.35

Localizer MHz	Glide Slope
111.90	331.1
111.95	330.95

i. ILS Minimums

1. The lowest authorized ILS minimums, with all required ground and airborne systems components operative, are:

(a) **Category I.** Decision Height (DH) 200 feet and Runway Visual Range (RVR) 2,400 feet (with touchdown zone and centerline lighting, RVR 1,800 feet), or (with Autopilot or FD or HUD, RVR 1,800 feet);

(b) Special Authorization Category I. DH 150 feet and Runway Visual Range (RVR) 1,400 feet, HUD to DH;

(c) **Category II.** DH 100 feet and RVR 1,200 feet (with autoland or HUD to touchdown and noted on authorization, RVR 1,000 feet);

(d) Special Authorization Category II with Reduced Lighting. DH 100 feet and RVR 1,200 feet with autoland or HUD to touchdown and noted on authorization (touchdown zone, centerline lighting, and ALSF-2 are not required);

(e) Category IIIa. No DH or DH below 100 feet and RVR not less than 700 feet;

(f) Category IIIb. No DH or DH below 50 feet and RVR less than 700 feet but not less than 150 feet; and

(g) Category IIIc. No DH and no RVR limitation.

NOTE-

Special authorization and equipment required for Categories II and III.

j. Inoperative ILS Components

1. Inoperative localizer. When the localizer fails, an ILS approach is not authorized.

2. Inoperative glide slope. When the glide slope fails, the ILS reverts to a non-precision localizer approach.

REFERENCE-

See the inoperative component table in the U.S. Government Terminal Procedures Publication (TPP), for adjustments to minimums due to inoperative airborne or ground system equipment.

k. ILS Course Distortion

1. All pilots should be aware that disturbances to ILS localizer and glide slope courses may occur when surface vehicles or aircraft are operated near the localizer or glide slope antennas. Most ILS installations are subject to signal interference by either surface vehicles, aircraft or both. ILS CRITICAL AREAS are established near each localizer and glide slope antenna.

2. ATC issues control instructions to avoid interfering operations within ILS critical areas at controlled airports during the hours the Airport Traffic Control Tower (ATCT) is in operation as follows:

(a) Weather Conditions. Official weather observation including controller observations and pilot reports (PIREPs) indicates a ceiling of less than 800 feet and/or visibility less than 2 miles.

(1) Localizer Critical Area. Except for aircraft that land, exit a runway, depart, or execute a missed approach, vehicles and aircraft are not authorized in or over the precision approach critical area when an arriving aircraft is inside the outer marker (OM) or the fix used in lieu of the OM. Additionally, whenever the official weather observation indicates a ceiling of less than 200 feet or RVR less than 2,000 feet, vehicles or aircraft operation are not authorized in or over the area when an arriving aircraft is inside the MM, or in the absence of a MM, 1/2 mile final.

(2) Glide Slope Critical Area. Do not authorize vehicles or aircraft operations in or over the area when an arriving aircraft is inside the ILS outer marker (OM), or the fix used in lieu of the OM, unless the arriving aircraft has reported the runway in sight and is circling or side-stepping to land on another runway.

(b) Weather Conditions. At or above ceiling 800 feet and/or visibility 2 miles.

(1) No critical area protective action is provided under these conditions.

(2) A flight crew, under these conditions, should advise the tower that it will conduct an AUTOLAND or COUPLED approach.

EXAMPLE-

Denver Tower, United 1153, Request Autoland/Coupled Approach (runway) ATC replies with:

United 1153, Denver Tower, Roger, Critical Areas not protected.

3. Aircraft holding below 5,000 feet between the outer marker and the airport may cause localizer signal variations for aircraft conducting the ILS approach. Accordingly, such holding is not authorized when weather or visibility conditions are less than ceiling 800 feet and/or visibility 2 miles.

4. Pilots are cautioned that vehicular traffic not subject to ATC may cause momentary deviation to ILS course or glide slope signals. Also, critical areas are not protected at uncontrolled airports or at airports with an operating control tower when weather or visibility conditions are above those requiring protective measures. Aircraft conducting coupled or autoland operations should be especially alert in monitoring automatic flight control systems. (See FIG 1-1-8.)

NOTE-

Unless otherwise coordinated through Flight Standards, ILS signals to Category I runways are not flight inspected below the point that is 100 feet less than the decision altitude (DA). Guidance signal anomalies may be encountered below this altitude.

1–1–10. Simplified Directional Facility (SDF)

a. The SDF provides a final approach course similar to that of the ILS localizer. It does not provide glide slope information. A clear understanding of the ILS localizer and the additional factors listed below completely describe the operational characteristics and use of the SDF.

b. The SDF transmits signals within the range of 108.10 to 111.95 MHz.

c. The approach techniques and procedures used in an SDF instrument approach are essentially the same as those employed in executing a standard localizer approach except the SDF course may not be aligned with the runway and the course may be wider, resulting in less precision.

d. Usable off-course indications are limited to 35 degrees either side of the course centerline. Instrument indications received beyond 35 degrees should be disregarded.

e. The SDF antenna may be offset from the runway centerline. Because of this, the angle of convergence between the final approach course and the runway bearing should be determined by reference to the instrument approach procedure chart. This angle is generally not more than 3 degrees. However, it should be noted that inasmuch as the approach course originates at the antenna site, an approach which is continued beyond the runway threshold will lead the aircraft to the SDF offset position rather than along the runway centerline.

f. The SDF signal is fixed at either 6 degrees or 12 degrees as necessary to provide maximum flyability and optimum course quality.

g. Identification consists of a three–letter identifier transmitted in Morse Code on the SDF frequency. The appropriate instrument approach chart will indicate the identifier used at a particular airport.

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

Navigation Aids

current aeronautical products; for example, Chart Supplement U.S., 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, enhanced navigation around Special Use Airspace, and entry points for commonly flown mountain passes. 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 computer entry 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 FAA Order JO 7350.9, Location Identifiers.

(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 7–6–3, VFR in Congested Areas, for more information.

(7) Mountain pass entry points are marked for convenience to assist pilots with flight planning and visual navigation. Do not attempt to fly a mountain pass directly from VFR waypoint to VFR waypoint—they do not create a path through the mountain pass. Alternative routes are always available. It is the pilot in command's responsibility to choose a suitable route for the intended flight and known conditions.

REFERENCE– AIM, Para 7–6–7, Mountain Flying.

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 Appendix 4, TBL 4–2, 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-C146() 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 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 ± 5 NM either side of centerline to ± 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 (± 1 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 ± 1 NM to ± 0.3 NM at the FAWP. As sensitivity changes from ± 1 NM to ± 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 ± 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) 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) Civilian pilots may obtain GPS RAIM availability information for nonprecision approach procedures by using a manufacturer-supplied RAIM prediction tool, or using the Service Availability Prediction Tool (SAPT) on the FAA en route and terminal RAIM prediction website. 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.

(3) The military provides airfield specific GPS RAIM NOTAMS for nonprecision 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.

(4) 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.

(5) 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.

(6) 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.

(7) 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 nor 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. (8) 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.

(h) 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 missed approach waypoint (MAWP) will always be a fly-over waypoint. A holding waypoint will always be designed as a fly-over waypoint in the navigational database but may be charted as a fly-by event unless the holding waypoint is used for another purpose in the procedure and both events require the waypoint to be a fly-over event. 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. Since the waypoint can only be charted one way, when this situation occurs, the fly-by waypoint symbol will be charted in all uses of the waypoint.

(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.

(i) **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.

(j) 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.

(k) 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).

TBL 1–1–5	
GPS IFR Equipment Classes/C	ategories

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	on capability.				
A1	yes		yes	yes	yes	yes
A2	yes		yes	yes	yes	no
Class B – GPS se	nsor data to an int	egrated navigation sy	stem (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 sensor data to an integrated navigation system (as in Class B) which provides enhanced guidance to an autopilot, or flight director, to reduce flight tech. errors. Limited to 14 CFR Part 121 or equivalent criteria.						
C1	yes		yes	yes	yes	yes
C2	yes		yes	yes	yes	no
C3		yes	yes	yes	yes	yes
C4		yes	yes	yes	yes	no

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

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

NOTE-

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

²Requires verification of data for correctness if database is expired.

³Requires current database or verification that the procedure has not been amended since the expiration of the database. ⁴VFR 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.

⁵Hand-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.*

1–1–18. 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. India and Europe are building similar systems: EGNOS, the European Geostationary Navigation Overlay System; and India's GPS and Geo-Augmented Navigation (GAGAN) system. 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 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

(b) The pilot-in-command holds a recreational pilot certificate and has met the requirements of 14 CFR Section 61.101; or

(c) The pilot-in-command holds a sport pilot certificate and has met the requirements of 14 CFR Section 61.325; or

(d) The aircraft is operated by a student pilot:

(1) Who seeks a private pilot certificate and has met the requirements of 14 CFR Section 61.95.

(2) Who seeks a recreational pilot or sport pilot certificate and has met the requirements of 14 CFR Section 61.94.

4. Unless otherwise authorized by ATC, each person operating a large turbine engine-powered airplane to or from a primary airport must operate at or above the designated floors while within the lateral limits of Class B airspace.

5. Unless otherwise authorized by ATC, each aircraft must be equipped as follows:

(a) For IFR operations, an operable VOR or TACAN receiver or an operable and suitable RNAV system; and

(b) For all operations, a two-way radio capable of communications with ATC on appropriate frequencies for that area; and

(c) Unless otherwise authorized by ATC, an operable radar beacon transponder with automatic altitude reporting capability and operable ADS-B Out equipment.

NOTE-

ATC may, upon notification, immediately authorize a deviation from the altitude reporting equipment requirement; however, a request for a deviation from the 4096 transponder equipment requirement must be submitted to the controlling ATC facility at least one hour before the proposed operation. A request for a deviation from the ADS-B equipage requirement must be submitted using the FAA's automated web authorization tool at least one hour but not more than 24 hours before the proposed operation.

REFERENCE-

AIM, Paragraph 4–1–20, Transponder and ADS–B Out Operation AC 90–114, Automatic Dependent Surveillance–Broadcast Operations

6. Mode C Veil. The airspace within 30 nautical miles of an airport listed in Appendix D, Section 1 of 14 CFR Part 91 (generally primary airports within Class B airspace areas), from the surface upward to 10,000 feet MSL. Unless otherwise authorized by

ATC, aircraft operating within this airspace must be equipped with an operable radar beacon transponder with automatic altitude reporting capability and operable ADS–B Out equipment.

However, aircraft that were not originally certificated with an engine-driven electrical system or that have not subsequently been certified with a system installed may conduct operations within a Mode C veil provided the aircraft remains outside Class A, B or C airspace; and below the altitude of the ceiling of a Class B or Class C airspace area designated for an airport or 10,000 feet MSL, whichever is lower.

c. Charts. Class B airspace is charted on Sectional Charts, IFR En Route Low Altitude, and Terminal Area Charts.

d. Flight Procedures.

1. Flights. Aircraft within Class B airspace are required to operate in accordance with current IFR procedures. A clearance for a visual approach to a primary airport is not authorization for turbine–powered airplanes to operate below the designated floors of the Class B airspace.

2. VFR Flights.

(a) Arriving aircraft must obtain an ATC clearance prior to entering Class B airspace and must contact ATC on the appropriate frequency, and in relation to geographical fixes shown on local charts. Although a pilot may be operating beneath the floor of the Class B airspace on initial contact, communications with ATC should be established in relation to the points indicated for spacing and sequencing purposes.

(b) Departing aircraft require a clearance to depart Class B airspace and should advise the clearance delivery position of their intended altitude and route of flight. ATC will normally advise VFR aircraft when leaving the geographical limits of the Class B airspace. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

(c) Aircraft not landing or departing the primary airport may obtain an ATC clearance to transit the Class B airspace when traffic conditions permit and provided the requirements of 14 CFR Section 91.131 are met. Such VFR aircraft are encouraged, to the extent possible, to operate at altitudes above or below the Class B airspace or transit through established VFR corridors. Pilots

operating in VFR corridors are urged to use frequency 122.750 MHz for the exchange of aircraft position information.

e. ATC Clearances and Separation. An ATC clearance is required to enter and operate within Class B airspace. VFR pilots are provided sequencing and separation from other aircraft while operating within Class B airspace.

REFERENCE-

AIM, Paragraph 4–1–18, Terminal Radar Services for VFR Aircraft. NOTE-

Separation and sequencing of VFR aircraft will be suspended in the event of a radar outage as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information and the time or place to contact the tower.

1. VFR aircraft are separated from all VFR/IFR aircraft which weigh 19,000 pounds or less by a minimum of:

- (a) Target resolution, or
- (b) 500 feet vertical separation, or
- (c) Visual separation.

2. VFR aircraft are separated from all VFR/IFR aircraft which weigh more than 19,000 and turbojets by no less than:

- (a) $1 \frac{1}{2}$ miles lateral separation, or
- (b) 500 feet vertical separation, or
- (c) Visual separation.

3. This program is not to be interpreted as relieving pilots of their responsibilities to see and avoid other traffic operating in basic VFR weather conditions, to adjust their operations and flight path as necessary to preclude serious wake encounters, to maintain appropriate terrain and obstruction clearance or to remain in weather conditions equal to or better than the minimums required by 14 CFR Section 91.155. Approach control should be advised and a revised clearance or instruction obtained when compliance with an assigned route, heading and/or altitude is likely to compromise pilot responsibility with respect to terrain and obstruction clearance, vortex exposure, and weather minimums.

4. ATC may assign altitudes to VFR aircraft that do not conform to 14 CFR Section 91.159. **"RESUME APPROPRIATE VFR ALTITUDES"**

will be broadcast when the altitude assignment is no longer needed for separation or when leaving Class B airspace. Pilots must return to an altitude that conforms to 14 CFR Section 91.159.

f. Proximity operations. VFR aircraft operating in proximity to Class B airspace are cautioned against operating too closely to the boundaries, especially where the floor of the Class B airspace is 3,000 feet or less above the surface or where VFR cruise altitudes are at or near the floor of higher levels. Observance of this precaution will reduce the potential for encountering an aircraft operating at the altitudes of Class B floors. Additionally, VFR aircraft are encouraged to utilize the VFR Planning Chart as a tool for planning flight in proximity to Class B airspace. Charted VFR Flyway Planning Charts are published on the back of the existing VFR Terminal Area Charts.

3-2-4. Class C Airspace

a. Definition. 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 airspace area is individually tailored, the airspace usually consists of a 5 NM radius core surface area that extends from the surface up to 4,000 feet above the airport elevation, and a 10 NM radius shelf area that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation.

b. Charts. Class C airspace is charted on Sectional Charts, IFR En Route Low Altitude, and Terminal Area Charts where appropriate.

c. Operating Rules and Pilot/Equipment Requirements:

1. Pilot Certification. No specific certification required.

2. Equipment.

(a) Two-way radio; and

(b) Unless otherwise authorized by ATC, an operable radar beacon transponder with automatic altitude reporting capability and operable ADS-B Out equipment.

NOTE-

See Paragraph 4–1–20, Transponder and ADS-B Out Operation, subparagraph f for Mode C transponder/ ADS-B requirements for operating above Class C airspace.

3. Arrival or Through Flight Entry Requirements. Two-way radio communication must be established with the ATC facility providing ATC services prior to entry and thereafter maintain those communications while in Class C airspace. Pilots of arriving aircraft should contact the Class C airspace ATC facility on the publicized frequency and give their position, altitude, radar beacon code, destination, and request Class C service. Radio contact should be initiated far enough from the Class C airspace boundary to preclude entering Class C airspace before two-way radio communications are established.

NOTE-

1. If the controller responds to a radio call with, "(aircraft callsign) standby," radio communications have been established and the pilot can enter the Class C airspace.

2. If workload or traffic conditions prevent immediate provision of Class C services, the controller will inform the pilot to remain outside the Class C airspace until conditions permit the services to be provided.

3. It is important to understand that if the controller responds to the initial radio call without using the aircraft identification, radio communications have not been established and the pilot may not enter the Class C airspace.

4. Class C airspace areas have a procedural Outer Area. Normally this area is 20 NM from the primary Class C airspace airport. Its vertical limit extends from the lower limits of radio/radar coverage up to the ceiling of the approach control's delegated airspace, excluding the Class C airspace itself, and other airspace as appropriate. (This outer area is not charted.)

5. Pilots approaching an airport with Class C service should be aware that if they descend below the base altitude of the 5 to 10 mile shelf during an instrument or visual approach, they may encounter non-transponder/non-ADS-B VFR aircraft.

EXAMPLE-

1. [Aircraft callsign] "remain outside the Class Charlie airspace and standby."

2. "Aircraft calling Dulles approach control, standby."

4. Departures from:

(a) A primary or satellite airport with an operating control tower. Two-way radio communications must be established and maintained with the control tower, and thereafter as instructed by ATC while operating in Class C airspace.

(b) A satellite airport without an operating control tower. Two-way radio communications must be established as soon as practicable after departing with the ATC facility having jurisdiction over the Class C airspace.

5. Aircraft Speed. Unless otherwise authorized or required by ATC, no person may operate an aircraft at or below 2,500 feet above the surface within 4 nautical miles of the primary airport of a Class C airspace area at an indicated airspeed of more than 200 knots (230 mph).

d. Air Traffic Services. When two-way radio communications and radar contact are established, all VFR aircraft are:

1. Sequenced to the primary airport.

2. Provided Class C services within the Class C airspace and the outer area.

3. Provided basic radar services beyond the outer area on a workload permitting basis. This can be terminated by the controller if workload dictates.

e. Aircraft Separation. Separation is provided within the Class C airspace and the outer area after two-way radio communications and radar contact are established. VFR aircraft are separated from IFR aircraft within the Class C airspace by any of the following:

1. Visual separation.

2. 500 feet vertical separation.

3. Target resolution.

4. Wake turbulence separation will be provided to all aircraft operating:

(a) Behind and less than 1,000 feet below super or heavy aircraft,

(b) To small aircraft operating behind and less than 500 feet below B757 aircraft, and

(c) To small aircraft following a large aircraft on final approach.

NOTE-

1. Separation and sequencing of VFR aircraft will be suspended in the event of a radar outage as this service is

dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information and the time or place to contact the tower.

2. Pilot participation is voluntary within the outer area and can be discontinued, within the outer area, at the pilot's request. Class C services will be provided in the outer area unless the pilot requests termination of the service.

3. Some facilities provide Class C services only during published hours. At other times, terminal IFR radar service will be provided. It is important to note that the communications and transponder/ADS-B requirements are dependent on the class of airspace established outside of the published hours.

f. Secondary Airports

1. In some locations Class C airspace may overlie the Class D surface area of a secondary airport. In order to allow that control tower to provide service to aircraft, portions of the overlapping Class C airspace may be procedurally excluded when the secondary airport tower is in operation. Aircraft operating in these procedurally excluded areas will only be provided airport traffic control services when in communication with the secondary airport tower.

2. Aircraft proceeding inbound to a satellite airport will be terminated at a sufficient distance to allow time to change to the appropriate tower or advisory frequency. Class C services to these aircraft will be discontinued when the aircraft is instructed to contact the tower or change to advisory frequency.

3. Aircraft departing secondary controlled airports will not receive Class C services until they have been radar identified and two-way communications have been established with the Class C airspace facility.

4. This program is not to be interpreted as relieving pilots of their responsibilities to see and avoid other traffic operating in basic VFR weather conditions, to adjust their operations and flight path as necessary to preclude serious wake encounters, to maintain appropriate terrain and obstruction clearance or to remain in weather conditions equal to or better than the minimums required by 14 CFR Section 91.155. Approach control should be advised and a revised clearance or instruction obtained when compliance with an assigned route, heading and/or altitude is likely to compromise pilot responsibility with respect to terrain and obstruction clearance, vortex exposure, and weather minimums.

g. Class C Airspace Areas by State. These states currently have designated Class C airspace areas that are depicted on sectional charts. Pilots should consult current sectional charts and NOTAMs for the latest information on services available. Pilots should be aware that some Class C airspace underlies or is adjacent to Class B airspace. (See TBL 3–2–1.)

TBL 3-2-1 Class C Airspace Areas by State

State/City	Airport
ALABAMA	
Birmingham	Birmingham–Shuttlesworth International
Huntsville	International-Carl T Jones Fld
Mobile	Regional
ALASKA	
Anchorage	Ted Stevens International
ARIZONA	
Davis-Monthan	AFB
Tucson	International
ARKANSAS	
Fayetteville (Springdale)	Northwest Arkansas Regional
Little Rock	Adams Field
CALIFORNIA	
Beale	AFB
Burbank	Bob Hope
Fresno	Yosemite International
Monterey	Peninsula
Oakland	Metropolitan Oakland International
Ontario	International
Riverside	March AFB
Sacramento	International
San Jose	Norman Y. Mineta International
Santa Ana	John Wayne/Orange County
Santa Barbara	Municipal
COLORADO	
Colorado Springs	Municipal
CONNECTICUT	
Windsor Locks	Bradley International
FLORIDA	
Daytona Beach	International
Fort Lauderdale	Hollywood International
Fort Myers	SW Florida Regional
Jacksonville	International
Orlando	Sanford International
Palm Beach	International
Pensacola	NAS
Pensacola	Regional
Sarasota	Bradenton International
Tallahassee	Regional
Whiting	NAS
GEORGIA	
Savannah	Hilton Head International

State/City	Airport
HAWAII	· · · · · · · · · · · · · · · · · · ·
Kahului	Kahului
ІДАНО	
Boise	Air Terminal
ILLINOIS	
Champaign	Urbana U of Illinois–Willard
Chicago	Midway International
Moline	Ouad City International
Peoria	Greater Peoria Regional
Springfield	Abraham Lincoln Capital
INDIANA	
Evansville	Regional
Fort Wayne	International
Indianapolis	International
South Bend	Regional
IOWA	Regional
Cedar Rapids	The Eastern Iowa
Des Moines	International
KANSAS	
Wichita	Mid-Continent
KENTUCKY	
Lexington	Blue Grass
Louisville	International–Standiford Field
LOUISIANA	
Baton Rouge	Metropolitan Ryan Field
Lafavette	Regional
Shreveport	Barksdale AFB
Shreveport	Regional
MAINE	Regional
Bangor	International
Portland	International Jetport
MICHIGAN	
Flint	Bishop International
Grand Rapids	Gerald R. Ford International
	Capital City
MISSISSIPPI	
Columbus	AFB
Jackson	Jackson–Evers International
MISSOURI	
Springfield	Springfield–Branson National
MONTANA	1 0
Billings	Logan International
NEBRASKA	6
Lincoln	Lincoln
Omaha	Eppley Airfield
Offutt	AFB
NEVADA	
Reno	Reno/Tahoe International
NEW HAMPSHIRE	
Manchester	Manchester
NEW JERSEY	
Atlantic City	International
NEW MEXICO	
Albuquerque	International Sunport

State/City	Airport
NEW YORK	
Albany	International
Buffalo	Niagara International
Islip	Long Island MacArthur
Rochester	Greater Rochester International
Syracuse	Hancock International
NORTH CAROLINA	
Asheville	Regional
Fayetteville	Regional/Grannis Field
Greensboro	Piedmont Triad International
Pope	AFB
Raleigh	Raleigh-Durham International
OHIO	
Akron	Akron-Canton Regional
Columbus	Port Columbus International
Dayton	James M. Cox International
Toledo	Express
OKLAHOMA	*
Oklahoma City	Will Rogers World
Tinker	AFB
Tulsa	International
OREGON	
Portland	International
PENNSYLVANIA	
Allentown	Lehigh Valley International
PUERTO RICO	
San Juan	Luis Munoz Marin International
RHODE ISLAND	
Providence	Theodore Francis Green State
SOUTH CAROLINA	
Charleston	AFB/International
Columbia	Metropolitan
Greer	Greenville-Spartanburg
	International
Myrtle Beach	Myrtle Beach International
Shaw	AFB
TENNESSEE	
Chattanooga	Lovell Field
Knoxville	McGhee Tyson
Nashville	International
TEXAS	
Abilene	Regional
Amarillo	Rick Husband International
Austin	Austin-Bergstrom International
Corpus Christi	International
Dyess	AFB
El Paso	International
Harlingen	Valley International
Laughlin	AFB
Lubbock	Preston Smith International
Midland	International
San Antonio	International
VERMONT	
Burlington	International
0	

State/City	Airport	
VIRGIN ISLANDS		
St. Thomas	Charlotte Amalie Cyril E. King	
VIRGINIA		
Richmond	International	
Norfolk	International	
Roanoke	Regional/Woodrum Field	
WASHINGTON		
Point Roberts	Vancouver International	
Spokane	Fairchild AFB	
Spokane	International	
Whidbey Island	NAS, Ault Field	
WEST VIRGINIA		
Charleston	Yeager	
WISCONSIN		
Green Bay	Austin Straubel International	
Madison	Dane County Regional–Traux Field	
Milwaukee	General Mitchell International	

3-2-5. Class D Airspace

a. Definition. Generally, Class D airspace extends upward 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.

1. Class D surface areas may be designated as full-time (24 hour tower operations) or part-time. Part-time Class D effective times are published in the Chart Supplement U.S.

2. Where a Class D surface area is part-time, the airspace may revert to either a Class E surface area (see paragraph 3–2–6e1) or Class G airspace. When a part–time Class D surface area changes to Class G, the surface area becomes Class G airspace up to, but not including, the overlying controlled airspace.

NOTE-

1. The airport listing in the Chart Supplement U.S. will state the part–time surface area status (for example, "other times CLASS E" or "other times CLASS G").

2. Normally, the overlying controlled airspace is the Class *E* transition area airspace that begins at either 700 feet *AGL* (charted as magenta vignette) or 1200 feet *AGL* (charted as blue vignette). This may be determined by consulting the applicable VFR Sectional or Terminal Area Charts.

b. Operating Rules and Pilot/Equipment Requirements:

1. Pilot Certification. No specific certification required.

2. Equipment. Unless otherwise authorized by ATC, an operable two–way radio is required.

3. Arrival or Through Flight Entry Requirements. Two-way radio communication must be established with the ATC facility providing ATC services prior to entry and thereafter maintain those communications while in the Class D airspace. Pilots of arriving aircraft should contact the control tower on the publicized frequency and give their position, altitude, destination, and any request(s). Radio contact should be initiated far enough from the Class D airspace boundary to preclude entering the Class D airspace before two-way radio communications are established.

NOTE-

1. If the controller responds to a radio call with, "[aircraft callsign] standby," radio communications have been established and the pilot can enter the Class D airspace.

2. If workload or traffic conditions prevent immediate entry into Class D airspace, the controller will inform the pilot to remain outside the Class D airspace until conditions permit entry.

EXAMPLE-

1. "[Aircraft callsign] remain outside the Class Delta airspace and standby."

It is important to understand that if the controller responds to the initial radio call without using the aircraft callsign, radio communications have not been established and the pilot may not enter the Class D airspace.

2. "Aircraft calling Manassas tower standby."

At those airports where the control tower does not operate 24 hours a day, the operating hours of the tower will be listed on the appropriate charts and in the Chart Supplement U.S. During the hours the tower is not in operation, the Class E surface area rules or a combination of Class E rules to 700 feet above ground level and Class G rules to the surface will become applicable. Check the Chart Supplement U.S. for specifics.

4. Departures from:

(a) A primary or satellite airport with an operating control tower. Two-way radio communications must be established and maintained with the control tower, and thereafter as instructed by ATC while operating in the Class D airspace.

(b) A satellite airport without an operating control tower. Two-way radio communications must

be established as soon as practicable after departing with the ATC facility having jurisdiction over the Class D airspace as soon as practicable after departing.

5. Aircraft Speed. Unless otherwise authorized or required by ATC, no person may operate an aircraft at or below 2,500 feet above the surface within 4 nautical miles of the primary airport of a Class D airspace area at an indicated airspeed of more than 200 knots (230 mph).

c. Class D airspace areas are depicted on Sectional and Terminal charts with blue segmented lines, and on IFR En Route Lows with a boxed [D].

d. Surface area arrival extensions:

1. Class D surface area arrival extensions for instrument approach procedures may be Class D or Class E airspace. As a general rule, if all extensions are 2 miles or less, they remain part of the Class D surface area. However, if any one extension is greater than 2 miles, then all extensions will be Class E airspace.

2. Surface area arrival extensions are effective during the published times of the surface area. For part–time Class D surface areas that revert to Class E airspace, the arrival extensions will remain in effect as Class E airspace. For part–time Class D surface areas that change to Class G airspace, the arrival extensions will become Class G at the same time.

e. Separation for VFR Aircraft. No separation services are provided to VFR aircraft.

3-2-6. Class E Airspace

a. Definition. Class E airspace is controlled airspace that is designated to serve a variety of terminal or en route purposes as described in this paragraph.

b. Operating Rules and Pilot/Equipment Requirements:

1. Pilot Certification. No specific certification required.

2. Equipment. Unless otherwise authorized by ATC:

(a) An operable radar beacon transponder with automatic altitude reporting capability and operable ADS-B Out equipment are required at and above 10,000 feet MSL within the 48 contiguous states and the District of Columbia, excluding the airspace at and below 2,500 feet above the surface, and

(b) Operable ADS–B Out equipment at and above 3,000 feet MSL over the Gulf of Mexico from the coastline of the United States out to 12 nautical miles.

NOTE-

The airspace described in (b) is specified in 14 CFR § 91.225 for ADS-B Out requirements. However, 14 CFR § 91.215 does not include this airspace for transponder requirements.

3. Arrival or Through Flight Entry Requirements. No specific requirements.

c. Charts. Class E airspace below 14,500 feet MSL is charted on Sectional, Terminal, and IFR Enroute Low Altitude charts.

d. Vertical limits. Except where designated at a lower altitude (see paragraph 3–2–6e, below, for specifics), Class E airspace in the United States consists of:

1. The airspace extending upward from 14,500 feet MSL to, but not including, 18,000 feet MSL overlying the 48 contiguous states, the District of Columbia and Alaska, including the waters within nautical 12 miles from the coast of the 48 contiguous states and Alaska; excluding:

(a) The Alaska peninsula west of longitude 160°00'00"W.; and

(b) The airspace below 1,500 feet above the surface of the earth unless specifically designated lower (for example, in mountainous terrain higher than 13,000 feet MSL).

2. The airspace above FL 600 is Class E airspace.

e. Functions of Class E Airspace. Class E airspace may be designated for the following purposes:

1. Surface area designated for an airport where a control tower is not in operation. Class E surface areas extend upward from the surface to a designated altitude, or to the adjacent or overlying controlled airspace. The airspace will be configured to contain all instrument procedures.

(a) To qualify for a Class E surface area, the airport must have weather observation and reporting capability, and communications capability must exist with aircraft down to the runway surface.

(b) A Class E surface area may also be designated to accommodate part-time operations at a Class C or Class D airspace location (for example, those periods when the control tower is not in operation).

(c) Pilots should refer to the airport page in the applicable Chart Supplement U.S. for surface area status information.

2. Extension to a surface area. Class E airspace may be designated as extensions to Class B, Class C, Class D, and Class E surface areas. Class E airspace extensions begin at the surface and extend up to the overlying controlled airspace. The extensions provide controlled airspace to contain standard instrument approach procedures without imposing a communications requirement on pilots operating under VFR. Surface area arrival extensions become part of the surface area and are in effect during the same times as the surface area.

NOTE-

When a Class C or Class D surface area is not in effect continuously (for example, where a control tower only operates part-time), the surface area airspace will change to either a Class E surface area or Class G airspace. In such cases, the "Airspace" entry for the airport in the Chart Supplement U.S. will state "other times Class E" or "other times Class G." When a part-time surface area changes to Class E airspace, the Class E arrival extensions will remain in effect as Class E airspace. If a part-time Class C, Class D, or Class E surface area becomes Class G airspace, the arrival extensions will change to Class G at the same time.

3. Airspace used for transition. Class E airspace areas may be designated for transitioning aircraft to/from the terminal or en route environment.

(a) Class E transition areas extend upward from either 700 feet AGL (shown as magenta vignette on sectional charts) or 1,200 feet AGL (blue vignette) and are designated for airports with an approved instrument procedure.

(b) The 700-foot/1200-foot AGL Class E airspace transition areas remain in effect continuously, regardless of airport operating hours or surface area status.

NOTE-

Do not confuse the 700-foot and 1200-foot Class E transition areas with surface areas or surface area extensions.

4. En Route Domestic Areas. There are Class E airspace areas that extend upward from a specified altitude and are en route domestic airspace areas that provide controlled airspace in those areas where there is a requirement to provide IFR en route ATC services but the Federal airway system is inadequate.

5. Federal Airways and Low-Altitude RNAV Routes. Federal airways and low-altitude RNAV routes are Class E airspace areas and, unless otherwise specified, extend upward from 1,200 feet AGL to, but not including,18,000 feet MSL.

(a) Federal airways consist of Low/Medium Frequency (L/MF) airways (colored Federal airways) and VOR Federal airways.

(1) L/MF airways are based on non-directional beacons (NDB) and are identified as green, red, amber, or blue.

(2) VOR Federal airways are based on VOR/VORTAC facilities and are identified by a "V" prefix.

(b) Low-altitude RNAV routes consist of T-routes and helicopter RNAV routes (TK-routes).

NOTE-

See AIM paragraph 5–3–4, Airways and Route Systems, for more details and charting information.

6. Offshore Airspace Areas. There are Class E airspace areas that extend upward from a specified altitude to, but not including, 18,000 feet MSL and are designated as offshore airspace areas. These areas provide controlled airspace beyond 12 miles from the coast of the U.S. in those areas where there is a requirement to provide IFR en route ATC services and within which the U.S. is applying domestic procedures.

f. Separation for VFR Aircraft. No separation services are provided to VFR aircraft.

Section 5. Other Airspace Areas

3–5–1. Airport Advisory/Information Services

a. There are two advisory type services available at selected airports.

1. Local Airport Advisory (LAA) service is available only in Alaska and is operated within 10 statute miles of an airport where a control tower is not operating but where a FSS is located on the airport. At such locations, the FSS provides a complete local airport advisory service to arriving and departing aircraft. During periods of fast changing weather the FSS will automatically provide Final Guard as part of the service from the time the aircraft reports "on-final" or "taking-the-active-runway" until the aircraft reports "on-the-ground" or "airborne."

NOTE-

Current policy, when requesting remote ATC services, requires that a pilot monitor the automated weather broadcast at the landing airport prior to requesting ATC services. The FSS automatically provides Final Guard, when appropriate, during LAA/Remote Airport Advisory (RAA) operations. Final Guard is a value added wind/altimeter monitoring service, which provides an automatic wind and altimeter check during active weather situations when the pilot reports on-final or taking the active runway. During the landing or take-off operation when the winds or altimeter are actively changing the FSS will blind broadcast significant changes when the specialist believes the change might affect the operation. *Pilots should acknowledge the first wind/altimeter check* but due to cockpit activity no acknowledgement is expected for the blind broadcasts. It is prudent for a pilot to report on-the-ground or airborne to end the service.

2. Remote Airport Information Service (RAIS) is provided in support of short term special events like small to medium fly-ins. The service is advertised by NOTAM D only. The FSS will not have access to a continuous readout of the current winds and altimeter; therefore, RAIS does not include weather and/or Final Guard service. However, known traffic, special event instructions, and all other services are provided.

NOTE-

The airport authority and/or manager should request RAIS support on official letterhead directly with the manager of the FSS that will provide the service at least 60 days in advance. Approval authority rests with the FSS manager and is based on workload and resource availability.

REFERENCE-

AIM, Paragraph 4–1–9, Traffic Advisory Practices at Airports Without Operating Control Towers.

b. It is not mandatory that pilots participate in the Airport Advisory programs. Participation enhances safety for everyone operating around busy GA airports; therefore, everyone is encouraged to participate and provide feedback that will help improve the program.

3-5-2. Military Training Routes

a. National security depends largely on the deterrent effect of our airborne military forces. To be proficient, the military services must train in a wide range of airborne tactics. One phase of this training involves "low level" combat tactics. The required maneuvers and high speeds are such that they may occasionally make the see-and-avoid aspect of VFR flight more difficult without increased vigilance in areas containing such operations. In an effort to ensure the greatest practical level of safety for all flight operations, the Military Training Route (MTR) program was conceived.

b. The MTR program is a joint venture by the FAA and the Department of Defense (DOD). MTRs are mutually developed for use by the military for the purpose of conducting low-altitude, high-speed training. The routes above 1,500 feet AGL are developed to be flown, to the maximum extent possible, under IFR. The routes at 1,500 feet AGL and below are generally developed to be flown under VFR.

c. Generally, MTRs are established below 10,000 feet MSL for operations at speeds in excess of 250 knots. However, route segments may be defined at higher altitudes for purposes of route continuity. For example, route segments may be defined for descent, climbout, and mountainous terrain. There are IFR and VFR routes as follows:

1. IFR Military Training Routes-(IR). Operations on these routes are conducted in accordance with IFR regardless of weather conditions.

2. VFR Military Training Routes-(VR). Operations on these routes are conducted in accordance with VFR except flight visibility must be 5 miles or more; and flights must not be conducted below a ceiling of less than 3,000 feet AGL.

d. Military training routes will be identified and charted as follows:

1. Route identification.

(a) MTRs with no segment above 1,500 feet AGL must be identified by four number characters; e.g., IR1206, VR1207.

(b) MTRs that include one or more segments above 1,500 feet AGL must be identified by three number characters; e.g., IR206, VR207.

(c) Alternate IR/VR routes or route segments are identified by using the basic/principal route designation followed by a letter suffix, e.g., IR008A, VR1007B, etc.

2. Route charting.

(a) **IFR Enroute Low Altitude Chart.** This chart will depict all IR routes and all VR routes that accommodate operations above 1,500 feet AGL.

(b) VFR Sectional Aeronautical Charts. These charts will depict military training activities such as IR and VR information.

(c) Area Planning (AP/1B) Chart (DOD Flight Information Publication–FLIP). This chart is published by the National Geospatial–Intelligence Agency (NGA) primarily for military users and contains detailed information on both IR and VR routes.

REFERENCE-AIM, Paragraph 9–1–5, Subparagraph a, National Geospatial–Intelligence Agency (NGA) Products.

e. The FLIP contains charts and narrative descriptions of these routes. To obtain this publication contact:

Defense Logistics Agency for Aviation Mapping Customer Operations (DLA AVN/QAM) 8000 Jefferson Davis Highway Richmond, VA 23297–5339 Toll free phone: 1–800–826–0342 Commercial: 804–279–6500

MTR information from the FLIP is available for pilot briefings through Flight Service. (See subparagraph f below.)

f. Availability of MTR information.

1. Pilots may obtain preflight MTR information through Flight Service (see paragraph 5–1–1, Preflight Preparation).

2. MTR routes are depicted on IFR En Route Low Altitude Charts and VFR Sectional Charts, which are available for free download on the FAA website at

https://www.faa.gov/air_traffic/flight_info/aeronav/ digital_products/.

g. Nonparticipating aircraft are not prohibited from flying within an MTR; however, extreme vigilance should be exercised when conducting flight through or near these routes. Pilots, while inflight, should contact the FSS within 100 NM of a particular MTR to obtain current information or route usage in their vicinity. Information available includes times of scheduled activity, altitudes in use on each route segment, and actual route width. Route width varies for each MTR and can extend several miles on either side of the charted MTR centerline. Route width information for IFR Military Training Route (IR) and VFR Military Training Route (VR) MTRs is also available in the FLIP AP/1B along with additional MTR (slow routes/air refueling routes) information. When requesting MTR information, pilots should give the FSS their position, route of flight, and destination in order to reduce frequency congestion and permit the FSS specialist to identify the MTR which could be a factor.

3-5-3. Temporary Flight Restrictions

a. General. This paragraph describes the types of conditions under which the FAA may impose temporary flight restrictions. It also explains which FAA elements have been delegated authority to issue a temporary flight restrictions NOTAM and lists the types of responsible agencies/offices from which the FAA will accept requests to establish temporary flight restrictions. The 14 CFR is explicit as to what operations are prohibited, restricted, or allowed in a temporary flight restrictions area. Pilots are responsible to comply with 14 CFR Sections 91.137, 91.138, 91.141 and 91.143 when conducting flight in an area where a temporary flight restrictions area is in effect, and should check appropriate NOTAMs during flight planning.

b. The purpose for establishing a temporary flight restrictions area is to:

1. Protect persons and property in the air or on the surface from an existing or imminent hazard associated with an incident on the surface when the presence of low flying aircraft would magnify, alter, spread, or compound that hazard (14 CFR Section 91.137(a)(1));

2. Provide a safe environment for the operation of disaster relief aircraft (14 CFR Section 91.137(a)(2)); or

3. Prevent an unsafe congestion of sightseeing aircraft above an incident or event which may generate a high degree of public interest (14 CFR Section 91.137(a)(3)).

4. Protect declared national disasters for humanitarian reasons in the State of Hawaii (14 CFR Section 91.138).

5. Protect the President, Vice President, or other public figures (14 CFR Section 91.141).

6. Provide a safe environment for space agency operations (14 CFR Section 91.143).

c. Except for hijacking situations, when the provisions of 14 CFR Section 91.137(a)(1) or (a)(2)are necessary, a temporary flight restrictions area will only be established by or through the area manager at the Air Route Traffic Control Center (ARTCC) having jurisdiction over the area concerned. A temporary flight restrictions NOTAM involving the conditions of 14 CFR Section 91.137(a)(3) will be issued at the direction of the service area office director having oversight of the airspace concerned. When hijacking situations are involved, a temporary flight restrictions area will be implemented through the TSA Aviation Command Center. The appropriate FAA air traffic element, upon receipt of such a request, will establish a temporary flight restrictions area under 14 CFR Section 91.137(a)(1).

d. The FAA accepts recommendations for the establishment of a temporary flight restrictions area under 14 CFR Section 91.137(a)(1) from military major command headquarters, regional directors of the Office of Emergency Planning, Civil Defense State Directors, State Governors, or other similar authority. For the situations involving 14 CFR Section 91.137(a)(2), the FAA accepts recommendations from military commanders serving as regional, subregional, or Search and Rescue (SAR) coordinators; by military commanders directing or

coordinating air operations associated with disaster relief; or by civil authorities directing or coordinating organized relief air operations (includes representatives of the Office of Emergency Planning, U.S. Forest Service, and State aeronautical agencies). Appropriate authorities for a temporary flight restrictions establishment under 14 CFR Section 91.137(a)(3) are any of those listed above or by State, county, or city government entities.

e. The type of restrictions issued will be kept to a minimum by the FAA consistent with achievement of the necessary objective. Situations which warrant the extreme restrictions of 14 CFR Section 91.137(a)(1)include, but are not limited to: toxic gas leaks or spills, flammable agents, or fumes which if fanned by rotor or propeller wash could endanger persons or property on the surface, or if entered by an aircraft could endanger persons or property in the air; imminent volcano eruptions which could endanger airborne aircraft and occupants; nuclear accident or incident; and hijackings. Situations which warrant the restrictions associated with 14 CFR Section 91.137(a)(2) include: forest fires which are being fought by releasing fire retardants from aircraft; and aircraft relief activities following a disaster (earthquake, tidal wave, flood, etc.). 14 CFR Section 91.137(a)(3) restrictions are established for events and incidents that would attract an unsafe congestion of sightseeing aircraft.

f. The amount of airspace needed to protect persons and property or provide a safe environment for rescue/relief aircraft operations is normally limited to within 2,000 feet above the surface and within a 3-nautical-mile radius. Incidents occurring within Class B, Class C, or Class D airspace will normally be handled through existing procedures and should not require the issuance of a temporary flight restrictions NOTAM. Temporary flight restrictions affecting airspace outside of the U.S. and its territories and possessions are issued with verbiage excluding that airspace outside of the 12-mile coastal limits.

g. The FSS nearest the incident site is normally the "coordination facility." When FAA communications assistance is required, the designated FSS will function as the primary communications facility for coordination between emergency control authorities and affected aircraft. The ARTCC may act as liaison for the emergency control authorities if adequate communications cannot be established between the

designated FSS and the relief organization. For example, the coordination facility may relay authorizations from the on-scene emergency response official in cases where news media aircraft operations are approved at the altitudes used by relief aircraft.

h. ATC may authorize operations in a temporary flight restrictions area under its own authority only when flight restrictions are established under 14 CFR Section 91.137(a)(2) and (a)(3). The appropriate ARTCC/airport traffic control tower manager will, however, ensure that such authorized flights do not hamper activities or interfere with the event for which restrictions were implemented. However, ATC will not authorize local IFR flights into the temporary flight restrictions area.

i. To preclude misunderstanding, the implementing NOTAM will contain specific and formatted information. The facility establishing a temporary flight restrictions area will format a NOTAM beginning with the phrase "FLIGHT RESTRIC-TIONS" followed by: the location of the temporary flight restrictions area; the effective period; the area defined in statute miles; the altitudes affected; the FAA coordination facility and commercial telephone number; the reason for the temporary flight restrictions; the agency directing any relief activities and its commercial telephone number; and other information considered appropriate by the issuing authority.

EXAMPLE-

1. *14 CFR Section 91.137(a)(1):*

The following NOTAM prohibits all aircraft operations except those specified in the NOTAM.

Flight restrictions Matthews, Virginia, effective immediately until 9610211200. Pursuant to 14 CFR Section 91.137(a)(1) temporary flight restrictions are in effect. Rescue operations in progress. Only relief aircraft operations under the direction of the Department of Defense are authorized in the airspace at and below 5,000 feet MSL within a 2-nautical-mile radius of Laser AFB, Matthews, Virginia. Commander, Laser AFB, in charge (897) 946–5543 (122.4). Steenson FSS (792) 555–6141 (123.1) is the FAA coordination facility.

2. 14 CFR Section 91.137(a)(2):

The following NOTAM permits flight operations in accordance with 14 CFR Section 91.137(a)(2). The on-site emergency response official to authorize media aircraft operations below the altitudes used by the relief aircraft. Flight restrictions 25 miles east of Bransome, Idaho,

effective immediately until 9601202359 UTC. Pursuant to 14 CFR Section 91.137(a)(2) temporary flight restrictions are in effect within a 4-nautical-mile radius of the intersection of county roads 564 and 315 at and below 3,500 feet MSL to provide a safe environment for fire fighting aircraft operations. Davis County sheriff's department (792) 555-8122 (122.9) is in charge of on-scene emergency response activities. Glivings FSS (792) 555-1618 (122.2) is the FAA coordination facility.

3. 14 CFR Section 91.137(a)(3):

The following NOTAM prohibits sightseeing aircraft operations.

Flight restrictions Brown, Tennessee, due to olympic activity. Effective 9606181100 UTC until 9607190200 UTC. Pursuant to 14 CFR Section 91.137(a)(3) temporary flight restrictions are in effect within a 3-nautical-mile radius of N355783/W835242 and Volunteer VORTAC 019 degree radial 3.7 DME fix at and below 2,500 feet MSL. Norton FSS (423) 555-6742 (126.6) is the FAA coordination facility.

4. 14 CFR Section 91.138:

The following NOTAM prohibits all aircraft except those operating under the authorization of the official in charge of associated emergency or disaster relief response activities, aircraft carrying law enforcement officials, aircraft carrying personnel involved in an emergency or legitimate scientific purposes, carrying properly accredited news media, and aircraft operating in accordance with an ATC clearance or instruction.

Flight restrictions Kapalua, Hawaii, effective 9605101200 UTC until 9605151500 UTC. Pursuant to 14 CFR Section 91.138 temporary flight restrictions are in effect within a 3-nautical-mile radius of N205778/W1564038 and Maui/OGG/VORTAC 275 degree radial at 14.1 nautical miles. John Doe 808-757-4469 or 122.4 is in charge of the operation. Honolulu/HNL 808-757-4470 (123.6) FSS is the FAA coordination facility.

5. 14 CFR Section 91.141:

The following NOTAM prohibits all aircraft.

Flight restrictions Stillwater, Oklahoma, June 21, 1996. Pursuant to 14 CFR Section 91.141 aircraft flight operations are prohibited within a 3-nautical-mile radius, below 2000 feet AGL of N360962/W970515 and the Stillwater/SWO/VOR/DME 176 degree radial 3.8-nautical-mile fix from 1400 local time to 1700 local time June 21, 1996, unless otherwise authorized by ATC.

6. 14 CFR Section 91.143:

The following NOTAM prohibits any aircraft of U.S. registry, or pilot any aircraft under the authority of an airman certificate issued by the FAA.

Kennedy space center space operations area effective immediately until 9610152100 UTC. Pursuant to 14 CFR Section 91.143, flight operations conducted by FAA certificated pilots or conducted in aircraft of U.S. registry are prohibited at any altitude from surface to unlimited, within the following area 30-nautical-mile radius of the Melbourne/MLB/VORTAC 010 degree radial 21-nautical-mile fix. St. Petersburg, Florida/PIE/FSS 813-545-1645 (122.2) is the FAA coordination facility and should be contacted for the current status of any airspace associated with the space shuttle operations. This airspace encompasses R2933, R2932, R2931, R2934, R2935, W497A and W158A. Additional warning and restricted areas will be active in conjunction with the operations. Pilots must consult all NOTAMs regarding this operation.

3–5–4. Parachute Jump Aircraft Operations

a. Procedures relating to parachute jump areas are contained in 14 CFR Part 105. Tabulations of parachute jump areas in the U.S. are contained in the Chart Supplement U.S.

b. Pilots of aircraft engaged in parachute jump operations are reminded that all reported altitudes must be with reference to mean sea level, or flight level, as appropriate, to enable ATC to provide meaningful traffic information.

c. Parachute operations in the vicinity of an airport without an operating control tower – there is no substitute for alertness while in the vicinity of an airport. It is essential that pilots conducting parachute operations be alert, look for other traffic, and exchange traffic information as recommended in Paragraph 4–1–9, Traffic Advisory Practices at Airports Without Operating Control Towers. In addition, pilots should avoid releasing parachutes while in an airport traffic pattern when there are other aircraft in that pattern. Pilots should make appropriate broadcasts on the designated Common Traffic Advisory Frequency (CTAF), and monitor that CTAF until all parachute activity has terminated or the aircraft has left the area. Prior to commencing a jump operation, the pilot should broadcast the aircraft's altitude and position in relation to the airport, the approximate relative time when the jump will commence and terminate, and listen to the position reports of other aircraft in the area.

3-5-5. Published VFR Routes

Published VFR routes for transitioning around, under and through complex airspace such as Class B airspace were developed through a number of FAA and industry initiatives. All of the following terms, i.e., "VFR Flyway" "VFR Corridor" and "Class B Airspace VFR Transition Route" have been used when referring to the same or different types of routes or airspace. The following paragraphs identify and clarify the functionality of each type of route, and specify where and when an ATC clearance is required.

a. VFR Flyways.

1. VFR Flyways and their associated Flyway Planning Charts were developed from the recommendations of a National Airspace Review Task Group. A VFR Flyway is defined as a general flight path not defined as a specific course, for use by pilots in planning flights into, out of, through or near complex terminal airspace to avoid Class B airspace. An ATC clearance is NOT required to fly these routes. AIM

FIG 3–5–1 VFR Flyway Planning Chart



Chapter 4. Air Traffic Control

Section 1. Services Available to Pilots

4-1-1. Air Route Traffic Control Centers

Centers are established primarily to provide air traffic service to aircraft operating on IFR flight plans within controlled airspace, and principally during the en route phase of flight.

4-1-2. Control Towers

Towers have been established to provide for a safe, orderly and expeditious flow of traffic on and in the vicinity of an airport. When the responsibility has been so delegated, towers also provide for the separation of IFR aircraft in the terminal areas.

REFERENCE– AIM, Paragraph 5–4–3, Approach Control.

4-1-3. Flight Service Stations

Flight Service Stations (FSSs) are air traffic facilities that provide pilot briefings, flight plan processing, en route flight advisories, search and rescue services, and assistance to lost aircraft and aircraft in emergency situations. FSSs also relay ATC clearances, process Notices to Air Missions, and broadcast aviation weather and aeronautical information. In Alaska, designated FSSs also take weather observations, and provide Airport Advisory Services (AAS).

4-1-4. Recording and Monitoring

a. Calls to air traffic control (ATC) facilities (ARTCCs, Towers, FSSs, Central Flow, and Operations Centers) over radio and ATC operational telephone lines (lines used for operational purposes such as controller instructions, briefings, opening and closing flight plans, issuance of IFR clearances and amendments, counter hijacking activities, etc.) may be monitored and recorded for operational uses such as accident investigations, accident prevention, search and rescue purposes, specialist training and evaluation, and technical evaluation and repair of control and communications systems.

b. Where the public access telephone is recorded, a beeper tone is not required. In place of the "beep"

tone the FCC has substituted a mandatory requirement that persons to be recorded be given notice they are to be recorded and give consent. Notice is given by this entry, consent to record is assumed by the individual placing a call to the operational facility.

4–1–5. Communications Release of IFR Aircraft Landing at an Airport Without an Operating Control Tower

Aircraft operating on an IFR flight plan, landing at an airport without an operating control tower will be advised to change to the airport advisory frequency when direct communications with ATC are no longer required. Towers and centers do not have nontower airport traffic and runway in use information. The instrument approach may not be aligned with the runway in use; therefore, if the information has not already been obtained, pilots should make an expeditious change to the airport advisory frequency when authorized.

REFERENCE – AIM, Paragraph 5–4–4, Advance Information on Instrument Approach.

4-1-6. Pilot Visits to Air Traffic Facilities

Pilots are encouraged to participate in local pilot/air traffic control outreach activities. However, due to security and workload concerns, requests for air traffic facility visits may not always be approved. Therefore, visit requests should be submitted through the air traffic facility as early as possible. Pilots should contact the facility and advise them of the number of persons in the group, the time and date of the proposed visit, and the primary interest of the group. The air traffic facility will provide further instructions if a request can be approved.

REFERENCE-

FAA Order 1600.69, FAA Facility Security Management Program.

4-1-7. Operation Rain Check

Operation Rain Check is a program designed and managed by local air traffic control facility management. Its purpose is to familiarize pilots and aspiring pilots with the ATC system, its functions, responsibilities and benefits. FAA Order JO 7210.3, Paragraph 4–2–2, Pilot Education. FAA Order 1600.69, FAA Facility Security Management Program.

4–1–8. Approach Control Service for VFR Arriving Aircraft

a. Numerous approach control facilities have established programs for arriving VFR aircraft to contact approach control for landing information. This information includes: wind, runway, and altimeter setting at the airport of intended landing. This information may be omitted if contained in the Automatic Terminal Information Service (ATIS) broadcast and the pilot states the appropriate ATIS code.

NOTE-

Pilot use of "have numbers" does not indicate receipt of the ATIS broadcast. In addition, the controller will provide traffic advisories on a workload permitting basis.

b. Such information will be furnished upon initial contact with concerned approach control facility. The pilot will be requested to change to the *tower* frequency at a predetermined time or point, to receive further landing information.

c. Where available, use of this procedure will not hinder the operation of VFR flights by requiring excessive spacing between aircraft or devious routing.

d. Compliance with this procedure is not mandatory but pilot participation is encouraged.

REFERENCE-

AIM, Paragraph 4–1–18, Terminal Radar Services for VFR Aircraft.

NOTE-

Approach control services for VFR aircraft are normally dependent on ATC radar. These services are not available during periods of a radar outage.

4–1–9. Traffic Advisory Practices at Airports Without Operating Control Towers

(See TBL 4-1-1.)

a. Airport Operations Without Operating Control Tower

1. There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that:

(a) All radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories; and

(b) Pilots use the correct airport name, as identified in appropriate aeronautical publications, to reduce the risk of confusion when communicating their position, intentions, and/or exchanging traffic information.

2. An airport may have a full or part-time tower or FSS located on the airport, a full or part-time UNICOM station or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain airport/traffic information when operating at an airport that does not have an operating tower: by communicating with an FSS, a UNICOM operator, or by making a self-announce broadcast.

NOTE-

FSS airport advisories are available only in Alaska.

3. Many airports are now providing 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 of the automated UNICOM will be published in the Chart Supplement U.S. and approach charts.

b. Communicating on a Common Frequency

1. The key to communicating at an airport without an operating control tower is selection of the correct common frequency. The acronym CTAF which stands for Common Traffic Advisory Frequency, is synonymous with this program. A CTAF is a frequency designated 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.

NOTE-

FSS frequencies are available only in Alaska.

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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. Straight-in Landings. The FAA discourages VFR straight-in approaches to landings due to the increased risk of a mid-air collision. However, if a pilot chooses to execute a straight-in approach for landing without entering the airport traffic pattern, the pilot should self-announce their position on the designated CTAF approximately 8 to 10 miles from the airport and coordinate their straight-in approach and landing with other airport traffic. Pilots executing a straight-in approach (IFR or VFR) do not have priority over other aircraft in the traffic pattern, and must comply with the provisions of 14 CFR 91.113 (g), Right-of-way rules.

5. Traffic Pattern Operations. All traffic within a 10-mile radius of a non-towered airport or a part-time-towered airport when the control tower is not operating, should monitor and communicate on the designated CTAF when entering the traffic pattern. Pilots operating in the traffic pattern or on a straight-in approach must be alert at all times to other aircraft in the pattern, or conducting straight-in approaches, and communicate their position to avoid a possible traffic conflict. In the airport traffic pattern and while on straight-in approaches to a runway, effective communication and a pilot's responsibility to see-and-avoid are essential mitigations to avoid a possible midair collision. In addition, following established traffic pattern procedures eliminates excessive maneuvering at low altitudes, reducing the risk of loss of aircraft control.

REFERENCE-

FAA Advisory Circular (AC) 90–66, Non–Towered Airport Flight Operations.

6. 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.

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

8. Recommended self-announce broadcasts: 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. When referring to a specific runway, pilots should use the runway number and not use the phrase "Active Runway."

(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-andgo, 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.

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 Unicom/Multicom Frequency Usage

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

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.)

TBL 4–1–3 Other Frequency Usage Designated by FCC

Use	Frequency
Air-to-air communication (private fixed wing aircraft).	122.750
Helicopter air-to-air communications; air traffic control operations.	123.025
Aviation instruction, Glider, Hot Air	123.300
Balloon (not to be used for advisory service).	123.500
Assignment to flight test land and	123.400^{1}
aircraft stations (not for air-to-air communication except for those	123.450 ²
aircraft operating in an oceanic FIR).	

¹This frequency is available only to itinerant stations that have a requirement to be periodically transferred to various locations.

²Mobile station operations on these frequencies are limited to an area within 320 km (200 mi) of an associated flight test land station.

4-1-12. Use of UNICOM for ATC Purposes

UNICOM service may be used for ATC purposes, only under the following circumstances:

a. Revision to proposed departure time.

b. Takeoff, arrival, or flight plan cancellation time.

c. ATC clearance, provided arrangements are made between the ATC facility and the UNICOM licensee to handle such messages.

4–1–13. Automatic Terminal Information Service (ATIS)

a. ATIS is the continuous broadcast of recorded noncontrol information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. The information is continuously broadcast over a discrete VHF radio frequency or the voice portion of a local NAVAID. Arrival ATIS transmissions on a discrete VHF radio frequency are engineered according to the individual facility requirements, which would normally be a protected service volume of 20 NM to 60 NM from the ATIS site and a maximum altitude of 25,000 feet AGL. In the case of a departure ATIS, the protected service volume cannot exceed 5 NM and 100 feet AGL. At most locations, ATIS signals may be received on the surface of the airport, but local conditions may limit the maximum ATIS reception distance and/or altitude. Pilots are urged to cooperate in the ATIS program as it relieves frequency congestion on approach control, ground control, and local control frequencies. The Chart Supplement U.S. indicates airports for which ATIS is provided.

- **b.** ATIS information includes:
 - 1. Airport/facility name
 - 2. Phonetic letter code
 - 3. Time of the latest weather sequence (UTC)
 - 4. Weather information consisting of:
 - (a) Wind direction and velocity
 - (b) Visibility
 - (c) Obstructions to vision

(d) Present weather consisting of: sky condition, temperature, dew point, altimeter, a density altitude advisory when appropriate, and other pertinent remarks included in the official weather observation

5. Instrument approach and runway in use.

The ceiling/sky condition, visibility, and obstructions to vision may be omitted from the ATIS broadcast if the ceiling is above 5,000 feet and the visibility is more than 5 miles. The departure runway will only be given if different from the landing runway except at locations having a separate ATIS for departure. The broadcast may include the appropriate frequency and instructions for VFR arrivals to make initial contact with approach control. Pilots of aircraft arriving or departing the terminal area can receive the continuous ATIS broadcast at times when cockpit duties are least pressing and listen to as many repeats as desired. ATIS broadcast must be updated upon the receipt of any official hourly and special weather. A new recording will also be made when there is a change in other pertinent data such as runway change, instrument approach in use, etc.

EXAMPLE-

Dulles International information Sierra. One four zero zero zulu. Wind three five zero at eight. Visibility one zero. Ceiling four thousand five hundred broken. Temperature three four. Dew point two eight. Altimeter three zero one zero. ILS runway one right approach in use. Departing runway three zero. Advise on initial contact you have information sierra.

c. Pilots should listen to ATIS broadcasts whenever ATIS is in operation.

d. Pilots should notify controllers on initial contact that they have received the ATIS broadcast by repeating the alphabetical code word appended to the broadcast.

EXAMPLE-

"Information Sierra received."

e. When a pilot acknowledges receipt of the ATIS broadcast, controllers may omit those items contained in the broadcast if they are current. Rapidly changing conditions will be issued by ATC and the ATIS will contain words as follows:

EXAMPLE-

"Latest ceiling/visibility/altimeter/wind/(other conditions) will be issued by approach control/tower."

NOTE-

The absence of a sky condition or ceiling and/or visibility on ATIS indicates a sky condition or ceiling of 5,000 feet or above and visibility of 5 miles or more. A remark may be made on the broadcast, "the weather is better than 5000 and 5," or the existing weather may be broadcast.

f. Controllers will issue pertinent information to pilots who do not acknowledge receipt of a broadcast or who acknowledge receipt of a broadcast which is not current.

g. To serve frequency limited aircraft, FSSs are equipped to transmit on the omnirange frequency at most en route VORs used as ATIS voice outlets. Such communication interrupts the ATIS broadcast. Pilots of aircraft equipped to receive on other FSS

frequencies are encouraged to do so in order that these override transmissions may be kept to an absolute minimum.

h. While it is a good operating practice for pilots to make use of the ATIS broadcast where it is available, some pilots use the phrase "have numbers" in communications with the control tower. Use of this phrase means that the pilot has received wind, runway, and altimeter information ONLY and the tower does not have to repeat this information. It does not indicate receipt of the ATIS broadcast and should never be used for this purpose.

4–1–14. Automatic Flight Information Service (AFIS) – Alaska FSSs Only

a. AFIS is the continuous broadcast of recorded non-control information at airports in Alaska where an FSS provides local airport advisory service. Its purpose is to improve FSS specialist efficiency by reducing frequency congestion on the local airport advisory frequency.

1. The AFIS broadcast will automate the repetitive transmission of essential but routine information (for example, weather, favored runway, braking action, airport NOTAMs, etc.). The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS frequency).

2. Use of AFIS is not mandatory, but pilots who choose to utilize two-way radio communications with the FSS are urged to listen to AFIS, as it relieves frequency congestion on the local airport advisory frequency. AFIS broadcasts are updated upon receipt of any official hourly and special weather, and changes in other pertinent data.

3. When a pilot acknowledges receipt of the AFIS broadcast, FSS specialists may omit those items contained in the broadcast if they are current. When rapidly changing conditions exist, the latest ceiling, visibility, altimeter, wind or other conditions may be omitted from the AFIS and will be issued by the FSS specialist on the appropriate radio frequency.

EXAMPLE-

"Kotzebue information ALPHA. One six five five zulu. Wind, two one zero at five; visibility two, fog; ceiling one hundred overcast; temperature minus one two, dew point minus one four; altimeter three one zero five. Altimeter in excess of three one zero zero, high pressure altimeter setting procedures are in effect. Favored runway two six. Weather in Kotzebue surface area is below V-F-R minima – an ATC clearance is required. Contact Kotzebue Radio on 123.6 for traffic advisories and advise intentions. Notice to Air Missions, Hotham NDB out of service. Transcribed Weather Broadcast out of service. Advise on initial contact you have ALPHA."

NOTE-

The absence of a sky condition or ceiling and/or visibility on Alaska FSS AFIS indicates a sky condition or ceiling of 5,000 feet or above and visibility of 5 miles or more. A remark may be made on the broadcast, "the weather is better than 5000 and 5."

b. Pilots should listen to Alaska FSSs AFIS broadcasts whenever Alaska FSSs AFIS is in operation.

NOTE-

Some Alaska FSSs are open part time and/or seasonally.

c. Pilots should notify controllers on initial contact that they have received the Alaska FSSs AFIS broadcast by repeating the phonetic alphabetic letter appended to the broadcast.

EXAMPLE-

"Information Alpha received."

d. While it is a good operating practice for pilots to make use of the Alaska FSS AFIS broadcast where it is available, some pilots use the phrase "have numbers" in communications with the FSS. Use of this phrase means that the pilot has received wind, runway, and altimeter information ONLY and the Alaska FSS does not have to repeat this information. It does not indicate receipt of the AFIS broadcast and should never be used for this purpose.

4–1–15. Radar Traffic Information Service

This is a service provided by radar ATC facilities. Pilots receiving this service are advised of any radar target observed on the radar display which may be in such proximity to the position of their aircraft or its intended route of flight that it warrants their attention. This service is not intended to relieve the pilot of the responsibility for continual vigilance to see and avoid other aircraft.

a. Purpose of the Service

1. The issuance of traffic information as observed on a radar display is based on the principle of assisting and advising a pilot that a particular radar target's position and track indicates it may intersect or pass in such proximity to that pilot's intended flight path that it warrants attention. This is to alert the pilot to the traffic, to be on the lookout for it, and thereby be in a better position to take appropriate action should the need arise. 2. Pilots are reminded that the surveillance radar used by ATC does not provide altitude information unless the aircraft is equipped with Mode C and the radar facility is capable of displaying altitude information.

b. Provisions of the Service

1. Many factors, such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion, could prevent the controller from providing this service. Controllers possess complete discretion for determining whether they are able to provide or continue to provide this service in a specific case. The controller's reason against providing or continuing to provide the service in a particular case is not subject to question nor need it be communicated to the pilot. In other words, the provision of this service is entirely dependent upon whether controllers believe they are in a position to provide it. Traffic information is routinely provided to all aircraft operating on IFR flight plans except when the pilot declines the service, or the pilot is operating within Class A airspace. Traffic information may be provided to flights not operating on IFR flight plans when requested by pilots of such flights.

NOTE-

Radar ATC facilities normally display and monitor both primary and secondary radar as well as ADS-B, except that secondary radar or ADS-B may be used as the sole display source in Class A airspace, and under some circumstances outside of Class A airspace (beyond primary coverage and in en route areas where only secondary and/or ADS-B is available). Secondary radar and/or ADS-B may also be used outside Class A airspace as the sole display source when the primary radar is temporarily unusable or out of service. Pilots in contact with the affected ATC facility are normally advised when a temporary outage occurs; i.e., "primary radar out of service; traffic advisories available on transponder or ADS-B aircraft only." This means simply that only aircraft that have transponders and ADS-B installed and in use will be depicted on ATC displays when the primary and/or secondary radar is temporarily out of service.

2. When receiving VFR radar advisory service, pilots should monitor the assigned frequency at all times. This is to preclude controllers' concern for radio failure or emergency assistance to aircraft under the controller's jurisdiction. VFR radar advisory service does not include vectors away from conflicting traffic unless requested by the pilot. When advisory service is no longer desired, advise the controller before changing frequencies and then

change your transponder code to 1200, if applicable. Pilots should also inform the controller when changing VFR cruising altitude. Except in programs where radar service is automatically terminated, the controller will advise the aircraft when radar is terminated.

NOTE-

Participation by VFR pilots in formal programs implemented at certain terminal locations constitutes pilot request. This also applies to participating pilots at those locations where arriving VFR flights are encouraged to make their first contact with the tower on the approach control frequency.

c. Issuance of Traffic Information. Traffic information will include the following concerning a target which may constitute traffic for an aircraft that is:

1. Radar identified

(a) Azimuth from the aircraft in terms of the 12 hour clock, or

(b) When rapidly maneuvering civil test or military aircraft prevent accurate issuance of traffic as in (a) above, specify the direction from an aircraft's position in terms of the eight cardinal compass points (N, NE, E, SE, S, SW, W, NW). This method must be terminated at the pilot's request.

(c) Distance from the aircraft in nautical miles;

(d) Direction in which the target is proceeding; and

(e) Type of aircraft and altitude if known.

EXAMPLE-

Traffic 10 o'clock, 3 miles, west-bound (type aircraft and altitude, if known, of the observed traffic). The altitude may be known, by means of Mode C, but not verified with the pilot for accuracy. (To be valid for separation purposes by ATC, the accuracy of Mode C readouts must be verified. This is usually accomplished upon initial entry into the radar system by a comparison of the readout to pilot stated altitude, or the field elevation in the case of continuous readout being received from an aircraft on the airport.) When necessary to issue traffic advisories containing unverified altitude information, the controller will issue the indicated altitude of the aircraft. The pilot may upon receipt of traffic information, request a vector (heading) to avoid such traffic. The vector will be provided to the extent possible as determined by the controller provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

2. Not radar identified

(a) Distance and direction with respect to a fix;

(b) Direction in which the target is proceeding; and

(c) Type of aircraft and altitude if known.

EXAMPLE-

Traffic 8 miles south of the airport northeast–bound, (type aircraft and altitude if known).

d. The examples depicted in the following figures point out the possible error in the position of this traffic when it is necessary for a pilot to apply drift correction to maintain this track. This error could also occur in the event a change in course is made at the time radar traffic information is issued.

FIG 4-1-1 Induced Error in Position of Traffic



EXAMPLE-

In FIG 4-1-1 traffic information would be issued to the pilot of aircraft "A" as 12 o'clock. The actual position of the traffic as seen by the pilot of aircraft "A" would be 2 o'clock. Traffic information issued to aircraft "B" would also be given as 12 o'clock, but in this case, the pilot of "B" would see the traffic at 10 o'clock.

FIG 4-1-2 Induced Error in Position of Traffic



EXAMPLE-

In FIG 4–1–2 traffic information would be issued to the pilot of aircraft "C" as 2 o'clock. The actual position of the traffic as seen by the pilot of aircraft "C" would be 3 o'clock. Traffic information issued to aircraft "D" would be at an 11 o'clock position. Since it is not necessary for the pilot of aircraft "D" to apply wind correction (crab) to

remain on track, the actual position of the traffic issued would be correct. Since the radar controller can only observe aircraft track (course) on the radar display, traffic advisories are issued accordingly, and pilots should give due consideration to this fact when looking for reported traffic.

4-1-16. Safety Alert

A safety alert will be issued to pilots of aircraft being controlled by ATC if the controller is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or other aircraft. The provision of this service is contingent upon the capability of the controller to have an awareness of a situation involving unsafe proximity to terrain, obstructions and uncontrolled aircraft. The issuance of a safety alert cannot be mandated, but it can be expected on a reasonable, though intermittent basis. Once the alert is issued, it is solely the pilot's prerogative to determine what course of action, if any, to take. This procedure is intended for use in time critical situations where aircraft safety is in question. Noncritical situations should be handled via the normal traffic alert procedures.

a. Terrain or Obstruction Alert

1. Controllers will immediately issue an alert to the pilot of an aircraft under their control when they recognize that the aircraft is at an altitude which, in their judgment, may be in an unsafe proximity to terrain/obstructions. The primary method of detecting unsafe proximity is through Mode C automatic altitude reports.

EXAMPLE-

Low altitude alert Cessna Three Four Juliet, check your altitude immediately. And if the aircraft is not yet on final approach, the MVA (MEA/MIA/MOCA) in your area is six thousand.

2. Most En Route and Terminal radar facilities have an automated function which, if operating, alerts controllers when a tracked Mode C equipped aircraft under their control is below or is predicted to be below a predetermined minimum safe altitude. This function, called Minimum Safe Altitude Warning (MSAW), is designed solely as a controller aid in detecting potentially unsafe aircraft proximity to terrain/obstructions. The radar facility will, when MSAW is operating, provide MSAW monitoring for all aircraft with an operating Mode C altitude encoding transponder that are tracked by the system and are:

(a) Operating on an IFR flight plan; or

(b) Operating VFR and have requested MSAW monitoring.

NOTE-

Pilots operating VFR may request MSAW monitoring if their aircraft are equipped with Mode C transponders.

EXAMPLE-

Apache Three Three Papa request MSAW monitoring.

3. Due to the lack of terrain and obstacle clearance data, accurate automation databases may not be available for providing MSAW information to aircraft overflying Mexico and Canada. Air traffic facilities along the United States/Mexico/Canada borders may have MSAW computer processing inhibited where accurate terrain data is not available.

b. Aircraft Conflict Alert.

1. Controllers will immediately issue an alert to the pilot of an aircraft under their control if they are aware of another aircraft which is not under their control, at an altitude which, in the controller's judgment, places both aircraft in unsafe proximity to each other. With the alert, when feasible, the controller will offer the pilot the position of the traffic if time permits and an alternate course(s) of action. Any alternate course(s) of action the controller may recommend to the pilot will be predicated only on other traffic being worked by the controller.

EXAMPLE-

American Three, traffic alert, (position of traffic, if time permits), advise you turn right/left heading (degrees) and/or climb/descend to (altitude) immediately.

4–1–17. Radar Assistance to VFR Aircraft

a. Radar equipped FAA ATC facilities provide radar assistance and navigation service (vectors) to VFR aircraft provided the aircraft can communicate with the facility, are within radar coverage, and can be radar identified.

b. Pilots should clearly understand that authorization to proceed in accordance with such radar navigational assistance does not constitute authorization for the pilot to violate CFRs. In effect, assistance provided is on the basis that navigational guidance information issued is advisory in nature and the job of flying the aircraft safely, remains with the pilot.

c. In many cases, controllers will be unable to determine if flight into instrument conditions will result from their instructions. To avoid possible hazards resulting from being vectored into IFR conditions, pilots should keep controllers advised of the weather conditions in which they are operating and along the course ahead.

d. Radar navigation assistance (vectors) may be initiated by the controller when one of the following conditions exist:

1. The controller suggests the vector and the pilot concurs.

2. A special program has been established and vectoring service has been advertised.

3. In the controller's judgment the vector is necessary for air safety.

e. Radar navigation assistance (vectors) and other radar derived information may be provided in response to pilot requests. Many factors, such as limitations of radar, volume of traffic, communications frequency, congestion, and controller workload could prevent the controller from providing it. Controllers have complete discretion for determining if they are able to provide the service in a particular case. Their decision not to provide the service in a particular case is not subject to question.

4–1–18. Terminal Radar Services for VFR Aircraft

a. Basic Radar Service:

1. In addition to the use of radar for the control of IFR aircraft, all commissioned radar facilities provide the following basic radar services for VFR aircraft:

(a) Safety alerts.

(b) Traffic advisories.

(c) Limited radar vectoring (on a workload permitting basis).

(d) Sequencing at locations where procedures have been established for this purpose and/or when covered by a Letter of Agreement.

NOTE-

When the stage services were developed, two basic radar services (traffic advisories and limited vectoring) were identified as "Stage I." This definition became unnecessary and the term "Stage I" was eliminated from use. The term "Stage II" has been eliminated in conjunction with the airspace reclassification, and sequencing services to locations with local procedures and/or letters of agreement to provide this service have been included in basic services to VFR aircraft. These basic services will still be provided by all terminal radar facilities whether they include Class B, Class C, Class D or Class E airspace. "Stage III" services have been replaced with "Class B" and "TRSA" service where applicable.

2. Vectoring service may be provided when requested by the pilot or with pilot concurrence when suggested by ATC.

3. Pilots of arriving aircraft should contact approach control on the publicized frequency and give their position, altitude, aircraft call sign, type aircraft, radar beacon code (if transponder equipped), destination, and request traffic information.

4. Approach control will issue wind and runway, except when the pilot states "have numbers" or this information is contained in the ATIS broadcast and the pilot states that the current ATIS information has been received. Traffic information is provided on a workload permitting basis. Approach control will specify the time or place at which the pilot is to contact the tower on local control frequency for further landing information. Radar service is automatically terminated and the aircraft need not be advised of termination when an arriving VFR aircraft receiving radar services to a tower-controlled airport where basic radar service is provided has landed, or to all other airports, is instructed to change to tower or advisory frequency. (See FAA Order JO 7110.65, Air Traffic Control, paragraph 5–1–9, Radar Service Termination.)

5. Sequencing for VFR aircraft is available at certain terminal locations (see locations listed in the Chart Supplement U.S.). The purpose of the service is to adjust the flow of arriving VFR and IFR aircraft into the traffic pattern in a safe and orderly manner and to provide radar traffic information to departing VFR aircraft. Pilot participation is urged but is not mandatory. Traffic information is provided on a workload permitting basis. Standard radar separation between VFR or between VFR and IFR aircraft is not provided.

(a) Pilots of arriving VFR aircraft should initiate radio contact on the publicized frequency with approach control when approximately 25 miles from the airport at which sequencing services are being provided. On initial contact by VFR aircraft, approach control will assume that sequencing service is requested. After radar contact is established, the pilot may use pilot navigation to enter the traffic pattern or, depending on traffic conditions, approach control may provide the pilot with routings or vectors necessary for proper sequencing with other participating VFR and IFR traffic en route to the airport. When a flight is positioned behind a preceding aircraft and the pilot reports having that aircraft in sight, the pilot will be instructed to follow the preceding aircraft. THE ATC INSTRUCTION TO FOLLOW THE PRECEDING AIRCRAFT DOES NOT AUTHORIZE THE PILOT TO COMPLY WITH ANY ATC CLEARANCE OR INSTRUC-TION ISSUED TO THE PRECEDING AIRCRAFT. If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence. If an arriving aircraft does not want radar service, the pilot should state "NEGATIVE RADAR SERVICE" or make a similar comment, on initial contact with approach control.

(b) Pilots of departing VFR aircraft are encouraged to request radar traffic information by notifying ground control, or where applicable, clearance delivery, on initial contact with their request and proposed direction of flight.

EXAMPLE-

Xray ground control, November One Eight Six, Cessna One Seventy Two, ready to taxi, VFR southbound at 2,500, have information bravo and request radar traffic information.

NOTE-

Following takeoff, the tower will advise when to contact departure control.

(c) Pilots of aircraft transiting the area and in radar contact/communication with approach control will receive traffic information on a controller workload permitting basis. Pilots of such aircraft should give their position, altitude, aircraft call sign, aircraft type, radar beacon code (if transponder equipped), destination, and/or route of flight.

b. TRSA Service (Radar Sequencing and Separation Service for VFR Aircraft in a TRSA).

1. This service has been implemented at certain terminal locations. The service is advertised in the Chart Supplement U.S. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the airspace defined as the Terminal Radar Service Area (TRSA). Pilot participation is urged but is not mandatory.

2. If any aircraft does not want the service, the pilot should state "NEGATIVE TRSA SERVICE" or make a similar comment, on initial contact with approach control or ground control, as appropriate.

3. TRSAs are depicted on sectional aeronautical charts and listed in the Chart Supplement U.S.

4. While operating within a TRSA, pilots are provided TRSA service and separation as prescribed in this paragraph. In the event of a radar outage, separation and sequencing of VFR aircraft will be suspended as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information, and the time or place to contact the tower. Traffic information will be provided on a workload permitting basis.

5. Visual separation is used when prevailing conditions permit and it will be applied as follows:

(a) When a VFR flight is positioned behind a preceding aircraft and the pilot reports having that aircraft in sight, the pilot will be instructed by ATC to follow the preceding aircraft. Radar service will be continued to the runway. THE ATC INSTRUCTION TO FOLLOW THE PRECEDING AIRCRAFT DOES NOT AUTHORIZE THE PILOT TO COMPLY WITH ANY ATC CLEARANCE OR INSTRUCTION ISSUED TO THE PRECEDING AIRCRAFT.

(b) If other "nonparticipating" or "local" aircraft are in the traffic pattern, the tower will issue a landing sequence.

(c) Departing VFR aircraft may be asked if they can visually follow a preceding departure out of the TRSA. The pilot will be instructed to follow the other aircraft provided that the pilot can maintain visual contact with that aircraft.

6. Participating VFR aircraft will be separated from IFR and other participating VFR aircraft by one of the following:

(a) 500 feet vertical separation.

(b) Visual separation.

(c) Target resolution (a process to ensure that correlated radar targets do not touch).

7. Participating pilots operating VFR in a TRSA:

(a) Must maintain an altitude when assigned by ATC unless the altitude assignment is to maintain at or below a specified altitude. ATC may assign altitudes for separation that do not conform to 14 CFR Section 91.159. When the altitude assignment is no longer needed for separation or when leaving the TRSA, the instruction will be broadcast, "RESUME APPROPRIATE VFR ALTITUDES." Pilots must then return to an altitude that conforms to 14 CFR Section 91.159 as soon as practicable.

(b) When not assigned an altitude, the pilot should coordinate with ATC prior to any altitude change.

8. Within the TRSA, traffic information on observed but unidentified targets will, to the extent possible, be provided to all IFR and participating VFR aircraft. The pilot will be vectored upon request to avoid the observed traffic, provided the aircraft to be vectored is within the airspace under the jurisdiction of the controller.

9. Departing aircraft should inform ATC of their intended destination and/or route of flight and proposed cruising altitude.

10. ATC will normally advise participating VFR aircraft when leaving the geographical limits of the TRSA. Radar service is not automatically terminated with this advisory unless specifically stated by the controller.

c. Class C Service. This service provides, in addition to basic radar service, approved separation between IFR and VFR aircraft, and sequencing of VFR arrivals to the primary airport.

d. Class B Service. This service provides, in addition to basic radar service, approved separation of aircraft based on IFR, VFR, and/or weight, and sequencing of VFR arrivals to the primary airport(s).

e. PILOT RESPONSIBILITY. THESE SER-VICES ARE NOT TO BE INTERPRETED AS RELIEVING PILOTS OF THEIR RESPONSIBILI-TIES TO SEE AND AVOID OTHER TRAFFIC OPERATING IN BASIC VFR WEATHER CONDI-TIONS, TO ADJUST THEIR OPERATIONS AND FLIGHT PATH AS NECESSARY TO PRECLUDE SERIOUS WAKE ENCOUNTERS, TO MAINTAIN APPROPRIATE TERRAIN AND OBSTRUCTION CLEARANCE, OR TO REMAIN IN WEATHER CONDITIONS EQUAL TO OR BETTER THAN THE MINIMUMS REQUIRED BY 14 CFR SECTION 91.155. WHENEVER COMPLIANCE WITH AN ASSIGNED ROUTE, HEADING AND/OR ALTITUDE IS LIKELY TO COMPRO-MISE PILOT RESPONSIBILITY RESPECTING TERRAIN AND OBSTRUCTION CLEARANCE, VORTEX EXPOSURE, AND WEATHER MINI-MUMS, APPROACH CONTROL SHOULD BE SO ADVISED AND A REVISED CLEARANCE OR INSTRUCTION OBTAINED.

f. ATC services for VFR aircraft participating in terminal radar services are dependent on ATC radar. Services for VFR aircraft are not available during periods of a radar outage. The pilot will be advised when VFR services are limited or not available.

NOTE-

Class B and Class C airspace are areas of regulated airspace. The absence of ATC radar does not negate the requirement of an ATC clearance to enter Class B airspace or two way radio contact with ATC to enter Class C airspace.

4–1–19. Tower En Route Control (TEC)

a. TEC is an ATC program to provide a service to aircraft proceeding to and from metropolitan areas. It links designated Approach Control Areas by a network of identified routes made up of the existing airway structure of the National Airspace System. The FAA initiated an expanded TEC program to include as many facilities as possible. The program's intent is to provide an overflow resource in the low altitude system which would enhance ATC services. A few facilities have historically allowed turbojets to proceed between certain city pairs, such as Milwaukee and Chicago, via tower en route and these locations may continue this service. However, the expanded TEC program will be applied, generally, for nonturbojet aircraft operating at and below 10,000 feet. The program is entirely within the approach control airspace of multiple terminal facilities. Essentially, it is for relatively short flights. Participating pilots are encouraged to use TEC for flights of two hours duration or less. If longer flights are planned, extensive coordination may be required within the multiple complex which could result in unanticipated delays.

b. Pilots requesting TEC are subject to the same delay factor at the destination airport as other aircraft

in the ATC system. In addition, departure and en route delays may occur depending upon individual facility workload. When a major metropolitan airport is incurring significant delays, pilots in the TEC program may want to consider an alternative airport experiencing no delay.

c. There are no unique requirements upon pilots to use the TEC program. Normal flight plan filing procedures will ensure proper flight plan processing. Pilots should include the acronym "TEC" in the remarks section of the flight plan when requesting tower en route control.

d. All approach controls in the system may not operate up to the maximum TEC altitude of 10,000 feet. IFR flight may be planned to any satellite airport in proximity to the major primary airport via the same routing.

4–1–20. Transponder and ADS–B Out Operation

a. General

1. Pilots should be aware that proper application of transponder and ADS-B operating procedures will provide both VFR and IFR aircraft with a higher degree of safety while operating on the ground and airborne. Transponder/ADS-B panel designs differ; therefore, a pilot should be thoroughly familiar with the operation of their particular equipment to maximize its full potential. ADS-B Out, and transponders with altitude reporting mode turned ON (Mode C or S), substantially increase the capability of surveillance systems to see an aircraft. This provides air traffic controllers, as well as pilots of suitably equipped aircraft (TCAS and ADS-B In), increased situational awareness and the ability to identify potential traffic conflicts. Even VFR pilots who are not in contact with ATC will be afforded greater protection from IFR aircraft and VFR aircraft that are receiving traffic advisories. Nevertheless, pilots should never relax their visual scanning for other aircraft, and should include the ADS-B In display (if equipped) in their normal traffic scan.

2. Air Traffic Control Radar Beacon System (ATCRBS) is similar to and compatible with military coded radar beacon equipment. Civil Mode A is identical to military Mode 3.

3. Transponder and ADS-B operations on the ground. Civil and military aircraft should operate

AIM

with the transponder in the altitude reporting mode (consult the aircraft's flight manual to determine the specific transponder position to enable altitude reporting) and ADS–B Out transmissions enabled at all airports, any time the aircraft is positioned on any portion of the airport movement area. This includes all defined taxiways and runways. Pilots must pay particular attention to ATIS and airport diagram notations, General Notes (included on airport charts), and comply with directions pertaining to transponder and ADS-B usage. Generally, these directions are:

(a) **Departures.** Select the transponder mode which allows altitude reporting and enable ADS-B during pushback or taxi-out from parking spot. Select TA or TA/RA (if equipped with TCAS) when taking the active runway.

(b) Arrivals. If TCAS equipped, deselect TA or TA/RA upon leaving the active runway, but continue transponder and ADS-B transmissions in the altitude reporting mode. Select STBY or OFF for transponder and ADS-B upon arriving at the aircraft's parking spot or gate.

4. Transponder and ADS-B Operations While Airborne.

(a) Unless otherwise requested by ATC, aircraft equipped with an ATC transponder maintained in accordance with 14 CFR Section 91.413 MUST operate with this equipment on the appropriate Mode 3/A code, or other code as assigned by ATC, and with altitude reporting enabled whenever in controlled airspace. If practicable, aircraft SHOULD operate with the transponder enabled in uncontrolled airspace.

(b) Aircraft equipped with ADS-B Out MUST operate with this equipment in the transmit mode at all times, unless otherwise requested by ATC.

(c) When participating in a VFR formation flight that is not receiving ATC services, only the lead aircraft should operate their transponder and ADS–B Out. All other aircraft should disable transponder and ADS–B transmissions once established within the formation.

NOTE-

If the formation flight is receiving ATC services, pilots can expect ATC to direct all non-lead aircraft to STOP SQUAWK, and should not do so until instructed.

5. A pilot on an IFR flight who elects to cancel the IFR flight plan prior to reaching their destination, should adjust the transponder/ADS-B according to VFR operations.

6. If entering a U.S. OFFSHORE AIRSPACE AREA from outside the U.S., the pilot should advise on first radio contact with a U.S. radar ATC facility that such equipment is available by adding "transponder" or "ADS-B" (if equipped) to the aircraft identification.

7. It should be noted by all users of ATC transponders and ADS-B Out systems that the surveillance coverage they can expect is limited to "line of sight" with ground radar and ADS-B radio sites. Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range or loss of aircraft contact. Though ADS-B often provides superior reception at low altitudes, poor coverage from any surveillance system can be improved by climbing to a higher altitude.

NOTE-

Pilots should refer to AIM, Paragraph 4–5–7, Automatic Dependent Surveillance – Broadcast (ADS–B) Services, for a complete description of operating limitations and procedures.

b. Transponder/ADS-B Code Designation

1. For ATC to utilize one of the 4096 discrete codes, a four-digit code designation will be used; for example, code 2102 will be expressed as "TWO ONE ZERO TWO."

NOTE-

Circumstances may occasionally require ATC to assign a non-discrete code; i.e., a code ending in "00."

REFERENCE-

FAA Order JO 7110.66, National Beacon Code Allocation Plan.

c. Automatic Altitude Reporting

1. Most transponders (Modes C and S) and all ADS-B Out systems are capable of automatic altitude reporting. This system converts aircraft altitude in 100-foot increments to coded digital information that is transmitted to the appropriate surveillance facility as well as to ADS-B In and TCAS systems.

2. Adjust the transponder/ADS-B to reply on the Mode 3/A code specified by ATC and with altitude reporting enabled, unless otherwise directed by ATC or unless the altitude reporting equipment has not been tested and calibrated as required by 14 CFR Section 91.217. If deactivation is required by ATC,
turn off the altitude reporting feature of your transponder/ADS-B. An instruction by ATC to "STOP ALTITUDE SQUAWK, ALTITUDE DIF-FERS BY (number of feet) FEET," may be an indication that the transmitted altitude information is incorrect, or that the aircraft's altimeter setting is incorrect. While an incorrect altimeter setting has no effect on the transmitted altitude information, it will cause the aircraft to fly at a true altitude different from the assigned altitude. When a controller indicates that an altitude readout is invalid, the pilot should verify that the aircraft altimeter is set correctly.

NOTE-

Altitude encoders are preset at standard atmospheric pressure. Local altimeter correction is applied by the surveillance facility before the altitude information is presented to ATC.

3. Pilots should report exact altitude or flight level to the nearest hundred foot increment when establishing initial contact with an ATC facility. Exact altitude or flight level reports on initial contact provide ATC with information that is required prior to using automatically reported altitude information for separation purposes. This will significantly reduce altitude verification requests.

d. IDENT Feature

Transponder/ADS-B Out equipment must be operated only as specified by ATC. Activate the "IDENT" feature only when requested by ATC.

e. Code Changes

1. When making routine code changes, pilots should avoid inadvertent selection of Codes 7500, 7600 or 7700 thereby causing momentary false alarms at automated ground facilities. For example, when switching from Code 2700 to Code 7200, switch first to 2200 then to 7200, NOT to 7700 and then 7200. This procedure applies to nondiscrete Code 7500 and all discrete codes in the 7600 and 7700 series (i.e., 7600–7677, 7700–7777) which will trigger special indicators in automated facilities. Only nondiscrete Code 7500 will be decoded as the hijack code.

2. Under no circumstances should a pilot of a civil aircraft operate the transponder on Code 7777. This code is reserved for military interceptor operations.

3. Military pilots operating VFR or IFR within restricted/warning areas should adjust their transpon-

ders to Code 4000 unless another code has been assigned by ATC.

f. Mode C Transponder and ADS-B Out Requirements

1. Specific details concerning requirements to carry and operate Mode C transponders and ADS–B Out, as well as exceptions and ATC authorized deviations from those requirements, are found in 14 CFR Sections 91.215, 91.225, and 99.13.

2. In general, the CFRs require aircraft to be equipped with an operable Mode C transponder and ADS–B Out when operating:

(a) In Class A, Class B, or Class C airspace areas;

(b) Above the ceiling and within the lateral boundaries of Class B or Class C airspace up to 10,000 feet MSL;

(c) Class E airspace at and above 10,000 feet MSL within the 48 contiguous states and the District of Columbia, excluding the airspace at and below 2,500 feet AGL;

(d) Within 30 miles of a Class B airspace primary airport, below 10,000 feet MSL (commonly referred to as the "Mode C Veil");

(e) For ADS–B Out: Class E airspace at and above 3,000 feet MSL over the Gulf of Mexico from the coastline of the United States out to 12 nautical miles.

NOTE-

The airspace described in (e) above is specified in 14 CFR § 91.225 for ADS-B Out requirements. However, 14 CFR § 91.215 does not include this airspace for ATC transponder requirements.

(f) Transponder and ADS-B Out requirements do not apply to any aircraft that was not originally certificated with an electrical system, or that has not subsequently been certified with such a system installed, including balloons and gliders. These aircraft may conduct operations without a transponder or ADS-B Out when operating:

(1) Outside any Class B or Class C airspace area; and

(2) Below the altitude of the ceiling of a Class B or Class C airspace area designated for an airport, or 10,000 feet MSL, whichever is lower.

3. 14 CFR Section 99.13 requires all aircraft flying into, within, or across the contiguous U.S.

ADIZ be equipped with a Mode C or Mode S transponder. Balloons, gliders and aircraft not equipped with an engine–driven electrical system are excepted from this requirement.

REFERENCE-

AIM, Chapter 5, Section 6, National Security and Interception Procedures.

4. Pilots must ensure that their aircraft transponder/ADS-B is operating on an appropriate ATC-assigned VFR/IFR code with altitude reporting enabled when operating in such airspace. If in doubt about the operational status of either feature of your transponder while airborne, contact the nearest ATC facility or FSS and they will advise you what facility you should contact for determining the status of your equipment.

5. In-flight requests for "immediate" deviation from the transponder requirements may be approved by controllers only for failed equipment, and only when the flight will continue IFR or when weather conditions prevent VFR descent and continued VFR flight in airspace not affected by the CFRs. All other requests for deviation should be made at least 1 hour before the proposed operation by contacting the nearest Flight Service or Air Traffic facility in person or by telephone. The nearest ARTCC will normally be the controlling agency and is responsible for coordinating requests involving deviations in other ARTCC areas.

6. In-flight requests for "immediate" deviation from the ADS-B Out requirements may be approved by ATC only for failed equipment, and may be accommodated based on workload, alternate surveillance availability, or other factors. All other requests for deviation must be made at least 1 hour before the proposed operation, following the procedures contained in Advisory Circular (AC) 90–114, Automatic Dependent Surveillance–Broadcast Operations.

g. Transponder/ADS-B Operation Under Visual Flight Rules (VFR)

1. Unless otherwise instructed by an ATC facility, adjust transponder/ADS-B to reply on Mode 3/A Code 1200 regardless of altitude.

NOTE-

1. Firefighting aircraft not in contact with ATC may squawk 1255 in lieu of 1200 while en route to, from, or within the designated firefighting area(s).

2. VFR aircraft flying authorized SAR missions for the USAF or USCG may be advised to squawk 1277 in lieu of 1200 while en route to, from, or within the designated search area.

3. VFR gliders should squawk 1202 in lieu of 1200. *REFERENCE*-

FAA Order JO 7110.66, National Beacon Code Allocation Plan.

2. When required to operate their transponder/ ADS-B, pilots must always operate that equipment with altitude reporting enabled, unless otherwise instructed by ATC or unless the installed equipment has not been tested and calibrated as required by 14 CFR Section 91.217. If deactivation is required, turn off altitude reporting.

3. When participating in a VFR formation flight that is not receiving ATC services, only the lead aircraft should operate their transponder and ADS–B Out. All other aircraft should disable transponder and ADS–B transmissions once established within the formation.

NOTE-

If the formation flight is receiving ATC services, pilots can expect ATC to direct all non-lead aircraft to STOP SQUAWK, and should not do so until instructed.

h. Cooperative Surveillance Phraseology

Air traffic controllers, both civil and military, will use the following phraseology when referring to operation of cooperative ATC surveillance equipment. Except as noted, the following ATC instructions do not apply to military transponders operating in other than Mode 3/A/C/S.

1. SQUAWK (number). Operate radar beacon transponder/ADS–B on designated code with altitude reporting enabled.

2. IDENT. Engage the "IDENT" feature (military I/P) of the transponder/ADS–B.

3. SQUAWK (number) AND IDENT. Operate transponder/ADS-B on specified code with altitude reporting enabled, and engage the "IDENT" (military I/P) feature.

4. SQUAWK STANDBY. Switch transponder/ADS–B to standby position.

5. SQUAWK NORMAL. Resume normal transponder/ADS-B operation on previously assigned code. (Used after "SQUAWK STANDBY," or by military after specific transponder tests).

6. SQUAWK ALTITUDE. Activate Mode C with automatic altitude reporting.

7. STOP ALTITUDE SQUAWK. Turn off automatic altitude reporting.

8. STOP SQUAWK (Mode in use). Stop transponder and ADS–B Out transmissions, or switch off only specified mode of the aircraft transponder (military).

9. SQUAWK MAYDAY. Operate transponder/ADS–B in the emergency position (Mode A Code 7700 for civil transponder. Mode 3 Code 7700 and emergency feature for military transponder.)

10. SQUAWK VFR. Operate radar beacon transponder/ADS-B on Code 1200 in the Mode A/3, or other appropriate VFR code, with altitude reporting enabled.

4–1–21. Airport Reservation Operations and Special Traffic Management Programs

This section describes procedures for obtaining required airport reservations at airports designated by the FAA and for airports operating under Special Traffic Management Programs.

a. Slot Controlled Airports.

1. The FAA may adopt rules to require advance operations for unscheduled operations at certain airports. In addition to the information in the rules adopted by the FAA, a listing of the airports and relevant information will be maintained on the FAA website listed below.

2. The FAA has established an Airport Reservation Office (ARO) to receive and process reservations for unscheduled flights at the slot controlled airports. The ARO uses the Enhanced Computer Voice Reservation System (e–CVRS) to allocate reservations. Reservations will be available beginning 72 hours in advance of the operation at the slot controlled airport. Standby lists are not maintained. Flights with declared emergencies do not require reservations. Refer to the website or touch-tone phone interface for the current listing of slot controlled airports, limitations, and reservation procedures.

NOTE-

The web interface/telephone numbers to obtain a reservation for unscheduled operations at a slot controlled airport are:

- 1. http://www.fly.faa.gov/ecvrs.
- 2. Touch-tone: 1-800-875-9694
- 3. Trouble number: 540-422-4246.

3. For more detailed information on operations and reservation procedures at a Slot Controlled Airport, please see 14 CFR Part 93, Subpart K – High Density Traffic Airports.

b. Special Traffic Management Programs (STMP).

1. Special procedures may be established when a location requires special traffic handling to accommodate above normal traffic demand (for example, the Indianapolis 500, Super Bowl, etc.) or reduced airport capacity (for example, airport runway/taxiway closures for airport construction). The special procedures may remain in effect until the problem has been resolved or until local traffic management procedures can handle the situation and a need for special handling no longer exists.

2. There will be two methods available for obtaining slot reservations through the ATC-SCC: the web interface and the touch-tone interface. If these methods are used, a NOTAM will be issued relaying the website address and toll free telephone number. Be sure to check current NOTAMs to determine: what airports are included in the STMP, the dates and times reservations are required, the time limits for reservation requests, the point of contact for reservations, and any other instructions.

NOTE-

The telephone numbers/web address to obtain a STMP slot are:

- 1.Touch-tone interface: 1-800-875-9755.
- 2. Web interface: www.fly.faa.gov.
- 3. Trouble number: 540-422-4246.

c. Users may contact the ARO at (540) 422–4246 if they have a problem making a reservation or have a question concerning the slot controlled airport/STMP regulations or procedures.

d. Making Reservations.

1. Internet Users. Detailed information and User Instruction Guides for using the Web interface to the reservation systems are available on the websites for the slot controlled airports (e-CVRS), http://www.fly.faa.gov/ecvrs; and STMPs (e-STMP), http://www.fly.faa.gov/estmp.

4–1–22. Requests for Waivers and Authorizations from Title 14, Code of Federal Regulations (14 CFR)

a. Requests for a Certificate of Waiver or Authorization (FAA Form 7711–2), or requests for renewal of a waiver or authorization, may be accepted by any FAA facility and will be forwarded, if necessary, to the appropriate office having waiver authority.

b. The grant of a Certificate of Waiver or Authorization from 14 CFR constitutes relief from specific regulations, to the degree and for the period of time specified in the certificate, and does not waive any state law or local ordinance. Should the proposed operations conflict with any state law or local ordinance, or require permission of local authorities or property owners, it is the applicant's responsibility to resolve the matter. The holder of a waiver is responsible for compliance with the terms of the waiver and its provisions. **c.** A waiver may be canceled at any time by the Administrator, the person authorized to grant the waiver, or the representative designated to monitor a specific operation. In such case either written notice of cancellation, or written confirmation of a verbal cancellation will be provided to the holder.

4–1–23. Weather Systems Processor

The Weather Systems Processor (WSP) was developed for use in the National Airspace System to provide weather processor enhancements to selected Airport Surveillance Radar (ASR)–9 facilities. The WSP provides Air Traffic with warnings of hazardous wind shear and microbursts. The WSP also provides users with terminal area 6–level weather, storm cell locations and movement, as well as the location and predicted future position and intensity of wind shifts that may affect airport operations. command must notify ATC as soon as possible and obtain an amended clearance. In an emergency situation which does not result in a deviation from the rules prescribed in 14 CFR Part 91 but which requires ATC to give priority to an aircraft, the pilot of such aircraft must, when requested by ATC, make a report within 48 hours of such emergency situation to the manager of that ATC facility.

g. The guiding principle is that the last ATC clearance has precedence over the previous ATC clearance. When the route or altitude in a previously issued clearance is amended, the controller will restate applicable altitude restrictions. If altitude to maintain is changed or restated, whether prior to departure or while airborne, and previously issued altitude restrictions are omitted, those altitude restrictions are canceled, including departure procedures and STAR altitude restrictions.

EXAMPLE-

1. A departure flight receives a clearance to destination airport to maintain FL 290. The clearance incorporates a DP which has certain altitude crossing restrictions. Shortly after takeoff, the flight receives a new clearance changing the maintaining FL from 290 to 250. If the altitude restrictions are still applicable, the controller restates them.

2. A departing aircraft is cleared to cross Fluky Intersection at or above 3,000 feet, Gordonville VOR at or above 12,000 feet, maintain FL 200. Shortly after departure, the altitude to be maintained is changed to FL 240. If the altitude restrictions are still applicable, the controller issues an amended clearance as follows: "cross Fluky Intersection at or above three thousand, cross Gordonville V-O-R at or above one two thousand, maintain Flight Level two four zero."

3. An arriving aircraft is cleared to the destination airport via V45 Delta VOR direct; the aircraft is cleared to cross Delta VOR at 10,000 feet, and then to maintain 6,000 feet. Prior to Delta VOR, the controller issues an amended clearance as follows: "turn right heading one eight zero for vector to runway three six I-L-S approach, maintain six thousand."

NOTE-

Because the altitude restriction "cross Delta V-O-R at 10,000 feet" was omitted from the amended clearance, it is no longer in effect.

h. Pilots of turbojet aircraft equipped with afterburner engines should advise ATC prior to takeoff if they intend to use afterburning during their climb to the en route altitude. Often, the controller

may be able to plan traffic to accommodate a high performance climb and allow the aircraft to climb to the planned altitude without restriction.

i. If an "expedite" climb or descent clearance is issued by ATC, and the altitude to maintain is subsequently changed or restated without an expedite instruction, the expedite instruction is canceled. Expedite climb/descent normally indicates to the pilot that the approximate best rate of climb/descent should be used without requiring an exceptional change in aircraft handling characteristics. Normally controllers will inform pilots of the reason for an instruction to expedite.

4-4-11. IFR Separation Standards

a. ATC effects separation of aircraft vertically by assigning different altitudes; longitudinally by providing an interval expressed in time or distance between aircraft on the same, converging, or crossing courses, and laterally by assigning different flight paths.

b. Separation will be provided between all aircraft operating on IFR flight plans except during that part of the flight (outside Class B airspace or a TRSA) being conducted on a VFR-on-top/VFR conditions clearance. Under these conditions, ATC may issue traffic advisories, but it is the sole responsibility of the pilot to be vigilant so as to see and avoid other aircraft.

c. When radar is employed in the separation of aircraft at the same altitude, a minimum of 3 miles separation is provided between aircraft operating within 40 miles of the radar antenna site, and 5 miles between aircraft operating beyond 40 miles from the antenna site. These minima may be increased or decreased in certain specific situations.

NOTE-

Certain separation standards may be increased in the terminal environment due to radar outages or other technical reasons.

4-4-12. Speed Adjustments

a. ATC will issue speed adjustments to pilots of radar-controlled aircraft to achieve or maintain appropriate spacing. If necessary, ATC will assign a speed when approving deviations or radar vectoring off procedures that include published speed restrictions. If no speed is assigned, speed becomes pilot's discretion. However, when the aircraft reaches the end of the STAR, the last published speed on the

STAR must be maintained until ATC deletes it, assigns a new speed, issues a vector, assigns a direct route, or issues an approach clearance.

b. ATC will express all speed adjustments in terms of knots based on indicated airspeed (IAS) in 5 or 10 knot increments except that at or above FL 240 speeds may be expressed in terms of Mach numbers in 0.01 increments. The use of Mach numbers is restricted to turbojet aircraft with Mach meters.

c. Pilots complying with speed adjustments (published or assigned) are expected to maintain a speed within plus or minus 10 knots or 0.02 Mach number of the specified speed.

d. When ATC assigns speed adjustments, it will be in accordance with the following recommended minimums:

1. To aircraft operating between FL 280 and 10,000 feet, a speed not less than 250 knots or the equivalent Mach number.

NOTE-

1. On a standard day the Mach numbers equivalent to 250 knots CAS (subject to minor variations) are:

FL 240-0.6 FL 250-0.61 FL 260-0.62 FL 270-0.64 FL 280-0.65 FL 290-0.66.

2. When an operational advantage will be realized, speeds lower than the recommended minima may be applied.

2. To arriving turbojet aircraft operating below 10,000 feet:

(a) A speed not less than 210 knots, except;

(b) Within 20 flying miles of the airport of intended landing, a speed not less than 170 knots.

3. To arriving reciprocating engine or turboprop aircraft within 20 flying miles of the runway threshold of the airport of intended landing, a speed not less than 150 knots.

4. To departing aircraft:

(a) Turbojet aircraft, a speed not less than 230 knots.

(b) Reciprocating engine aircraft, a speed not less than 150 knots.

e. When ATC combines a speed adjustment with a descent clearance, the sequence of delivery, with the word "then" between, indicates the expected order of execution.

EXAMPLE-

1. Descend and maintain (altitude); then, reduce speed to (speed).

2. Reduce speed to (speed); then, descend and maintain (altitude).

NOTE-

The maximum speeds below 10,000 feet as established in 14 CFR Section 91.117 still apply. If there is any doubt concerning the manner in which such a clearance is to be executed, request clarification from ATC.

f. If ATC determines (before an approach clearance is issued) that it is no longer necessary to apply speed adjustment procedures, they will:

1. Advise the pilot to "resume normal speed." Normal speed is used to terminate ATC assigned speed adjustments on segments where no published speed restrictions apply. It does not cancel published restrictions on upcoming procedures. This does not relieve the pilot of those speed restrictions which are applicable to 14 CFR Section 91.117.

EXAMPLE-

(An aircraft is flying a SID with no published speed restrictions. ATC issues a speed adjustment and instructs the aircraft where the adjustment ends): "Maintain two two zero knots until BALTR then resume normal speed."

NOTE-

The ATC assigned speed assignment of two two zero knots would apply until BALTR. The aircraft would then resume a normal operating speed while remaining in compliance with 14 CFR Section 91.117.

2. Instruct pilots to "comply with speed restrictions" when the aircraft is joining or resuming a charted procedure or route with published speed restrictions.

EXAMPLE-

(ATC vectors an aircraft off of a SID to rejoin the procedure at a subsequent waypoint. When instructing the aircraft to resume the procedure, ATC also wants the aircraft to comply with the published procedure speed restrictions): "Resume the SALTY ONE departure. Comply with speed restrictions."

CAUTION-

The phraseology "Descend via/Climb via SID" requires compliance with all altitude and/or speed restrictions depicted on the procedure.

3. Instruct the pilot to "resume published speed." Resume published speed is issued to

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with a series of short, regularly spaced eye movements that bring successive areas of the sky into the central visual field. Each movement should not exceed ten degrees, and each area should be observed for at least one second to enable collision detection. Although many pilots seem to prefer the method of horizontal back–and–forth scanning every pilot should develop a scanning pattern that is not only comfortable but assures optimum effectiveness. Pilots should remember, however, that they have a regulatory responsibility (14 CFR Section 91.113(a)) to see and avoid other aircraft when weather conditions permit.

4–4–15. Use of Visual Clearing Procedures and Scanning Techniques

a. Before Takeoff. Prior to taxiing onto a runway or landing area in preparation for takeoff, pilots should scan the approach areas for possible landing traffic and execute the appropriate clearing maneuvers to provide them a clear view of the approach areas.

b. Climbs and Descents. During climbs and descents in flight conditions which permit visual detection of other traffic, pilots should execute gentle banks, left and right at a frequency which permits continuous visual scanning of the airspace about them.

c. Straight and Level. Sustained periods of straight and level flight in conditions which permit visual detection of other traffic should be broken at intervals with appropriate clearing procedures to provide effective visual scanning.

d. Traffic Pattern. Entries into traffic patterns while descending create specific collision hazards and should be avoided.

e. Traffic at VOR Sites. All operators should emphasize the need for sustained vigilance in the vicinity of VORs and airway intersections due to the convergence of traffic.

f. Training Operations. Operators of pilot training programs are urged to adopt the following practices:

1. Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out "clear" left, right, above, or

below) to instill and sustain the habit of vigilance during maneuvering.

2. High-wing airplane. Momentarily raise the wing in the direction of the intended turn and look.

3. Low-wing airplane. Momentarily lower the wing in the direction of the intended turn and look.

4. Appropriate clearing procedures should precede the execution of all turns including chandelles, lazy eights, stalls, slow flight, climbs, straight and level, spins, and other combination maneuvers.

g. Scanning Techniques for Traffic Avoidance.

1. Pilots must be aware of the limitations inherent in the visual scanning process. These limitations may include:

(a) Reduced scan frequency due to concentration on flight instruments or tablets and distraction with passengers.

(b) Blind spots related to high-wing and low-wing aircraft in addition to windshield posts and sun visors.

(c) Prevailing weather conditions including reduced visibility and the position of the sun.

(d) The attitude of the aircraft will create additional blind spots.

(e) The physical limitations of the human eye, including the time required to (re)focus on near and far objects, from the instruments to the horizon for example; empty field myopia, narrow field of vision and atmospheric lighting all affect our ability to detect another aircraft.

2. Best practices to see and avoid:

(a) ADS–B In is an effective system to help pilots see and avoid other aircraft. If your aircraft is equipped with ADS–B In, it is important to understand its features and how to use it properly. Many units provide visual and/or audio alerts to supplement the system's traffic display. Pilots should incorporate the traffic display in their normal traffic scan to provide awareness of nearby aircraft. Prior to taxiing onto an airport movement area, ADS–B In can provide advance indication of arriving aircraft and aircraft in the traffic pattern. Systems that incorporate a traffic–alerting feature can help minimize the pilot's inclination to fixate on the display. Refer to 4–5–7e, ADS–B Limitations. (b) Understand the limitations of ADS-B In. In certain airspace, not all aircraft will be equipped with ADS-B Out or transponders and will not be visible on your ADS-B In display.

(c) Limit the amount of time that you focus on flight instruments or tablets.

(d) Develop a strategic approach to scanning for traffic. Scan the entire sky and try not to focus straight ahead.

4–4–16. Traffic Alert and Collision Avoidance System (TCAS I & II)

a. TCAS I provides proximity warning only, to assist the pilot in the visual acquisition of intruder aircraft. No recommended avoidance maneuvers are provided nor authorized as a direct result of a TCAS I warning. It is intended for use by smaller commuter aircraft holding 10 to 30 passenger seats, and general aviation aircraft.

b. TCAS II provides traffic advisories (TA) and resolution advisories (RA). Resolution advisories provide recommended maneuvers in a vertical direction (climb or descend only) to avoid conflicting traffic. Transport category aircraft, and larger commuter and business aircraft holding 31 passenger seats or more, are required to be TCAS II equipped.

1. When a TA occurs, attempt to establish visual contact with the traffic but do not deviate from an assigned clearance based only on TA information.

2. When an RA occurs, pilots should respond immediately to the RA displays and maneuver as indicated unless doing so would jeopardize the safe operation of the flight, or the flight crew can ensure separation with the help of definitive visual acquisition of the aircraft causing the RA.

3. Each pilot who deviates from an ATC clearance in response to an RA must notify ATC of that deviation as soon as practicable, and notify ATC when clear of conflict and returning to their previously assigned clearance.

c. Deviations from rules, policies, or clearances should be kept to the minimum necessary to satisfy an

RA. Most RA maneuvering requires minimum excursion from assigned altitude.

d. The serving IFR air traffic facility is not responsible to provide approved standard IFR separation to an IFR aircraft, from other aircraft, terrain, or obstructions after an RA maneuver until one of the following conditions exists:

1. The aircraft has returned to its assigned altitude and course.

2. Alternate ATC instructions have been issued.

3. A crew member informs ATC that the TCAS maneuver has been completed.

NOTE-

TCAS does not alter or diminish the pilot's basic authority and responsibility to ensure safe flight. Since TCAS does not respond to aircraft which are not transponder equipped or aircraft with a transponder failure, TCAS alone does not ensure safe separation in every case. At this time, no air traffic service nor handling is predicated on the availability of TCAS equipment in the aircraft.

4-4-17. Traffic Information Service (TIS)

a. TIS provides proximity warning only, to assist the pilot in the visual acquisition of intruder aircraft. No recommended avoidance maneuvers are provided nor authorized as a direct result of a TIS intruder display or TIS alert. It is intended for use by aircraft in which TCAS is not required.

b. TIS does not alter or diminish the pilot's basic authority and responsibility to ensure safe flight. Since TIS does not respond to aircraft which are not transponder equipped, aircraft with a transponder failure, or aircraft out of radar coverage, TIS alone does not ensure safe separation in every case.

c. At this time, no air traffic service nor handling is predicated on the availability of TIS equipment in the aircraft.

d. Presently, no air traffic services or handling is predicated on the availability of an ADS–B cockpit display. A "traffic–in–sight" reply to ATC must be based on seeing an aircraft out–the–window, <u>NOT</u> on the cockpit display.

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Section 5. Surveillance Systems

4-5-1. Radar

a. Capabilities

1. Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. Range is determined by measuring the time it takes (at the speed of light) for the radio wave to go out to the object and then return to the receiving antenna. The direction of a detected object from a radar site is determined by the position of the rotating antenna when the reflected portion of the radio wave is received.

2. More reliable maintenance and improved equipment have reduced radar system failures to a negligible factor. Most facilities actually have some components duplicated, one operating and another which immediately takes over when a malfunction occurs to the primary component.

b. Limitations

1. It is very important for the aviation community to recognize the fact that there are limitations to radar service and that ATC controllers may not always be able to issue traffic advisories concerning aircraft which are not under ATC control and cannot be seen on radar. (See FIG 4-5-1.)



FIG 4-5-1 Limitations to Radar Service (a) The characteristics of radio waves are such that they normally travel in a continuous straight line unless they are:

(1) "Bent" by abnormal atmospheric phenomena such as temperature inversions;

(2) Reflected or attenuated by dense objects such as heavy clouds, precipitation, ground obstacles, mountains, etc.; or

(3) Screened by high terrain features.

(b) The bending of radar pulses, often called anomalous propagation or ducting, may cause many extraneous blips to appear on the radar operator's display if the beam has been bent toward the ground or may decrease the detection range if the wave is bent upward. It is difficult to solve the effects of anomalous propagation, but using beacon radar and electronically eliminating stationary and slow moving targets by a method called moving target indicator (MTI) usually negate the problem.

(c) Radar energy that strikes dense objects will be reflected and displayed on the operator's scope thereby blocking out aircraft at the same range and greatly weakening or completely eliminating the display of targets at a greater range. Again, radar beacon and MTI are very effectively used to combat ground clutter and weather phenomena, and a method of circularly polarizing the radar beam will eliminate some weather returns. A negative characteristic of MTI is that an aircraft flying a speed that coincides with the canceling signal of the MTI (tangential or "blind" speed) may not be displayed to the radar controller.

(d) Relatively low altitude aircraft will not be seen if they are screened by mountains or are below the radar beam due to earth curvature. The historical solution to screening has been the installation of strategically placed multiple radars, which has been done in some areas, but ADS–B now provides ATC surveillance in some areas with challenging terrain where multiple radar installations would be impractical.

(e) There are several other factors which affect radar control. The amount of reflective surface of an aircraft will determine the size of the radar return. Therefore, a small light airplane or a sleek jet fighter will be more difficult to see on primary radar than a large commercial jet or military bomber. Here again, the use of transponder or ADS–B equipment is invaluable. In addition, all FAA ATC facilities display automatically reported altitude information to the controller from appropriately equipped aircraft.

(f) At some locations within the ATC en route environment, secondary-radar-only (no primary radar) gap filler radar systems are used to give lower altitude radar coverage between two larger radar systems, each of which provides both primary and secondary radar coverage. ADS-B serves this same role, supplementing both primary and secondary radar. In those geographical areas served by secondary radar only or ADS-B, aircraft without either transponders or ADS-B equipment cannot be provided with radar service. Additionally, transponder or ADS-B equipped aircraft cannot be provided with radar advisories concerning primary targets and ATC radar-derived weather.

REFERENCE-

Pilot/Controller Glossary Term- Radar.

(g) With regard to air traffic radar reception, wind turbines generally do not affect the quality of air traffic surveillance radar returns for transponder and ADS-B Out equipped aircraft. Air traffic interference issues apply to the search radar and Non-Transponder/Non-ADS-B Out equipped aircraft.

NOTE-

Generally, one or two wind turbines don't present a significant radar reception loss. A rule of thumb is three (3) or more turbines constitute a wind turbine farm and thus negatively affect the search radar product.

(1) Detection loss in the area of a wind turbine farm is substantial. In extreme circumstances, this can extend for more than 1.0 nautical mile (NM) horizontally around the nearest turbine and at all altitudes above the wind turbine farm. (See FIG 4-5-2.)

FIG 4–5–2 Wind Turbine Farm Area of Potential Interference



NOTE-

All aircraft should comply with 14 CFR §91.119(c) "...aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure."

(2) To avoid interference Non-Transponder/Non-ADS-B Out equipped aircraft should avoid flight within 1.0 NM horizontally, at all altitudes, from the wind turbine farms.

(3) Because detection loss near and above wind turbine farms for search-only targets causes dropped tracks, erroneous tracks, and can result in loss of separation, it is imperative that Non-Transponder/Non-ADS-B Out equipped aircraft operate at the proper VFR altitudes per hemispheric rule and utilize see-and-avoid techniques.

(4) Pilots should be aware that air traffic controllers cannot provide separation from Non-Transponder/Non-ADS-B Out equipped aircraft in the vicinity of wind turbine farms. See-and-avoid is the pilot's responsibility, as these non-equipped aircraft may not appear on radar and will not appear on the Traffic Information Services-Broadcast (TIS-B).

(h) The controller's ability to advise a pilot flying on instruments or in visual conditions of the aircraft's proximity to another aircraft will be limited if the unknown aircraft is not observed on radar, if no flight plan information is available, or if the volume of traffic and workload prevent issuing traffic information. The controller's first priority is given to establishing vertical, lateral, or longitudinal separation between aircraft flying IFR under the control of ATC.

c. FAA radar units operate continuously at the locations shown in the Chart Supplement U.S., and their services are available to all pilots, both civil and military. Contact the associated FAA control tower or ARTCC on any frequency guarded for initial instructions, or in an emergency, any FAA facility for information on the nearest radar service.

4–5–2. Air Traffic Control Radar Beacon System (ATCRBS)

a. The ATCRBS, sometimes referred to as secondary surveillance radar, consists of three main components:

1. Interrogator. Primary radar relies on a signal being transmitted from the radar antenna site and for this signal to be reflected or "bounced back" from an object (such as an aircraft). This reflected signal is then displayed as a "target" on the controller's radarscope. In the ATCRBS, the Interrogator, a ground based radar beacon transmitter–receiver, scans in synchronism with the primary radar and transmits discrete radio signals which repetitiously request all transponders, on the mode being used, to reply. The replies received are then mixed with the primary returns and both are displayed on the same radarscope.

2. Transponder. This airborne radar beacon transmitter–receiver automatically receives the sig-

nals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much stronger than a primary radar return.

3. Radarscope. The radarscope used by the controller displays returns from both the primary radar system and the ATCRBS. These returns, called targets, are what the controller refers to in the control and separation of traffic.

b. The job of identifying and maintaining identification of primary radar targets is a long and tedious task for the controller. Some of the advantages of ATCRBS over primary radar are:

1. Reinforcement of radar targets.

2. Rapid target identification.

3. Unique display of selected codes.

c. A part of the ATCRBS ground equipment is the decoder. This equipment enables a controller to assign discrete transponder codes to each aircraft under his/her control. Normally only one code will be assigned for the entire flight. Assignments are made by the ARTCC computer on the basis of the National Beacon Code Allocation Plan. The equipment is also designed to receive Mode C altitude information from the aircraft.

NOTE-

Refer to figures with explanatory legends for an illustration of the target symbology depicted on radar scopes in the NAS Stage A (en route), the ARTS III (terminal) Systems, and other nonautomated (broadband) radar systems. (See FIG 4-5-3 and FIG 4-5-4.)

d. It should be emphasized that aircraft transponders greatly improve the effectiveness of radar systems.

REFERENCE-

AIM, Paragraph 4–1–20, Transponder and ADS-B Out Operation.

FIG 4-5-3 ARTS III Radar Scope With Alphanumeric Data



NOTE-

A number of radar terminals do not have ARTS equipment. Those facilities and certain ARTCCs outside the contiguous U.S. would have radar displays similar to the lower right hand subset. ARTS facilities and NAS Stage A ARTCCs, when operating in the nonautomation mode, would also have similar displays and certain services based on automation may not be available.

EXAMPLE-

- 1. Areas of precipitation (can be reduced by CP)
- 2. Arrival/departure tabular list
- 3. Trackball (control) position symbol (A)
- 4. Airway (lines are sometimes deleted in part)
- 5. Radar limit line for control
- 6. Obstruction (video map)

7. Primary radar returns of obstacles or terrain (can be removed by MTI)

8. Satellite airports

9. Runway centerlines (marks and spaces indicate miles)

- 10. Primary airport with parallel runways
- 11. Approach gates
- 12. Tracked target (primary and beacon target)
- 13. Control position symbol

14. Untracked target select code (monitored) with Mode C readout of 5,000'

- 15. Untracked target without Mode C
- 16. Primary target
- 17. Beacon target only (secondary radar) (transponder)
- 18. Primary and beacon target
- **19.** Leader line

20. Altitude Mode C readout is 6,000'

(Note: readouts may not be displayed because of nonreceipt of beacon information, garbled beacon signals, and flight plan data which is displayed alternately with the altitude readout)

21. Ground speed readout is 240 knots (Note: readouts may not be displayed because of a loss of beacon signal, a controller alert that a pilot was squawking emergency, radio failure, etc.)

22. Aircraft ID

23. Asterisk indicates a controller entry in Mode C block. In this case 5,000' is entered and "05" would alternate with Mode C readout.

24. Indicates heavy

25. "Low ALT" flashes to indicate when an aircraft's predicted descent places the aircraft in an unsafe proximity to terrain.

(Note: this feature does not function if the aircraft is not squawking Mode C. When a helicopter or aircraft is known to be operating below the lower safe limit, the "low ALT" can be changed to "inhibit" and flashing ceases.)

26. NAVAIDs

27. Airways

28. Primary target only

29. Nonmonitored. No Mode C (an asterisk would indicate nonmonitored with Mode C)

30. Beacon target only (secondary radar based on aircraft transponder)

31. Tracked target (primary and beacon target) control position A

32. Aircraft is squawking emergency Code 7700 and is nonmonitored, untracked, Mode C

33. Controller assigned runway 36 right alternates with Mode C readout

(Note: a three letter identifier could also indicate the arrival is at specific airport)

- 34. Ident flashes
- 35. Identing target blossoms

36. Untracked target identing on a selected code

37. Range marks (10 and 15 miles) (can be changed/offset)

- 38. Aircraft controlled by center
- 39. Targets in suspend status

40. Coast/suspend list (aircraft holding, temporary loss of beacon/target, etc.)

41. Radio failure (emergency information)

42. Select beacon codes (being monitored)

43. General information (ATIS, runway, approach in use)

- 44. Altimeter setting
- 45. Time
- 46. System data area

FIG 4–5–4

NAS Stage A Controllers View Plan Display

This figure illustrates the controller's radar scope (PVD) when operating in the full automation (RDP) mode, which is normally 20 hours per day.

(When not in automation mode, the display is similar to the broadband mode shown in the ARTS III radar scope figure. Certain ARTCCs outside the contiguous U.S. also operate in "broadband" mode.)



EXAMPLE– Target symbols:

- 1. Uncorrelated primary radar target [°] [+]
- 2. Correlated primary radar target [×] *See note below.
- 3. Uncorrelated beacon target [/]
- 4. Correlated beacon target [\]
- *5. Identing beacon target* $[\equiv]$

*Note: in Number 2 correlated means the association of radar data with the computer projected track of an identified aircraft.

Position symbols:

- 6. Free track (no flight plan tracking) []
- 7. Flat track (flight plan tracking) $[\diamond]$
- 8. Coast (beacon target lost) [#]
- 9. Present position hold [\overline{X}]

Data block information:

10. Aircraft ident *See note below.

11. Assigned altitude FL 280, Mode C altitude same or within \pm 200' of assigned altitude. \Rightarrow See note below.

12. Computer ID #191, handoff is to sector 33 (0-33 would mean handoff accepted)
*See note below.

13. Assigned altitude 17,000', aircraft is climbing, Mode C readout was 14,300 when last beacon interrogation was received.

14. Leader line connecting target symbol and data block

15. Track velocity and direction vector line (projected ahead of target)

16. Assigned altitude 7,000, aircraft is descending, last Mode C readout (or last reported altitude) was 100' above FL 230

17. Transponder code shows in full data block only when different than assigned code

18. Aircraft is 300' above assigned altitude

19. Reported altitude (no Mode C readout) same as assigned. (An "n" would indicate no reported altitude.)

20. Transponder set on emergency Code 7700 (EMRG flashes to attract attention)

21. Transponder Code 1200 (VFR) with no Mode C

22. Code 1200 (VFR) with Mode C and last altitude readout

23. Transponder set on radio failure Code 7600 (RDOF flashes)

24. Computer ID #228, CST indicates target is in coast status

25. Assigned altitude FL 290, transponder code (these two items constitute a "limited data block")

*Note: numbers 10, 11, and 12 constitute a "full data block"

Other symbols:

26. Navigational aid

27. Airway or jet route

28. Outline of weather returns based on primary radar. "H" represents areas of high density precipitation which might be thunderstorms. Radial lines indicated lower density precipitation.

29. Obstruction

30. Airports

Major: □ Small: Г

4-5-3. Surveillance Radar

a. Surveillance radars are divided into two general categories: Airport Surveillance Radar (ASR) and Air Route Surveillance Radar (ARSR).

1. ASR is designed to provide relatively short-range coverage in the general vicinity of an airport and to serve as an expeditious means of handling terminal area traffic through observation of precise aircraft locations on a radarscope. The ASR can also be used as an instrument approach aid.

2. ARSR is a long-range radar system designed primarily to provide a display of aircraft locations over large areas.

b. Surveillance radars scan through 360 degrees of azimuth and present target information on a radar display located in a tower or center. This information is used independently or in conjunction with other navigational aids in the control of air traffic.

4-5-4. Precision Approach Radar (PAR)

a. PAR is designed for use as a landing aid rather than an aid for sequencing and spacing aircraft. PAR equipment may be used as a primary landing aid (See Chapter 5, Air Traffic Procedures, for additional information), or it may be used to monitor other types of approaches. It is designed to display range, azimuth, and elevation information.

b. Two antennas are used in the PAR array, one scanning a vertical plane, and the other scanning horizontally. Since the range is limited to 10 miles, azimuth to 20 degrees, and elevation to 7 degrees, only the final approach area is covered. Each scope is divided into two parts. The upper half presents altitude and distance information, and the lower half presents azimuth and distance.

4–5–5. Airport Surface Detection Equipment (ASDE–X)/Airport Surface Surveillance Capability (ASSC)

a. ASDE–X/ASSC is a multi–sensor surface surveillance system the FAA is acquiring for airports in the United States. This system provides high resolution, short–range, clutter free surveillance information about aircraft and vehicles, both moving and fixed, located on or near the surface of the airport's runways and taxiways under all weather and visibility conditions. The system consists of:

1. A Primary Radar System. ASDE–X/ ASSC system coverage includes the airport surface and the airspace up to 200 feet above the surface. Typically located on the control tower or other strategic location on the airport, the Primary Radar antenna is able to detect and display aircraft that are not equipped with or have malfunctioning transponders or ADS–B.

2. Interfaces. ASDE–X/ASSC contains an automation interface for flight identification via all automation platforms and interfaces with the terminal radar for position information.

3. Automation. A Multi–sensor Data Processor (MSDP) combines all sensor reports into a single target which is displayed to the air traffic controller.

4. Air Traffic Control Tower Display. A high resolution, color monitor in the control tower cab provides controllers with a seamless picture of airport operations on the airport surface.

b. The combination of data collected from the multiple sensors ensures that the most accurate information about aircraft location is received in the tower, thereby increasing surface safety and efficiency.

c. The following facilities are operational with ASDE-X:

BWI	Baltimore Washington International
BOS	Boston Logan International
BDL	Bradley International
MDW	Chicago Midway
ORD	Chicago O'Hare International
CLT	Charlotte Douglas International
DFW	Dallas/Fort Worth International
DEN	Denver International
DTW	Detroit Metro Wayne County
FLL	Fort Lauderdale/Hollywood Intl
MKE	General Mitchell International
IAH	George Bush International
ATL	Hartsfield–Jackson Atlanta Intl
HNL	Honolulu International
JFK	John F. Kennedy International
SNA	John Wayne–Orange County
LGA	LaGuardia

STL	Lambert St. Louis International
LAS	Las Vegas Harry Reid International
LAX	Los Angeles International
SDF	Louisville International
MEM	Memphis International
MIA	Miami International
MSP	Minneapolis St. Paul International
EWR	Newark International
MCO	Orlando International
PHL	Philadelphia International
PHX	Phoenix Sky Harbor International
DCA	Ronald Reagan Washington National
SAN	San Diego International
SLC	Salt Lake City International
SEA	Seattle–Tacoma International
PVD	Theodore Francis Green State
IAD	Washington Dulles International
HOU	William P. Hobby International

d. The following facilities have been projected to receive ASSC:

TBL 4-5-2

SFO	San Francisco International
CLE	Cleveland-Hopkins International
MCI	Kansas City International
CVG	Cincinnati/Northern Kentucky Intl
PDX	Portland International
MSY	Louis Armstrong New Orleans Intl
PIT	Pittsburgh International
ANC	Ted Stevens Anchorage International
ADW	Joint Base Andrews AFB

4–5–6. Traffic Information Service (TIS)

a. Introduction. The Traffic Information Service (TIS) provides information to the cockpit via data link, that is similar to VFR radar traffic advisories normally received over voice radio. Among the first FAA-provided data services, TIS is intended to improve the safety and efficiency of "see and avoid" flight through an automatic display that informs the pilot of nearby traffic and potential conflict situations. This traffic display is intended to assist the pilot in visual acquisition of these aircraft. TIS employs an enhanced capability of the terminal Mode S radar system, which contains the surveillance data, as well as the data link required to "uplink" this information to suitably-equipped aircraft (known as a TIS "client"). TIS provides estimated position, altitude, altitude trend, and ground track information for up to 8 intruder aircraft within 7 NM horizontally, +3,500 and -3,000 feet vertically of the client aircraft (see FIG 4–5–5, TIS Proximity Coverage Volume). The range of a target reported at a distance greater than 7 NM only indicates that this target will be a threat within 34 seconds and does not display a precise distance. TIS will alert the pilot to aircraft (under surveillance of the Mode S radar) that are estimated to be within 34 seconds of potential collision, regardless of distance or altitude. TIS surveillance data is derived from the same radar used by ATC; this data is uplinked to the client aircraft on each radar scan (nominally every 5 seconds).

b. Requirements.

1. In order to use TIS, the client and any intruder aircraft must be equipped with the appropriate cockpit equipment and fly within the radar coverage of a Mode S radar capable of providing TIS. Typically, this will be within 55 NM of the sites depicted in FIG 4–5–6, Terminal Mode S Radar Sites. ATC communication is not a requirement to receive TIS, although it may be required by the particular airspace or flight operations in which TIS is being used.



FIG 4-5-6 Terminal Mode S Radar Sites



FIG 4-5-7 Traffic Information Service (TIS) Avionics Block Diagram



2. The cockpit equipment functionality required by a TIS client aircraft to receive the service consists of the following (refer to FIG 4–5–7):

(a) Mode S data link transponder with altitude encoder.

(b) Data link applications processor with TIS software installed.

(c) Control-display unit.

(d) Optional equipment includes a digital heading source to correct display errors caused by "crab angle" and turning maneuvers.

NOTE-

Some of the above functions will likely be combined into single pieces of avionics, such as (a) and (b).

3. To be visible to the TIS client, the intruder aircraft must, at a minimum, have an operating transponder (Mode A, C or S). All altitude information provided by TIS from intruder aircraft is derived from Mode C reports, if appropriately equipped.

4. TIS will initially be provided by the terminal Mode S systems that are paired with ASR-9 digital primary radars. These systems are in locations with the greatest traffic densities, thus will provide the greatest initial benefit. The remaining terminal Mode S sensors, which are paired with ASR-7 or ASR-8 analog primary radars, will provide TIS pending modification or relocation of these sites. See FIG 4–5–6, Terminal Mode S Radar Sites, for site locations. There is no mechanism in place, such as NOTAMs, to provide status update on individual radar sites since TIS is a nonessential, supplemental information service.

The FAA also operates en route Mode S radars (not illustrated) that rotate once every 12 seconds. These sites will require additional development of TIS before any possible implementation. There are no plans to implement TIS in the en route Mode S radars at the present time.

c. Capabilities.

1. TIS provides ground-based surveillance information over the Mode S data link to properly equipped client aircraft to aid in visual acquisition of proximate air traffic. The actual avionics capability of each installation will vary and the supplemental handbook material must be consulted prior to using TIS. A maximum of eight (8) intruder aircraft may be displayed; if more than eight aircraft match intruder parameters, the eight "most significant" intruders are uplinked. These "most significant" intruders are usually the ones in closest proximity and/or the greatest threat to the TIS client.

2. TIS, through the Mode S ground sensor, provides the following data on each intruder aircraft:

(a) Relative bearing information in 6-degree increments.

(b) Relative range information in 1/8 NM to 1 NM increments (depending on range).

(c) Relative altitude in 100-foot increments (within 1,000 feet) or 500-foot increments (from 1,000-3,500 feet) if the intruder aircraft has operating altitude reporting capability.

(d) Estimated intruder ground track in 45-degree increments.

(e) Altitude trend data (level within 500 fpm or climbing/descending >500 fpm) if the intruder aircraft has operating altitude reporting capability.

(f) Intruder priority as either an "traffic advisory" or "proximate" intruder.

3. When flying from surveillance coverage of one Mode S sensor to another, the transfer of TIS is an automatic function of the avionics system and requires no action from the pilot.

4. There are a variety of status messages that are provided by either the airborne system or ground equipment to alert the pilot of high priority intruders and data link system status. These messages include the following:

(a) Alert. Identifies a potential collision hazard within 34 seconds. This alert may be visual and/or audible, such as a flashing display symbol or a headset tone. A target is a threat if the time to the closest approach in vertical and horizontal coordinates is less than 30 seconds <u>and</u> the closest approach is expected to be within 500 feet vertically and 0.5 nautical miles laterally.

(b) TIS Traffic. TIS traffic data is displayed.

(c) Coasting. The TIS display is more than 6 seconds old. This indicates a missing uplink from the ground system. When the TIS display information is more than 12 seconds old, the "No Traffic" status will be indicated.

(d) No Traffic. No intruders meet proximate or alert criteria. This condition may exist when the TIS system is fully functional or may indicate "coasting" between 12 and 59 seconds old (see (c) above).

(e) TIS Unavailable. The pilot has requested TIS, but no ground system is available. This condition will also be displayed when TIS uplinks are missing for 60 seconds or more.

(f) **TIS Disabled.** The pilot has not requested TIS or has disconnected from TIS.

(g) Good-bye. The client aircraft has flown outside of TIS coverage.

NOTE-

Depending on the avionics manufacturer implementation, it is possible that some of these messages will not be directly available to the pilot.

5. Depending on avionics system design, TIS may be presented to the pilot in a variety of different displays, including text and/or graphics. Voice annunciation may also be used, either alone or in combination with a visual display. FIG 4–5–7, Traffic Information Service (TIS), Avionics Block Diagram, shows an example of a TIS display using symbology similar to the Traffic Alert and Collision Avoidance System (TCAS) installed on most passenger air carrier/commuter aircraft in the U.S. The small symbol in the center represents the client aircraft and the display is oriented "track up," with the 12 o'clock position at the top. The range rings indicate 2 and 5 NM. Each intruder is depicted by a symbol positioned at the approximate relative bearing and range from the client aircraft. The circular symbol near the center indicates an "alert" intruder and the diamond symbols indicate "proximate" intruders.

6. The inset in the lower right corner of FIG 4–5–7, Traffic Information Service (TIS), Avionics Block Diagram, shows a possible TIS data block display. The following information is contained in this data block:

(a) The intruder, located approximately four o'clock, three miles, is a "proximate" aircraft and currently not a collision threat to the client aircraft. This is indicated by the diamond symbol used in this example. (b) The intruder ground track diverges to the right of the client aircraft, indicated by the small arrow.

(c) The intruder altitude is 700 feet less than or below the client aircraft, indicated by the "-07" located under the symbol.

(d) The intruder is descending >500 fpm, indicated by the downward arrow next to the "-07" relative altitude information. The absence of this arrow when an altitude tag is present indicates level flight or a climb/descent rate less than 500 fpm.

NOTE-

If the intruder did not have an operating altitude encoder (Mode C), the altitude and altitude trend "tags" would have been omitted.

d. Limitations.

1. TIS 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). TIS must not be used for avoidance maneuvers during IMC or other times when there is no visual contact with the intruder aircraft. TIS is intended only to assist in visual acquisition of other aircraft in VMC. Avoidance maneuvers are neither provided nor authorized as a direct result of a TIS intruder display or TIS alert.

2. While TIS is a useful aid to visual traffic avoidance, it has some system limitations that must be fully understood to ensure proper use. Many of these limitations are inherent in secondary radar surveillance. In other words, the information provided by TIS will be no better than that provided to ATC. Other limitations and anomalies are associated with the TIS predictive algorithm.

(a) Intruder Display Limitations. TIS will only display aircraft with operating transponders installed. TIS relies on surveillance of the Mode S radar, which is a "secondary surveillance" radar similar to the ATCRBS described in paragraph 4–5–2.

(b) TIS Client Altitude Reporting Requirement. Altitude reporting is required by the TIS client aircraft in order to receive TIS. If the altitude encoder is inoperative or disabled, TIS will be unavailable, as TIS requests will not be honored by the ground system. As such, TIS requires altitude reporting to determine the Proximity Coverage Volume as indicated in FIG 4–5–5. TIS users must be alert to

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altitude encoder malfunctions, as TIS has no mechanism to determine if client altitude reporting is correct. A failure of this nature will cause erroneous and possibly unpredictable TIS operation. If this malfunction is suspected, confirmation of altitude reporting with ATC is suggested.

(c) Intruder Altitude Reporting. Intruders without altitude reporting capability will be displayed without the accompanying altitude tag. Additionally, nonaltitude reporting intruders are assumed to be at the same altitude as the TIS client for alert computations. This helps to ensure that the pilot will be alerted to all traffic under radar coverage, but the actual altitude difference may be substantial. Therefore, visual acquisition may be difficult in this instance.

(d) Coverage Limitations. Since TIS is provided by ground-based, secondary surveillance radar, it is subject to all limitations of that radar. If an aircraft is not detected by the radar, it cannot be displayed on TIS. Examples of these limitations are as follows:

(1) TIS will typically be provided within 55 NM of the radars depicted in FIG 4–5–6, Terminal Mode S Radar Sites. This maximum range can vary by radar site and is always subject to "line of sight" limitations; the radar and data link signals will be blocked by obstructions, terrain, and curvature of the earth.

(2) TIS will be unavailable at low altitudes in many areas of the country, particularly in mountainous regions. Also, when flying near the "floor" of radar coverage in a particular area, intruders below the client aircraft may not be detected by TIS.

(3) TIS will be temporarily disrupted when flying directly over the radar site providing coverage if no adjacent site assumes the service. A ground-based radar, similar to a VOR or NDB, has a zenith cone, sometimes referred to as the cone of confusion or cone of silence. This is the area of ambiguity directly above the station where bearing information is unreliable. The zenith cone setting for TIS is 34 degrees: Any aircraft above that angle with respect to the radar horizon will lose TIS coverage from that radar until it is below this 34 degree angle. The aircraft may not actually lose service in areas of multiple radar coverage since an adjacent radar will provide TIS. If no other TIS-capable radar is available, the "Good-bye" message will be received and TIS terminated until coverage is resumed.

(e) Intermittent Operations. TIS operation may be intermittent during turns or other maneuvering, particularly if the transponder system does not include antenna diversity (antenna mounted on the top and bottom of the aircraft). As in (d) above, TIS is dependent on two-way, "line of sight" communications between the aircraft and the Mode S radar. Whenever the structure of the client aircraft comes between the transponder antenna (usually located on the underside of the aircraft) and the ground-based radar antenna, the signal may be temporarily interrupted.

(f) TIS Predictive Algorithm. TIS information is collected one radar scan prior to the scan during which the uplink occurs. Therefore, the surveillance information is approximately 5 seconds old. In order to present the intruders in a "real time" position, TIS uses a "predictive algorithm" in its tracking software. This algorithm uses track history data to extrapolate intruders to their expected positions consistent with the time of display in the cockpit. Occasionally, aircraft maneuvering will cause this algorithm to induce errors in the TIS display. These errors primarily affect relative bearing information; intruder distance and altitude will remain relatively accurate and may be used to assist in "see and avoid." Some of the more common examples of these errors are as follows:

(1) When client or intruder aircraft maneuver excessively or abruptly, the tracking algorithm will report incorrect horizontal position until the maneuvering aircraft stabilizes.

(2) When a rapidly closing intruder is on a course that crosses the client at a shallow angle (either overtaking or head on) and either aircraft abruptly changes course within $\frac{1}{4}$ NM, TIS will display the intruder on the opposite side of the client than it actually is.

These are relatively rare occurrences and will be corrected in a few radar scans once the course has stabilized.

(g) Heading/Course Reference. Not all TIS aircraft installations will have onboard heading reference information. In these installations, aircraft course reference to the TIS display is provided by the Mode S radar. The radar only determines ground

track information and has no indication of the client aircraft heading. In these installations, all intruder bearing information is referenced to ground track and does not account for wind correction. Additionally, since ground-based radar will require several scans to determine aircraft course following a course change, a lag in TIS display orientation (intruder aircraft bearing) will occur. As in (f) above, intruder distance and altitude are still usable.

(h) Closely-Spaced Intruder Errors. When operating more than 30 NM from the Mode S sensor, TIS forces any intruder within 3/8 NM of the TIS client to appear at the same horizontal position as the client aircraft. Without this feature, TIS could display intruders in a manner confusing to the pilot in critical situations (for example, a closely-spaced intruder that is actually to the right of the client may appear on the TIS display to the left). At longer distances from the radar, TIS cannot accurately determine relative bearing/distance information on intruder aircraft that are in close proximity to the client.

Because TIS uses a ground-based, rotating radar for surveillance information, the accuracy of TIS data is dependent on the distance from the sensor (radar) providing the service. This is much the same phenomenon as experienced with ground-based navigational aids, such as a VOR. As distance from the radar increases, the accuracy of surveillance decreases. Since TIS does not inform the pilot of distance from the Mode S radar, the pilot must assume that any intruder appearing at the same position as the client aircraft may actually be up to 3/8 NM away in any direction. Consistent with the operation of TIS, an alert on the display (regardless of distance from the radar) should stimulate an outside visual scan, intruder acquisition, and traffic avoidance based on outside reference.

e. Reports of TIS Malfunctions.

1. Users of TIS can render valuable assistance in the early correction of malfunctions by reporting their observations of undesirable performance. Reporters should identify the time of observation, location, type and identity of aircraft, and describe the condition observed; the type of transponder processor, and software in use can also be useful information. Since TIS performance is monitored by maintenance personnel rather than ATC, it is suggested that malfunctions be reported by radio or telephone to the nearest Flight Service Station (FSS) facility.

NOTE-

TIS operates at only those terminal Mode S radar sites depicted in FIG 4–5–6. Though similar in some ways, TIS is not related to TIS–B (Traffic Information Service– Broadcast).

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

a. Introduction.

1. Automatic Dependent Surveillance–Broadcast (ADS–B) is a surveillance technology deployed throughout the NAS (see FIG 4–5–8). The ADS–B system is composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft by using the GNSS and transmit its position along with additional information about the aircraft to ground stations for use by ATC and other ADS–B services. This information is transmitted at a rate of approximately once per second. (See FIG 4–5–9 and FIG 4–5–10.)

2. In the United States, ADS-B equipped aircraft exchange information on one of two frequencies: 978 or 1090 MHz. The 1090 MHz frequency is also associated with Mode A, C, and S transponder operations. 1090 MHz transponders with integrated ADS-B functionality extend the transponder message sets with additional ADS-B information. This additional information is known as an "extended squitter" message and is referred to as 1090ES. ADS-B equipment operating on 978 MHz is known as the Universal Access Transceiver (UAT).

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. All aircraft operating within the airspace defined in 14 CFR § 91.225 are 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 (Class A airspace) are required to have 1090ES equipment. 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 regulations do

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).

FIG 4–5–8 ADS–B, TIS–B, and FIS–B: Broadcast Services Architecture



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.

FIG 4-5-9 En Route – ADS–B/ADS–R/TIS–B/FIS–B Service Ceilings/Floors



TIV up to FL290 (ADS-R hockey puck ±5,000') FL250 TIV up to FL278 (TIS-B hockey puck ±3,800') ADS-R TIS-B ADS-B FL240 FIS-B •1090 & dual-equipped •Targets to FL290 •Targets to FL278 up to FL250 •Airborne Clients •Airborne Clients to Slot assignments to FL240 FL240 made to ensure •1090, UAT, and dual-•No Ground-State •No Ground-State that there is at equipped up to FL240 **Clients or Targets Clients or Targets** least one set of •No Ground-State unique slots in Targets view up to FL240 floor TIV = Traffic Information Volume

FIG 4-5-10 Terminal – ADS-B/ADS-R/TIS-B/FIS-B Service Ceilings/Floors

2. One of the data elements transmitted by ADS-B is the aircraft's Flight Identification (FLT ID). The FLT ID is comprised of a maximum of seven alphanumeric characters and must correspond to the aircraft identification filed in the flight plan. For airline and commuter aircraft, the FLT ID is usually the company name and flight number (for example, AAL3432), and is typically entered into the avionics by the flight crew during preflight. For general aviation (GA), if aircraft avionics allow dynamic modification of the FLT ID, the pilot can enter it prior to flight. However, some ADS-B avionics require the FLT ID to be set to the aircraft registration number (for example, N1234Q) by the installer and cannot be changed by the pilot from the cockpit. In both cases, the FLT ID must correspond to the aircraft identification filed in its flight plan.

ATC automation systems use the transmitted ADS–B FLT ID to uniquely identify each aircraft within a given airspace, and to correlate it to its filed flight plan for the purpose of providing surveillance and separation services. If the FLT ID and the filed aircraft identification are not identical, a Call Sign Mis–Match (CSMM) is generated and ATC automation systems may not associate the aircraft with its filed flight plan. In this case, air traffic services may be delayed or unavailable until the CSMM is corrected. Consequently, it is imperative that flight crews and GA pilots ensure the FLT ID entry correctly matches the aircraft identification filed in their flight plan.

3. Each ADS–B aircraft is assigned a unique ICAO address (also known as a 24–bit address) that is broadcast by the ADS–B transmitter. This ICAO address is programmed at installation. Should multiple aircraft broadcast the same ICAO address while transiting the same ADS–B Only Service Volume, the ADS–B network may be unable to track the targets correctly. If radar reinforcement is available, tracking will continue. If radar is unavailable, the controller may lose target tracking entirely on one or both targets. Consequently, it is imperative that the ICAO address entry is correct.

4. Aircraft that are equipped with ADS–B avionics on the UAT datalink have a feature that allows them to broadcast an anonymous 24–bit ICAO address. In this mode, the UAT system creates a randomized address that does not match the actual

ICAO address assigned to the aircraft. The UAT anonymous 24-bit address feature may only be used when the operator has not filed an IFR flight plan and is not requesting ATC services. In the anonymity mode, the aircraft's beacon code must be set to 1200 and, depending on the manufacturer's implementation, the aircraft FLT ID might not be transmitted. Pilots should be aware that while in UAT anonymity mode, they will not be eligible to receive ATC separation and flight following services, and may not benefit from enhanced ADS-B search and rescue capabilities.

5. 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 inflight and airport surface use. Unless otherwise directed by ATC, transponder/ADS–B systems should be turned "on" and remain "on" whenever operating in the air or on the airport surface movement area.

d. ATC Surveillance Services using ADS-B – Procedures and Recommended Phraseology

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 ATC services are anticipated when either a VFR or IFR flight plan is filed, the aircraft identification (as entered in the flight plan) must be entered as the FLT ID in the ADS–B avionics.

2. Inflight:

When requesting surveillance services while airborne, pilots must disable the anonymous feature, if so equipped, prior to contacting ATC. Pilots must also ensure that their transmitted ADS–B FLT ID matches the aircraft identification as entered in their flight plan.

3. Aircraft with an Inoperative/Malfunctioning ADS–B Transmitter:

(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 if it becomes necessary to turn off the aircraft's ADS-B transmitter.

PHRASEOLOGY-

STOP ADS-B TRANSMISSIONS.

(c) Other malfunctions and considerations:

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

4. Procedures for Accommodation of Non-ADS-B Equipped Aircraft:

(a) Pilots of aircraft not equipped with ADS-B may only operate outside airspace designated as ADS-B airspace in 14 CFR §91.225. Pilots of unequipped aircraft wishing to fly any portion of a flight in ADS-B airspace may seek a deviation from the regulation to conduct operations without the required equipment. Direction for obtaining this deviation are available in Advisory Circular 90–114.

(b) While air traffic controllers can identify which aircraft are ADS-B equipped and which are not, there is no indication if a non-equipped pilot has obtained a preflight authorization to enter ADS-B airspace. Situations may occur when the pilot of a non-equipped aircraft, without an authorization to operate in ADS-B airspace receives an ATC-initiated in-flight clearance to fly a heading, route, or altitude that would penetrate ADS-B airspace. Such clearances may be for traffic, weather, or simply to shorten the aircraft's route of flight. When this occurs, the pilot should acknowledge and execute the clearance, but must advise the controller that they are not ADS-B equipped and have not received prior authorization to operate in ADS-B airspace. The controller, at their discretion, will either acknowledge and proceed with the new clearance, or modify the clearance to avoid ADS-B airspace. In either case, the FAA will normally not take enforcement action for non-equipage in these circumstances.

NOTE-

Pilots operating without ADS-B equipment must not request route or altitude changes that will result in an incursion into ADS-B airspace except for safety of flight; for example, weather avoidance. Unequipped aircraft that have not received a pre-flight deviation authorization will only be considered in compliance with regulation if the amendment to flight is initiated by ATC.

EXAMPLE-

1. *ATC*: "November Two Three Quebec, turn fifteen degrees left, proceed direct Bradford when able, rest of route unchanged."

Aircraft: "November Two Three Quebec, turning fifteen degrees left, direct Bradford when able, rest of route unchanged. Be advised, we are negative ADS–B equipment and have not received authorization to operate in ADS–B airspace."

ATC: "November Two Three Quebec, roger" or

"November Two Three Quebec, roger, turn twenty degrees right, rejoin Victor Ten, rest of route unchanged."

2. *ATC*: "November Four Alpha Tango, climb and maintain one zero thousand for traffic."

Aircraft: "November Four Alpha Tango, leaving eight thousand for one zero thousand. Be advised, we are negative ADS-B equipment and have not received authorization to operate in ADS-B airspace."

ATC: "November Four Alpha Tango, roger"

or

"November Four Alpha Tango, roger, cancel climb clearance, maintain eight thousand."

REFERENCE-

Federal Register Notice, Volume 84, Number 62, dated April 1, 2019

e. ADS-B Limitations.

The ADS-B cockpit display of traffic is NOT 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. No avoidance maneuvers are provided or authorized, as a direct result of an ADS-B target being displayed in the cockpit.

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. Since ADS–B performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone, or by sending an email to the ADS–B help desk at adsb@faa.gov. Reports should include:

1. Condition observed;

- 2. Date and time of observation;
- 3. Altitude and location of observation;
- 4. Type and call sign of the aircraft; and

5. Type and software version of avionics system.

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

a. Introduction

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 sensors. TIS-B service will be available throughout the NAS where there are both adequate surveillance coverage 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. (See FIG 4–5–9 and FIG 4–5–10.)

b. 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.

c. 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.

d. 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.

e. 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. Since TIS–B performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone, or by sending an email to the ADS–B help desk at adsb@faa.gov. Reports should include:

- 1. Condition observed;
- 2. Date and time of observation;
- **3.** Altitude and location of observation;
- 4. Type and call sign of the aircraft; and

5. Type and software version of avionics system.

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

a. Introduction.

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 reception is line-of-sight within the service volume of the ground infrastructure. (See FIG 4–5–9 and FIG 4–5–10.)

b. Weather Products.

FIS-B does not replace a preflight weather briefing from a source listed in paragraph 7–1–2, FAA Weather Services, or inflight updates from an FSS or ATC. FIS-B information may be used by the pilot for the safe conduct of flight and aircraft movement; however, the information should not be the only source of weather or aeronautical information. A pilot should be particularly alert and understand the limitations and quality assurance issues associated with individual products. This includes graphical representation of next generation weather radar (NEXRAD) imagery and Notices to Air Missions (NOTAMs)/temporary flight restrictions (TFRs).

REFERENCE-

AIM, Para 7–1–9, Flight Information Services (FIS). Advisory Circular (AC) 00–63, Use of Cockpit Displays of Digital Weather and Aeronautical Information.

c. Reports of FIS-B Malfunctions.

Users of FIS–B can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. Since FIS–B performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone, or by sending an email to the ADS–B help desk at adsb@faa.gov. Reports should include:

- 1. Condition observed;
- 2. Date and time of observation;
- **3.** Altitude and location of observation;
- 4. Type and call sign of the aircraft; and

5. Type and software version of avionics system.

Product	Update Interval ¹	Transmission Interval (95%) ²	Basic Product
AIRMET	As Available	5 minutes	Yes
AWW/WW	As Available, then at 15 minute intervals for 1 hour	5 minutes	No
Ceiling	As Available	10 minutes	No
Convective SIGMET	As Available, then at 15 minute intervals for 1 hour	5 minutes	Yes
D-ATIS	As Available	1 minute	No
Echo Top	5 minutes	5 minutes	No
METAR/SPECI	1 minute (where available), As Available otherwise	5 minutes	Yes
MRMS NEXRAD (CONUS)	2 minutes	15 minutes	Yes
MRMS NEXRAD (Regional)	2 minutes	2.5 minutes	Yes
NOTAMs-D/FDC	As Available	10 minutes	Yes
NOTAMs-TFR	As Available	10 minutes	Yes
PIREP	As Available	10 minutes	Yes
SIGMET	As Available, then at 15 minute intervals for 1 hour	5 minutes	Yes
SUA Status	As Available	10 minutes	Yes
TAF/AMEND	6 Hours (±15 minutes)	10 minutes	Yes
Temperature Aloft	12 Hours (±15 minutes)	10 minutes	Yes
TWIP	As Available	1 minute	No
Winds aloft	12 Hours (±15 minutes)	10 minutes	Yes
Lightning strikes ³	5 minutes	5 minutes	Yes
Turbulence ³	1 minute	15 minutes	Yes
Icing, Forecast Potential (FIP) ³	60 minutes	15 minutes	Yes
Cloud tops ³	30 minutes	15 minutes	Yes
1 Minute AWOS ³	1 minute	10 minutes	No
Graphical–AIRMET ³	As Available	5 minutes	Yes
Center Weather Advisory (CWA) ³	As Available	10 minutes	Yes
Temporary Restricted Areas (TRA)	As Available	10 minutes	Yes
Temporary Military Operations Areas (TMOA)	As Available	10 minutes	Yes

TBL 4–5–3 FIS–B Over UAT Product Update and Transmission Intervals

¹ The Update Interval is the rate at which the product data is available from the source.

 2 The Transmission Interval is the amount of time within which a new or updated product transmission must be completed (95%) and the rate or repetition interval at which the product is rebroadcast (95%).

³ The transmission and update intervals for the expanded set of basic meteorological products may be adjusted based on FAA and vendor agreement on the final product formats and performance requirements.

NOTE-

1. Details concerning the content, format, and symbols of the various data link products provided should be obtained from the specific avionics manufacturer.

2. NOTAM-D and NOTAM-FDC products broadcast via FIS-B are limited to those issued or effective within the past 30 days.

4–5–10. Automatic Dependent Surveillance–Rebroadcast (ADS–R)

a. Introduction.

ADS-R is a datalink translation function of the ADS-B ground system required to accommodate the two separate operating frequencies (978 MHz and 1090 ES). The ADS-B system receives the ADS-B messages transmitted on one frequency and ADS-R translates and reformats the information for rebroadcast and use on the other frequency. This allows ADS-B In equipped aircraft to see nearby ADS-B Out traffic regardless of the operating link of the other aircraft. Aircraft operating on the same

ADS-B frequency exchange information directly and do not require the ADS-R translation function. (See FIG 4-5-9 and FIG 4-5-10.)

b. Reports of ADS-R Malfunctions.

Users of ADS–R can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. Since ADS–R performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone, or by sending an email to the ADS–B help desk at adsb@faa.gov. Reports should include:

1. Condition observed;

2. Date and time of observation;

3. Altitude and location of observation;

4. Type and call sign of the aircraft and;

5. Type and software version of avionics system.

4-7-1. Introduction and General Policies

a. Air traffic control (ATC) may apply 50 nautical mile (NM) lateral separation (i.e., lateral spacing) between airplanes authorized for Required Navigation Performance (RNP) 10 or RNP 4 operating in the Gulf of Mexico. 50 NM lateral separation may be applied in the following airspace:

1. Houston Oceanic Control Area (CTA)/Flight Information Region (FIR).

2. Gulf of Mexico portion of the Miami Oceanic CTA/FIR.

3. Monterrey CTA.

4. Merida High CTA within the Mexico FIR/UTA.

b. Within the Gulf of Mexico airspace described above, pairs of airplanes whose flight plans indicate approval for PBN and either RNP 10 or RNP 4 may be spaced by ATC at lateral intervals of 50 NM. ATC will space any airplane without RNP 10 or RNP 4 capability such that at least 90 NM lateral separation is maintained with other airplanes in the Miami Oceanic CTA, and at least 100 NM separation is maintained in the Houston, Monterrey, and Merida CTAs.

c. The reduced lateral separation allows more airplanes to fly on optimum routes/altitudes over the Gulf of Mexico.

d. 50 NM lateral separation is not applied on routes defined by ground navigation aids or on Gulf RNAV Routes Q100, Q102, or Q105.

e. Useful information for flight planning and operations over the Gulf of Mexico, under this 50 NM lateral separation policy, as well as information on how to obtain RNP 10 or RNP 4 authorization, can be found in the West Atlantic, Gulf of Mexico, and Caribbean Resource Guide for U.S. Operators located at: https://www.faa.gov/headquartersoffices/ avs/wat-gomex-and-caribbean-resource-guide.

f. Pilots should use Strategic Lateral Offset Procedures (SLOP) in the course of regular operations within the Gulf of Mexico CTAs. SLOP

procedures and limitations are published in the U.S. Aeronautical Information Publication (AIP), ENR Section 7.1, General Procedures; Advisory Circular (AC) 91–70, Oceanic and Remote Continental Airspace Operations; and ICAO Document 4444, Procedures for Air Navigation Services – Air Traffic Management.

4–7–2. Accommodating Non–RNP 10 Aircraft

a. Operators not authorized for RNP 10 or RNP 4 may still file for any route and altitude within the Gulf of Mexico CTAs. However, clearance on the operator's preferred route and/or altitude will be provided as traffic allows for 90 or 100 NM lateral separation between the non-RNP 10 aircraft and any others. Priority will be given to RNP 10 or RNP 4 aircraft.

b. Operators of aircraft not authorized RNP 10 or RNP 4 must include the annotation "RMK/NON-RNP10" in Item 18 of their ATC flight plan.

c. Pilots of non-RNP 10 aircraft are to remind ATC of their RNP status; i.e., report "negative RNP 10" upon initial contact with ATC in each Gulf CTA.

d. Operators will likely benefit from the effort they invest to obtain RNP 10 or RNP 4 authorization, provided they are flying aircraft equipped to meet RNP 10 or RNP 4 standards.

4–7–3. Obtaining RNP 10 or RNP 4 Operational Authorization

a. For U.S. operators, AC 90–105, Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System and in Oceanic and Remote Continental Airspace, provides the aircraft and operator qualification criteria for RNP 10 or RNP 4 authorizations. FAA personnel at flight standards district offices (FSDO) and certificate management offices (CMO) will use the guidance contained in AC 90–105 to evaluate an operator's application for RNP 10 or RNP 4 authorization. Authorization to conduct RNP operations in oceanic airspace is

provided to all U.S. operators through issuance of Operations Specification (OpSpec), Management Specification (MSpec), or Letter of Authorization (LOA) B036, as applicable to the nature of the operation; for example, Part 121, Part 91, etc. Operators may wish to review FAA Order 8900.1, Flight Standards Information Management System, volume 3, chapter 18, section 4, to understand the specific criteria for issuing OpSpec, MSpec, and/or LOA B036.

b. The operator's RNP 10 or RNP 4 authorization should include any equipment requirements and RNP 10 time limits (if operating solely inertial-based navigation systems), which must be observed when conducting RNP operations. RNP 4 requires tighter navigation and track maintenance accuracy than RNP 10.

4–7–4. Authority for Operations with a Single Long–Range Navigation System

Operators may be authorized to take advantage of 50 NM lateral separation in the Gulf of Mexico CTAs when equipped with only a single long-range navigation system. RNP 10 with a single long-range navigation system is authorized via OpSpec, MSpec, or LOA B054. Operators should contact their FSDO or CMO to obtain information on the specific requirements for obtaining B054. Volume 3, chapter 18, section 4 of FAA Order 8900.1 provides the qualification criteria to be used by FAA aviation safety inspectors in issuing B054.

4-7-5. Flight Plan Requirements

a. In order for an operator with RNP 10 or RNP 4 authorization to obtain 50 NM lateral separation in the Gulf of Mexico CTAs, and therefore obtain

preferred routing available to RNP authorized aircraft, the international flight plan form (FAA 7233–4) must be annotated as follows:

1. Item 10a (Equipment) must include the letter "R."

2. Item 18 must include either "PBN/A1" for RNP 10 authorization or "PBN/L1" for RNP 4 authorization.

b. Indication of RNP 4 authorization implies the aircraft and pilots are also authorized RNP 10.

c. Chapter 5, section 1, of this manual includes information on all flight plan codes. RNP 10 has the same meaning and application as RNAV 10. They share the same code.

4-7-6. Contingency Procedures

Pilots operating under reduced lateral separation must be particularly familiar with, and prepared to rapidly implement, the standard contingency procedures specifically written for operations when outside ATC surveillance and direct VHF communications (for example, the oceanic environment). Specific procedures have been developed for weather deviations. Operators should ensure all flight crews operating in this type of environment have been provided the standard contingency procedures in a readily accessible format. The margin for error when operating at reduced separation mandates correct and expeditious application of the standard contingency procedures. These internationally accepted procedures are published in ICAO Document 4444, chapter 15. The procedures are also reprinted in the U.S. Aeronautical Information Publication (AIP), En Route (ENR) Section 7.3, Special Procedures for In-flight Contingencies in Oceanic Airspace; and AC 91-70.

When the altimeter setting(s) on which the approach is based is not available, the approach is not authorized. Baro–VNAV must be flown using the local altimeter setting only. Where no local altimeter is available, the LNAV/VNAV line will still be published for use by WAAS receivers with a note that Baro–VNAV is not authorized. When a local and at least one other altimeter setting source is authorized and the local altimeter is not available Baro–VNAV is not authorized; however, the LNAV/VNAV minima can still be used by WAAS receivers using the alternate altimeter setting source.

NOTE-

Barometric Vertical Navigation (baro–VNAV). An RNAV system function which uses barometric altitude information from the aircraft's altimeter to compute and present a vertical guidance path to the pilot. The specified vertical path is computed as a geometric path, typically computed between two waypoints or an angle based computation from a single waypoint. Further guidance may be found in Advisory Circular 90–105.

5. A pilot adhering to the altitudes, flight paths, and weather minimums depicted on the IAP chart or vectors and altitudes issued by the radar controller, is assured of terrain and obstruction clearance and runway or airport alignment during approach for landing.

6. IAPs are designed to provide an IFR descent from the en route environment to a point where a safe landing can be made. They are prescribed and approved by appropriate civil or military authority to ensure a safe descent during instrument flight conditions at a specific airport. It is important that pilots understand these procedures and their use prior to attempting to fly instrument approaches.

7. TERPS criteria are provided for the following types of instrument approach procedures:

(a) Precision Approach (PA). An instrument approach based on a navigation system that provides course and glidepath deviation information meeting the precision standards of ICAO Annex 10. For example, PAR, ILS, and GLS are precision approaches.

(b) Approach with Vertical Guidance (APV). An instrument approach based on a navigation system that is not required to meet the precision approach standards of ICAO Annex 10 but provides course and glidepath deviation information. For (c) Nonprecision Approach (NPA). An instrument approach based on a navigation system which provides course deviation information, but no glidepath deviation information. For example, VOR, NDB and LNAV. As noted in subparagraph k, Vertical Descent Angle (VDA) on Nonprecision Approaches, some approach procedures may provide a Vertical Descent Angle as an aid in flying a stabilized approach, without requiring its use in order to fly the procedure. This does not make the approach an APV procedure, since it must still be flown to an MDA and has not been evaluated with a glidepath.

b. The method used to depict prescribed altitudes on instrument approach charts differs according to techniques employed by different chart publishers. Prescribed altitudes may be depicted in four different configurations: minimum, maximum, mandatory, and recommended. The U.S. Government distributes charts produced by National Geospatial–Intelligence Agency (NGA) and FAA. Altitudes are depicted on these charts in the profile view with underscore, overscore, both or none to identify them as minimum, maximum, mandatory or recommended.

1. Minimum altitude will be depicted with the altitude value underscored. Aircraft are required to maintain altitude at or above the depicted value, e.g., <u>3000</u>.

2. Maximum altitude will be depicted with the altitude value overscored. Aircraft are required to maintain altitude at or below the depicted value, e.g., $\overline{4000}$.

3. Mandatory altitude will be depicted with the altitude value both underscored and overscored. Aircraft are required to maintain altitude at the depicted value, e.g., $\overline{5000}$.

4. Recommended altitude will be depicted with no overscore or underscore. These altitudes are depicted for descent planning, e.g., 6000.

NOTE-

1. Pilots are cautioned to adhere to altitudes as prescribed because, in certain instances, they may be used as the basis for vertical separation of aircraft by ATC. When a depicted altitude is specified in the ATC clearance, that altitude becomes mandatory as defined above.

2. The ILS glide slope is intended to be intercepted at the published glide slope intercept altitude. This point marks the PFAF and is depicted by the "lightning bolt" symbol

on U.S. Government charts. Intercepting the glide slope at this altitude marks the beginning of the final approach segment and ensures required obstacle clearance during descent from the glide slope intercept altitude to the lowest published decision altitude for the approach. Interception and tracking of the glide slope prior to the published glide slope interception altitude does not necessarily ensure that minimum, maximum, and/or mandatory altitudes published for any preceding fixes will be complied with during the descent. If the pilot chooses to track the glide slope prior to the glide slope interception altitude, they remain responsible for complying with published altitudes for any preceding stepdown fixes encountered during the subsequent descent.

3. Approaches used for simultaneous (parallel) independent and simultaneous close parallel operations procedurally require descending on the glideslope from the altitude at which the approach clearance is issued (refer to 5-4-15 and 5-4-16). For simultaneous close parallel (PRM) approaches, the Attention All Users Page (AAUP) may publish a note which indicates that descending on the glideslope/glidepath meets all crossing restrictions. However, if no such note is published, and for simultaneous independent approaches (4300 and greater runway separation) where an AAUP is not published, pilots are cautioned to monitor their descent on the glideslope/path outside of the PFAF to ensure compliance with published crossing restrictions.

4. When parallel approach courses are less than 2500 feet apart and reduced in-trail spacing is authorized for simultaneous dependent operations, a chart note will indicate that simultaneous operations require use of vertical guidance and that the pilot should maintain last assigned altitude until established on glide slope. These approaches procedurally require utilization of the ILS glide slope for wake turbulence mitigation. Pilots should not confuse these simultaneous dependent operations with (SOIA) simultaneous close parallel PRM approaches, where PRM appears in the approach title.

5. Altitude restrictions depicted at stepdown fixes within the final approach segment are

applicable only when flying a Non-Precision Approach to a straight-in or circling line of minima identified as an MDA (H). These altitude restrictions may be annotated with a note "LOC only" or "LNAV only." Stepdown fix altitude restrictions within the final approach segment do not apply to pilots using Precision Approach (ILS) or Approach with Vertical Guidance (LPV, LNAV/VNAV) lines of minima identified as a DA(H), since obstacle clearance on these approaches is based on the aircraft following the applicable vertical guidance. Pilots are responsible for adherence to stepdown fix altitude restrictions when outside the final approach segment (i.e., initial or intermediate segment), regardless of which type of procedure the pilot is flying. (See FIG 5–4–1.)

c. The Minimum Safe Altitudes (MSA) is published for emergency use on IAP or departure procedure (DP) graphic charts. MSAs provide 1,000 feet of clearance over all obstacles, but do not necessarily assure acceptable navigation signal coverage. The MSA depiction on the plan view of an approach chart or on a DP graphic chart contains the identifier of the center point of the MSA, the applicable radius of the MSA, a depiction of the sector(s), and the minimum altitudes above mean sea level which provide obstacle clearance. For conventional navigation systems, the MSA is normally based on the primary omnidirectional facility on which the IAP or DP graphic chart is predicated, but may be based on the airport reference point (ARP) if no suitable facility is available. For RNAV approaches or DP graphic charts, the MSA is based on an RNAV waypoint. MSAs normally have a 25 NM radius; however, for conventional navigation systems, this radius may be expanded to 30 NM if necessary to encompass the airport landing surfaces. A single sector altitude is normally established, however when the MSA is based on a facility and it is necessary to obtain relief from obstacles, an MSA with up to four sectors may be established.
6. U.S. Government charts depict TAAs using icons located in the plan view outside the depiction of the actual approach procedure. (See FIG 5–4–6). Use of icons is necessary to avoid obscuring any portion of the "T" procedure (altitudes, courses, minimum altitudes, etc.). The icon for each TAA area will be located and oriented on the plan view with respect to the direction of arrival to the approach procedure, and

will show all TAA minimum altitudes and sector/radius subdivisions. The IAF for each area of the TAA is included on the icon where it appears on the approach to help the pilot orient the icon to the approach procedure. The IAF name and the distance of the TAA area boundary from the IAF are included on the outside arc of the TAA area icon.

FIG 5-4-6 RNAV (GPS) Approach Chart



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 5–4–7 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 5-4-7 TAA with Left and Right Base Areas Eliminated

(b) FIG 5–4–8 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.

AIM

FIG 5-4-8 TAA with Left Base and Part of Straight-In Area Eliminated



(c) FIG 5–4–9 depicts a TAA with right base leg and part of the straight-in area eliminated.



FIG 5-4-9 TAA with Right Base Eliminated

8. When an airway does not cross the lateral TAA boundaries, a feeder route will be established from an airway fix or NAVAID to the TAA boundary to provide a transition from the en route structure to the appropriate IAF. Each feeder route will terminate

at the TAA boundary and will be aligned along a path pointing to the associated IAF. Pilots should descend to the TAA altitude after crossing the TAA boundary and cleared for the approach by ATC. (See FIG 5-4-10).



FIG 5-4-10

9. Each waypoint on the "T" is assigned a pronounceable 5-letter name, except the missed approach waypoint. These names are used for ATC communications, RNAV databases, and aeronautical

navigation products. The missed approach waypoint is assigned a pronounceable name when it is not located at the runway threshold.

FIG 5-4-11 Minimum Vectoring Altitude Charts



e. Minimum Vectoring Altitudes (MVAs) are established for use by ATC when radar ATC is exercised. MVA charts are prepared by air traffic facilities at locations where there are numerous different minimum IFR altitudes. Each MVA chart has sectors large enough to accommodate vectoring of aircraft within the sector at the MVA. Each sector boundary is at least 3 miles from the obstruction determining the MVA. To avoid a large sector with an excessively high MVA due to an isolated prominent obstruction, the obstruction may be enclosed in a buffer area whose boundaries are at least 3 miles from the obstruction. This is done to facilitate vectoring around the obstruction. (See FIG 5–4–11.)

1. The minimum vectoring altitude in each sector provides 1,000 feet above the highest obstacle in nonmountainous areas and 2,000 feet above the highest obstacle in designated mountainous areas. Where lower MVAs are required in designated mountainous areas to achieve compatibility with terminal routes or to permit vectoring to an IAP, 1,000 feet of obstacle clearance may be authorized with the use of ATC surveillance. The minimum vectoring altitude will provide at least 300 feet above the floor of controlled airspace.

NOTE-

OROCA is a published altitude which provides 1,000 feet of terrain and obstruction clearance in the U.S. (2,000 feet of clearance in designated mountainous areas). These altitudes are not assessed for NAVAID signal coverage, air traffic control surveillance, or communications coverage, and are published for general situational awareness, flight planning and in-flight contingency use.

2. Because of differences in the areas considered for MVA, and those applied to other minimum altitudes, and the ability to isolate specific obstacles, some MVAs may be lower than the nonradar Minimum En Route Altitudes (MEAs), Minimum Obstruction Clearance Altitudes (MOCAs) or other minimum altitudes depicted on charts for a given location. While being radar vectored, IFR altitude assignments by ATC will be at or above MVA.

3. The MVA/MIA may be lower than the TAA minimum altitude. If ATC has assigned an altitude to an aircraft that is below the TAA minimum altitude, the aircraft will either be assigned an altitude to maintain until established on a segment of a published route or instrument approach procedure, or climbed to the TAA altitude.

f. Circling. Circling minimums charted on an RNAV (GPS) approach chart may be lower than the LNAV/VNAV line of minima, but <u>never</u> lower than the LNAV line of minima (straight-in approach). Pilots may safely perform the circling maneuver at

the circling published line of minima if the approach and circling maneuver is properly performed according to aircraft category and operational limitations.

FIG 5-4-12 Example of LNAV and Circling Minima Lower Than LNAV/VNAV DA. Harrisburg International RNAV (GPS) RWY 13

CATEGORY		Α	В	С	D
LPV	DA	558/24 250 (300 - ½)			
LNAV/ VNAV	DA	1572 - 5 1264 (1300 - 5)			
LNAV	MDA	1180 / 24 872 (900 - ½)	1180 / 40 872 (900 - ¾)	1180 / 2 872 (900 – 2)	1180 / 2 ¼ 872 (900 – 2 ¼)
CIRCLING		1180 – 1 870 (900 – 1)	1180 - 1 ¼ 870 (900 - 1 ¼)	1180 – 2 ½ 870 (900 – 2 ½)	1180 - 2 ¾ 870 (900 - 2 ¾)

FIG 5-4-13 Explanation of LNAV and/or Circling Minima Lower than LNAV/VNAV DA



g. FIG 5–4–13 provides a visual representation of an obstacle evaluation and calculation of LNAV MDA, Circling MDA, LNAV/VNAV DA.

1. No vertical guidance (LNAV). A line is drawn horizontal at obstacle height and 250 feet added for Required Obstacle Clearance (ROC). The

controlling obstacle used to determine LNAV MDA can be different than the controlling obstacle used in determining ROC for circling MDA. Other factors may force a number larger than 250 ft to be added to the LNAV OCS. The number is rounded up to the next higher 20 foot increment.

5 - 4 - 19

2. Circling MDA. The circling MDA will provide 300 foot obstacle clearance within the area considered for obstacle clearance and may be lower than the LNAV/VNAV DA, but never lower than the straight in LNAV MDA. This may occur when different controlling obstacles are used or when other controlling factors force the LNAV MDA to be higher than 250 feet above the LNAV OCS. In FIG 5–4–12, the required obstacle clearance for both the LNAV and Circle resulted in the same MDA, but lower than the LNAV/VNAV DA. FIG 5–4–13 provides an illustration of this type of situation.

3. Vertical guidance (LNAV/VNAV). A line is drawn horizontal at obstacle height until reaching the obstacle clearance surface (OCS). At the OCS, a vertical line is drawn until reaching the glide path. This is the DA for the approach. This method places the offending obstacle in front of the LNAV/VNAV DA so it can be seen and avoided. In some situations, this may result in the LNAV/VNAV DA being higher than the LNAV and/or Circling MDA.

h. The Visual Descent Point (VDP), identified by the symbol (V), is a defined point on the final approach course of a nonprecision straight-in approach procedure from which a stabilized visual descent from the MDA to the runway touchdown point may be commenced. The pilot should not descend below the MDA prior to reaching the VDP. The VDP will be identified by DME or RNAV along-track distance to the MAP. The VDP distance is based on the lowest MDA published on the IAP and harmonized with the angle of the visual glide slope indicator (VGSI) (if installed) or the procedure VDA (if no VGSI is installed). A VDP may not be published under certain circumstances which may result in a destabilized descent between the MDA and the runway touchdown point. Such circumstances include an obstacle penetrating the visual surface between the MDA and runway threshold, lack of distance measuring capability, or the procedure design prevents a VDP to be identified.

1. VGSI systems may be used as a visual aid to the pilot to determine if the aircraft is in a position to make a stabilized descent from the MDA. When the visibility is close to minimums, the VGSI may not be visible at the VDP due to its location beyond the MAP. **2.** Pilots not equipped to receive the VDP should fly the approach procedure as though no VDP had been provided.

3. On a straight-in nonprecision IAP, descent below the MDA between the VDP and the MAP may be inadvisable or impossible. Aircraft speed, height above the runway, descent rate, amount of turn, and runway length are some of the factors which must be considered by the pilot to determine if a safe descent and landing can be accomplished.

i. A visual segment obstruction evaluation is accomplished during procedure design on all IAPs. Obstacles (both lighted and unlighted) are allowed to penetrate the visual segment obstacle identification surfaces. Identified obstacle penetrations may cause restrictions to instrument approach operations which may include an increased approach visibility requirement, not publishing a VDP, and/or prohibiting night instrument operations to the runway. There is no implicit obstacle protection from the MDA/DA to the touchdown point. Accordingly, it is the responsibility of the pilot to visually acquire and avoid obstacles below the MDA/DA during transition to landing.

1. Unlighted obstacle penetrations may result in prohibiting night instrument operations to the runway. A chart note will be published in the pilot briefing strip "Procedure NA at Night."

2. Use of a VGSI may be approved in lieu of obstruction lighting to restore night instrument operations to the runway. A chart note will be published in the pilot briefing strip " Straight-in Rwy XX at Night, operational VGSI required, remain on or above VGSI glidepath until threshold."

j. The highest obstacle (man-made, terrain, or vegetation) will be charted on the planview of an IAP. Other obstacles may be charted in either the planview or the airport sketch based on distance from the runway and available chart space. The elevation of the charted obstacle will be shown to the nearest foot above mean sea level. Obstacles without a verified accuracy are indicated by a \pm symbol following the elevation value.

k. Vertical Descent Angle (VDA). FAA policy is to publish a VDA/TCH on all nonprecision approaches except those published in conjunction with vertically guided minimums (i.e., ILS or LOC RWY XX) or no-FAF procedures without a step-down fix (i.e., on-airport VOR or NDB). A

VDA does not guarantee obstacle protection below the MDA in the visual segment. The presence of a VDA does not change any nonprecision approach requirements.

1. Obstacles may penetrate the obstacle identification surface below the MDA in the visual segment of an IAP that has a published VDA/TCH. When the VDA/TCH is not authorized due to an obstacle penetration that would require a pilot to deviate from the VDA between MDA and touchdown, the VDA/TCH will be replaced with the note "Visual Segment- Obstacles" in the profile view of the IAP (See FIG 5–4–14). Accordingly, pilots are advised to carefully review approach procedures to identify where the optimum stabilized descent to landing can be initiated. Pilots that follow the previously published descent angle, provided by the RNAV system, below the MDA on procedures with this note may encounter obstacles in the visual segment. Pilots must visually avoid any obstacles below the MDA.

(a) VDA/TCH data is furnished by FAA on the official source document for publication on IAP charts and for coding in the navigation database unless, as noted previously, replaced by the note "Visual Segment – Obstacles."

(b) Commercial chart providers and navigation systems may publish or calculate a VDA/TCH even when the FAA does not provide such data. Pilots are cautioned that they are responsible for obstacle avoidance in the visual segment regardless of the presence or absence of a VDA/TCH and associated navigation system advisory vertical guidance.

2. The threshold crossing height (TCH) used to compute the descent angle is published with the VDA. The VDA and TCH information are charted on the profile view of the IAP following the fix (FAF/stepdown) used to compute the VDA. If no PA/APV IAP is established to the same runway, the VDA will be equal to or higher than the glide path angle of the VGSI installed on the same runway provided it is within instrument procedure criteria. A chart note will indicate if the VGSI is not coincident with the VDA. Pilots must be aware that the published VDA is for advisory information only and not to be considered instrument procedure derived vertical guidance. The VDA solely offers an aid to help pilots establish a continuous, stabilized descent during final approach.

3. Pilots may use the published angle and estimated/actual groundspeed to find a target rate of descent from the rate of descent table published in the back of the U.S. Terminal Procedures Publication. This rate of descent can be flown with the Vertical Velocity Indicator (VVI) in order to use the VDA as an aid to flying a stabilized descent. No special equipment is required.



FIG 5-4-14 Example of a Chart Note 4. A straight-in aligned procedure may be restricted to circling only minimums when an excessive descent gradient necessitates. The descent angle between the FAF/stepdown fix and the Circling MDA must not exceed the maximum descent angle allowed by TERPS criteria. A published VDA on these procedures does not imply that landing straight ahead is recommended or even possible. The descent rate based on the VDA may exceed the capabilities of the aircraft and the pilot must determine how to best maneuver the aircraft within the circling area in order to land safely.

I. In isolated cases, an IAP may contain a published visual flight path. These procedures are annotated "Fly Visual to Airport" or "Fly Visual." A dashed arrow indicating the visual flight path will be included in the profile and plan views with an approximate heading and distance to the end of the runway.

1. The depicted ground track associated with the "Fly Visual to Airport" segment should be flown as a "Dead Reckoning" course. When executing the "Fly Visual to Airport" segment, the flight visibility must not be less than that prescribed in the IAP; the pilot must remain clear of clouds and proceed to the airport maintaining visual contact with the ground. Altitude on the visual flight path is at the discretion of the pilot, and it is the responsibility of the pilot to visually acquire and avoid obstacles in the "Fly Visual to Airport" segment.

2. Missed approach obstacle clearance is assured only if the missed approach is commenced at the published MAP. Before initiating an IAP that contains a "Fly Visual to Airport" segment, the pilot should have preplanned climb out options based on aircraft performance and terrain features. Obstacle clearance is the responsibility of the pilot when the approach is continued beyond the MAP.

NOTE-

The FAA Administrator retains the authority to approve instrument approach procedures where the pilot may not necessarily have one of the visual references specified in 14 CFR § 91.175 and related rules. It is not a function of procedure design to ensure compliance with § 91.175. The annotation "Fly Visual to Airport" provides relief from § 91.175 requirements that the pilot have distinctly visible and identifiable visual references prior to descent below MDA/DA.

m. Area Navigation (RNAV) Instrument Approach Charts. Reliance on RNAV systems for instrument operations is becoming more commonplace as new systems such as GPS and augmented GPS such as the Wide Area Augmentation System (WAAS) are developed and deployed. In order to support full integration of RNAV procedures into the National Airspace System (NAS), the FAA developed a new charting format for IAPs (See FIG 5-4-6). This format avoids unnecessary duplication and proliferation of instrument approach charts. The original stand alone GPS charts, titled simply "GPS," are being converted to the newer format as the procedures are revised. One reason for the revision is the addition of WAAS based minima to the approach chart. The reformatted approach chart is titled "RNAV (GPS) RWY XX." Up to four lines of minima are included on these charts. Ground Based Augmentation System (GBAS) Landing System (GLS) was a placeholder for future WAAS and LAAS minima, and the minima was always listed as N/A. The GLS minima line has now been replaced by the WAAS LPV (Localizer Performance with Vertical Guidance) minima on most RNAV (GPS) charts. LNAV/VNAV (lateral navigation/vertical navigation) was added to support both WAAS electronic vertical guidance and Barometric VNAV. LPV and LNAV/VNAV are both APV procedures as described in paragraph 5–4–5a7. The original GPS minima, titled "S-XX," for straight in runway XX, is retitled LNAV (lateral navigation). Circling minima may also be published. A new type of nonprecision WAAS minima will also be published on this chart and titled LP (localizer performance). LP will be published in locations where vertically guided minima cannot be provided due to terrain and obstacles and therefore, no LPV or LNAV/VNAV minima will be published. GBAS procedures are published on a separate chart and the GLS minima line is to be used only for GBAS. ATC clearance for the RNAV procedure authorizes a properly certified pilot to utilize any minimums for which the aircraft is certified (for example, a WAAS equipped aircraft utilizes the LPV or LP minima but a GPS only aircraft may not). The RNAV chart includes information formatted for quick reference by the pilot or flight crew at the top of the chart. This portion of the chart, developed based on a study by the Department of Transportation, Volpe National Transportation System Center, is commonly referred to as the pilot briefing.

1. The minima lines are:

(a) GLS. "GLS" is the acronym for GBAS Landing System. The U.S. version of GBAS has traditionally been referred to as LAAS. The worldwide community has adopted GBAS as the official term for this type of navigation system. To coincide with international terminology, the FAA is also adopting the term GBAS to be consistent with the international community. This line was originally published as a placeholder for both WAAS and LAAS minima and marked as N/A since no minima was published. As the concepts for GBAS and WAAS procedure publication have evolved, GLS will now be used only for GBAS minima, which will be on a separate approach chart. Most RNAV(GPS) approach charts have had the GLS minima line replaced by a WAAS LPV line of minima.

(b) LPV. "LPV" is the acronym for localizer performance with vertical guidance. RNAV (GPS) approaches to LPV lines of minima take advantage of the improved accuracy of WAAS lateral and vertical guidance to provide an approach that is very similar to a Category I Instrument Landing System (ILS). The approach to LPV line of minima is designed for angular guidance with increasing sensitivity as the aircraft gets closer to the runway. The sensitivities are nearly identical to those of the ILS at similar distances. This was done intentionally to allow the skills required to proficiently fly an ILS to readily transfer to flying RNAV (GPS) approaches to the LPV line of minima. Just as with an ILS, the LPV has vertical guidance and is flown to a DA. Aircraft can fly this minima line with a statement in the Aircraft Flight Manual that the installed equipment supports LPV approaches. This includes Class 3 and 4 TSO-C146 GPS/WAAS equipment.

(c) LNAV/VNAV. LNAV/VNAV identifies APV minimums developed to accommodate an RNAV IAP with vertical guidance, usually provided by approach certified Baro–VNAV, but with lateral and vertical integrity limits larger than a precision approach or LPV. LNAV stands for Lateral Navigation; VNAV stands for Vertical Navigation. This minima line can be flown by aircraft with a statement in the Aircraft Flight Manual that the installed equipment supports GPS approaches and has an approach–approved barometric VNAV, or if the aircraft has been demonstrated to support LNAV/VNAV approaches. This includes Class 2, 3 and 4 TSO-C146 GPS/WAAS equipment. Aircraft using LNAV/VNAV minimums will descend to landing via an internally generated descent path based on satellite or other approach approved VNAV systems. Since electronic vertical guidance is provided, the minima will be published as a DA. Other navigation systems may be specifically authorized to use this line of minima. (See Section A, Terms/Landing Minima Data, of the U.S. Terminal Procedures books.)

(d) LP. "LP" is the acronym for localizer performance. Approaches to LP lines of minima take advantage of the improved accuracy of WAAS to provide approaches, with lateral guidance and angular guidance. Angular guidance does not refer to a glideslope angle but rather to the increased lateral sensitivity as the aircraft gets closer to the runway, similar to localizer approaches. However, the LP line of minima is a Minimum Descent Altitude (MDA) rather than a DA (H). Procedures with LP lines of minima will not be published with another approach that contains approved vertical guidance (LNAV/ VNAV or LPV). It is possible to have LP and LNAV published on the same approach chart but LP will only be published if it provides lower minima than an LNAV line of minima. LP is not a fail-down mode for LPV. LP will only be published if terrain, obstructions, or some other reason prevent publishing a vertically guided procedure. WAAS avionics may provide GNSS-based advisory vertical guidance during an approach to an LP line of minima. Barometric altimeter information remains the primary altitude reference for complying with any altitude restrictions. WAAS equipment may not support LP, even if it supports LPV, if it was approved before TSO-C145b and TSO-C146b. Receivers approved under previous TSOs may require an upgrade by the manufacturer in order to be used to fly to LP minima. Receivers approved for LP must have a statement in the approved Flight Manual or Supplemental Flight Manual including LP as one of the approved approach types.

(e) LNAV. This minima is for lateral navigation only, and the approach minimum altitude will be published as a minimum descent altitude (MDA). LNAV provides the same level of service as the present GPS stand alone approaches. LNAV minimums support the following navigation systems: WAAS, when the navigation solution will not support vertical navigation; and, GPS navigation systems

which are presently authorized to conduct GPS approaches.

NOTE-

GPS receivers approved for approach operations in accordance with: AC 20–138, Airworthiness Approval of Positioning and Navigation Systems, qualify for this minima. WAAS navigation equipment must be approved in accordance with the requirements specified in TSO–C145() or TSO–C146() and installed in accordance with Advisory Circular AC 20–138.

2. Other systems may be authorized to utilize these approaches. See the description in Section A of the U.S. Terminal Procedures books for details. Operational approval must also be obtained for Baro–VNAV systems to operate to the LNAV/VNAV minimums. Baro–VNAV may not be authorized on some approaches due to other factors, such as no local altimeter source being available. Baro–VNAV is not authorized on LPV procedures. Pilots are directed to their local Flight Standards District Office (FSDO) for additional information.

NOTE-

RNAV and Baro-VNAV systems must have a manufacturer supplied electronic database which must include the waypoints, altitudes, and vertical data for the procedure to be flown. 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.

3. ILS or RNAV (GPS) charts.

(a) Some RNAV (GPS) charts will also contain an ILS line of minima to make use of the ILS precision final in conjunction with the RNAV GPS capabilities for the portions of the procedure prior to the final approach segment and for the missed approach. Obstacle clearance for the portions of the procedure other than the final approach segment is still based on GPS criteria.

NOTE-

Some GPS receiver installations inhibit GPS navigation whenever ANY ILS frequency is tuned. Pilots flying aircraft with receivers installed in this manner must wait until they are on the intermediate segment of the procedure prior to the PFAF (PFAF is the active waypoint) to tune the ILS frequency and must tune the ILS back to a VOR frequency in order to fly the GPS based missed approach.

(b) Charting. There are charting differences between ILS, RNAV (GPS), and GLS approaches.

(1) The LAAS procedure is titled "GLS RWY XX" on the approach chart.

(2) The VDB provides information to the airborne receiver where the guidance is synthesized.

(3) The LAAS procedure is identified by a four alpha-numeric character field referred to as the RPI or approach ID and is similar to the IDENT feature of the ILS.

(4) The RPI is charted.

(5) Most RNAV(GPS) approach charts have had the GLS (NA) minima line replaced by an LPV line of minima.

(6) Since the concepts for LAAS and WAAS procedure publication have evolved, GLS will now be used only for LAAS minima, which will be on a separate approach chart.

4. Required Navigation Performance (RNP).

(a) Pilots are advised to refer to the "TERMS/LANDING MINIMUMS DATA" (Section A) of the U.S. Government Terminal Procedures books for aircraft approach eligibility requirements by specific RNP level requirements.

(b) Some aircraft have RNP approval in their AFM without a GPS sensor. The lowest level of sensors that the FAA will support for RNP service is DME/DME. However, necessary DME signal may not be available at the airport of intended operations. For those locations having an RNAV chart published with LNAV/VNAV minimums, a procedure note may be provided such as "DME/DME RNP-0.3 NA." This means that RNP aircraft dependent on DME/DME to achieve RNP-0.3 are not authorized to conduct this approach. Where DME facility availability is a factor, the note may read "DME/DME RNP-0.3 Authorized; ABC and XYZ Required." This means that ABC and XYZ facilities have been determined by flight inspection to be required in the navigation solution to assure RNP-0.3. VOR/DME updating must not be used for approach procedures.

5. Chart Terminology.

(a) Decision Altitude (DA) replaces the familiar term Decision Height (DH). DA conforms to the international convention where altitudes relate to MSL and heights relate to AGL. DA will eventually be published for other types of instrument approach procedures with vertical guidance, as well. DA indicates to the pilot that the published descent profile is flown to the DA (MSL), where a missed approach will be initiated if visual references for landing are not

established. Obstacle clearance is provided to allow a momentary descent below DA while transitioning from the final approach to the missed approach. The aircraft is expected to follow the missed instructions while continuing along the published final approach course to at least the published runway threshold waypoint or MAP (if not at the threshold) before executing any turns.

(b) Minimum Descent Altitude (MDA) has been in use for many years, and will continue to be used for the LNAV only and circling procedures.

(c) Threshold Crossing Height (TCH) has been traditionally used in "precision" approaches as the height of the glide slope above threshold. With publication of LNAV/VNAV minimums and RNAV descent angles, including graphically depicted descent profiles, TCH also applies to the height of the "descent angle," or glidepath, at the threshold. Unless otherwise required for larger type aircraft which may be using the IAP, the typical TCH is 30 to 50 feet.

6. The MINIMA FORMAT will also change slightly.

(a) Each line of minima on the RNAV IAP is titled to reflect the level of service available; e.g., GLS, LPV, LNAV/VNAV, LP, and LNAV. CIR-CLING minima will also be provided.

(b) The minima title box indicates the nature of the minimum altitude for the IAP. For example:

(1) DA will be published next to the minima line title for minimums supporting vertical guidance such as for GLS, LPV or LNAV/VNAV.

(2) MDA will be published as the minima line on approaches with lateral guidance only, LNAV, or LP. Descent below the MDA must meet the conditions stated in 14 CFR Section 91.175.

(3) Where two or more systems, such as LPV and LNAV/VNAV, share the same minima, each line of minima will be displayed separately.

7. Chart Symbology changed slightly to include:

(a) **Descent Profile.** The published descent profile and a graphical depiction of the vertical path to the runway will be shown. Graphical depiction of the RNAV vertical guidance will differ from the traditional depiction of an ILS glide slope (feather)

through the use of a shorter vertical track beginning at the decision altitude.

(1) It is FAA policy to design IAPs with minimum altitudes established at fixes/waypoints to achieve optimum stabilized (constant rate) descents within each procedure segment. This design can enhance the safety of the operations and contribute toward reduction in the occurrence of controlled flight into terrain (CFIT) accidents. Additionally, the National Transportation Safety Board (NTSB) recently emphasized that pilots could benefit from publication of the appropriate IAP descent angle for a stabilized descent on final approach. The RNAV IAP format includes the descent angle to the hundredth of a degree; e.g., 3.00 degrees. The angle will be provided in the graphically depicted descent profile.

(2) The stabilized approach may be performed by reference to vertical navigation information provided by WAAS or LNAV/VNAV systems; or for LNAV-only systems, by the pilot determining the appropriate aircraft attitude/ groundspeed combination to attain a constant rate descent which best emulates the published angle. To aid the pilot, U.S. Government Terminal Procedures Publication charts publish an expanded Rate of Descent Table on the inside of the back hard cover for use in planning and executing precision descents under known or approximate groundspeed conditions.

(b) Visual Descent Point (VDP). A VDP will be published on most RNAV IAPs. VDPs apply only to aircraft utilizing LP or LNAV minima, not LPV or LNAV/VNAV minimums.

(c) Missed Approach Symbology. In order to make missed approach guidance more readily understood, a method has been developed to display missed approach guidance in the profile view through the use of quick reference icons. Due to limited space in the profile area, only four or fewer icons can be shown. However, the icons may not provide representation of the entire missed approach procedure. The entire set of textual missed approach instructions are provided at the top of the approach chart in the pilot briefing. (See FIG 5–4–6).

(d) Waypoints. All RNAV or GPS standalone IAPs are flown using data pertaining to the particular IAP obtained from an onboard database, including the sequence of all WPs used for the approach and missed approach, except that step down waypoints may not be included in some TSO-C129 receiver databases. Included in the database, in most receivers, is coding that informs the navigation system of which WPs are fly-over (FO) or fly-by (FB). The navigation system may provide guidance appropriately – including leading the turn prior to a fly-by WP; or causing overflight of a fly-over WP. Where the navigation system does not provide such guidance, the pilot must accomplish the turn lead or waypoint overflight manually. Chart symbology for the FB WP provides pilot awareness of expected actions. Refer to the legend of the U.S. Terminal Procedures books.

(e) TAAs are described in paragraph 5–4–5d, Terminal Arrival Area (TAA). When published, the RNAV chart depicts the TAA areas through the use of "icons" representing each TAA area associated with the RNAV procedure (See FIG 5–4–6). These icons are depicted in the plan view of the approach chart, generally arranged on the chart in accordance with their position relative to the aircraft's arrival from the en route structure. The WP, to which navigation is appropriate and expected within each specific TAA area, will be named and depicted on the associated TAA icon. Each depicted named WP is the IAF for arrivals from within that area. TAAs may not be used on all RNAV procedures because of airspace congestion or other reasons.

(f) Published Temperature Limitations. There are currently two temperature limitations that may be published in the notes box of the middle briefing strip on an instrument approach procedure (IAP). The two published temperature limitations are:

(1) A temperature range limitation associated with the use of baro-VNAV that may be published on a United States PBN IAP titled RNAV (GPS) or RNAV (RNP); and/or

(2) A Cold Temperature Airport (CTA) limitation designated by a snowflake ICON and temperature in Celsius (C) that is published on every IAP for the airfield.

REFERENCE-

AIM, Chapter 7, Section 3, Cold Temperature Barometric Altimeter Errors, Setting Procedures and Cold Temperature Airports (CTA).

(g) WAAS Channel Number/Approach ID. The WAAS Channel Number is an optional equipment capability that allows the use of a 5-digit number to select a specific final approach segment without using the menu method. The Approach ID is an airport unique 4-character combination for verifying the selection and extraction of the correct final approach segment information from the aircraft database. It is similar to the ILS ident, but displayed visually rather than aurally. The Approach ID consists of the letter W for WAAS, the runway number, and a letter other than L, C or R, which could be confused with Left, Center and Right, e.g., W35A. Approach IDs are assigned in the order that WAAS approaches are built to that runway number at that airport. The WAAS Channel Number and Approach ID are displayed in the upper left corner of the approach procedure pilot briefing.

(h) At locations where outages of WAAS vertical guidance may occur daily due to initial system limitations, a negative W symbol (W) will be placed on RNAV (GPS) approach charts. Many of these outages will be very short in duration, but may result in the disruption of the vertical portion of the approach. The W symbol indicates that NOTAMs or Air Traffic advisories are not provided for outages which occur in the WAAS LNAV/VNAV or LPV vertical service. 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 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. As the WAAS coverage is expanded, the W will be removed.

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.

5-4-6. Approach Clearance

a. An aircraft which has been cleared to a holding fix and subsequently "cleared . . . approach" has not received new routing. Even though clearance for the approach may have been issued prior to the aircraft reaching the holding fix, ATC would expect the pilot to proceed via the holding fix (his/her last assigned

route), and the feeder route associated with that fix (if a feeder route is published on the approach chart) to the initial approach fix (IAF) to commence the approach. WHEN CLEARED FOR THE APPROACH, THE PUBLISHED OFF AIRWAY (FEEDER) ROUTES THAT LEAD FROM THE EN ROUTE STRUCTURE TO THE IAF ARE PART OF THE APPROACH CLEARANCE.

b. If a feeder route to an IAF begins at a fix located along the route of flight prior to reaching the holding fix, and clearance for an approach is issued, a pilot should commence the approach via the published feeder route; i.e., the aircraft would not be expected to overfly the feeder route and return to it. The pilot is expected to commence the approach in a similar manner at the IAF, if the IAF for the procedure is located along the route of flight to the holding fix.

c. If a route of flight directly to the initial approach fix is desired, it should be so stated by the controller with phraseology to include the words "direct . . . ," "proceed direct" or a similar phrase which the pilot can interpret without question. When uncertain of the clearance, immediately query ATC as to what route of flight is desired.

d. The name of an instrument approach, as published, is used to identify the approach, even though a component of the approach aid, such as the glideslope on an Instrument Landing System, is inoperative or unreliable. The controller will use the name of the approach as published, but must advise the aircraft at the time an approach clearance is issued that the inoperative or unreliable approach aid component is unusable, except when the title of the published approach procedures otherwise allows; for example, ILS Rwy 05 or LOC Rwy 05.

e. The following applies to aircraft on radar vectors and/or cleared "direct to" in conjunction with an approach clearance:

1. Maintain the last altitude assigned by ATC until the aircraft is established on a published segment of a transition route, or approach procedure segment, or other published route, for which a lower altitude is published on the chart. If already on an established route, or approach or arrival segment, you may descend to whatever minimum altitude is listed for that route or segment.

2. Continue on the vector heading until intercepting the next published ground track applicable to the approach clearance.

3. Once reaching the final approach fix via the published segments, the pilot may continue on approach to a landing.

4. If proceeding to an IAF with a published course reversal (procedure turn or hold-in-lieu of PT pattern), except when cleared for a straight in approach by ATC, the pilot must execute the procedure turn/hold-in-lieu of PT, and complete the approach.

5. If cleared to an IAF/IF via a NoPT route, or no procedure turn/hold-in-lieu of PT is published, continue with the published approach.

6. In addition to the above, RNAV aircraft may be issued a clearance direct to the IAF/IF at intercept angles not greater than 90 degrees for both conventional and RNAV instrument approaches. Controllers may issue a heading or a course direct to a fix between the IF and FAF at intercept angles not greater than 30 degrees for both conventional and RNAV instrument approaches. In all cases, controllers will assign altitudes that ensure obstacle clearance and will permit a normal descent to the FAF. When clearing aircraft direct to the IF, ATC will radar monitor the aircraft until the IF and will advise the pilot to expect clearance direct to the IF at least 5 miles from the fix. ATC must issue a straight-in approach clearance when clearing an aircraft direct to an IAF/IF with a procedure turn or hold-in-lieu of a procedure turn, and ATC does not want the aircraft to execute the course reversal.

NOTE-

Refer to 14 CFR 91.175 (i).

7. RNAV aircraft may be issued a clearance direct to the FAF that is also charted as an IAF, in which case the pilot is expected to execute the depicted procedure turn or hold-in-lieu of procedure turn. ATC will not issue a straight-in approach clearance. If the pilot desires a straight-in approach, they must request vectors to the final approach course outside of the FAF or fly a published "NoPT" route. When visual approaches are in use, ATC may clear an aircraft direct to the FAF.

NOTE-

1. In anticipation of a clearance by ATC to any fix published on an instrument approach procedure, pilots of RNAV aircraft are advised to select an appropriate IAF or feeder fix when loading an instrument approach procedure into the RNAV system.

2. Selection of "Vectors-to-Final" or "Vectors" option for an instrument approach may prevent approach fixes located outside of the FAF from being loaded into an RNAV system. Therefore, the selection of these options is discouraged due to increased workload for pilots to reprogram the navigation system.

8. Arrival Holding. Some approach charts have an arrival holding pattern depicted at an IAF or at a feeder fix located along an airway. The arrival hold is depicted using a "thin line" since it is not always a mandatory part of the instrument procedure.

(a) Arrival holding is charted where holding is frequently required prior to starting the approach procedure so that detailed holding instructions are not required. The arrival holding pattern is not authorized unless assigned by ATC. Holding at the same fix may also be depicted on the en route chart.

(b) Arrival holding is also charted where it is necessary to use a holding pattern to align the aircraft for procedure entry from an airway due to turn angle limitations imposed by procedure design standards. When the turn angle from an airway into the approach procedure exceeds the permissible limits, an arrival holding pattern may be published along with a note on the procedure specifying the fix, the airway, and arrival direction where use of the arrival hold is required for procedure entry. Unlike a hold-in-lieu of procedure turn, use of the arrival holding pattern is not authorized until assigned by ATC. If ATC does not assign the arrival hold before reaching the holding fix, the pilot should request the hold for procedure entry. Once established on the inbound holding course and an approach clearance has been received, the published procedure can commence. Alternatively, if using the holding pattern for procedure entry is not desired, the pilot may ask ATC for maneuvering airspace to align the aircraft with the feeder course.

EXAMPLE-

Planview Chart Note: "Proc NA via V343 northeast bound without holding at JOXIT. ATC CLNC REQD."

f. An RF leg is defined as a constant radius circular path around a defined turn center that starts and terminates at a fix. An RF leg may be published as part of a procedure. Since not all aircraft have the capability to fly these leg types, pilots are responsible for knowing if they can conduct an RNAV approach with an RF leg. Requirements for RF legs will be

indicated on the approach chart in the notes section or at the applicable initial approach fix. Controllers will clear RNAV-equipped aircraft for instrument approach procedures containing RF legs:

- 1. Via published transitions, or
- 2. In accordance with paragraph e6 above, and

3. ATC will not clear aircraft direct to any waypoint beginning or within an RF leg, and will not assign fix/waypoint crossing speeds in excess of charted speed restrictions.

EXAMPLE-

Controllers will not clear aircraft direct to THIRD because that waypoint begins the RF leg, and aircraft cannot be vectored or cleared to TURNN or vectored to intercept the approach segment at any point between THIRD and FORTH because this is the RF leg. (See FIG 5–4–15.)

g. When necessary to cancel a previously issued approach clearance, the controller will advise the pilot "Cancel Approach Clearance" followed by any additional instructions when applicable.

5-4-7. Instrument Approach Procedures

a. Aircraft approach category means a grouping of aircraft based on a speed of V_{REF} at the maximum certified landing weight, if specified, or if V_{REF} is not specified, 1.3_{VSO} at the maximum certified landing weight. V_{REF} , V_{SO} , and the maximum certified landing weight are those values as established for the aircraft by the certification authority of the country of registry. A pilot must maneuver the aircraft within the circling approach protected area (see FIG 5–4–27) to achieve the obstacle and terrain clearances provided by procedure design criteria.

b. In addition to pilot techniques for maneuvering, one acceptable method to reduce the risk of flying out of the circling approach protected area is to use either the minima corresponding to the category determined during certification or minima associated with a higher category. Helicopters may use Category A minima. If it is necessary to operate at a speed in excess of the upper limit of the speed range for an aircraft's category, the minimums for the higher category should be used. This may occur with certain aircraft types operating in heavy/gusty wind, icing, or non-normal conditions. For example, an airplane which fits into Category B, but is circling to land at a speed of 145 knots, should use the approach Category D minimums. As an additional example, a Category A airplane (or helicopter) which is

operating at 130 knots on a straight–in approach should use the approach Category C minimums.

c. A pilot who chooses an alternative method when it is necessary to maneuver at a speed that exceeds the category speed limit (for example, where higher category minimums are not published) should consider the following factors that can significantly affect the actual ground track flown:

1. Bank angle. For example, at 165 knots groundspeed, the radius of turn increases from 4,194 feet using 30 degrees of bank to 6,654 feet when using 20 degrees of bank. When using a shallower bank angle, it may be necessary to modify the flightpath or indicated airspeed to remain within the circling approach protected area. Pilots should be aware that excessive bank angle can lead to a loss of aircraft control.

2. Indicated airspeed. Procedure design criteria typically utilize the highest speed for a particular category. If a pilot chooses to operate at a higher speed, other factors should be modified to ensure that the aircraft remains within the circling approach protected area.

3. Wind speed and direction. For example, it is not uncommon to maneuver the aircraft to a downwind leg where the groundspeed will be considerably higher than the indicated airspeed. Pilots must carefully plan the initiation of all turns to ensure that the aircraft remains within the circling approach protected area.

4. Pilot technique. Pilots frequently have many options with regard to flightpath when conducting circling approaches. Sound planning and judgment are vital to proper execution. The lateral and vertical path to be flown should be carefully considered using current weather and terrain information to ensure that the aircraft remains within the circling approach protected area.

d. It is important to remember that 14 CFR Section 91.175(c) requires that "where a DA/DH or MDA is applicable, no pilot may operate an aircraft below the authorized MDA or continue an approach below the authorized DA/DH unless the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and for operations conducted under Part 121 or Part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing."

e. See the following category limits:

1. Category A: Speed less than 91 knots.

2. Category B: Speed 91 knots or more but less than 121 knots.

3. Category C: Speed 121 knots or more but less than 141 knots.

4. Category D: Speed 141 knots or more but less than 166 knots.

5. Category E: Speed 166 knots or more.

NOTE-

 V_{REF} in the above definition refers to the speed used in establishing the approved landing distance under the airworthiness regulations constituting the type certification basis of the airplane, regardless of whether that speed for a particular airplane is 1.3 V_{SO} , 1.23 V_{SR} , or some higher speed required for airplane controllability. This speed, at the maximum certificated landing weight, determines the lowest applicable approach category for all approaches regardless of actual landing weight.

f. When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, must, in addition to complying with the minimum altitudes for IFR operations (14 CFR Section 91.177), maintain the last assigned altitude unless a different altitude is assigned by ATC, or until the aircraft is established on a segment of a published route or IAP. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Notwithstanding this pilot responsibility, for aircraft operating on unpublished routes or while being radar vectored, ATC will, except when conducting a radar approach, issue an IFR approach clearance only after the aircraft is established on a segment of a published route or IAP, or assign an altitude to maintain until the aircraft is established on a segment of a published route or instrument approach procedure. For this purpose, the procedure turn of a published IAP must not be considered a segment of that IAP until the aircraft reaches the initial fix or navigation facility upon which the procedure turn is predicated.

EXAMPLE-

Cross Redding VOR at or above five thousand, cleared VOR runway three four approach. or

AIM

Five miles from outer marker, turn right heading three three zero, maintain two thousand until established on the localizer, cleared ILS runway three six approach.

NOTE-

1. The altitude assigned will assure IFR obstruction clearance from the point at which the approach clearance is issued until established on a segment of a published route or IAP. If uncertain of the meaning of the clearance, immediately request clarification from ATC.

2. An aircraft is not established on an approach while below published approach altitudes. If the MVA/MIA allows, and ATC assigns an altitude below an IF or IAF altitude, the pilot will be issued an altitude to maintain until past a point that the aircraft is established on the approach.

g. Several IAPs, using various navigation and approach aids may be authorized for an airport. ATC may advise that a particular approach procedure is being used, primarily to expedite traffic. If issued a clearance that specifies a particular approach procedure, notify ATC immediately if a different one is desired. In this event it may be necessary for ATC to withhold clearance for the different approach until such time as traffic conditions permit. However, a pilot involved in an emergency situation will be given priority. If the pilot is not familiar with the specific approach procedure, ATC should be advised and they will provide detailed information on the execution of the procedure.

REFERENCE-

AIM, Paragraph 5-4-4, Advance Information on Instrument Approach.

h. The name of an instrument approach, as published, is used to identify the approach, even though a component of the approach aid, such as the glideslope on an Instrument Landing System, is inoperative or unreliable. The controller will use the name of the approach as published, but must advise the aircraft at the time an approach clearance is issued that the inoperative or unreliable approach aid component is unusable, except when the title of the published approach procedures otherwise allows, for example, ILS or LOC.

i. Except when being radar vectored to the final approach course, when cleared for a specifically prescribed IAP; i.e., "cleared ILS runway one niner approach" or when "cleared approach" i.e., execution of any procedure prescribed for the airport, pilots must execute the entire procedure commencing at an IAF or an associated feeder route as described on the IAP chart unless an appropriate new or revised ATC clearance is received, or the IFR flight plan is canceled.

j. Pilots planning flights to locations which are private airfields or which have instrument approach procedures based on private navigation aids should obtain approval from the owner. In addition, the pilot must be authorized by the FAA to fly special instrument approach procedures associated with private navigation aids (see paragraph 5–4–8). Owners of navigation aids that are not for public use may elect to turn off the signal for whatever reason they may have; for example, maintenance, energy conservation, etc. Air traffic controllers are not required to question pilots to determine if they have permission to land at a private airfield or to use procedures based on privately owned navigation aids, and they may not know the status of the navigation aid. Controllers presume a pilot has obtained approval from the owner and the FAA for use of special instrument approach procedures and is aware of any details of the procedure if an IFR flight plan was filed to that airport.

k. Pilots should not rely on radar to identify a fix unless the fix is indicated as "RADAR" on the IAP. Pilots may request radar identification of an OM, but the controller may not be able to provide the service due either to workload or not having the fix on the video map.

I. If a missed approach is required, advise ATC and include the reason (unless initiated by ATC). Comply with the missed approach instructions for the instrument approach procedure being executed, unless otherwise directed by ATC.

REFERENCE-

AIM, Paragraph 5–4–21, Missed Approach. AIM, Paragraph 5–5–5, Missed Approach.

5–4–8. Special Instrument Approach Procedures

Instrument Approach Procedure (IAP) charts reflect the criteria associated with the U.S. Standard for Terminal Instrument [Approach] Procedures (TERP), which prescribes standardized methods for use in developing IAPs. Standard IAPs are published in the Federal Register (FR) in accordance with Title 14 of the Code of Federal Regulations, Part 97, and are available for use by appropriately qualified pilots operating properly equipped and airworthy aircraft in accordance with operating rules and procedures acceptable to the FAA. Special IAPs are also developed using TERPS but are not given public notice in the FR. The FAA authorizes only certain individual pilots and/or pilots in individual organizations to use special IAPs, and may require additional crew training and/or aircraft equipment or performance, and may also require the use of landing aids, communications, or weather services not available for public use. Additionally, IAPs that service private use airports or heliports are generally special IAPs. FDC NOTAMs for Specials, FDC T-NOTAMs, may also be used to promulgate safety-of-flight information relating to Specials provided the location has a valid landing area identifier and is serviced by the United States NOTAM system. Pilots may access NOTAMs online or through an FAA Flight Service Station (FSS). FSS specialists will not automatically provide NOTAM information to pilots for special IAPs during telephone pre-flight briefings. Pilots who are authorized by the FAA to use special IAPs must specifically request FDC NOTAM information for the particular special IAP they plan to use.

5–4–9. Procedure Turn and Hold–in–lieu of Procedure Turn

a. A procedure turn is the maneuver prescribed when it is necessary to reverse direction to establish the aircraft inbound on an intermediate or final approach course. The procedure turn or hold-inlieu-of-PT is a required maneuver when it is depicted on the approach chart, unless cleared by ATC for a straight-in approach. Additionally, the procedure turn or hold-in-lieu-of-PT is not permitted when the symbol "No PT" is depicted on the initial segment being used, when a RADAR VECTOR to the final approach course is provided, or when conducting a timed approach from a holding fix. The altitude prescribed for the procedure turn is a minimum altitude until the aircraft is established on the inbound course. The maneuver must be completed within the distance specified in the profile view. For a hold-in-lieu-of-PT, the holding pattern direction must be flown as depicted and the specified leg length/timing must not be exceeded.

NOTE-

The pilot may elect to use the procedure turn or hold-in-lieu-of-PT when it is not required by the procedure, but must first receive an amended clearance from ATC. If the pilot is uncertain whether the ATC clearance intends for a procedure turn to be conducted or to allow for a straight-in approach, the pilot must immediately request clarification from ATC (14 CFR Section 91.123).

1. On U.S. Government charts, a barbed arrow indicates the maneuvering side of the outbound course on which the procedure turn is made. Headings are provided for course reversal using the 45 degree type procedure turn. However, the point at which the turn may be commenced and the type and rate of turn is left to the discretion of the pilot (limited by the charted remain within xx NM distance). Some of the options are the 45 degree procedure turn, the racetrack pattern, the teardrop procedure turn, or the 80 degree \leftrightarrow 260 degree course reversal. Racetrack entries should be conducted on the maneuvering side where the majority of protected airspace resides. If an entry places the pilot on the non-maneuvering side of the PT, correction to intercept the outbound course ensures remaining within protected airspace. Some procedure turns are specified by procedural track. These turns must be flown exactly as depicted.

2. Descent to the procedure turn (PT) completion altitude from the PT fix altitude (when one has been published or assigned by ATC) must not begin until crossing over the PT fix or abeam and proceeding outbound. Some procedures contain a note in the chart profile view that says "Maintain (altitude) or above until established outbound for procedure turn" (See FIG 5-4-16). Newer procedures will simply depict an "at or above" altitude at the PT fix without a chart note (See FIG 5–4–17). Both are there to ensure required obstacle clearance is provided in the procedure turn entry zone (See FIG 5–4–18). Absence of a chart note or specified minimum altitude adjacent to the PT fix is an indication that descent to the procedure turn altitude can commence immediately upon crossing over the PT fix, regardless of the direction of flight. This is because the minimum altitudes in the PT entry zone and the PT maneuvering zone are the same.

THIRD Max 210KIAS SCOND (IAF) TURNN FORTH B FAF MAP Runway 18

FIG 5-4-15 Example of an RNAV Approach with RF Leg

FIG 5-4-16



FIG 5-4-17







3. When the approach procedure involves a procedure turn, a maximum speed of not greater than 200 knots (IAS) should be observed from first overheading the course reversal IAF through the procedure turn maneuver to ensure containment within the obstruction clearance area. Pilots should begin the outbound turn immediately after passing the procedure turn fix. The procedure turn maneuver must be executed within the distance specified in the profile view. The normal procedure turn distance is 10 miles. This may be reduced to a minimum of 5 miles where only Category A or helicopter aircraft are to be operated or increased to as much as 15 miles to accommodate high performance aircraft.

4. A teardrop procedure or penetration turn may be specified in some procedures for a required course

reversal. The teardrop procedure consists of departure from an initial approach fix on an outbound course followed by a turn toward and intercepting the inbound course at or prior to the intermediate fix or point. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. Where no fix is available to mark the beginning of the intermediate segment, it must be assumed to commence at a point 10 miles prior to the final approach fix. When the facility is located on the airport, an aircraft is considered to be on final approach upon completion of the penetration turn. However, the final approach segment begins on the final approach course 10 miles from the facility.

5. A holding pattern in lieu of procedure turn may be specified for course reversal in some

procedures. In such cases, the holding pattern is established over an intermediate fix or a final approach fix. The holding pattern distance or time specified in the profile view must be observed. For a hold-in-lieu-of-PT, the holding pattern direction must be flown as depicted and the specified leg length/timing must not be exceeded. Maximum holding airspeed limitations as set forth for all holding patterns apply. The holding pattern maneuver is completed when the aircraft is established on the inbound course after executing the appropriate entry. If cleared for the approach prior to returning to the holding fix, and the aircraft is at the prescribed altitude, additional circuits of the holding pattern are not necessary nor expected by ATC. If pilots elect to make additional circuits to lose excessive altitude or to become better established on course, it is their responsibility to so advise ATC upon receipt of their approach clearance.

6. A procedure turn is not required when an approach can be made directly from a specified intermediate fix to the final approach fix. In such cases, the term "NoPT" is used with the appropriate course and altitude to denote that the procedure turn is not required. If a procedure turn is desired, and when cleared to do so by ATC, descent below the procedure turn altitude should not be made until the aircraft is established on the inbound course, since some NoPT altitudes may be lower than the procedure turn altitudes.

b. Limitations on Procedure Turns

1. In the case of a radar initial approach to a final approach fix or position, or a timed approach from a holding fix, or where the procedure specifies NoPT, no pilot may make a procedure turn unless, when final approach clearance is received, the pilot so advises ATC and a clearance is received to execute a procedure turn.

2. When a teardrop procedure turn is depicted and a course reversal is required, this type turn must be executed.

3. When a holding pattern replaces a procedure turn, the holding pattern must be followed, except when RADAR VECTORING is provided or when NoPT is shown on the approach course. The recommended entry procedures will ensure the aircraft remains within the holding pattern's

protected airspace. As in the procedure turn, the descent from the minimum holding pattern altitude to the final approach fix altitude (when lower) may not commence until the aircraft is established on the inbound course. Where a holding pattern is established in-lieu-of a procedure turn, the maximum holding pattern airspeeds apply.

REFERENCE-

AIM, Paragraph 5-3-8 j2, Holding.

4. The absence of the procedure turn barb in the plan view indicates that a procedure turn is not authorized for that procedure.

5–4–10. Timed Approaches from a Holding Fix

a. TIMED APPROACHES may be conducted when the following conditions are met:

1. A control tower is in operation at the airport where the approaches are conducted.

2. Direct communications are maintained between the pilot and the center or approach controller until the pilot is instructed to contact the tower.

3. If more than one missed approach procedure is available, none require a course reversal.

4. If only one missed approach procedure is available, the following conditions are met:

(a) Course reversal is not required; and,

(b) Reported ceiling and visibility are equal to or greater than the highest prescribed circling minimums for the IAP.

5. When cleared for the approach, pilots must not execute a procedure turn. (14 CFR Section 91.175.)

b. Although the controller will not specifically state that "timed approaches are in use," the assigning of a time to depart the final approach fix inbound (nonprecision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach) is indicative that timed approach procedures are being utilized, or in lieu of holding, the controller may use radar vectors to the Final Approach Course to establish a mileage interval between aircraft that will ensure the appropriate time sequence between the final approach fix/outer marker or fix used in lieu of the outer marker and the airport.

to leave the holding point has been received, the pilot should adjust the flight path to leave the fix as closely as possible to the designated time. (See FIG 5-4-19.)





EXAMPLE-

At 12:03 local time, in the example shown, a pilot holding, receives instructions to leave the fix inbound at 12:07. These instructions are received just as the pilot has completed turn at the outbound end of the holding pattern and is proceeding inbound towards the fix. Arriving back over the fix, the pilot notes that the time is 12:04 and that there are 3 minutes to lose in order to leave the fix at the assigned time. Since the time remaining is more than two minutes, the pilot plans to fly a race

track pattern rather than a 360 degree turn, which would use up 2 minutes. The turns at the ends of the race track pattern will consume approximately 2 minutes. Three minutes to go, minus 2 minutes required for the turns, leaves 1 minute for level flight. Since two portions of level flight will be required to get back to the fix inbound, the pilot halves the 1 minute remaining and plans to fly level for 30 seconds outbound before starting the turn back to the fix on final approach. If the winds were negligible at flight altitude, this procedure would bring the pilot should across the fix precisely at the specified time of 12:07. However, if expecting headwind on final approach, the pilot should shorten the 30 second outbound course somewhat, knowing that the wind will carry the aircraft away from the fix faster while outbound and decrease the ground speed while returning to the fix. On the other hand, compensating for a tailwind on final approach, the pilot should tend to hold the aircraft closer to the fix while outbound and increase the ground speed while returning to the fix.

5-4-11. Radar Approaches

a. The only airborne radio equipment required for radar approaches is a functioning radio transmitter and receiver. The radar controller vectors the aircraft to align it with the runway centerline. The controller continues the vectors to keep the aircraft on course until the pilot can complete the approach and landing by visual reference to the surface. There are two types of radar approaches: Precision (PAR) and Surveillance (ASR).

b. A radar approach may be given to any aircraft upon request and may be offered to pilots of aircraft in distress or to expedite traffic, however, an ASR might not be approved unless there is an ATC operational requirement, or in an unusual or emergency situation. Acceptance of a PAR or ASR by a pilot does not waive the prescribed weather minimums for the airport or for the particular aircraft operator concerned. The decision to make a radar approach when the reported weather is below the established minimums rests with the pilot.

c. PAR and ASR minimums are published on separate pages in the FAA Terminal Procedures Publication (TPP).

1. Precision Approach (PAR). A PAR is one in which a controller provides highly accurate navigational guidance in azimuth and elevation to a pilot. Pilots are given headings to fly, to direct them to, and keep their aircraft aligned with the extended centerline of the landing runway. They are told to anticipate glidepath interception approximately 10 to 30 seconds before it occurs and when to start descent. The published Decision Height will be given only if the pilot requests it. If the aircraft is observed to deviate above or below the glidepath, the pilot is given the relative amount of deviation by use of terms "slightly" or "well" and is expected to adjust the aircraft's rate of descent/ascent to return to the glidepath. Trend information is also issued with respect to the elevation of the aircraft and may be modified by the terms "rapidly" and "slowly"; e.g., "well above glidepath, coming down rapidly." Range from touchdown is given at least once each mile. If an aircraft is observed by the controller to proceed outside of specified safety zone limits in azimuth and/or elevation and continue to operate outside these prescribed limits, the pilot will be directed to execute a missed approach or to fly a specified course unless the pilot has the runway environment (runway, approach lights, etc.) in sight. Navigational guidance in azimuth and elevation is provided the pilot until the aircraft reaches the published Decision Height (DH). Advisory course and glidepath information is furnished by the controller until the aircraft passes over the landing threshold, at which point the pilot is advised of any deviation from the runway centerline. Radar service is automatically terminated upon completion of the approach.

2. Surveillance Approach (ASR). An ASR is one in which a controller provides navigational guidance in azimuth only. The pilot is furnished headings to fly to align the aircraft with the extended centerline of the landing runway. Since the radar information used for a surveillance approach is considerably less precise than that used for a precision approach, the accuracy of the approach will not be as great and higher minimums will apply. Guidance in elevation is not possible but the pilot will be advised when to commence descent to the Minimum Descent Altitude (MDA) or, if appropriate, to an intermediate step-down fix Minimum Crossing Altitude and subsequently to the prescribed MDA. In addition, the pilot will be advised of the location of the Missed Approach Point (MAP) prescribed for the procedure and the aircraft's position each mile on final from the runway, airport or heliport or MAP, as appropriate. If requested by the pilot, recommended altitudes will be issued at each mile, based on the

descent gradient established for the procedure, down to the last mile that is at or above the MDA. Normally, navigational guidance will be provided until the aircraft reaches the MAP. Controllers will terminate guidance and instruct the pilot to execute a missed approach unless at the MAP the pilot has the runway, airport or heliport in sight or, for a helicopter point-in-space approach, the prescribed visual reference with the surface is established. Also, if, at any time during the approach the controller considers that safe guidance for the remainder of the approach cannot be provided, the controller will terminate guidance and instruct the pilot to execute a missed approach. Similarly, guidance termination and missed approach will be effected upon pilot request and, for civil aircraft only, controllers may terminate guidance when the pilot reports the runway, airport/heliport or visual surface route (point-inspace approach) in sight or otherwise indicates that continued guidance is not required. Radar service is automatically terminated at the completion of a radar approach.

NOTE-

The published MDA for straight-in approaches will be issued to the pilot before beginning descent. When a surveillance approach will terminate in a circle-to-land maneuver, the pilot must furnish the aircraft approach category to the controller. The controller will then provide the pilot with the appropriate MDA.

3. NO-GYRO Approach. This approach is available to a pilot under radar control who experiences circumstances wherein the directional gyro or other stabilized compass is inoperative or inaccurate. When this occurs, the pilot should so advise ATC and request a No-Gyro vector or approach. Pilots of aircraft not equipped with a directional gyro or other stabilized compass who desire radar handling may also request a No-Gyro vector or approach. The pilot should make all turns at standard rate and should execute the turn immediately upon receipt of instructions. For example, "TURN RIGHT," "STOP TURN." When a surveillance or precision approach is made, the pilot will be advised after the aircraft has been turned onto final approach to make turns at half standard rate.

5–4–12. Radar Monitoring of Instrument Approaches

a. PAR facilities operated by the FAA and the

military services at some joint-use (civil and military) and military installations monitor aircraft on instrument approaches and issue radar advisories to the pilot when weather is below VFR minimums (1,000 and 3), at night, or when requested by a pilot. This service is provided only when the PAR Final Approach Course coincides with the final approach of the navigational aid and only during the operational hours of the PAR. The radar advisories serve only as a secondary aid since the pilot has selected the navigational aid as the primary aid for the approach.

b. Prior to starting final approach, the pilot will be advised of the frequency on which the advisories will be transmitted. If, for any reason, radar advisories cannot be furnished, the pilot will be so advised.

c. Advisory information, derived from radar observations, includes information on:

1. Passing the final approach fix inbound (nonprecision approach) or passing the outer marker or fix used in lieu of the outer marker inbound (precision approach).

NOTE-

At this point, the pilot may be requested to report sighting the approach lights or the runway.

2. Trend advisories with respect to elevation and/or azimuth radar position and movement will be provided.

NOTE-

Whenever the aircraft nears the PAR safety limit, the pilot will be advised that the aircraft is well above or below the glidepath or well left or right of course. Glidepath information is given only to those aircraft executing a precision approach, such as ILS. Altitude information is not transmitted to aircraft executing other than precision approaches because the descent portions of these approaches generally do not coincide with the depicted PAR glidepath.

3. If, after repeated advisories, the aircraft proceeds outside the PAR safety limit or if a radical deviation is observed, the pilot will be advised to execute a missed approach unless the prescribed visual reference with the surface is established.

d. Radar service is automatically terminated upon completion of the approach.

5–4–13. Simultaneous Approaches to Parallel Runways



FIG 5-4-20 Simultaneous Approaches (Approach Courses Parallel and Offset between 2.5 and 3.0 degrees)

a. ATC procedures permit ILS/RNAV/GLS instrument approach operations to dual or triple parallel runway configurations. ILS/RNAV/GLS approaches to parallel runways are grouped into three classes: Simultaneous Dependent Approaches; Simultaneous Independent Approaches; and Simultaneous Close Parallel PRM Approaches. RNAV approach procedures that are approved for simultaneous operations require GPS as the sensor for position updating. VOR/DME, DME/DME and

IRU RNAV updating is not authorized. The classification of a parallel runway approach procedure is dependent on adjacent parallel runway centerline separation, ATC procedures, and airport ATC final approach radar monitoring and communications capabilities. At some airports, one or more approach courses may be offset up to 3 degrees. ILS approaches with offset localizer configurations result in loss of Category II/III capabilities and an increase in decision altitude/height (50').

b. Depending on weather conditions, traffic volume, and the specific combination of runways being utilized for arrival operations, a runway may be used for different types of simultaneous operations, including closely spaced dependent or independent approaches. Pilots should ensure that they understand the type of operation that is being conducted, and ask ATC for clarification if necessary.

c. Parallel approach operations demand heightened pilot situational awareness. A thorough Approach Procedure Chart review should be conducted with, as a minimum, emphasis on the following approach chart information: name and number of the approach, localizer frequency, inbound localizer/azimuth course, glideslope/glidepath intercept altitude, glideslope crossing altitude at the final approach fix, decision height, missed approach instructions, special notes/procedures, and the assigned runway location/proximity to adjacent runways. Pilots are informed by ATC or through the ATIS that simultaneous approaches are in use.

d. The close proximity of adjacent aircraft conducting simultaneous independent approaches, especially simultaneous close parallel PRM approaches mandates strict pilot compliance with all ATC clearances. ATC assigned airspeeds, altitudes, and headings must be complied with in a timely manner. Autopilot coupled approaches require pilot knowledge of procedures necessary to comply with ATC instructions. Simultaneous independent approaches, particularly simultaneous close parallel PRM approaches necessitate precise approach course tracking to minimize final monitor controller intervention, and unwanted No Transgression Zone

(NTZ) penetration. In the unlikely event of a breakout, ATC will not assign altitudes lower than the minimum vectoring altitude. Pilots should notify ATC immediately if there is a degradation of aircraft or navigation systems.

e. Strict radio discipline is mandatory during simultaneous independent and simultaneous close parallel PRM approach operations. This includes an alert listening watch and the avoidance of lengthy, unnecessary radio transmissions. Attention must be given to proper call sign usage to prevent the inadvertent execution of clearances intended for another aircraft. Use of abbreviated call signs must be avoided to preclude confusion of aircraft with similar sounding call signs. Pilots must be alert to unusually long periods of silence or any unusual background sounds in their radio receiver. A stuck microphone may block the issuance of ATC instructions on the tower frequency by the final monitor controller during simultaneous independent and simultaneous close parallel PRM approaches. In the case of PRM approaches, the use of a second frequency by the monitor controller mitigates the "stuck mike" or other blockage on the tower frequency.

REFERENCE-

AIM, Chapter 4, Section 2, Radio Communications Phraseology and Techniques, gives additional communications information.

f. Use of Traffic Collision Avoidance Systems (TCAS) provides an additional element of safety to parallel approach operations. Pilots should follow recommended TCAS operating procedures presented in approved flight manuals, original equipment manufacturer recommendations, professional newsletters, and FAA publications.

5–4–14. Simultaneous Dependent Approaches





a. Simultaneous dependent approaches are an ATC procedure permitting approaches to airports having parallel runway centerlines separated by at least 2,500 feet up to 9,000 feet. Integral parts of a total system are ILS or other system providing approach navigation, radar, communications, ATC procedures, and required airborne equipment. RNAV equipment in the aircraft or GLS equipment on the ground and in the aircraft may replace the required

airborne and ground based ILS equipment. Although non-precision minimums may be published, pilots must only use those procedures specifically authorized by chart note. For example, the chart note "LNAV NA during simultaneous operations," requires vertical guidance. When given a choice, pilots should always fly a precision approach whenever possible. **b.** A simultaneous dependent approach differs from a simultaneous independent approach in that, the minimum distance between parallel runway centerlines may be reduced; there is no requirement for radar monitoring or advisories; and a staggered separation of aircraft on the adjacent final course is required.

c. A minimum of 1.0 NM radar separation (diagonal) is required between successive aircraft on the adjacent final approach course when runway centerlines are at least 2,500 feet but no more than 3,600 feet apart. A minimum of 1.5 NM radar separation (diagonal) is required between successive aircraft on the adjacent final approach course when runway centerlines are more than 3,600 feet but no more than 8,300 feet apart. When runway centerlines are more than 8,300 feet but no more than 9,000 feet apart a minimum of 2 NM diagonal radar separation is provided. Aircraft on the same final approach course within 10 NM of the runway end are provided a minimum of 3 NM radar separation, reduced to 2.5 NM in certain circumstances. In addition, a minimum of 1,000 feet vertical or a minimum of three miles radar separation is provided between aircraft during turn on to the parallel final approach course.

d. Whenever parallel approaches are in use, pilots are informed by ATC or via the ATIS that approaches to both runways are in use. The charted IAP also notes which runways may be used simultaneously. In addition, the radar controller will have the interphone capability of communicating with the tower controller where separation responsibility has not been delegated to the tower.

NOTE-

ATC will not specifically identify these operations as being dependent when advertised on the ATIS.

EXAMPLE-

Simultaneous ILS Runway 19 right and ILS Runway 19 left in use.

e. At certain airports, simultaneous dependent approaches are permitted to runways spaced less than 2,500 feet apart. In this case, ATC will provide no less than the minimum authorized diagonal separation with the leader always arriving on the same runway. The trailing aircraft is permitted reduced diagonal separation, instead of the single runway separation normally utilized for runways spaced less than 2,500 feet apart. For wake turbulence mitigation reasons:

1. Reduced diagonal spacing is only permitted when certain aircraft wake category pairings exist; typically when the leader is either in the large or small wake turbulence category, and

2. All aircraft must descend on the glideslope from the altitude at which they were cleared for the approach during these operations.

When reduced separation is authorized, the IAP briefing strip 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 approaches with reduced separation or SOIA PRM approaches may be conducted to Runways 28R and 28L at KSFO spaced 750 feet apart, depending on weather conditions and traffic volume. Pilots should use caution so as not to confuse these operations. Plan for SOIA procedures only when ATC assigns a PRM approach or the ATIS advertises PRM approaches are in use. KSFO is the only airport where both procedures are presently conducted.

REFERENCE-

AIM, Paragraph 5–4–16, Simultaneous Close Parallel PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA).

5–4–15. Simultaneous Independent ILS/RNAV/GLS Approaches

FIG 5-4-22 Simultaneous Independent ILS/RNAV/GLS Approaches



a. System. An approach system permitting simultaneous approaches to parallel runways with centerlines separated by at least 4,300 feet. Separation between 4,300 and 9,000 feet (9,200' for airports above 5,000') utilizing NTZ final monitor controllers. Simultaneous 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 radar, communications, ATC procedures, and ILS or other required airborne equipment. A chart note identifies that the approach is authorized for simultaneous use.

When simultaneous operations are in use, it will be advertised on the ATIS. When advised that simultaneous approaches are in use, pilots must advise approach control immediately of malfunctioning or inoperative receivers, or if a simultaneous approach is not desired. Although non-precision minimums may be published, pilots must only use those procedures specifically authorized by chart note. For example, the chart note "LNAV NA during simultaneous operations," requires vertical guidance. When given a choice, pilots should always fly a precision approach whenever possible.

NOTE-

ATC does not use the word independent or parallel when advertising these operations on the ATIS.

EXAMPLE-

Simultaneous ILS Runway 24 left and ILS Runway 24 right approaches in use.

b. Radar Services. These services are provided for each simultaneous independent approach.

AIM

1. During turn on to parallel final approach, aircraft are normally provided 3 miles radar separation or a minimum of 1,000 feet vertical separation. The assigned altitude must be maintained until intercepting the glidepath, unless cleared otherwise by ATC. Aircraft will not be vectored to intercept the final approach course at an angle greater than thirty degrees.

NOTE-

Some simultaneous operations permit the aircraft to track an RNAV course beginning on downwind and continuing in a turn to intercept the final approach course. In this case, separation with the aircraft on the adjacent final approach course is provided by the monitor controller with reference to an NTZ.

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 NM 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 PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA)



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 (final monitor aid) consists of a high resolution ATC radar display with 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 Independent ILS/RNAV/GLS Approaches.

2. 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, radar display, publication of an AAUP, and use of a secondary PRM communications frequency. PRM approaches are depicted on a separate IAP titled (Procedure type) PRM Rwy XXX (Simultaneous Close Parallel or Close Parallel).

NOTE-

ATC does not use the word "independent" when advertising these operations on the ATIS.

EXAMPLE-

Simultaneous ILS PRM Runway 33 left and ILS PRM Runway 33 right approaches in use.

(a) The pilot may request to conduct a different type of PRM approach to the same runway other than the one that is presently being used; for example, RNAV instead of ILS. However, pilots must always obtain ATC approval to conduct a different type of approach. Also, in the event of the loss of ground-based NAVAIDS, the ATIS may advertise other types of PRM approaches to the affected runway or runways.

(b) The Attention All Users Page (AAUP) will address procedures for conducting PRM approaches.

b. 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 a PRM approach.

1. Pilot Training Requirement. Pilots must complete special pilot training, as outlined below, before accepting a clearance for a simultaneous close parallel 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 includes the requirement for pilots to view the FAA training slide presentation, "Precision Runway Monitor (PRM) Pilot Procedures." Refer to https://www.faa.gov/training_testing/training/prm/ or search key words "FAA PRM" for additional information and to view or download the slide presentation.

(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 slide presentation, "Precision Runway Monitor (PRM) Pilot Procedures." Refer to https://www.faa.gov/training_testing/training/prm/ or search key words "FAA PRM" for additional information and to view or download the slide presentation. AIM

(2) Pilots *not* operating transport category 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 training slide presentation, "Precision Runway Monitor (PRM) Pilot Procedures." Refer to https://www.faa.gov/training_testing/training/prm/ or search key words "FAA PRM" for additional information and to view or download the slide presentation.

NOTE-

Depending on weather conditions, traffic volume, and the specific combination of runways being utilized for arrival operations, a runway may be used for different types of simultaneous operations, including closely spaced dependent or independent approaches. Use PRM procedures only when the ATIS advertises their use. For other types of simultaneous approaches, see paragraphs 5-4-14 and 5-4-15.

c. ATC Directed Breakout. An ATC directed "breakout" is defined as a vector off the final approach course of a threatened aircraft in response to another aircraft penetrating the NTZ.

d. Dual Communications. The aircraft flying the PRM approach must have the capability of enabling the pilot/s to listen to two communications frequencies simultaneously. 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 the PRM frequency if the tower 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.

e. Radar Services.

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 glideslope/glidepath, unless cleared otherwise by ATC. Aircraft will not be vectored to intercept the

final approach course at an angle greater than thirty degrees.

2. The final monitor controller will have the capability of overriding the tower controller on the tower frequency as well as transmitting on the PRM frequency.

3. 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).

4. To ensure separation is maintained, and in order to avoid an imminent situation during PRM approaches, pilots must immediately comply with monitor controller instructions.

5. 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) IMMEDIATELY AND RETURN TO THE FINAL APPROACH COURSE,"

or

"(Aircraft call sign) TURN (left/right) AND RETURN TO THE FINAL APPROACH COURSE."

6. 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)." 7. Radar monitoring will automatically be terminated when visual separation is applied, or the aircraft reports the approach lights or runway in sight or within 1 NM of the runway threshold. Final monitor controllers will not advise pilots when radar monitoring is terminated.

f. Attention All Users Page (AAUP). At airports that conduct PRM operations, the AAUP informs pilots under the "General" section of information relative to all the PRM approaches published at a specific airport, and this section must be briefed in its entirety. Under the "Runway Specific" section, only items relative to the runway to be used for landing need be briefed. (See FIG 5–4–24.) A single AAUP is utilized for multiple PRM approach charts at the same airport, which are listed on the AAUP. The requirement for informing ATC if the pilot is unable to accept a PRM clearance is also presented. The "General" section of AAUP addresses the following:

1. Review of the procedure for executing a climbing or descending breakout;

2. Breakout phraseology beginning with the words, "Traffic Alert;"

3. Descending on the glideslope/glidepath meets all crossing restrictions;

4. Briefing the PRM approach also satisfies the non–PRM approach briefing of the same type of approach to the same runway; and

5. Description of the dual communications procedure.

The "Runway Specific" section of the AAUP addresses those issues which only apply to certain runway ends that utilize PRM approaches. There may be no Runway Specific procedures, a single item applicable to only one runway end, or multiple items for a single or multiple runway end/s. Examples of SOIA runway specific procedures are as follows:

FIG 5-4-24 PRM Attention All Users Page (AAUP)

	USA INTL (USA)					
	USA CITY					
(PRM CLOSE PARALLEL)						
Pilots who are unable to participate will be afforded appropriate						
arrival services as operational conditions permit and must notify						
the controlling ATC facility as soon as practica miles from destination.	al, but at least 120					
ILS PRM or LOC PRM Ruges 10R 10C	281 280					
RNAV (GPS) PRM RWYS 10R, 10C, 28	L. 28C					
General	.,					
 Review procedure for executing a climbit 	ing and					
descending PRM breakout.	0					
- Breakout phraseology: "TRAFFIC ALERT	(call sign) TURN					
(left/right) IMMEDIATELY HEADING (degree	s)					
CLIMB/DESCEND AND MAINTAIN (altitude).	"					
 All breakouts: Hand flown, initiate imm 	ediately.					
 Descending on the glideslope/glidepath 	ensures					
compliance with any charted crossing restri	ctions.					
 Dual VHF COMM: When assigned or pla 	nning a specific					
PRM approach, tune a second receiver to th	e PRM monitor					
the values a seture the DDM frequency if	cy (I.e., ATIS), set					
decelect the audie. When directed by ATC	ecessary, then					
switch to the tower frequency and select th	n secondary					
radio audio to ON.	ie secondary					
 If later assigned the same runway, non- 	-PRM approach,					
consider it briefed provided the same minin	nums are utilized.					
PRM related chart notes and frequency no l	onger apply.					
- TCAS during breakout: Follow TCAS clin	mb/descend if it					
differs from ATC, while executing the break	out turn.					
Runway Specific	10 - 10					
 Runway 10R: Exit at taxiway Tango when 	never practical.					
PRMAPPROACH AAUP 41*59%-87*54W	USA INTL (USA)					
	USA CITY					

g. Simultaneous Offset Instrument Approach (SOIA).

1. SOIA is 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 a straight–in PRM approach to one runway, and a PRM offset approach with glides-lope/glidepath to the adjacent runway. In SOIA

operations, aircraft are paired, with the aircraft conducting the straight-in PRM approach always positioned slightly ahead of the aircraft conducting the offset PRM approach.

2. The straight-in PRM approach plates used in SOIA operations are identical to other straight-in PRM approach plates, with an additional note, which provides the separation between the two runways

3. Controllers monitor the SOIA PRM approaches in exactly the same manner as is done for other PRM approaches. The procedures and system requirements for SOIA PRM approaches are identical with those used for simultaneous close parallel PRM approaches until near the offset PRM approach missed approach point (MAP), where visual acquisition of the straight-in aircraft by the aircraft conducting the offset PRM approach occurs. Since SOIA PRM approaches are identical to other PRM approaches (except for the visual segment in the offset approach), an understanding of the procedures for conducting PRM approaches is essential before conducting a SOIA PRM operation.

4. In SOIA, the approach course separation (instead of the runway separation) meets established close parallel approach criteria. (See FIG 5-4-25 for the generic SOIA approach geometry.) A visual segment of the offset PRM approach is established between the offset MAP and the runway threshold. Aircraft transition in visual conditions from the offset course, beginning at the offset MAP, to align with the runway and can be stabilized by 500 feet above ground level (AGL) on the extended runway centerline. A cloud ceiling for the approach is established so that the aircraft conducting the offset approach has nominally at least 30 seconds or more to acquire the leading straight-in aircraft prior to reaching the offset MAP. If visual acquisition is not accomplished prior to crossing the offset MAP, a missed approach must be executed.

5. 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 missed approach procedure published on the charted IAP. In the SOIA design of the offset approach, lateral course guidance terminates at the fictitious threshold point (FTP), which is an extension of the final approach course beyond the offset MAP 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 offset LDA glideslope. No matter what type of offset approach is being conducted, reliance on lateral guidance is discontinued at the charted MAP and replaced by visual maneuvering to accomplish runway alignment.

(a) As a result of this approach coding, when executing a missed approach at and after passing the charted offset 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 may 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.

(b) 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 an uncoded waypoint. In this case, the location is determined by noting its distance from the runway waypoint or using an authorized distance as published on the charted IAP.

(c) 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.
FIG 5-4-25 **SOIA Approach Geometry**



NOTE-

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.

6. SOIA PRM approaches utilize the same dual communications procedures as do other PRM approaches.

NOTE-

At KSFO, pilots conducting SOIA operations select the monitor frequency audio when communicating with the final radar controller, not the tower controller as is customary. In this special case, the monitor controller's transmissions, if required, override the final controller's frequency. This procedure is addressed on the AAUP.

(a) SOIA utilizes the same AAUP format as do other PRM approaches. The minimum weather conditions that are required are listed. Because of the more complex nature of instructions for conducting SOIA approaches, the "Runway Specific" items are more numerous and lengthy.

(b) Examples of SOIA offset runway specific notes:

(1) Aircraft must remain on the offset course until passing the offset MAP prior to maneuvering to align with the centerline of the offset approach runway.

(2) Pilots are authorized to continue past the offset MAP to align with runway centerline when:

[a] the straight-in approach traffic is in sight and is expected to remain in sight,

[b] ATC has been advised that "traffic is in sight." (ATC is not required to acknowledge this transmission),

[c] the runway environment is in sight. Otherwise, a missed approach must be executed. Between the offset MAP and the runway threshold, pilots conducting the offset PRM approach must not pass the straight–in aircraft and are responsible for separating themselves visually from traffic conducting the straight–in 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 straight–in PRM approach is lost and execute a missed approach unless otherwise instructed by ATC.

(c) Examples of SOIA straight-in runway specific notes:

(1) To facilitate the offset aircraft in providing wake mitigation, pilots should descend on, not above, the glideslope/glidepath.

(2) Conducting the straight-in approach, pilots should be aware that the aircraft conducting the offset approach will be approaching from the right/left rear and will be operating in close proximity to the straight-in aircraft.

7. Recap.

The following are differences between widely spaced simultaneous approaches (at least 4,300 feet between the runway centerlines) and Simultaneous PRM close parallel approaches which are of importance to the pilot:

(a) Runway Spacing. Prior to PRM 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 and as close as 3,000 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, the assumption is made 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 (breakout) instruction and maneuver (as instructed by ATC) away from a blundering aircraft.

(b) Communications. Dual VHF communications procedures should be carefully followed. One of the assumptions made that permits the safe conduct of PRM approaches is that there will be no blocked communications.

(c) Hand-flown Breakouts. The use of the autopilot is encouraged while flying a 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.

(d) 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. These approaches can be identified by the letter "V" in the title; for example, "ILS V Rwy 17 (CONVERGING)". 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 use, 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 (Authorization Required) Instrument Procedures

a. RNP AR procedures require authorization analogous to the special authorization required for Category II or III ILS procedures. All operators require specific authorization from the FAA to fly any RNP AR approach or departure procedure. The FAA issues RNP AR authorization via operations specification (OpSpec), management specification (MSpec), or letter of authorization (LOA). There are no exceptions. Operators can find comprehensive information on RNP AR aircraft eligibility, operating procedures, and training requirements in AC 90–101, Approval Guidance for RNP Procedures with AR.

b. Unique characteristics of RNP AR Operations Approach title. The FAA titles all RNP AR instrument approach procedures (IAP) as "RNAV (RNP) RWY XX." Internationally, operators may find RNP AR IAPs titled "RNP RWY XX (AR)." All RNP AR procedures will clearly state "Authorization Required" on the procedure chart.

c. RNP value. RNP AR procedures are characterized by use of a lateral Obstacle Evaluation Area (OEA) equal to two times the RNP value (2 x RNP) in nautical miles. No secondary lateral OEA or additional buffers are used. RNP AR procedures require a minimum lateral accuracy value of RNP 0.30. Each published line of minima in an RNP AR procedure has an associated RNP value that defines the procedure's lateral performance requirement in the Final Approach Segment. Each approved RNP AR operator's FAA-issued authorization will identify a minimum authorized RNP approach value. This value may vary depending on aircraft configuration or operational procedures (e.g., use of flight director or autopilot).

d. Radius-to-fix (RF) legs. Many RNP AR IFPs contain RF legs. Aircraft eligibility for RF legs is required in any authorization for RNP AR operations.

e. Missed Approach RNP value less than 1.00 NM. Some RNP AR IFPs require an RNP lateral accuracy value of less than 1.00 NM in the missed approach segment. The operator's FAA-issued RNP AR authorization will specify whether the operator may fly a missed approach procedure requiring a lateral accuracy value less than 1.00 NM. AC 90–101 identifies specific operating procedures and training requirements applicable to this aspect of RNP AR procedures.

f. Non-standard speeds or climb gradients. RNP AR approaches may require non-standard approach speeds and/or missed approach climb gradients. RNP AR approach charts will reflect any non-standard requirements and pilots must confirm they can meet those requirements before commencing the approach.

g. RNP AR Departure Procedures (RNP AR DP). RNP AR approach authorization is a mandatory prerequisite for an operator to be eligible to perform RNP AR DPs. RNP AR DPs can utilize a minimum RNP value of RNP 0.30, may include higher than standard climb gradients, and may include RF turns. Close in RF turns associated with RNP AR DPs may begin as soon as the departure end of the runway (DER). For specific eligibility guidance, operators should refer to AC 90–101.

FIG 5-4-26 Example of an RNP AR DP



5-4-19. Side-step Maneuver

a. ATC may authorize a standard instrument approach procedure which serves either one of parallel runways that are separated by 1,200 feet or less followed by a straight-in landing on the adjacent runway.

b. Aircraft that will execute a side-step maneuver will be cleared for a specified approach procedure and landing on the adjacent parallel runway. Example, "cleared ILS runway 7 left approach, side-step to runway 7 right." Pilots are expected to commence the side-step maneuver as soon as possible after the runway or runway environment is in sight. Compliance with minimum altitudes associated with stepdown fixes is expected even after the side-step maneuver is initiated.

NOTE-

Side-step minima are flown to a Minimum Descent Altitude (MDA) regardless of the approach authorized.

c. Landing minimums to the adjacent runway will be based on nonprecision criteria and therefore higher than the precision minimums to the primary runway, but will normally be lower than the published circling minimums.

5-4-20. Approach and Landing Minimums

a. Landing Minimums. The rules applicable to landing minimums are contained in 14 CFR Section 91.175. TBL 5–4–1 may be used to convert RVR to ground or flight visibility. For converting RVR values that fall between listed values, use the next higher RVR value; do not interpolate. For example, when converting 1800 RVR, use 2400 RVR with the resultant visibility of 1/2 mile.

b. Obstacle Clearance. Final approach obstacle clearance is provided from the start of the final segment to the runway or missed approach point, whichever occurs last. Side–step obstacle protection is provided by increasing the width of the final approach obstacle clearance area.

<i>TBL 5-4-1</i> RVR Value Conversions			
RVR	Visibility (statute miles)		
1600	1/4		
2400	1/2		
3200	5/8		
4000	3/4		
4500	7/8		
5000	1		
6000	1 1/4		

1. Circling approach protected areas are defined by the tangential connection of arcs drawn from each runway end (see FIG 5–4–27). Circling approach protected areas developed prior to late 2012 used fixed radius distances, dependent on aircraft approach category, as shown in the table on page B2 of the U.S. TPP. The approaches using standard circling approach areas can be identified by the absence of the "negative C" symbol on the circling line of minima. Circling approach protected areas developed after late 2012 use the radius distance shown in the table on page B2 of the U.S. TPP, dependent on aircraft approach category, and the altitude of the circling MDA, which accounts for true airspeed increase with altitude. The approaches using expanded circling approach areas can be identified by the presence of the "negative C" symbol on the circling line of minima (see FIG 5-4-28). Because of obstacles near the airport, a portion of the circling area may be restricted by a procedural note; for example, "Circling NA E of RWY 17-35." Obstacle clearance is provided at the published minimums (MDA) for the pilot who makes a straight-in approach, side-steps, or circles. Once below the MDA the pilot must see and avoid obstacles. Executing the missed approach after starting to maneuver usually places the aircraft beyond the MAP. The aircraft is clear of obstacles when at or above the MDA while inside the circling area, but simply joining the missed approach ground track from the circling maneuver may not provide vertical obstacle clearance once the aircraft exits the circling area. Additional climb inside the circling area may be required before joining the missed approach track. See paragraph 5-4-21, Missed Approach, for additional considerations when starting a missed approach at other than the MAP.

FIG 5-4-27 Final Approach Obstacle Clearance



NOTE-

Circling approach area radii vary according to approach category and MSL circling altitude due to TAS changes—see FIG 5–4–28.

FIG 5-4-28

Standard and Expanded Circling Approach Radii in the U.S. TPP

STANDARD CIRCLING APPROACH MANEUVERING RADIUS

Circling approach protected areas developed prior to late 2012 used the radius distances shown in the following table, expressed in nautical miles (NM), dependent on aircraft approach category. The approaches using standard circling approach areas can be identified by the absence of the radius symbol on the circling line of minima.

Circling MDA in fact MSI	Approach Category and Circling Radius (NM)				
Circling MDA in feel MSL	CAT A	CAT B	CAT C	CAT D	CAT E
All Altitudes	1.3	1.5	1.7	2.3	4.5

C EXPANDED CIRCLING APPROACH MANEUVERING AIRSPACE RADIUS

Circling approach protected areas developed after late 2012 use the radius distance shown in the following table, expressed in nautical miles (NM), dependent on aircraft approach category, and the altitude of the circling MDA, which accounts for true airspeed increase with altitude. The approaches using expanded circling approach areas can be identified by the presence of the **C** symbol on the circling line of minima.

Circling MDA in fact MSI	Approach Category and Circling Radius (NM)				
Circling MDA III leel MSL	CAT A	CAT B	CAT C	CAT D	CAT E
1000 or less	1.3	1.7	2.7	3.6	4.5
1001-3000	1.3	1.8	2.8	3.7	4.6
3001-5000	1.3	1.8	2.9	3.8	4.8
5001-7000	1.3	1.9	3.0	4.0	5.0
7001-9000	1.4	2.0	3.2	4.2	5.3
9001 and above	1.4	2.1	3.3	4.4	5.5

volume of airspace above an area beginning at the runway threshold, at the threshold elevation, and centered on the extended runway centerline. The POFZ is 200 feet (60m) long and 800 feet (240m) wide. The POFZ must be clear when an aircraft on a vertically guided final approach is within 2 nautical miles of the runway threshold and the official weather observation is a ceiling below 250 feet or visibility less than $\frac{3}{4}$ statute mile (SM) (or runway visual range below 4,000 feet). If the POFZ is not clear, the MINIMUM authorized height above touchdown (HAT) and visibility is 250 feet and 3/4 SM. The POFZ is considered clear even if the wing of the aircraft holding on a taxiway waiting for runway clearance penetrates the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. The POFZ is applicable at all runway ends including displaced thresholds.

2. Precision Obstacle Free Zone (POFZ). A

FIG 5-4-29 **Precision Obstacle Free Zone (POFZ)**



c. Straight-in Minimums are shown on the IAP when the final approach course is within 30 degrees of the runway alignment and a normal descent can be made from the IFR altitude shown on the IAP to the runway surface. When either the normal rate of descent or the runway alignment factor of 30 degrees is exceeded, a straight-in minimum is not published and a circling minimum applies. The fact that a straight-in minimum is not published does not preclude pilots from landing straight-in if they have the active runway in sight and have sufficient time to

AIM

make a normal approach for landing. Under such conditions and when ATC has cleared them for landing on that runway, pilots are not expected to circle even though only circling minimums are published. If they desire to circle, they should advise ATC.

d. Side-Step Maneuver Minimums. Landing minimums for a side-step maneuver to the adjacent runway will normally be higher than the minimums to the primary runway.

e. Published Approach Minimums. Approach minimums are published for different aircraft categories and consist of a minimum altitude (DA, DH, MDA) and required visibility. These minimums are determined by applying the appropriate TERPS criteria. When a fix is incorporated in a nonprecision final segment, two sets of minimums may be published: one for the pilot that is able to identify the fix, and a second for the pilot that cannot. Two sets of minimums may also be published when a second altimeter source is used in the procedure. When a nonprecision procedure incorporates both a stepdown fix in the final segment and a second altimeter source, two sets of minimums are published to account for the stepdown fix and a note addresses minimums for the second altimeter source.

f. Circling Minimums. In some busy terminal areas, ATC may not allow circling and circling minimums will not be published. Published circling minimums provide obstacle clearance when pilots remain within the appropriate area of protection. Pilots should remain at or above the circling altitude until the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers. Circling may require maneuvers at low altitude, at low airspeed, and in marginal weather conditions. Pilots must use sound judgment, have an indepth knowledge of their capabilities, and fully understand the aircraft performance to determine the exact circling maneuver since weather, unique airport design, and the aircraft position, altitude, and airspeed must all be considered. The following basic rules apply:

1. Maneuver the shortest path to the base or downwind leg, as appropriate, considering existing weather conditions. There is no restriction from passing over the airport or other runways.

2. It should be recognized that circling maneuvers may be made while VFR or other flying is in progress at the airport. Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.

3. At airports without a control tower, it may be desirable to fly over the airport to observe wind and turn indicators and other traffic which may be on the runway or flying in the vicinity of the airport.

REFERENCE-

AC 90–66A, Recommended Standards Traffic patterns for Aeronautical Operations at Airports without Operating Control Towers.

4. The missed approach point (MAP) varies depending upon the approach flown. For vertically guided approaches, the MAP is at the decision altitude/decision height. Non-vertically guided and circling procedures share the same MAP and the pilot determines this MAP by timing from the final approach fix, by a fix, a NAVAID, or a waypoint. Circling from a GLS, an ILS without a localizer line of minima or an RNAV (GPS) approach without an LNAV line of minima is prohibited.

g. Instrument Approach at a Military Field. When instrument approaches are conducted by civil aircraft at military airports, they must be conducted in accordance with the procedures and minimums approved by the military agency having jurisdiction over the airport.

5–4–21. Missed Approach

a. When a landing cannot be accomplished, advise ATC and, upon reaching the missed approach point defined on the approach procedure chart, the pilot must comply with the missed approach instructions for the procedure being used or with an alternate missed approach procedure specified by ATC.

b. Obstacle protection for missed approach is predicated on the missed approach being initiated at the decision altitude/decision height (DA/DH) or at the missed approach point and not lower than minimum descent altitude (MDA). A climb gradient of at least 200 feet per nautical mile is required, (except for Copter approaches, where a climb of at least 400 feet per nautical mile is required), unless a higher climb gradient is published in the notes section of the approach procedure chart. When higher than standard climb gradients are specified, the end point of the non-standard climb will be specified at either an altitude or a fix. Pilots must preplan to ensure that

the aircraft can meet the climb gradient (expressed in feet per nautical mile) required by the procedure in the event of a missed approach, and be aware that flying at a higher than anticipated ground speed increases the climb rate requirement (feet per minute). Tables for the conversion of climb gradients (feet per nautical mile) to climb rate (feet per minute), based on ground speed, are included on page D1 of the U.S. Terminal Procedures booklets. Reasonable buffers are provided for normal maneuvers. However, no consideration is given to an abnormally early turn. Therefore, when an early missed approach is executed, pilots should, unless otherwise cleared by ATC, fly the IAP as specified on the approach plate to the missed approach point at or above the MDA or DH before executing a turning maneuver.

c. If visual reference is lost while circling-to-land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by ATC). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn toward the landing runway and continue the turn until established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft position at the time visual reference is lost. Adherence to the procedure will help assure that an aircraft will remain laterally within the circling and missed approach obstruction clearance areas. Refer to paragraph h concerning vertical obstruction clearance when starting a missed approach at other than the MAP. (See FIG 5-4-30.)

d. At locations where ATC radar service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure. (See FIG 5–4–31.)

e. Some locations may have a preplanned alternate missed approach procedure for use in the event the primary NAVAID used for the missed approach procedure is unavailable. To avoid confusion, the alternate missed approach instructions are not published on the chart. However, the alternate missed approach holding pattern will be depicted on the instrument approach chart for pilot situational awareness and to assist ATC by not having to issue detailed holding instructions. The alternate missed

approach may be based on NAVAIDs not used in the approach procedure or the primary missed approach. When the alternate missed approach procedure is implemented by NOTAM, it becomes a mandatory part of the procedure. The NOTAM will specify both the textual instructions and any additional equipment requirements necessary to complete the procedure. Air traffic may also issue instructions for the alternate missed approach when necessary, such as when the primary missed approach NAVAID fails during the approach. Pilots may reject an ATC clearance for an alternate missed approach that requires equipment not necessary for the published approach procedure when the alternate missed approach is issued after beginning the approach. However, when the alternate missed approach is issued prior to beginning the approach the pilot must either accept the entire procedure (including the alternate missed approach), request a different approach procedure, or coordinate with ATC for alternative action to be taken, i.e., proceed to an alternate airport, etc.

f. When approach has been missed, request clearance for specific action; i.e., to alternative airport, another approach, etc.

g. Pilots must ensure that they have climbed to a safe altitude prior to proceeding off the published missed approach, especially in nonradar environments. Abandoning the missed approach prior to reaching the published altitude may not provide adequate terrain clearance. Additional climb may be required after reaching the holding pattern before proceeding back to the IAF or to an alternate.

h. A clearance for an instrument approach procedure includes a clearance to fly the published missed approach procedure, unless otherwise instructed by ATC. The published missed approach procedure provides obstacle clearance only when the missed approach is conducted on the missed approach segment from or above the missed approach point, and assumes a climb rate of 200 feet/NM or higher, as published. If the aircraft initiates a missed approach at a point other than the missed approach point (see paragraph 5–4–5b), from below MDA or DA (H), or on a circling approach, obstacle clearance is not necessarily provided by following the published missed approach procedure, nor is separation assured from other air traffic in the vicinity.







In the event a balked (rejected) landing occurs at a position other than the published missed approach point, the pilot should contact ATC as soon as possible to obtain an amended clearance. If unable to contact ATC for any reason, the pilot should attempt to re-intercept a published segment of the missed approach and comply with route and altitude instructions. If unable to contact ATC, and in the pilot's judgment it is no longer appropriate to fly the published missed approach procedure, then consider either maintaining visual conditions if practicable and reattempt a landing, or a circle-climb over the airport. Should a missed approach become necessary when operating to an airport that is not served by an operating control tower, continuous contact with an air traffic facility may not be possible. In this case, the pilot should execute the appropriate go-around/ missed approach procedure without delay and contact ATC when able to do so.

Prior to initiating an instrument approach procedure, the pilot should assess the actions to be taken in the event of a balked (rejected) landing beyond the missed approach point or below the MDA or DA (H) considering the anticipated weather conditions and available aircraft performance. 14 CFR 91.175(e) authorizes the pilot to fly an appropriate missed approach procedure that ensures obstruction clearance, but it does not necessarily consider separation from other air traffic. The pilot must consider other factors such as the aircraft's geographical location with respect to the prescribed missed approach point, direction of flight, and/or minimum turning altitudes in the prescribed missed approach procedure. The pilot must also consider aircraft performance, visual climb restrictions, charted obstacles, published obstacle departure procedure, takeoff visual climb requirements as expressed by nonstandard takeoff minima, other traffic expected to be in the vicinity, or other factors not specifically expressed by the approach procedures.

5–4–22. Use of Enhanced Flight Vision Systems (EFVS) on Instrument Approaches

a. Introduction. During an instrument approach,

an EFVS can enable a pilot to see the approach lights, visual references associated with the runway environment, and other objects or features that might not be visible using natural vision alone. An EFVS uses a head-up display (HUD), or an equivalent display that is a head-up presentation, to combine flight information, flight symbology, navigation guidance, and a real-time image of the external scene to the pilot. Combining the flight information, navigation guidance, and sensor imagery on a HUD (or equivalent display) allows the pilot to continue looking forward along the flightpath throughout the entire approach, landing, and rollout.

An EFVS operation is an operation in which visibility conditions require an EFVS to be used in lieu of natural vision to perform an approach or landing, determine enhanced flight visibility, identify required visual references, or conduct a rollout. There are two types of EFVS operations:

1. EFVS operations to touchdown and rollout.

2. EFVS operations to 100 feet above the touchdown zone elevation (TDZE).

b. EFVS Operations to Touchdown and Rollout. An EFVS operation to touchdown and rollout is an operation in which the pilot uses the enhanced vision imagery provided by an EFVS in lieu of natural vision to descend below DA or DH to touchdown and rollout. (See FIG 5–4–32.) These operations may be conducted only on Standard Instrument Approach Procedures (SIAP) or special IAPs that have a DA or DH (for example, precision or APV approach). An EFVS operation to touchdown and rollout may not be conducted on an approach that has circling minimums. The regulations for EFVS operations to touchdown and rollout can be found in 14 CFR § 91.176(a).



FIG 5-4-32 EFVS Operation to Touchdown and Rollout

c. EFVS Operations to 100 Feet Above the TDZE. An EFVS operation to 100 feet above the TDZE is an operation in which the pilot uses the enhanced vision imagery provided by an EFVS in lieu of natural vision to descend below DA/DH or MDA down to 100 feet above the TDZE. (See FIG 5–4–33.) To continue the approach below 100 feet above the TDZE, a pilot must have sufficient flight visibility to identify the required visual references using natural vision and must continue to

use the EFVS to ensure the enhanced flight visibility meets the visibility requirements of the IAP being flown. These operations may be conducted on SIAPs or special IAPs that have a DA/DH or MDA. An EFVS operation to 100 feet above the TDZE may not be conducted on an approach that has circling minimums. The regulations for EFVS operations to 100 feet above the TDZE can be found in 14 CFR § 91.176(b).

FIG 5-4-33 EFVS Operation to 100 ft Above the TDZE



d. EFVS Equipment Requirements. An EFVS that is installed on a U.S.-registered aircraft and is used to conduct EFVS operations must conform to an FAA-type design approval (i.e., a type certificate (TC), amended TC, or supplemental type certificate (STC)). A foreign-registered aircraft used to conduct EFVS operations that does not have an FAA-type design approval must be equipped with an EFVS that has been approved by either the State of the Operator or the State of Registry to meet the requirements of ICAO Annex 6. Equipment requirements for an EFVS operation to touchdown and rollout can be found in 14 CFR § 91.176(a)(1), and the equipment requirements for an EFVS operation to 100 feet above the TDZE can be found in 14 CFR § 91.176(b)(1). An operator can determine the eligibility of their aircraft to conduct EFVS operations by referring to the Airplane Flight Manual, Airplane Flight Manual Supplement, Rotorcraft Flight Manual, or Rotorcraft Flight Manual Supplement as applicable.

e. Operating Requirements. Any operator who conducts EFVS operations to touchdown and rollout (14 CFR § 91.176(a)) must have an OpSpec, MSpec, or LOA that specifically authorizes those operations. Parts 91K, 121, 125, 129, and 135 operators who conduct EFVS operations to 100 feet above the TDZE (14 CFR § 91.176(b))must have an OpSpec, MSpec, or LOA that specifically authorizes the operation. Part 91 operators (other than 91K operators) are not required to have an LOA to conduct EFVS operations to 100 feet above the TDZE in the United States. However, an optional LOA is available to facilitate operational approval from foreign Civil Aviation Authorities (CAA). To conduct an EFVS operation to touchdown and rollout during an authorized Category II or III operation, the operator must have:

1. An OpSpec, MSpec, or LOA authorizing EFVS operations to touchdown and rollout (14 CFR § 91.176(a)); and

2. An OpSpec, MSpec, or LOA authorizing Category II or Category III operations.

f. EFVS Operations in Rotorcraft. Currently, EFVS operations in rotorcraft can only be conducted on IAPs that are flown to a runway. Instrument approach criteria, procedures, and appropriate visual references have not yet been developed for straight–in landing operations below DA/DH or MDA under IFR to heliports or platforms. An EFVS cannot be used in lieu of natural vision to descend below published minimums on copter approaches to a point in space (PinS) followed by a "proceed visual flight rules (VFR)" visual segment, or on approaches designed to a specific landing site using a "proceed visually" visual segment.

g. EFVS Pilot Requirements. A pilot who conducts EFVS operations must receive ground and flight training specific to the EFVS operation to be conducted. The training must be obtained from an authorized training provider under a training program approved by the FAA. Additionally, recent flight experience and proficiency or competency check requirements apply to EFVS operations. These requirements are addressed in 14 CFR §§ 61.66, 91.1065, 121.441, Appendix F to Part 121, 125.287, and 135.293.

h. Enhanced Flight Visibility and Visual Reference Requirements. To descend below DA/DH or MDA during EFVS operations under 14 CFR § 91.176(a) or (b), a pilot must make a determination that the enhanced flight visibility observed by using an EFVS is not less than what is prescribed by the IAP being flown. In addition, the visual references required in 14 CFR § 91.176(a) or (b) must be distinctly visible and identifiable to the pilot using the EFVS. The determination of enhanced flight visibility is a separate action from that of identifying required visual references, and is different from ground-reported visibility. Even though the reported visibility or the visibility observed using natural vision may be less, as long as the EFVS provides the required enhanced flight visibility and a pilot meets all of the other requirements, the pilot can continue descending below DA/DH or MDA using the EFVS. Suitable enhanced flight visibility is necessary to ensure the aircraft is in a position to continue the approach and land. It is important to understand that using an EFVS does not result in obtaining lower minima with

respect to the visibility or the DA/DH or MDA specified in the IAP. An EFVS simply provides another means of operating in the visual segment of an IAP. The DA/DH or MDA and the visibility value specified in the IAP to be flown do not change.

i. Flight Planning and Beginning or Continuing an Approach Under IFR. A Part 121, 125, or 135 operator's OpSpec or LOA for EFVS operations may authorize an EFVS operational credit dispatching or releasing a flight and for beginning or continuing an instrument approach procedure. When a pilot reaches DA/DH or MDA, the pilot conducts the EFVS operation in accordance with 14 CFR § 91.176(a) or (b) and their authorization to conduct EFVS operations.

j. Missed Approach Considerations. In order to conduct an EFVS operation, the EFVS must be operable. In the event of a failure of any required component of an EFVS at any point in the approach to touchdown, a missed approach is required. However, this provision does not preclude a pilot's authority to continue an approach if continuation of an approach is considered by the pilot to be a safer course of action.

k. Light Emitting Diode (LED) Airport Lighting Impact on EFVS Operations. Incandescent lamps are being replaced with LEDs at some airports in threshold lights, taxiway edge lights, taxiway centerline lights, low intensity runway edge lights, windcone lights, beacons, and some obstruction lighting. Additionally, there are plans to replace incandescent lamps with LEDs in approach lighting systems. Pilots should be aware that LED lights cannot be sensed by infrared–based EFVSs. Further, the FAA does not currently collect or disseminate information about where LED lighting is installed.

I. Other Vision Systems. Unlike an EFVS that meets the equipment requirements of 14 CFR § 91.176, a Synthetic Vision System (SVS) or Synthetic Vision Guidance System (SVGS) does not provide a real-time sensor image of the outside scene and also does not meet the equipment requirements for EFVS operations. A pilot cannot use a synthetic vision image on a head-up or a head-down display in lieu of natural vision to descend below DA/DH or MDA. An EFVS can, however, be integrated with an SVS, also known as a Combined Vision System (CVS). A CVS can be used to conduct EFVS operations if all of the requirements for an EFVS are satisfied and the SVS image does not interfere with the pilot's ability to see the external scene, to identify the required visual references, or to see the sensor image.

m. Additional Information. Operational criteria for EFVS can be found in Advisory Circular (AC) 90–106, Enhanced Flight Vision System Operations, and airworthiness criteria for EFVS can be found in AC 20–167, Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment.

5-4-23. Visual Approach

a. A visual approach is conducted on an IFR flight plan and authorizes a pilot to proceed visually and clear of clouds to the airport. The pilot must have either the airport or the preceding identified aircraft in sight. This approach must be authorized and controlled by the appropriate air traffic control facility. Reported weather at the airport must have a ceiling at or above 1,000 feet and visibility 3 miles or greater. ATC may authorize this type of approach when it will be operationally beneficial. Visual approaches are an IFR procedure conducted under IFR in visual meteorological conditions. Cloud clearance requirements of 14 CFR Section 91.155 are not applicable, unless required by operation specifications. When conducting visual approaches, pilots are encouraged to use other available navigational aids to assist in positive lateral and vertical alignment with the runway.

b. Operating to an Airport Without Weather Reporting Service. ATC will advise the pilot when weather is not available at the destination airport. ATC may initiate a visual approach provided there is a reasonable assurance that weather at the airport is a ceiling at or above 1,000 feet and visibility 3 miles or greater (e.g., area weather reports, PIREPs, etc.).

c. Operating to an Airport With an Operating Control Tower. Aircraft may be authorized to conduct a visual approach to one runway while other aircraft are conducting IFR or VFR approaches to another parallel, intersecting, or converging runway. ATC may authorize a visual approach after advising all aircraft involved that other aircraft are conducting operations to the other runway. This may be accomplished through use of the ATIS. 1. When operating to parallel runways separated by less than 2,500 feet, ATC will ensure approved separation is provided unless the succeeding aircraft reports sighting the preceding aircraft to the adjacent parallel and visual separation is applied.

2. When operating to parallel runways separated by at least 2,500 feet but less than 4,300 feet, ATC will ensure approved separation is provided until the aircraft are issued an approach clearance and one pilot has acknowledged receipt of a visual approach clearance, and the other pilot has acknowledged receipt of a visual or instrument approach clearance, and aircraft are established on a heading or established on a direct course to a fix or cleared on an RNAV/instrument approach procedure which will intercept the extended centerline of the runway at an angle not greater than 30 degrees.

3. When operating to parallel runways separated by 4,300 feet or more, ATC will ensure approved separation is provided until one of the aircraft has been issued and the pilot has acknowledged receipt of the visual approach clearance, and each aircraft is assigned a heading, or established on a direct course to a fix, or cleared on an RNAV/instrument approach procedure which will allow the aircraft to intercept the extended centerline of the runway at an angle not greater than 30 degrees.

NOTE-

The intent of the 30 degree intercept angle is to reduce the potential for overshoots of the final and to preclude side-by-side operations with one or both aircraft in a belly-up configuration during the turn-on.

d. Clearance for Visual Approach. At locations with an operating control tower, ATC will issue approach clearances that will include an assigned runway. At locations without an operating control tower or where a part–time tower is closed, ATC will issue a visual approach clearance to the airport only.

e. Separation Responsibilities. If the pilot has the airport in sight but cannot see the aircraft to be followed, ATC may clear the aircraft for a visual approach; however, ATC retains both separation and wake vortex separation responsibility. When visually following a preceding aircraft, acceptance of the visual approach clearance constitutes acceptance of pilot responsibility for maintaining a safe approach interval and adequate wake turbulence separation.

f. A visual approach is not an IAP and therefore has no missed approach segment. If a go–around is

necessary for any reason, aircraft operating at controlled airports will be issued an appropriate clearance or instruction by the tower to enter the traffic pattern for landing or proceed as otherwise instructed. In either case, the pilot is responsible to maintain terrain and obstruction avoidance until reaching an ATC assigned altitude if issued, and ATC will provide approved separation or visual separation from other IFR aircraft. At uncontrolled airports, aircraft are expected to remain clear of clouds and complete a landing as soon as possible. If a landing cannot be accomplished, the aircraft is expected to remain clear of clouds and contact ATC as soon as possible for further clearance. Separation from other IFR aircraft will be maintained under these circumstances.

g. Visual approaches reduce pilot/controller workload and expedite traffic by shortening flight paths to the airport. It is the pilot's responsibility to advise ATC as soon as possible if a visual approach is not desired.

h. Authorization to conduct a visual approach is an IFR authorization and does not alter IFR flight plan cancellation responsibility.

REFERENCE– AIM Paragraph 5–1–15, Canceling IFR Flight Plan.

i. Radar service is automatically terminated, without advising the pilot, when the aircraft is instructed to change to advisory frequency.

5–4–24. Charted Visual Flight Procedure (CVFP)

a. CVFPs are charted visual approaches established for environmental/noise considerations, and/or when necessary for the safety and efficiency of air traffic operations. The approach charts depict prominent landmarks, courses, and recommended altitudes to specific runways. CVFPs are designed to be used primarily for turbojet aircraft.

b. These procedures will be used only at airports with an operating control tower.

c. Most approach charts will depict some NAVAID information which is for supplemental navigational guidance only.

d. Unless indicating a Class B airspace floor, all depicted altitudes are for noise abatement purposes and are recommended only. Pilots are not prohibited

from flying other than recommended altitudes if operational requirements dictate.

e. When landmarks used for navigation are not visible at night, the approach will be annotated *"PROCEDURE NOT AUTHORIZED AT NIGHT."*

f. CVFPs usually begin within 20 flying miles from the airport.

g. Published weather minimums for CVFPs are based on minimum vectoring altitudes rather than the recommended altitudes depicted on charts.

h. CVFPs are not instrument approaches and do not have missed approach segments.

i. ATC will not issue clearances for CVFPs when the weather is less than the published minimum.

j. ATC will clear aircraft for a CVFP after the pilot reports siting a charted landmark or a preceding aircraft. If instructed to follow a preceding aircraft, pilots are responsible for maintaining a safe approach interval and wake turbulence separation.

k. Pilots should advise ATC if at any point they are unable to continue an approach or lose sight of a preceding aircraft. Missed approaches will be handled as a go-around.

I. When conducting visual approaches, pilots are encouraged to use other available navigational aids to assist in positive lateral and vertical alignment with the assigned runway.

5-4-25. Contact Approach

a. Pilots operating in accordance with an IFR flight plan, provided they are clear of clouds and have at least 1 mile flight visibility and can reasonably expect to continue to the destination airport in those conditions, may request ATC authorization for a contact approach.

b. Controllers may authorize a contact approach provided:

1. The contact approach is specifically requested by the pilot. ATC cannot initiate this approach.

EXAMPLE-

Request contact approach.

2. The reported ground visibility at the destination airport is at least 1 statute mile.

3. The contact approach will be made to an airport having a standard or special instrument approach procedure.

4. Approved separation is applied between aircraft so cleared and between these aircraft and other IFR or special VFR aircraft.

EXAMPLE-

Cleared contact approach (and, if required) at or below (altitude) (routing) if not possible (alternative procedures) and advise.

c. A contact approach is an approach procedure that may be used by a pilot (with prior authorization from ATC) in lieu of conducting a standard or special IAP to an airport. It is not intended for use by a pilot on an IFR flight clearance to operate to an airport not having a published and functioning IAP. Nor is it intended for an aircraft to conduct an instrument approach to one airport and then, when "in the clear," discontinue that approach and proceed to another airport. In the execution of a contact approach, the pilot assumes the responsibility for obstruction clearance. If radar service is being received, it will automatically terminate when the pilot is instructed to change to advisory frequency.

5-4-26. Landing Priority

A clearance for a specific type of approach (ILS, RNAV, GLS, ADF, VOR or Visual Approach) to an aircraft operating on an IFR flight plan does not mean that landing priority will be given over other traffic. ATCTs handle all aircraft, regardless of the type of flight plan, on a "first–come, first–served" basis. Therefore, because of local traffic or runway in use, it may be necessary for the controller in the interest of safety, to provide a different landing sequence. In any case, a landing sequence will be issued to each aircraft as soon as possible to enable the pilot to properly adjust the aircraft's flight path.

5-4-27. Overhead Approach Maneuver

a. Pilots operating in accordance with an IFR flight plan in Visual Meteorological Condi-

tions (VMC) may request ATC authorization for an overhead maneuver. An overhead maneuver is not an instrument approach procedure. Overhead maneuver patterns are developed at airports where aircraft have an operational need to conduct the maneuver. An aircraft conducting an overhead maneuver is considered to be VFR and the IFR flight plan is canceled when the aircraft reaches the initial point on the initial approach portion of the maneuver. (See FIG 5-4-34.) The existence of a standard overhead maneuver pattern does not eliminate the possible requirement for an aircraft to conform to conventional rectangular patterns if an overhead maneuver cannot be approved. Aircraft operating to an airport without a functioning control tower must initiate cancellation of an IFR flight plan prior to executing the overhead maneuver. Cancellation of the IFR flight plan must be accomplished after crossing the landing threshold on the initial portion of the maneuver or after landing. Controllers may authorize an overhead maneuver and issue the following to arriving aircraft:

1. Pattern altitude and direction of traffic. This information may be omitted if either is standard.

PHRASEOLOGY-

PATTERN ALTITUDE (altitude). RIGHT TURNS.

2. Request for a report on initial approach.

PHRASEOLOGY-

REPORT INITIAL.

3. "Break" information and a request for the pilot to report. The "Break Point" will be specified if nonstandard. Pilots may be requested to report "break" if required for traffic or other reasons.

PHRASEOLOGY-

BREAK AT (specified point). REPORT BREAK.

FIG 5-4-34 Overhead Maneuver



(a) Advises pilots to "resume normal speed" when the aircraft is on a heading, random routing, charted procedure, or route without published speed restrictions.

(b) Instructs pilots to "comply with speed restrictions" when the aircraft is joining or resuming a charted procedure or route with published speed restrictions.

CAUTION-

The phraseology "Climb via SID" requires compliance with all altitude and/or speed restrictions depicted on the procedure.

(c) Instructs pilots to "resume published speed" when aircraft are cleared via a charted instrument flight procedure that contains published speed restrictions.

(d) Advises aircraft to "delete speed restrictions" when ATC assigned or published speed restrictions on a charted procedure are no longer required.

(e) Clears pilots for approach without restating previously issued speed adjustments.

REFERENCE-

Pilot/Controller Glossary Term – Resume Normal Speed. Pilot/Controller Glossary Term – Resume Published Speed.

6. Gives due consideration to aircraft capabilities to reduce speed while descending.

7. Does not assign speed adjustments to aircraft at or above FL 390 without pilot consent.

5–5–10. Traffic Advisories (Traffic Information)

a. Pilot.

1. Acknowledges receipt of traffic advisories.

2. Informs controller if traffic in sight.

3. Advises ATC if a vector to avoid traffic is desired.

4. Does not expect to receive radar traffic advisories on all traffic. Some aircraft may not appear on the radar display. Be aware that the controller may be occupied with higher priority duties and unable to issue traffic information for a variety of reasons.

5. Advises controller if service is not desired.

b. Controller.

1. Issues radar traffic to the maximum extent consistent with higher priority duties except in Class A airspace.

2. Provides vectors to assist aircraft to avoid observed traffic when requested by the pilot.

3. Issues traffic information to aircraft in the Class B, Class C, and Class D surface areas for sequencing purposes.

4. Controllers are required to issue traffic advisories to each aircraft operating on intersecting or nonintersecting converging runways where projected flight paths will cross.

5-5-11. Visual Approach

a. Pilot.

1. If a visual approach is not desired, advises ATC.

2. Complies with controller's instructions for vectors toward the airport of intended landing or to a visual position behind a preceding aircraft.

3. The pilot must, at all times, have either the airport or the preceding aircraft in sight. After being cleared for a visual approach, proceed to the airport in a normal manner or follow the preceding aircraft. Remain clear of clouds while conducting a visual approach.

4. If the pilot accepts a visual approach clearance to visually follow a preceding aircraft, you are required to establish a safe landing interval behind the aircraft you were instructed to follow. You are responsible for wake turbulence separation.

5. Advise ATC immediately if the pilot is unable to continue following the preceding aircraft, cannot remain clear of clouds, needs to climb, or loses sight of the airport.

6. In the event of a go-around, the pilot is responsible to maintain terrain and obstruction avoidance until reaching an ATC assigned altitude if issued.

7. Be aware that radar service is automatically terminated, without being advised by ATC, when the pilot is instructed to change to advisory frequency.

8. Be aware that there may be other traffic in the traffic pattern and the landing sequence may differ from the traffic sequence assigned by approach control or ARTCC.

b. Controller.

1. Do not clear an aircraft for a visual approach unless reported weather at the airport is ceiling at or above 1,000 feet and visibility is 3 miles or greater. When weather is not available for the destination airport, inform the pilot and do not initiate a visual approach to that airport unless there is reasonable assurance that descent and flight to the airport can be made visually.

2. Issue visual approach clearance when the pilot reports sighting either the airport or a preceding aircraft which is to be followed.

3. Provide separation except when visual separation is being applied by the pilot.

4. Continue flight following and traffic information until the aircraft has landed or has been instructed to change to advisory frequency.

5. For all aircraft, inform the pilot when the preceding aircraft is a heavy. Inform the pilot of a small aircraft when the preceding aircraft is a B757. Visual separation is prohibited behind super aircraft.

6. When weather is available for the destination airport, do not initiate a vector for a visual approach unless the reported ceiling at the airport is 500 feet or more above the MVA and visibility is 3 miles or more. If vectoring weather minima are not available but weather at the airport is ceiling at or above 1,000 feet and visibility of 3 miles or greater, visual approaches may still be conducted.

5-5-12. Visual Separation

a. Pilot.

1. Acceptance of instructions to follow another aircraft or to provide visual separation from it is an acknowledgment that the pilot will maneuver the aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. Pilots are responsible to maintain visual separation until flight paths (altitudes and/or courses) diverge.

2. If instructed by ATC to follow another aircraft or to provide visual separation from it, promptly notify the controller if you lose sight of that aircraft, are unable to maintain continued visual contact with it, or cannot accept the responsibility for your own separation for any reason. **3.** The pilot also accepts responsibility for wake turbulence separation under these conditions.

b. Controller. Applies visual separation only:

1. Within the terminal area when a controller has both aircraft in sight or by instructing a pilot who sees the other aircraft to maintain visual separation from it.

2. Pilots are responsible to maintain visual separation until flight paths (altitudes and/or courses) diverge.

3. Within en route airspace when aircraft are on opposite courses and one pilot reports having seen the other aircraft and that the aircraft have passed each other.

5-5-13. VFR-on-top

a. Pilot.

1. This clearance must be requested by the pilot on an IFR flight plan, and if approved, allows the pilot the choice (subject to any ATC restrictions) to select an altitude or flight level in lieu of an assigned altitude.

NOTE-

VFR-on-top is not permitted in certain airspace areas, such as Class A airspace, certain restricted areas, etc. Consequently, IFR flights operating VFR-on-top will avoid such airspace.

REFERENCE-

AIM, Paragraph 4–4–8, IFR Clearance VFR–on–top. AIM, Paragraph 4–4–11, IFR Separation Standards. AIM, Paragraph 5–3–2, Position Reporting. AIM, Paragraph 5–3–3, Additional Reports.

2. By requesting a VFR-on-top clearance, the pilot assumes the sole responsibility to be vigilant so as to see and avoid other aircraft and to:

(a) Fly at the appropriate VFR altitude as prescribed in 14 CFR Section 91.159.

(b) Comply with the VFR visibility and distance from clouds criteria in 14 CFR Section 91.155, *Basic VFR Weather Minimums*.

(c) Comply with instrument flight rules that are applicable to this flight; i.e., minimum IFR altitudes, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.

3. Should advise ATC prior to any altitude change to ensure the exchange of accurate traffic information.

b. Controller.

1. May clear an aircraft to maintain VFR-on-top if the pilot of an aircraft on an IFR flight plan requests the clearance.

2. Informs the pilot of an aircraft cleared to climb to VFR-on-top the reported height of the tops or that no top report is available; issues an alternate clearance if necessary; and once the aircraft reports reaching VFR-on-top, reclears the aircraft to maintain VFR-on-top.

3. Before issuing clearance, ascertain that the aircraft is not in or will not enter Class A airspace.

5-5-14. Instrument Departures

a. Pilot.

1. Prior to departure considers the type of terrain and other obstructions on or in the vicinity of the departure airport.

2. Determines if obstruction avoidance can be maintained visually or that the departure procedure should be followed.

3. Determines whether an obstacle departure procedure (ODP) and/or DP is available for obstruction avoidance. One option may be a Visual Climb Over Airport (VCOA). Pilots must advise ATC as early as possible of the intent to fly the VCOA prior to departure.

4. At airports where IAPs have not been published, hence no published departure procedure, determines what action will be necessary and takes such action that will assure a safe departure.

b. Controller.

1. At locations with airport traffic control service, when necessary, specifies direction of takeoff, turn, or initial heading to be flown after takeoff, consistent with published departure procedures (DP) or diverse vector areas (DVA), where applicable.

2. At locations without airport traffic control service but within Class E surface area when necessary to specify direction of takeoff, turn, or initial heading to be flown, obtains pilot's concurrence that the procedure will allow the pilot to comply with local traffic patterns, terrain, and obstruction avoidance.

3. When the initial heading will take the aircraft off an assigned procedure (for example, an RNAV SID with a published lateral path to a waypoint and crossing restrictions from the departure end of runway), the controller will assign an altitude to maintain with the initial heading.

4. Includes established departure procedures as part of the ATC clearance when pilot compliance is necessary to ensure separation.

5. At locations with both SIDs and DVAs, ATC will provide an amended departure clearance to cancel a previously assigned SID and subsequently utilize a DVA or vice versa. The amended clearance will be provided to the pilot in a timely manner so that the pilot may confirm adequate climb performance exists to determine if the amended clearance is acceptable, and brief the changes in advance of entering the runway.

6. At locations with a DVA, ATC is not permitted to utilize a SID and DVA concurrently.

5-5-15. Minimum Fuel Advisory

a. Pilot.

1. Advise ATC of your minimum fuel status when your fuel supply has reached a state where, upon reaching destination, you cannot accept any undue delay.

2. Be aware this is not an emergency situation, but merely an advisory that indicates an emergency situation is possible should any undue delay occur.

3. On initial contact the term "minimum fuel" should be used after stating call sign.

EXAMPLE-

Salt Lake Approach, United 621, "minimum fuel."

4. Be aware a minimum fuel advisory does not imply a need for traffic priority.

5. If the remaining usable fuel supply suggests the need for traffic priority to ensure a safe landing, you should declare an emergency due to low fuel and report fuel remaining in minutes.

REFERENCE-

Pilot/Controller Glossary Term- Fuel Remaining.

b. Controller.

1. When an aircraft declares a state of minimum fuel, relay this information to the facility to whom control jurisdiction is transferred.

2. Be alert for any occurrence which might delay the aircraft.

5-5-16. RNAV and RNP Operations

a. Pilot.

AIM

1. If unable to comply with the requirements of an RNAV or RNP procedure, pilots must advise air traffic control as soon as possible. For example, "N1234, failure of GPS system, unable RNAV, request amended clearance."

2. Pilots are not authorized to fly a published RNAV or RNP procedure (instrument approach, departure, or arrival procedure) unless it is retrievable by the procedure name from the current aircraft navigation database and conforms to the charted procedure. 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.

3. Whenever possible, RNAV routes (Q- or T-route) should be extracted from the database in their entirety, rather than loading RNAV route waypoints from the database into the flight plan individually. However, selecting and inserting individual, named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted.

4. Pilots must not change any database waypoint type from a fly-by to fly-over, or vice versa. No other modification of database waypoints or the creation of user-defined waypoints on published RNAV or RNP procedures is permitted, except to:

(a) Change altitude and/or airspeed waypoint constraints to comply with an ATC clearance/ instruction.

(b) Insert a waypoint along the published route to assist in complying with ATC instruction, example, "Descend via the WILMS arrival except cross 30 north of BRUCE at/or below FL 210." This is limited only to systems that allow along-track waypoint construction.

5. Pilots of FMS-equipped aircraft, who are assigned an RNAV DP or STAR procedure and subsequently receive a change of runway, transition or procedure, must verify that the appropriate changes are loaded and available for navigation.

6. For RNAV 1 DPs and STARs, pilots must use a CDI, flight director and/or autopilot, in lateral navigation mode. Other methods providing an equivalent level of performance may also be acceptable.

7. For RNAV 1 DPs and STARs, pilots of aircraft without GPS, using DME/DME/IRU, must ensure the aircraft navigation system position is confirmed, within 1,000 feet, at the start point of take–off roll. The use of an automatic or manual runway update is an acceptable means of compliance with this requirement. Other methods providing an equivalent level of performance may also be acceptable.

8. For procedures or routes requiring the use of GPS, if the navigation system does not automatically alert the flight crew of a loss of GPS, the operator must develop procedures to verify correct GPS operation.

9. RNAV terminal procedures (DP and STAR) may be amended by ATC issuing radar vectors and/or clearances direct to a waypoint. Pilots should avoid premature manual deletion of waypoints from their active "legs" page to allow for rejoining procedures.

10. RAIM Prediction: If TSO-C129 equipment is used to solely satisfy the RNAV and RNP requirement, GPS RAIM availability must be confirmed for the intended route of flight (route and time). If RAIM is not available, pilots need an approved alternate means of navigation.

REFERENCE-

AIM, Paragraph 5–1–16, RNAV and RNP Operations.

11. Definition of "established" for RNAV and RNP operations. An aircraft is considered to be established on-course during RNAV and RNP operations anytime it is within 1 times the required accuracy for the segment being flown. For example, while operating on a Q-Route (RNAV 2), the aircraft is considered to be established on-course when it is within 2 NM of the course centerline.

NOTE-

1. Pilots must be aware of how their navigation system operates, along with any AFM limitations, and confirm that the aircraft's lateral deviation display (or map display if being used as an allowed alternate means) is suitable for the accuracy of the segment being flown. Automatic scaling and alerting changes are appropriate for some operations. For example, TSO-C129 systems change within 30 miles of destination and within 2 miles of FAF to support approach

pilot from complying with (a) or (b) above, the pilot must report immediately after departure: the time of departure, the altitude, and the estimated time of arrival over the first reporting point along the flight route.

3. Foreign civil aircraft. If the pilot of a foreign civil aircraft that intends to enter the U.S. through an ADIZ cannot comply with the reporting requirements in subparagraphs c1 or c2 above, as applicable, the pilot must report the position of the aircraft to the appropriate aeronautical facility not less than 1 hour and not more than 2 hours average direct cruising distance from the U.S.

d. Land-Based ADIZ. Land-Based ADIZ are activated and deactivated over U.S. metropolitan areas as needed, with dimensions, activation dates and other relevant information disseminated via NOTAM. Pilots unable to comply with all NOTAM requirements must remain clear of Land-Based ADIZ. Pilots entering a Land-Based ADIZ without authorization or who fail to follow all requirements risk interception by military fighter aircraft.

e. Exceptions to ADIZ requirements.

1. Except for the national security requirements in paragraph 5–6–2, transponder requirements in subparagraph 5–6–4b1, and position reporting in subparagraph 5–6–4c, the ADIZ requirements in 14 CFR Part 99 described in this section do not apply to the following aircraft operations pursuant to Section 99.1(b), Applicability:

(a) Within the 48 contiguous States or within the State of Alaska, on a flight which remains within 10 NM of the point of departure;

(b) Operating at true airspeed of less than 180 knots in the Hawaii ADIZ or over any island, or within 12 NM of the coastline of any island, in the Hawaii ADIZ;

(c) Operating at true airspeed of less than 180 knots in the Alaska ADIZ while the pilot maintains a continuous listening watch on the appropriate frequency; or

(d) Operating at true airspeed of less than 180 knots in the Guam ADIZ.

2. An FAA air route traffic control center (ARTCC) may exempt certain aircraft operations on a local basis in concurrence with the DOD or pursuant to an agreement with a U.S. Federal security or

intelligence agency. (See 14 CFR 99.1 for additional information.)

f. A VFR flight plan filed inflight makes an aircraft subject to interception for positive identification when entering an ADIZ. Pilots are therefore urged to file the required DVFR flight plan either in person or by telephone prior to departure when able.

5–6–5. Civil Aircraft Operations To or From U.S. Territorial Airspace

a. Civil aircraft, except as described in subparagraph 5-6-5b below, are authorized to operate to or from U.S. territorial airspace if in compliance with all of the following conditions:

1. File and are on an active flight plan (IFR, VFR, or DVFR);

2. Are equipped with an operational transponder with altitude reporting capability, and continuously squawk an ATC assigned transponder code;

3. Maintain two-way radio communications with ATC;

4. Comply with all other applicable ADIZ requirements described in paragraph 5-6-4 and any other national security requirements in paragraph 5-6-2;

5. Comply with all applicable U.S. Customs and Border Protection (CBP) requirements, including Advance Passenger Information System (APIS) requirements (see subparagraph 5–6–5c below for CBP APIS information), in accordance with 19 CFR Part 122, *Air Commerce Regulations*; and

6. Are in receipt of, and are operating in accordance with, an FAA routing authorization if the aircraft is registered in a U.S. State Department-designated special interest country or is operating with the ICAO three letter designator (3LD) of a company in a country listed as a U.S. State Department-designated special interest country, unless the operator holds valid FAA Part 129 operations specifications. VFR and DVFR flight operations are prohibited for any aircraft requiring an FAA routing authorization. (See paragraph 5–6–11 for FAA routing authorization information).

b. Civil aircraft registered in the U.S., Canada, or Mexico with a maximum certificated takeoff gross weight of 100,309 pounds (45,500 kgs) or less that are operating without an operational transponder, and/or the ability to maintain two-way radio communications with ATC, are authorized to operate to or from U.S. territorial airspace over Alaska if in compliance with all of the following conditions:

1. Depart and land at an airport within the U.S. or Canada;

2. Enter or exit U.S. territorial airspace over Alaska north of the fifty-fourth parallel;

3. File and are on an active flight plan;

4. Comply with all other applicable ADIZ requirements described in paragraph 5-6-4 and any other national security requirements in paragraph 5-6-2;

5. Squawk 1200 if VFR and equipped with a transponder; and

6. Comply with all applicable U.S. CBP requirements, including Advance Passenger Information System (APIS) requirements (see subparagraph 5–6–5c below for CBP APIS information), in accordance with 19 CFR Part 122, *Air Commerce Regulations*.

c. CBP APIS Information. Information about U.S. CBP APIS requirements is available at http://www.cbp.gov.

5–6–6. Civil Aircraft Operations Within U.S. Territorial Airspace

a. Civil aircraft with a maximum certificated takeoff gross weight less than or equal to 100,309 pounds (45,500 kgs) are authorized to operate within U.S. territorial airspace in accordance with all applicable regulations and VFR in airport traffic pattern areas of U.S. airports near the U.S. border, except for those described in subparagraph 5–6–6b below.

b. Civil aircraft with a maximum certificated takeoff gross weight less than or equal to 100,309 pounds (45,500 kgs) and registered in a U.S. State Department-designated special interest country or operating with the ICAO 3LD of a company in a country listed as a U.S. State Department-designated special interest country, unless the operator holds valid FAA Part 129 operations specifications, must operate within U.S. territorial airspace in accordance with the same requirements as civil aircraft with a

maximum certificated takeoff gross weight greater than 100,309 pounds (45,500 kgs), as described in subparagraph 5–6–6c below.

c. Civil aircraft with a maximum certificated takeoff gross weight greater than 100,309 pounds (45,500 kgs) are authorized to operate within U.S. territorial airspace if in compliance with all of the following conditions:

1. File and are on an active flight plan (IFR or VFR);

2. Equipped with an operational transponder with altitude reporting capability, and continuously squawk an ATC assigned transponder code;

3. Equipped with an operational ADS-B Out when operating in airspace specified in 14 CFR 91.225;

4. Maintain two-way radio communications with ATC;

5. Aircraft not registered in the U.S. must operate under an approved Transportation Security Administration (TSA) aviation security program (see paragraph 5-6-10 for TSA aviation security program information) or in accordance with an FAA/TSA airspace waiver (see paragraph 5-6-9 for FAA/TSA airspace waiver information), except as authorized in 5-6-6c7. below;

6. Are in receipt of, and are operating in accordance with an FAA routing authorization and an FAA/TSA airspace waiver if the aircraft is registered in a U.S. State Department-designated special interest country or is operating with the ICAO 3LD of a company in a country listed as a U.S. State Department-designated special interest country, unless the operator holds valid FAA Part 129 operations specifications. VFR and DVFR flight operations are prohibited for any aircraft requiring an FAA routing authorization. (See paragraph 5–6–11 for FAA routing authorization information.); and

7. Aircraft not registered in the U.S., when conducting post-maintenance, manufacturer, production, or acceptance flight test operations, are exempt from the requirements in 5-6-6c5 above if all of the following requirements are met:

(a) A U.S. company must have operational control of the aircraft;

(b) An FAA-certificated pilot must serve as pilot in command;

2. Observations & Warnings (Obs/Warn). The Obs/Warn option provides an option to display weather data for the current time and the previous 14 hours (rounded to the nearest hour). Users may advance through time using the arrow buttons or by clicking on the desired hour. Provided below are the Obs/Warn product tabs available on the GFA website:

- (a) METAR
- (b) Precipitation/Weather (PCPN/WX)
- (c) Ceiling & Visibility (CIG/VIS)
- (d) Pilot Weather Report (PIREP)
- (e) Radar & Satellite (RAD/SAT)

3. The GFA will be continuously updated and available online at **http://aviationweather.gov/gfa**. Upon clicking the link above, select INFO on the top right corner of the map display. The next screen presents the option of selecting Overview, Products, and Tutorial. Simply select the tab of interest to explore the enhanced digital and graphical weather products designed to replace the legacy FA. Users

should also refer to AC 00-45, Aviation Weather Services, for more detailed information on the GFA.

4. GFA Static Images. Some users with limited internet connectivity may access static images via the Aviation Weather Center (AWC) at: http://www.aviationweather.gov/gfa/plot. There are two static graphical images available, titled Aviation Cloud Forecast and Aviation Surface Forecast. The Aviation Cloud Forecast provides cloud coverage, bases, layers, and tops with Airmet Sierra for mountain obscuration and Airmet Zulu for icing overlaid. The Aviation Surface Forecast provides visibility, weather phenomena, and winds (including wind gusts) with Airmet Sierra for instrument flight rules conditions and Airmet Tango for sustained surface winds of 30 knots or more overlaid. These images are presented on ten separate maps providing forecast views for the entire CONUS on one and nine regional views which provide more detail for the user. They are updated every 3 hours and provide forecast snapshots for 3, 6, 9, 12, 15, and 18 hours into the future. (See FIG 7-1-2 and FIG 7-1-3.)

FIG 7-1-2 Aviation Surface Forecast





FIG 7-1-3 Aviation Cloud Forecast

7-1-5. Preflight Briefing

a. Flight Service is one of the primary sources for obtaining preflight briefings and to file flight plans by phone or the Internet. Flight Service Specialists are qualified and certificated as Pilot Weather Briefers by the FAA. 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. Prior to every flight, pilots should gather all information vital to the nature of the flight. Pilots can receive a regulatory compliant briefing without contacting Flight Service. Pilots are encouraged to use automated resources and review AC 91-92, Pilot's Guide to a Preflight Briefing, for more information. Pilots who prefer to contact Flight Service are encouraged to conduct a self-brief prior to calling. Conducting a self-brief before contacting Flight Service provides familiarity of meteorological and aeronautical conditions applicable to the route of flight and promotes a better understanding of weather information. Three basic types of preflight briefings (Standard, Abbreviated, and Outlook) are available to serve the pilot's specific needs. Pilots should specify to the briefer the type of briefing they want, along with their appropriate background information.

This will enable the briefer to tailor the information to the pilot's intended flight. The following paragraphs describe the types of briefings available and the information provided in each briefing. *REFERENCE-*

AIM, Para 5–1–1, Preflight Preparation, 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 online resources. 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

no manual input available, would be announced as follows:

EXAMPLE-

"Ceiling one thousand overcast ... visibility three ... precipitation ... temperature three zero, dew point missing ... wind calm ... altimeter three zero zero one."

(d) "REMARKS" are announced in the following order of priority:

- (1) Automated "REMARKS."
 - [a] Density Altitude.
 - [b] Variable Visibility.
 - [c] Variable Wind Direction.
- (2) Manual Input "REMARKS."
 - [a] Sky Condition.
 - [b] Visibility.
 - [c] Weather and Obstructions to Vision.
 - [d] Temperature.
 - [e] Dew Point.
 - [f] Wind; and
 - **[g]** Altimeter Setting.

EXAMPLE-

"Remarks ... density altitude, two thousand five hundred ... visibility variable between one and two ... wind direction variable between two four zero and three one zero ... observer ceiling estimated two thousand broken ... observer temperature two, dew point minus five."

d. Automated Surface Observing System (ASOS)/Automated Weather Observing System (AWOS) The ASOS/AWOS is the primary surface weather observing system of the U.S. (See Key to Decode an ASOS/AWOS (METAR) Observation, FIG 7–1–7 and FIG 7–1–8.) The program to install and operate these systems throughout the U.S. is a joint effort of the NWS, the FAA and the Department of Defense. ASOS/AWOS is designed to support aviation operations and weather forecast activities. The ASOS/AWOS will provide continuous minuteby-minute observations and perform the basic observing functions necessary to generate an aviation routine weather report (METAR) and other aviation weather information. The information may be transmitted over a discrete VHF radio frequency or the voice portion of a local NAVAID. ASOS/AWOS transmissions on a discrete VHF radio frequency are engineered to be receivable to a maximum of 25 NM

from the ASOS/AWOS site and a maximum altitude of 10,000 feet AGL. At many locations, ASOS/ AWOS signals may be received on the surface of the airport, but local conditions may limit the maximum reception distance and/or altitude. While the automated system and the human may differ in their methods of data collection and interpretation, both produce an observation quite similar in form and content. For the "objective" elements such as pressure, ambient temperature, dew point temperature, wind, and precipitation accumulation, both the automated system and the observer use a fixed location and time-averaging technique. The quantitative differences between the observer and the automated observation of these elements are negligible. For the "subjective" elements, however, observers use a fixed time, spatial averaging technique to describe the visual elements (sky condition, visibility and present weather), while the automated systems use a fixed location, time averaging technique. Although this is a fundamental change, the manual and automated techniques yield remarkably similar results within the limits of their respective capabilities.

1. System Description.

(a) The ASOS/AWOS at each airport location consists of four main components:

- (1) Individual weather sensors.
- (2) Data collection and processing units.
- (3) Peripherals and displays.

(b) The ASOS/AWOS sensors perform the basic function of data acquisition. They continuously sample and measure the ambient environment, derive raw sensor data and make them available to the collection and processing units.

2. Every ASOS/AWOS will contain the following basic set of sensors:

(a) Cloud height indicator (one or possibly three).

(b) Visibility sensor (one or possibly three).

(c) Precipitation identification sensor.

(d) Freezing rain sensor (at select sites).

(e) Pressure sensors (two sensors at small airports; three sensors at large airports).

(f) Ambient temperature/Dew point temperature sensor.

(g) Anemometer (wind direction and speed sensor).

(h) Rainfall accumulation sensor.

(i) Automated Lightning Detection and Reporting System (ALDARS) (excluding Alaska and Pacific Island sites).

3. The ASOS/AWOS data outlets include:

(a) Those necessary for on-site airport users.

(b) National communications networks.

(c) Computer-generated voice (available through FAA radio broadcast to pilots, and dial-in telephone line).

NOTE-

Wind direction is reported relative to magnetic north in ATIS as well as ASOS and AWOS radio (voice) broadcasts.

4. An ASOS/AWOS report without human intervention will contain only that weather data

capable of being reported automatically. The modifier for this METAR report is "AUTO." When an observer augments or backs-up an ASOS/AWOS site, the "AUTO" modifier disappears.

5. There are two types of automated stations, AO1 for automated weather reporting stations without a precipitation discriminator, and AO2 for automated stations with a precipitation discriminator. As appropriate, "AO1" and "AO2" must appear in remarks. (A precipitation discriminator can determine the difference between liquid and frozen/freezing precipitation).

NOTE-

To decode an ASOS/AWOS report, refer to FIG 7–1–7 *and FIG* 7–1–8.

REFERENCE-

A complete explanation of METAR terminology is located in AIM, Para 7–1–28, Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR).

FIG 7-3-2 Missoula Intl RNAV (GPS) Y RWY 12



and, therefore, are not marked and/or lighted. Many of those that do require notice do not exceed 200 feet AGL or meet the Obstruction Standard of 14 CFR Part 77 and, therefore, are not marked and/or lighted. All pilots are cautioned to remain extremely vigilant for these power lines or their supporting structures when following natural flyways or during the approach and landing phase. This is particularly important for seaplane and/or float equipped aircraft when landing on, or departing from, unfamiliar lakes or rivers.

d. Other Objects/Structures. There are other objects or structures that could adversely affect your flight such as construction cranes near an airport, newly constructed buildings, new towers, etc. Many of these structures do not meet charting requirements or may not yet be charted because of the charting cycle. Some structures do not require obstruction marking and/or lighting and some may not be marked and lighted even though the FAA recommended it.

7–6–5. Avoid Flight Beneath Unmanned Balloons

a. The majority of unmanned free balloons currently being operated have, extending below them, either a suspension device to which the payload or instrument package is attached, or a trailing wire antenna, or both. In many instances these balloon subsystems may be invisible to the pilot until the aircraft is close to the balloon, thereby creating a potentially dangerous situation. Therefore, good judgment on the part of the pilot dictates that aircraft should remain well clear of all unmanned free balloons and flight below them should be avoided at all times.

b. Pilots are urged to report any unmanned free balloons sighted to the nearest FAA ground facility with which communication is established. Such information will assist FAA ATC facilities to identify and flight follow unmanned free balloons operating in the airspace.

7–6–6. Unmanned Aircraft Systems

a. Unmanned Aircraft Systems (UAS), formerly referred to as "Unmanned Aerial Vehicles" (UAVs) or "drones," are having an increasing operational presence in the NAS. Once the exclusive domain of the military, UAS are now being operated by various

entities. Although these aircraft are "unmanned," UAS are flown by a remotely located pilot and crew. Physical and performance characteristics of unmanned aircraft (UA) vary greatly and unlike model aircraft that typically operate lower than 400 feet AGL, UA may be found operating at virtually any altitude and any speed. Sizes of UA can be as small as several pounds to as large as a commercial transport aircraft. UAS come in various categories including airplane, rotorcraft, powered–lift (tilt– rotor), and lighter–than–air. Propulsion systems of UAS include a broad range of alternatives from piston powered and turbojet engines to battery and solar–powered electric motors.

b. To ensure segregation of UAS operations from other aircraft, the military typically conducts UAS operations within restricted or other special use airspace. However, UAS operations are now being approved in the NAS outside of special use airspace through the use of FAA-issued Certificates of Waiver or Authorization (COA) or through the issuance of a special airworthiness certificate. COA and special airworthiness approvals authorize UAS flight operations to be contained within specific geographic boundaries and altitudes, usually require coordination with an ATC facility, and typically require the issuance of a NOTAM describing the operation to be conducted. UAS approvals also require observers to provide "see-and-avoid" capability to the UAS crew and to provide the necessary compliance with 14 CFR Section 91.113. For UAS operations approved at or above FL180, UAS operate under the same requirements as that of manned aircraft (i.e., flights are operated under instrument flight rules, are in communication with ATC, and are appropriately equipped).

c. UAS operations may be approved at either controlled or uncontrolled airports and are typically disseminated by NOTAM. In all cases, approved UAS operations must comply with all applicable regulations and/or special provisions specified in the COA or in the operating limitations of the special airworthiness certificate. At uncontrolled airports, UAS operations are advised to operate well clear of all known manned aircraft operations. Pilots of manned aircraft are advised to follow normal operating procedures and are urged to monitor the CTAF for any potential UAS activity. At controlled airports, local ATC procedures may be in place to handle UAS operations and should not require any special procedures from manned aircraft entering or departing the traffic pattern or operating in the vicinity of the airport.

d. In addition to approved UAS operations described above, a recently approved agreement between the FAA and the Department of Defense authorizes small UAS operations wholly contained within Class G airspace, and in no instance, greater than 1200 feet AGL over military owned or leased property. These operations do not require any special authorization as long as the UA remains within the lateral boundaries of the military installation as well as other provisions including the issuance of a NOTAM. Unlike special use airspace, these areas may not be depicted on an aeronautical chart.

e. There are several factors a pilot should consider regarding UAS activity in an effort to reduce potential flight hazards. Pilots are urged to exercise increased vigilance when operating in the vicinity of restricted or other special use airspace, military operations areas, and any military installation. Areas with a preponderance of UAS activity are typically noted on sectional charts advising pilots of this activity. Since the size of a UA can be very small, they may be difficult to see and track. If a UA is encountered during flight, as with manned aircraft, never assume that the pilot or crew of the UAS can see you, maintain increased vigilance with the UA and always be prepared for evasive action if necessary. Always check NOTAMs for potential UAS activity along the intended route of flight and exercise increased vigilance in areas specified in the NOTAM.

7-6-7. Mountain Flying

a. Your first experience of flying over mountainous terrain (particularly if most of your flight time has been over the flatlands of the Midwest) could be a *never-to-be-forgotten nightmare* if proper planning is not done and if you are not aware of the potential hazards awaiting. Those familiar section lines are not present in the mountains; those flat, level fields for forced landings are practically nonexistent; abrupt changes in wind direction and velocity occur; severe updrafts and downdrafts are common, particularly near or above abrupt changes of terrain such as cliffs or rugged areas; even the clouds look different and can build up with startling rapidity. Mountain flying need not be hazardous if you follow the recommendations below.

b. File a Flight Plan. Plan your route to avoid topography which would prevent a safe forced landing. The route should be over populated areas and well known mountain passes. Sufficient altitude should be maintained to permit gliding to a safe landing in the event of engine failure.

c. Don't fly a light aircraft when the winds aloft, at your proposed altitude, exceed 35 miles per hour. Expect the winds to be of much greater velocity over mountain passes than reported a few miles from them. Approach mountain passes with as much altitude as possible. Downdrafts of from 1,500 to 2,000 feet per minute are not uncommon on the leeward side.

d. Don't fly near or above abrupt changes in terrain. Severe turbulence can be expected, especially in high wind conditions.

e. Understand Mountain Obscuration. The term Mountain Obscuration (MTOS) is used to describe a visibility condition that is distinguished from IFR because ceilings, by definition, are described as "above ground level" (AGL). In mountainous terrain clouds can form at altitudes significantly higher than the weather reporting station and at the same time nearby mountaintops may be obscured by low visibility. In these areas the ground level can also vary greatly over a small area. Beware if operating VFR-on-top. You could be operating closer to the terrain than you think because the tops of mountains are hidden in a cloud deck below. MTOS areas are identified daily on The Aviation Weather Center located at: http://www.aviationweather.gov.

f. Navigating in confined terrain when flying through mountain passes can be challenging. For high-traffic mountain passes, VFR checkpoints may be provided on VFR navigation charts to increase situational awareness by indicating key landmarks inside confined terrain. A collocated VFR waypoint and checkpoint may be provided to assist with identifying natural entry points for commonly flown mountain passes. Pilots should reference the name of the charted VFR checkpoint, wherever possible, when making position reports on CTAF frequencies to reduce the risk of midair collisions. Pilots should evaluate the terrain along the route they intend to fly with respect to their aircraft type and performance capabilities, local weather, and their experience level to avoid flying into confined areas without adequate room to execute a 180 degree turn, should conditions

require. Always fly with a planned escape route in mind.

REFERENCE– AIM, Para 1–1–17, Global Positioning System (GPS).

g. VFR flight operations may be conducted at night in mountainous terrain with the application of sound judgment and common sense. Proper pre-flight planning, giving ample consideration to winds and weather, knowledge of the terrain and pilot experience in mountain flying are prerequisites for safety of flight. Continuous visual contact with the surface and obstructions is a major concern and flight operations under an overcast or in the vicinity of clouds should be approached with extreme caution.

h. When landing at a high altitude field, the same indicated airspeed should be used as at low elevation fields. *Remember:* that due to the less dense air at altitude, this same indicated airspeed actually results in higher true airspeed, a faster landing speed, and more important, a longer landing distance. During gusty wind conditions which often prevail at high altitude fields, a power approach and power landing is recommended. Additionally, due to the faster groundspeed, your takeoff distance will increase considerably over that required at low altitudes.

i. Effects of Density Altitude. Performance figures in the aircraft owner's handbook for length of takeoff run, horsepower, rate of climb, etc., are generally based on standard atmosphere conditions (59 degrees Fahrenheit (15 degrees Celsius), pressure 29.92 inches of mercury) at sea level. However, inexperienced pilots, as well as experienced pilots, may run into trouble when they encounter an altogether different set of conditions. This is particularly true in hot weather and at higher elevations. Aircraft operations at altitudes above sea level and at higher than standard temperatures are commonplace in mountainous areas. Such operations quite often result in a drastic reduction of aircraft performance capabilities because of the changing air density. Density altitude is a measure of air density. It is not to be confused with pressure altitude, true altitude, or absolute altitude. It is not to be used as a height reference, but as a determining criteria in the performance capability of an aircraft. Air density decreases with altitude. As air density decreases, density altitude increases. The further effects of high temperature and high humidity are cumulative, resulting in an increasing high density altitude

condition. High density altitude reduces all aircraft performance parameters. To the pilot, this means that the normal horsepower output is reduced, propeller efficiency is reduced, and a higher true airspeed is required to sustain the aircraft throughout its operating parameters. It means an increase in runway length requirements for takeoff and landings, and decreased rate of climb. An average small airplane, for example, requiring 1,000 feet for takeoff at sea level under standard atmospheric conditions will require a takeoff run of approximately 2,000 feet at an operational altitude of 5,000 feet.

NOTE-

A turbo-charged aircraft engine provides a slight advantage in that it provides sea level horsepower up to a specified altitude above sea level.

1. Density Altitude Advisories. At airports with elevations of 2,000 feet and higher, control towers and FSSs will broadcast the advisory "Check Density Altitude" when the temperature reaches a predetermined level. These advisories will be broadcast on appropriate tower frequencies or, where available, ATIS. FSSs will broadcast these advisories as a part of Local Airport Advisory.

2. These advisories are provided by air traffic facilities, as a reminder to pilots that high temperatures and high field elevations will cause significant changes in aircraft characteristics. The pilot retains the responsibility to compute density altitude, when appropriate, as a part of preflight duties.

NOTE-

All FSSs will compute the current density altitude upon request.

j. Mountain Wave. Many pilots go all their lives without understanding what a mountain wave is. Quite a few have lost their lives because of this lack of understanding. One need not be a licensed meteorologist to understand the mountain wave phenomenon.

1. Mountain waves occur when air is being blown over a mountain range or even the ridge of a sharp bluff area. As the air hits the upwind side of the range, it starts to climb, thus creating what is generally a smooth updraft which turns into a turbulent downdraft as the air passes the crest of the ridge. From this point, for many miles downwind, there will be a series of downdrafts and updrafts. Satellite photos of the Rockies have shown mountain waves extending as far as 700 miles downwind of the range. Along the east coast area, such photos of the Appalachian chain have picked up the mountain wave phenomenon over a hundred miles eastward. All it takes to form a mountain wave is wind blowing across the range at 15 knots or better at an intersection angle of not less than 30 degrees.

2. Pilots from flatland areas should understand a few things about mountain waves in order to stay out of trouble. When approaching a mountain range from the upwind side (generally the west), there will usually be a smooth updraft; therefore, it is not quite as dangerous an area as the lee of the range. From the leeward side, it is always a good idea to add an extra thousand feet or so of altitude because downdrafts can exceed the climb capability of the aircraft. Never expect an updraft when approaching a mountain chain from the leeward. Always be prepared to cope with a downdraft and turbulence.

3. When approaching a mountain ridge from the downwind side, it is recommended that the ridge be approached at approximately a 45 degree angle to the horizontal direction of the ridge. This permits a safer retreat from the ridge with less stress on the aircraft should severe turbulence and downdraft be experienced. If severe turbulence is encountered, simultaneously reduce power and adjust pitch until aircraft approaches maneuvering speed, then adjust power and trim to maintain maneuvering speed and fly away from the turbulent area.

7–6–8. Use of Runway Half–way Signs at Unimproved Airports

When installed, runway half-way signs provide the pilot with a reference point to judge takeoff acceleration trends. Assuming that the runway length is appropriate for takeoff (considering runway condition and slope, elevation, aircraft weight, wind, and temperature), typical takeoff acceleration should allow the airplane to reach 70 percent of lift-off airspeed by the midpoint of the runway. The "rule of thumb" is that should airplane acceleration not allow the airspeed to reach this value by the midpoint, the takeoff should be aborted, as it may not be possible to liftoff in the remaining runway.

Several points are important when considering using this "rule of thumb":

a. Airspeed indicators in small airplanes are not required to be evaluated at speeds below stalling, and may not be usable at 70 percent of liftoff airspeed.

b. This "rule of thumb" is based on a uniform surface condition. Puddles, soft spots, areas of tall and/or wet grass, loose gravel, etc., may impede acceleration or even cause deceleration. Even if the airplane achieves 70 percent of liftoff airspeed by the midpoint, the condition of the remainder of the runway may not allow further acceleration. The entire length of the runway should be inspected prior to takeoff to ensure a usable surface.

c. This "rule of thumb" applies only to runway required for actual liftoff. In the event that obstacles affect the takeoff climb path, appropriate distance must be available after liftoff to accelerate to best angle of climb speed and to clear the obstacles. This will, in effect, require the airplane to accelerate to a higher speed by midpoint, particularly if the obstacles are close to the end of the runway. In addition, this technique does not take into account the effects of upslope or tailwinds on takeoff performance. These factors will also require greater acceleration than normal and, under some circumstances, prevent takeoff entirely.

d. Use of this "rule of thumb" does not alleviate the pilot's responsibility to comply with applicable Federal Aviation Regulations, the limitations and performance data provided in the FAA approved Airplane Flight Manual (AFM), or, in the absence of an FAA approved AFM, other data provided by the aircraft manufacturer.

In addition to their use during takeoff, runway half–way signs offer the pilot increased awareness of his or her position along the runway during landing operations.

NOTE-

No FAA standard exists for the appearance of the runway half-way sign. FIG 7–6–1 shows a graphical depiction of a typical runway half-way sign.



7-6-9. Seaplane Safety

a. Acquiring a seaplane class rating affords access to many areas not available to landplane pilots. Adding a seaplane class rating to your pilot certificate can be relatively uncomplicated and inexpensive. However, more effort is required to become a safe, efficient, competent "bush" pilot. The natural hazards of the backwoods have given way to modern man-made hazards. Except for the far north, the available bodies of water are no longer the exclusive domain of the airman. Seaplane pilots must be vigilant for hazards such as electric power lines, power, sail and rowboats, rafts, mooring lines, water skiers, swimmers, etc.

b. Seaplane pilots must have a thorough understanding of the right-of-way rules as they apply to aircraft versus other vessels. Seaplane pilots are expected to know and adhere to both the U.S. Coast Guard's (USCG) Navigation Rules, International–Inland, and 14 CFR Section 91.115, Right–of–Way Rules; Water Operations. The navigation rules of the road are a set of collision avoidance rules as they apply to aircraft on the water. A seaplane is considered a vessel when on the water for the purposes of these collision avoidance rules. In general, a seaplane on the water must keep well clear of all vessels and avoid impeding their navigation. The CFR requires, in part, that aircraft operating on the water "... shall, insofar as possible, keep clear of

all vessels and avoid impeding their navigation, and shall give way to any vessel or other aircraft that is given the right-of-way" This means that a seaplane should avoid boats and commercial shipping when on the water. If on a collision course, the seaplane should slow, stop, or maneuver to the right, away from the bow of the oncoming vessel. Also, while on the surface with an engine running, an aircraft must give way to all nonpowered vessels. Since a seaplane in the water may not be as maneuverable as one in the air, the aircraft on the water has right-of-way over one in the air, and one taking off has right-of-way over one landing. A seaplane is exempt from the USCG safety equipment requirements, including the requirements for Personal Flotation Devices (PFD). Requiring seaplanes on the water to comply with USCG equipment requirements in addition to the FAA equipment requirements would be an unnecessary burden on seaplane owners and operators.

c. Unless they are under Federal jurisdiction, navigable bodies of water are under the jurisdiction of the state, or in a few cases, privately owned. Unless they are specifically restricted, aircraft have as much right to operate on these bodies of water as other vessels. To avoid problems, check with Federal or local officials in advance of operating on unfamiliar waters. In addition to the agencies listed in TBL 7-6-1, the nearest Flight Standards District Office can usually offer some practical suggestions as well as regulatory information. If you land on a restricted body of water because of an inflight emergency, or in ignorance of the restrictions you have violated, report as quickly as practical to the nearest local official having jurisdiction and explain your situation.

d. When operating a seaplane over or into remote areas, appropriate attention should be given to survival gear. Minimum kits are recommended for summer and winter, and are required by law for flight into sparsely settled areas of Canada and Alaska. Alaska State Department of Transportation and Canadian Ministry of Transport officials can provide specific information on survival gear requirements. The kit should be assembled in one container and be easily reachable and preferably floatable.

Authority to Consult For Use of a Body of Water			
Location	Authority	Contact	
Wilderness Area	U.S. Department of Agriculture, Forest Service	Local forest ranger	
National Forest	USDA Forest Service	Local forest ranger	
National Park	U.S. Department of the Interior, National Park Service	Local park ranger	
Indian Reservation	USDI, Bureau of Indian Affairs	Local Bureau office	
State Park	State government or state forestry or park service	Local state aviation office for further information	
Canadian National and Provincial Parks	Supervised and restricted on an individual basis from province to province and by different departments of the Canadian government; consult Canadian Flight Information Manual and/or Water Aerodrome Supplement	Park Superintendent in an emergency	

TBL 7-6-1 Jurisdictions Controlling Navigable Bodies of Water

e. The FAA recommends that each seaplane owner or operator provide flotation gear for occupants any time a seaplane operates on or near water. 14 CFR Section 91.205(b)(12) requires approved flotation gear for aircraft operated for hire over water and beyond power-off gliding distance from shore. FAA-approved gear differs from that required for navigable waterways under USCG rules. FAA-approved life vests are inflatable designs as compared to the USCG's noninflatable PFD's that may consist of solid, bulky material. Such USCG PFDs are impractical for seaplanes and other aircraft because they may block passage through the relatively narrow exits available to pilots and passengers. Life vests approved under Technical Standard Order (TSO) TSO-C13E contain fully inflatable compartments. The wearer inflates the compartments (AFTER exiting the aircraft) primarily by independent CO2 cartridges, with an oral inflation tube as a backup. The flotation gear also contains a water-activated, self-illuminating signal light. The fact that pilots and

passengers can easily don and wear inflatable life vests (when not inflated) provides maximum effectiveness and allows for unrestricted movement. It is imperative that passengers are briefed on the location and proper use of available PFDs prior to leaving the dock.

f. The FAA recommends that seaplane owners and operators obtain Advisory Circular (AC) 91–69, Seaplane Safety for 14 CFR Part 91 Operations, free from the U.S. Department of Transportation, Subsequent Distribution Office, SVC–121.23, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20785; fax: (301) 386–5394. The USCG Navigation Rules International–Inland (COMDTINSTM 16672.2B) is available for a fee from the Government Publishing Office by facsimile request to (202) 512–2250, and can be ordered using Mastercard or Visa.

7-6-10. Flight Operations in Volcanic Ash

a. Severe volcanic eruptions which send ash and sulphur dioxide (SO₂) gas into the upper atmosphere occur somewhere around the world several times each year. Flying into a volcanic ash cloud can be exceedingly dangerous. A B747–200 lost all four engines after such an encounter and a B747–400 had the same nearly catastrophic experience. Piston–powered aircraft are less likely to lose power but severe damage is almost certain to ensue after an encounter with a volcanic ash cloud which is only a few hours old.

b. Most important is to avoid any encounter with volcanic ash. The ash plume may not be visible, especially in instrument conditions or at night; and even if visible, it is difficult to distinguish visually between an ash cloud and an ordinary weather cloud. Volcanic ash clouds are not displayed on airborne or ATC radar. The pilot must rely on reports from air traffic controllers and other pilots to determine the location of the ash cloud and use that information to remain well clear of the area. Additionally, the presence of a sulphur-like odor throughout the cabin may indicate the presence of SO₂ emitted by volcanic activity, but may or may not indicate the presence of volcanic ash. Every attempt should be made to remain on the upwind side of the volcano.

c. It is recommended that pilots encountering an ash cloud should immediately reduce thrust to idle (altitude permitting), and reverse course in order to
escape from the cloud. Ash clouds may extend for hundreds of miles and pilots should not attempt to fly through or climb out of the cloud. In addition, the following procedures are recommended:

1. Disengage the autothrottle if engaged. This will prevent the autothrottle from increasing engine thrust;

2. Turn on continuous ignition;

3. Turn on all accessory airbleeds including all air conditioning packs, nacelles, and wing anti-ice. This will provide an additional engine stall margin by reducing engine pressure.

d. The following has been reported by flightcrews who have experienced encounters with volcanic dust clouds:

1. Smoke or dust appearing in the cockpit.

2. An acrid odor similar to electrical smoke.

3. Multiple engine malfunctions, such as compressor stalls, increasing EGT, torching from tailpipe, and flameouts.

4. At night, St. Elmo's fire or other static discharges accompanied by a bright orange glow in the engine inlets.

5. A fire warning in the forward cargo area.

e. It may become necessary to shut down and then restart engines to prevent exceeding EGT limits. Volcanic ash may block the pitot system and result in unreliable airspeed indications.

f. If you see a volcanic eruption and have not been previously notified of it, you may have been the first person to observe it. In this case, immediately contact ATC and alert them to the existence of the eruption. If possible, use the Volcanic Activity Reporting form (VAR) depicted in Appendix 2 of this manual. Items 1 through 8 of the VAR should be transmitted immediately. The information requested in items 9 through 16 should be passed after landing. If a VAR form is not immediately available, relay enough information to identify the position and nature of the volcanic activity. Do not become unnecessarily alarmed if there is merely steam or very low-level eruptions of ash.

g. When landing at airports where volcanic ash has been deposited on the runway, be aware that even a thin layer of dry ash can be detrimental to braking

action. Wet ash on the runway may also reduce effectiveness of braking. It is recommended that reverse thrust be limited to minimum practical to reduce the possibility of reduced visibility and engine ingestion of airborne ash.

h. When departing from airports where volcanic ash has been deposited, it is recommended that pilots avoid operating in visible airborne ash. Allow ash to settle before initiating takeoff roll. It is also recommended that flap extension be delayed until initiating the before takeoff checklist and that a rolling takeoff be executed to avoid blowing ash back into the air.

7–6–11. Emergency Airborne Inspection of Other Aircraft

a. Providing airborne assistance to another aircraft may involve flying in very close proximity to that aircraft. Most pilots receive little, if any, formal training or instruction in this type of flying activity. Close proximity flying without sufficient time to plan (i.e., in an emergency situation), coupled with the stress involved in a perceived emergency can be hazardous.

b. The pilot in the best position to assess the situation should take the responsibility of coordinating the airborne intercept and inspection, and take into account the unique flight characteristics and differences of the category(s) of aircraft involved.

c. Some of the safety considerations are:

1. Area, direction and speed of the intercept;

2. Aerodynamic effects (i.e., rotorcraft downwash);

3. Minimum safe separation distances;

4. Communications requirements, lost communications procedures, coordination with ATC;

5. Suitability of diverting the distressed aircraft to the nearest safe airport; and

6. Emergency actions to terminate the intercept.

d. Close proximity, inflight inspection of another aircraft is uniquely hazardous. The pilot-in-command of the aircraft experiencing the problem/emergency must not relinquish control of the situation and/or jeopardize the safety of their aircraft. The maneuver must be accomplished with minimum risk to both aircraft.

7-6-12. Precipitation Static

a. Precipitation static is caused by aircraft in flight coming in contact with uncharged particles. These particles can be rain, snow, fog, sleet, hail, volcanic ash, dust; any solid or liquid particles. When the aircraft strikes these neutral particles the positive element of the particle is reflected away from the aircraft and the negative particle adheres to the skin of the aircraft. In a very short period of time a substantial negative charge will develop on the skin of the aircraft. If the aircraft is not equipped with static dischargers, or has an ineffective static discharger system, when a sufficient negative voltage level is reached, the aircraft may go into "CORONA." That is, it will discharge the static electricity from the extremities of the aircraft, such as the wing tips, horizontal stabilizer, vertical stabilizer, antenna, propeller tips, etc. This discharge of static electricity is what you will hear in your headphones and is what we call P-static.

b. A review of pilot reports often shows different symptoms with each problem that is encountered. The following list of problems is a summary of many pilot reports from many different aircraft. Each problem was caused by P-static:

1. Complete loss of VHF communications.

2. Erroneous magnetic compass readings (30 percent in error).

3. High pitched squeal on audio.

4. Motor boat sound on audio.

5. Loss of all avionics in clouds.

6. VLF navigation system inoperative most of the time.

7. Erratic instrument readouts.

8. Weak transmissions and poor receptivity of radios.

9. "St. Elmo's Fire" on windshield.

c. Each of these symptoms is caused by one general problem on the airframe. This problem is the inability of the accumulated charge to flow easily to the wing tips and tail of the airframe, and properly discharge to the airstream.

d. Static dischargers work on the principal of creating a relatively easy path for discharging negative charges that develop on the aircraft by using a discharger with fine metal points, carbon coated rods, or carbon wicks rather than wait until a large charge is developed and discharged off the trailing edges of the aircraft that will interfere with avionics equipment. This process offers approximately 50 decibels (dB) static noise reduction which is adequate in most cases to be below the threshold of noise that would cause interference in avionics equipment.

e. It is important to remember that precipitation static problems can only be corrected with the proper number of quality static dischargers, properly installed on a properly bonded aircraft. P-static is indeed a problem in the all weather operation of the aircraft, but there are effective ways to combat it. All possible methods of reducing the effects of P-static should be considered so as to provide the best possible performance in the flight environment.

f. A wide variety of discharger designs is available on the commercial market. The inclusion of well-designed dischargers may be expected to improve airframe noise in P-static conditions by as much as 50 dB. Essentially, the discharger provides a path by which accumulated charge may leave the airframe quietly. This is generally accomplished by providing a group of tiny corona points to permit onset of corona-current flow at a low aircraft potential. Additionally, aerodynamic design of dischargers to permit corona to occur at the lowest possible atmospheric pressure also lowers the corona threshold. In addition to permitting a low-potential discharge, the discharger will minimize the radiation of radio frequency (RF) energy which accompanies the corona discharge, in order to minimize effects of RF components at communications and navigation frequencies on avionics performance. These effects are reduced through resistive attachment of the corona point(s) to the airframe, preserving direct current connection but attenuating the higher-frequency components of the discharge.

g. Each manufacturer of static dischargers offers information concerning appropriate discharger location on specific airframes. Such locations emphasize the trailing outboard surfaces of wings and horizontal tail surfaces, plus the tip of the vertical stabilizer, where charge tends to accumulate on the airframe. Sufficient dischargers must be provided to allow for current-carrying capacity which will maintain airframe potential below the corona threshold of the trailing edges.

h. In order to achieve full performance of avionic equipment, the static discharge system will require periodic maintenance. A pilot knowledgeable of P-static causes and effects is an important element in assuring optimum performance by early recognition of these types of problems.

7–6–13. Light Amplification by Stimulated Emission of Radiation (Laser) Operations and Reporting Illumination of Aircraft

a. Lasers have many applications. Of concern to users of the National Airspace System are those laser events that may affect pilots, e.g., outdoor laser light shows or demonstrations for entertainment and advertisements at special events and theme parks. Generally, the beams from these events appear as bright blue–green in color; however, they may be red, yellow, or white. However, some laser systems produce light which is invisible to the human eye.

b. FAA regulations prohibit the disruption of aviation activity by any person on the ground or in the air. The FAA and the Food and Drug Administration (the Federal agency that has the responsibility to enforce compliance with Federal requirements for laser systems and laser light show products) are working together to ensure that operators of these devices do not pose a hazard to aircraft operators.

c. Pilots should be aware that illumination from these laser operations are able to create temporary vision impairment miles from the actual location. In addition, these operations can produce permanent eye damage. Pilots should make themselves aware of where these activities are being conducted and avoid these areas if possible.

d. Recent and increasing incidents of unauthorized illumination of aircraft by lasers, as well as the proliferation and increasing sophistication of laser devices available to the general public, dictates that the FAA, in coordination with other government agencies, take action to safeguard flights from these unauthorized illuminations.

e. Pilots should report laser illumination activity to the controlling Air Traffic Control facilities, Federal Contract Towers or Flight Service Stations as soon as

possible after the event. The following information should be included:

- **1.** UTC Date and Time of Event.
- 2. Call Sign or Aircraft Registration Number.
- 3. Type Aircraft.
- 4. Nearest Major City.
- 5. Altitude.

6. Location of Event (Latitude/Longitude and/ or Fixed Radial Distance (FRD)).

7. Brief Description of the Event and any other Pertinent Information.

f. Pilots are also encouraged to complete the Laser Beam Exposure Questionnaire located on the FAA Laser Safety Initiative website at http://www.faa.gov/about/initiatives/lasers/ and submit electronically per the directions on the questionnaire, as soon as possible after landing.

g. When a laser event is reported to an air traffic facility, a general caution warning will be broad-casted on all appropriate frequencies every five minutes for 20 minutes and broadcasted on the ATIS for one hour following the report.

PHRASEOLOGY-

UNAUTHORIZED LASER ILLUMINATION EVENT, (UTC time), (location), (altitude), (color), (direction).

EXAMPLE-

"Unauthorized laser illumination event, at 0100z, 8 mile final runway 18R at 3,000 feet, green laser from the southwest."

REFERENCE-

FAA Order JO 7110.65, Para 10-2-14, Unauthorized Laser Illumination of Aircraft.

FAA Order JO 7210.3, Para 2–1–27, Reporting Unauthorized Laser Illumination of Aircraft.

h. When these activities become known to the FAA, Notices to Air Missions (NOTAMs) are issued to inform the aviation community of the events. Pilots should consult NOTAMs or the Special Notices section of the Chart Supplement U.S. for information regarding these activities.

7–6–14. Flying in Flat Light, Brown Out Conditions, and White Out Conditions

a. Flat Light. Flat light is an optical illusion, also known as "**sector or partial white out**." It is not as severe as "white out" but the condition causes pilots to lose their depth–of–field and contrast in vision.

Flat light conditions are usually accompanied by overcast skies inhibiting any visual clues. Such conditions can occur anywhere in the world, primarily in snow covered areas but can occur in dust, sand, mud flats, or on glassy water. Flat light can completely obscure features of the terrain, creating an inability to distinguish distances and closure rates. As a result of this reflected light, it can give pilots the illusion that they are ascending or descending when they may actually be flying level. However, with good judgment and proper training and planning, it is possible to safely operate an aircraft in flat light conditions.

b. Brown Out. A brownout (or *brown-out*) is an in-flight visibility restriction due to dust or sand in the air. In a brownout, the pilot cannot see nearby objects which provide the outside visual references necessary to control the aircraft near the ground. This can cause spatial disorientation and loss of situational awareness leading to an accident.

1. The following factors will affect the probability and severity of brownout: rotor disk loading, rotor configuration, soil composition, wind, approach speed, and approach angle.

2. The brownout phenomenon causes accidents during helicopter landing and take-off operations in dust, fine dirt, sand, or arid desert terrain. Intense, blinding dust clouds stirred up by the helicopter rotor downwash during near-ground flight causes significant flight safety risks from aircraft and ground obstacle collisions, and dynamic rollover due to sloped and uneven terrain.

3. This is a dangerous phenomenon experienced by many helicopters when making landing approaches in dusty environments, whereby sand or dust particles become swept up in the rotor outwash and obscure the pilot's vision of the terrain. This is particularly dangerous because the pilot needs those visual cues from their surroundings in order to make a safe landing.

4. Blowing sand and dust can cause an illusion of a tilted horizon. A pilot not using the flight instruments for reference may instinctively try to level the aircraft with respect to the false horizon, resulting in an accident. Helicopter rotor wash also causes sand to blow around outside the cockpit windows, possibly leading the pilot to experience an illusion where the helicopter appears to be turning when it is actually in a level hover. This can also cause the pilot to make incorrect control inputs which can quickly lead to disaster when hovering near the ground. In night landings, aircraft lighting can enhance the visual illusions by illuminating the brownout cloud.

c. White Out. As defined in meteorological terms, white out occurs when a person becomes engulfed in a uniformly white glow. The glow is a result of being surrounded by blowing snow, dust, sand, mud or water. There are no shadows, no horizon or clouds and all depth–of–field and orientation are lost. A white out situation is severe in that there are no visual references. Flying is not recommended in any white out situation. Flat light conditions can lead to a white out environment quite rapidly, and both atmospheric conditions are insidious; they sneak up on you as your visual references slowly begin to disappear. White out has been the cause of several aviation accidents.

d. Self Induced White Out. This effect typically occurs when a helicopter takes off or lands on a snow-covered area. The rotor down wash picks up particles and re-circulates them through the rotor down wash. The effect can vary in intensity depending upon the amount of light on the surface. This can happen on the sunniest, brightest day with good contrast everywhere. However, when it happens, there can be a complete loss of visual clues. If the pilot has not prepared for this immediate loss of visibility, the results can be disastrous. Good planning does not prevent one from encountering flat light or white out conditions.

e. Never take off in a white out situation.

1. Realize that in flat light conditions it may be possible to depart but not to return to that site. During takeoff, make sure you have a reference point. Do not lose sight of it until you have a departure reference point in view. Be prepared to return to the takeoff reference if the departure reference does not come into view.

2. Flat light is common to snow skiers. One way to compensate for the lack of visual contrast and depth-of-field loss is by wearing amber tinted lenses (also known as blue blockers). Special note of caution: Eyewear is <u>not</u> ideal for every pilot. Take into consideration personal factors—age, light sensitivity, and ambient lighting conditions.

3. So what should a pilot do when all visual references are lost?

(a) Trust the cockpit instruments.

(b) Execute a 180 degree turnaround and start looking for outside references.

(c) Above all – fly the aircraft.

f. Landing in Low Light Conditions. When landing in a low light condition – use extreme caution. Look for intermediate reference points, in addition to checkpoints along each leg of the route for course confirmation and timing. The lower the ambient light becomes, the more reference points a pilot should use.

g. Airport Landings.

1. Look for features around the airport or approach path that can be used in determining depth perception. Buildings, towers, vehicles or other aircraft serve well for this measurement. Use something that will provide you with a sense of height above the ground, in addition to orienting you to the runway.

2. Be cautious of snowdrifts and snow banks – anything that can distinguish the edge of the runway. Look for subtle changes in snow texture or shading to identify ridges or changes in snow depth.

h. Off-Airport Landings.

1. In the event of an off-airport landing, pilots have used a number of different visual cues to gain reference. Use whatever you must to create the contrast you need. Natural references seem to work best (trees, rocks, snow ribs, etc.)

- (a) Over flight.
- (b) Use of markers.
- (c) Weighted flags.
- (d) Smoke bombs.
- (e) Any colored rags.
- (f) Dye markers.
- (g) Kool-aid.
- (h) Trees or tree branches.

2. It is difficult to determine the depth of snow in areas that are level. Dropping items from the aircraft to use as reference points should be used as a visual aid only and not as a primary landing reference. Unless your marker is biodegradable, be sure to retrieve it after landing. Never put yourself in a position where no visual references exist.

3. Abort landing if blowing snow obscures your reference. Make your decisions early. Don't assume you can pick up a lost reference point when you get closer.

4. Exercise extreme caution when flying from sunlight into shade. Physical awareness may tell you that you are flying straight but you may actually be in a spiral dive with centrifugal force pressing against you. Having no visual references enhances this illusion. Just because you have a good visual reference does not mean that it's safe to continue. There may be snow-covered terrain not visible in the direction that you are traveling. Getting caught in a no visual reference situation can be fatal.

i. Flying Around a Lake.

1. When flying along lakeshores, use them as a reference point. Even if you can see the other side, realize that your depth perception may be poor. It is easy to fly into the surface. If you must cross the lake, check the altimeter frequently and maintain a safe altitude while you still have a good reference. Don't descend below that altitude.

2. The same rules apply to seemingly flat areas of snow. If you don't have good references, avoid going there.

j. Other Traffic. Be on the look out for other traffic in the area. Other aircraft may be using your same reference point. Chances are greater of colliding with someone traveling in the same direction as you, than someone flying in the opposite direction.

k. Ceilings. Low ceilings have caught many pilots off guard. Clouds do not always form parallel to the surface, or at the same altitude. Pilots may try to compensate for this by flying with a slight bank and thus creating a descending turn.

I. Glaciers. Be conscious of your altitude when flying over glaciers. The glaciers may be rising faster than you are climbing.

7–6–15. Operations in Ground Icing Conditions

a. The presence of aircraft airframe icing during takeoff, typically caused by improper or no deicing of the aircraft being accomplished prior to flight has contributed to many recent accidents in turbine aircraft. The General Aviation Joint Steering Committee (GAJSC) is the primary vehicle for government-industry cooperation, communication, and coordination on GA accident mitigation. The Turbine Aircraft Operations Subgroup (TAOS) works to mitigate accidents in turbine accident aviation. While there is sufficient information and guidance currently available regarding the effects of icing on aircraft and methods for deicing, the TAOS has developed a list of recommended actions to further assist pilots and operators in this area.

While the efforts of the TAOS specifically focus on turbine aircraft, it is recognized that their recommendations are applicable to and can be adapted for the pilot of a small, piston powered aircraft too.

b. The following recommendations are offered:

1. Ensure that your aircraft's lift–generating surfaces are COMPLETELY free of contamination before flight through a tactile (hands on) check of the critical surfaces when feasible. Even when otherwise permitted, operators should avoid smooth or polished frost on lift–generating surfaces as an acceptable preflight condition.

2. Review and refresh your cold weather standard operating procedures.

3. Review and be familiar with the Airplane Flight Manual (AFM) limitations and procedures necessary to deal with icing conditions prior to flight, as well as in flight.

4. Protect your aircraft while on the ground, if possible, from sleet and freezing rain by taking advantage of aircraft hangars.

5. Take full advantage of the opportunities available at airports for deicing. Do not refuse deicing services simply because of cost.

6. Always consider canceling or delaying a flight if weather conditions do not support a safe operation.

c. If you haven't already developed a set of Standard Operating Procedures for cold weather operations, they should include:

1. Procedures based on information that is applicable to the aircraft operated, such as AFM limitations and procedures;

2. Concise and easy to understand guidance that outlines best operational practices;

3. A systematic procedure for recognizing, evaluating and addressing the associated icing risk, and offer clear guidance to mitigate this risk;

4. An aid (such as a checklist or reference cards) that is readily available during normal day-to-day aircraft operations.

d. There are several sources for guidance relating to airframe icing, including:

1. http://aircrafticing.grc.nasa.gov/index.html

2. http://www.ibac.org/is-bao/isbao.htm

3. http://www.natasafety1st.org/bus_deice.htm

4. Advisory Circular (AC) 91–74, Pilot Guide, Flight in Icing Conditions.

5. AC 135–17, Pilot Guide Small Aircraft Ground Deicing.

6. AC 135–9, FAR Part 135 Icing Limitations.

7. AC 120–60, Ground Deicing and Anti–icing Program.

8. AC 135–16, Ground Deicing and Anti–icing Training and Checking.

The FAA Approved Deicing Program Updates is published annually as a Flight Standards Information Bulletin for Air Transportation and contains detailed information on deicing and anti–icing procedures and holdover times. It may be accessed at the following website by selecting the current year's information bulletins:

http://www.faa.gov/library/manuals/examiners_insp ectors/8400/fsat

7–6–16. Avoid Flight in the Vicinity of Exhaust Plumes (Smoke Stacks and Cooling Towers)

a. Flight Hazards Exist Around Exhaust Plumes. Exhaust plumes are defined as visible or invisible emissions from power plants, industrial production facilities, or other industrial systems that release large amounts of vertically directed unstable gases (effluent). High temperature exhaust plumes can cause significant air disturbances such as turbulence and vertical shear. Other identified potential hazards include, but are not necessarily limited to: reduced visibility, oxygen depletion, engine particulate contamination, exposure to gaseous oxides, and/or icing. Results of encountering a plume may include airframe damage, aircraft upset, and/or engine damage/failure. These hazards are most critical during low altitude flight in calm and cold air, especially in and around approach and departure corridors or airport traffic areas.

Whether plumes are visible or invisible, the total extent of their turbulent affect is difficult to predict. Some studies do predict that the significant turbulent effects of an exhaust plume can extend to heights of over 1,000 feet above the height of the top of the stack or cooling tower. Any effects will be more pronounced in calm stable air where the plume is very hot and the surrounding area is still and cold. Fortunately, studies also predict that any amount of crosswind will help to dissipate the effects. However, the size of the tower or stack is not a good indicator of the predicted effect the plume may produce. The major effects are related to the heat or size of the plume effluent, the ambient air temperature, and the wind speed affecting the plume. Smaller aircraft can expect to feel an effect at a higher altitude than heavier aircraft.

b. When able, a pilot should steer clear of exhaust plumes by flying on the upwind side of smokestacks or cooling towers. When a plume is visible via smoke or a condensation cloud, remain clear and realize a plume may have both visible and invisible characteristics. Exhaust stacks without visible plumes may still be in full operation, and airspace in the vicinity should be treated with caution. As with mountain wave turbulence or clear air turbulence, an invisible plume may be encountered unexpectedly. Cooling towers, power plant stacks, exhaust fans, and other similar structures are depicted in FIG 7–6–2.

Pilots are encouraged to exercise caution when flying in the vicinity of exhaust plumes. Pilots are also encouraged to reference the Chart Supplement U.S. where amplifying notes may caution pilots and identify the location of structure(s) emitting exhaust plumes.

The best available information on this phenomenon must come from pilots via the PIREP reporting procedures. All pilots encountering hazardous plume conditions are urgently requested to report time, location, and intensity (light, moderate, severe, or extreme) of the element to the FAA facility with which they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other PIREPs and position reports (AIM paragraph 7–1–21, PIREPS Relating to Turbulence).



7-6-17. Space Launch and Reentry Area

Locations where commercial space launch and/or reentry operations occur. Hazardous operations occur in space launch and reentry areas, and for pilot awareness, a rocket-shaped symbol is used to depict them on sectional aeronautical charts. These locations may have vertical launches from launch pads, horizontal launches from runways, and/or reentering vehicles coming back to land. Because of the wide range of hazards associated with space launch and reentry areas, pilots are expected to check NOTAMs for the specific area prior to flight to determine the location and lateral boundaries of the associated hazard area, and the active time. NOTAMs may include terms such as "rocket launch activity," "space launch," or "space reentry," depending upon the type of operation. Space launch and reentry areas are not established for amateur rocket operations conducted per 14 CFR Part 101.

FIG 7-6-3 Space Launch and Reentry Area Depicted on a Sectional Chart



		TBL 4-3	
Item	10b	Surveillance	Capabilities

ENTER "N" if no surveillance equipment for the route to be flown is carried, or the equipment is unserviceable,								
or								
ENTER On	ENTER One or more of the following descriptors, to a maximum of 20 characters, to describe the serviceable surveillance							
equipment and/or capabilities on board.								
ENIER no	more than one tran	isponder code (Modes A, C, or S)						
SSK Modes	SA ana C: Tronsnondor	Made A (A divite 1006 rades)						
A	Transponder	Mode A (4 digits – 4096 codes)						
SSP Mode	s.	Mode A (4 dighs – 4090 codes) and Mode C						
F	Transponder	Mode S including aircraft identification pressure-altitude and extended souther						
L	Transponder	(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 surveillance capability						
Р	Transponder	Mode S, including pressure-altitude, but no aircraft identification capability						
S	Transponder	Mode S, including both pressure-altitude and aircraft identification capability						
Х	Transponder	Mode S, with neither aircraft identification nor pressure-altitude						
NOTE-								
Enhanced s	urveillance capabi	ility is the ability of the aircraft to down–link aircraft derived data via Mode S transponder.						
ADS-B:								
B1	ADS-B with de	dicated 1090 MHz ADS-B "out" capability						
B2	ADS-B with de	dicated 1090 MHz ADS-B "out" and "in" capability						
U1	ADS-B with "o	out" capability using UAT						
U2	ADS-B with "o	out" and "in" capability using UAT						
V1	ADS-B with "o	out" capability using VDL Mode 4						
V2	ADS–B with "o	out" and "in" capability using VDL Mode 4						
NOTE-								
File no mor	e than one code fo	r each type of capability, e.g., file B1 or B2 and not both						
ADS-C:								
D1	ADS-C with FA	ANS 1/A capabilities						
G1	ADS-C with A	ΓN capabilities						
Alphanume	ric characters not i	ncluded above are reserved.						
EXAMPLE	E—							
ADE3RV/H	HB2U2V2G1							
NOTE-								
1. The RSP	specification(s), if	applicable, will be listed in Item 18 following the indicator SUR/, using the characters						
"RSP" followed by the specifications value. Currently RSP180 and RSP400 are in use.								

2. List additional surveillance equipment or capabilities in Item 18 following the indicator SUR/.

Item	Purpose	Entry	Explanation
NAV/ entries used by FAA	Radius to Fix (RF) capability	Z1	RNP-capable flight is authorized for Radius to Fix operations.
	Fixed Radius Transitions (FRT)	Z2	RNP-capable flight is authorized for Fixed Radius Transi- tions.
	Time of Arrival Control (TOAC)	Z5	RNP-capable flight is authorized for Time of Arrival Control.
	Advanced RNP (A-RNP)	P1	Flight is authorized for A-RNP operations.
	Helicopter RNP 0.3	R1	Flight is authorized for RNP 0.3 operations (pertains to helicopters only).
	RNP 2 Continental	M1	Flight is authorized for RNP 2 continental operations.
	RNP 2 Oceanic/Remote	M2	Flight is authorized for RNP 2 oceanic/remote operations.
COM/ entries used by FAA	N/A	N/A	The FAA currently does not use any entries in COM/.
DAT/ entries	Capability and preference	Priority number	Entries are combined with a priority number, for example;
used by FAA	for delivery of pre-depar-	followed by:	1FANS2PDC means a preference for departure clearance
	ture clearance	FANS	delivered via FANS 1/A; with capability to also receive the
		FANSP PDC	clearance via ACARS PDC.
		PDC VOICE	FANS = FANS I/A DCL $FANSP = FANS I/A + DCL$
		VOICE	PDC = ACARS PDC
			VOICE = PDC via voice (no automated delivery)
SUR/ entries used by FAA	Req. Surveillance Perfor- mance	RSP180	Aircraft is authorized for Required Surveillance Performance RSP180
		RSP400	Aircraft is authorized for Required Surveillance Performance RSP400
	ADS-B	260B	Aircraft has 1090 MHz Extended Squitter ADS–B compliant with RTCA DO–260B (complies with FAA requirements)
		282B	Aircraft has 978 MHz UAT ADS–B compliant with RTCA DO–282B (complies with FAA requirements)

TBL 4-4 Item 18 NAV/, COM/, DAT/, and SUR/ capabilities used by FAA

NOTE-

1. Other entries in NAV/, COM/, DAT/, and SUR/ are permitted for international flights when instructed by other service providers. Direction on use of these capabilities by the FAA is detailed in the following sections.

2. In NAV/, descriptors for advanced capabilities (Z1, P1, R1, M1, and M2) should be entered as a single character string with no intervening spaces, and separated from any other entries in NAV/ by a space.

EXAMPLE-NAV/Z1P1M2 SBAS

Tune of Douting	Canability Dequired	Itom 10a	Item 18 PBN/	Item 18 NAV/	Notos	
Type of Kouting	Capability Kequired	item iva	See NOTE 2	See NOTE 3	Notes	
RNAV SID or STAR	DNAV 1	GR	D2		If GNSS	
(See NOTE 1)	NINAV I	DIR	D4		If DME/DME/IRU	
RNP SID or STAR	RNP 1 GNSS	GR	02		If GNSS only	
(See NOTE 2)	RNP 1 GNSS	DGIR	01		If GNSS primary and DME/DME/IRU backup	
RNP SID or STAR with RF	RNP 1 GNSS	GRZ	02	Z1	If GNSS only	
(See NOTE 2)	RNP 1 GNSS	DGIRZ	01	Z1	If GNSS primary and DME/DME/IRU backup	
Domestic Q-Route (see	DNAV 2	GR	C2		If GNSS	
Gulf of Mexico Q-Routes)	KINAV Z	DIR	C4		If DME/DME/IRU	
T-Route	RNAV 2	GR	C2		GNSS is required for T-Routes	
RNAV (GPS) Approach	RNP Approach, GPS	GR	S 1			
RNAV (GPS) Approach	RNP Approach, GPS Baro-VNAV	GR	S2			
RNAV (GPS) Approach with RF required	RNP Approach, GPS RF Capability	GRZ	S2	Z1	Domestic arrivals do not need to file PBN approach	
RNP AR Approach with RF	RNP (Special Autho- rization Required) RF Leg Capability	GR	T1		capabilities to request the approach.	
RNP AR Approach with- out RF	RNP (Special Autho- rization Required)	GR	T2			

TBL 4-13 Filing for Performance Based Navigation (PBN) Routes

NOTE-

1. If the flight is requesting an RNAV SID only (no RNAV STAR) or RNAV STAR only (no RNAV SID) then consult guidance on the FAA website at

https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/air_traffic_services/flight_plan_filing.

2. *PBN* descriptor D1 includes the capabilities of D2, D3, and D4. PBN descriptor B1 includes the capabilities of B2, B3, B4, and B5. PBN descriptor C1 includes the capabilities of C2, C3, and C4.

3. In NAV/, descriptors for advanced capabilities (Z1, P1, R1, M1, and M2) should be entered as a single character string with no intervening spaces, and separated from any other entries in NAV/ by a space.

EXAMPLE-

NAV/Z1P1M2 SBAS

7. Automated Departure Clearance Delivery (DCL or PDC). When planning to use automated pre-departure clearance delivery capability, file as indicated below.

(a) PDC provides pre-departure clearances from the FAA to the operator's designated flight operations center, which then delivers the clearance to the pilot by various means. Use of PDC does not require any special flight plan entry.

(b) DCL provides pre-departure clearances from the FAA directly to the cockpit/FMS via Controller Pilot Datalink Communications (CPDLC). Use of DCL requires flight plan entries as follows:

• Include CPDLC codes in Item 10a only if the flight is capable of en route/oceanic CPDLC, the codes are not required for DCL.

• Include Z in Item 10a to indicate there is information provided in Item 18 DAT/.

• Include the clearance delivery methods of which the flight is capable, and order of preference in Item 18 DAT/. (See AIM 5–2–2)

- VOICE deliver clearance via Voice
- PDC deliver clearance via PDC
- FANS deliver clearance via FANS 1/A
- FANSP deliver clearance via FANS 1/A+

EXAMPLE– DAT/1FANS2PDC DAT/1FANSP2VOICE

8. Operating in Reduced Vertical Separation Minima (RVSM) Airspace (Item 10a). When planning to fly in RVSM airspace (FL 290 up to and including FL 410) then file as indicated below.

(a) If capable and approved for RVSM operations, per AIM 4–6–1, Applicability and RVSM Mandate (Date/Time and Area), file a W in Item 10a. Include the aircraft registration mark in Item 18 REG/, which is used to post-operationally monitor the safety of RVSM operations.

• Do not file a "W" in Item 10a if the aircraft is capable of RVSM operations, but is not approved to operate in RVSM airspace.

• If RVSM capability is lost after the flight plan is filed, request that ATC remove the 'W' from Item 10a.

(b) When requesting to operate non-RVSM in RVSM airspace, using one of the exceptions identified in AIM 4–6–10, do not include a "W" in Item 10a. Include STS/NONRVSM in Item 18. STS/NONRVSM is used only as part of a request to operate non-RVSM in RVSM airspace.

9. Eligibility for Reduced Oceanic Separation. Indicate eligibility for the listed reduced separation minima as indicated in the tables below. Full Operational Requirements for these services are found in the U.S. Aeronautical Information Publication (AIP) ENR 7, Oceanic Operations, available at http://www.faa.gov/air_traffic/publications/atpubs/aip_html/index.html.

TBL 4-14 Filing for Gulf of Mexico CTA

					Flight Plan Entries				
Dimension of Separa- tion	Separation Minima	ADS-C Surveillance Requirements	Comm. Re- quirement	PBN Re- quirement	ADS–C in Item 10b	CPDLC in Item 10a	PBN in Item 18 PBN/ (also File 'R' in Item 10a)	PBN in Item 18 NAV/	
Lateral	50 NM	N/A (ADS-C not required)	Voice comm– HF or VHF as required to maintain con- tact over the entire route to be flown.	RNP10 or RNP4	N/A	N/A	A1 or L1	N/A	

NOTE-

If not RNAV10/RNP10 capable and planning to operate in the Gulf of Mexico CTA, then put the notation NONRNP10 in Item 18 RMK/, preferably first.

TBL 4-15 Filing for 50 NM Lateral Separation in Anchorage Arctic FIR

					Flight Plan Entries				
Dimension of Separa- tion	Separa- tion Mini- ma	ADS–C Surveillance Requirements	Comm. Re- quirement	PBN Require- ment	ADS–C in Item 10b	CPDLC in Item 10a	PBN in Item 18 PBN/ (also File 'R' in Item 10a)	PBN in Item 18 NAV/	
Lateral	50 NM	N/A (ADS–C not required)	None be- yond normal requirements for the airspace	RNP10 or RNP4	N/A	N/A	A1 or L1	N/A	

TBL 4-16

Filing for 30 NM Lateral, 30 NM Longitudinal, and 50 NM Longitudinal Oceanic Separation in Anchorage, Oakland, and New York Oceanic CTAs

					Flight Plan Entries			
Dimension of Separation	ension of Separation ADS–C aration Minima Requ		Comm. Re- quirement	PBN Require- ment	ADS–C in Item 10b	CPDLC in Item 10a	PBN in Item 18 PBN/ (also File 'R' in Item 10a)	PBN in Item 18 NAV/
Longitudinal	50 NM	Position report at least every 27 min- utes (at least every 32 minutes if both air- craft are approved for RNP-4 opera- tions)	CPDLC	RNP10	D1	J5 and/or J7	A1	N/A
Longitudinal	30 NM	ADS-C position re- port at least every 10 minutes	CPDLC	RNP4	D1	J5 and/or J7	L1	N/A
Lateral	30 NM	ADS-C-based later- al deviation event contract with 5NM lateral deviation from planned routing set as threshold for triggering ADS re- port of lateral devia- tion event	CPDLC	RNP4	D1	J5 and/or J7	L1	N/A

TBL 4-17 Filing for Reduced Oceanic Separation when RSP/RCP Required on March 29, 2018

					Flight Plan Entries				
Dimension of Separation	Separation Minima	RSP Re- quirement	RCP Re- quirement	PBN Require- ment	RSP in Item 18 SUR/	RCP in Item 10a	CDPLC in Item10a	PBN in Item 18 PBN/ (also File 'R' in Item 10a)	PBN in Item 18 NAV/
Lateral	55.5 km 30 NM	180	240	RNP 2 or RNP 4	RSP180	P2	J5, and/or J6, and/or J7	L1	
Perfor- mance– based Longitudinal	5 Minutes	180	240	RNAV 10 (RNP 10) RNP 4, or RNP 2 oceanic/ remote	RSP180	P2	J5, and/or J6, and/or J7	A1 or L1	M2
Perfor- mance- based Longitudinal	55.5 km 30 NM	180	240	RNP 4 or RNP 2 oceanic/ remote	RSP180	P2	J5, and/or J6, and/or J7	L1	M2
Perfor- mance– based Longitudinal	93 km 50 NM	180	240	RNAV 10 (RNP 10) or RNP 4	RSP180	P2	J5, and/or J6, and/or J7	A1 or L1	

NOTE-

1. Filing of RNP 2 alone is not supported in FAA controlled airspace; PBN/L1 (for RNP 4) or PBN/A1 (for RNP 10) must be filed to obtain the indicated separation.

2. Use of "RNP2" in NAV/ signifies continental RNP 2 (and means the same as M1). Continental RNP 2 is not adequate for reduced oceanic separation. Descriptor M2 indicates RNP 2 global/oceanic RNP 2 capability.

10. Date of Flight (Item 18 DOF/)

Flights planned more than 23 hours after the time the flight plan is filed, must include the date of flight in DOF/ expressed in a six-digit format YYMMDD, where YY equals the year (Y), MM equals the month, and DD equals the day.

NOTE-

FAA ATC systems will not accept flight plans more than 23 hours prior to their proposed departure time. FAA Flight Service and commercial flight planning services generally accept flight plans earlier and forward to ATC at an appropriate time, typically 2 to 4 hours before the flight.

EXAMPLE-

DOF/171130

11. Reasons for Special Handling (Item 18 STS/)

(a) Indicate the applicable Special Handling in Item 18 STS/ as shown in TBL 4–18.

NOTE-

Priority for a flight is not automatically granted based on filing one of these codes but is based on documented procedures. In some cases, additional information may also be required in remarks; follow all such instructions as well.

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: CALIBRATED AIRSPEED NATIONAL SECURITY AREA REDUCED VERTICAL SEPARATION MINIMUM (RVSM) AIRSPACE
- e. Terms Modified: SPECIAL USE AIRSPACE

f. Editorial/format changes were made where necessary. Revision bars were not used due to the insignificant nature of the changes.

11/3/22

C

CALCULATED LANDING TIME- A term that may be used in place of tentative or actual calculated landing time, whichever applies.

CALIBRATED AIRSPEED (CAS) – The indicated airspeed of an aircraft, corrected for position and instrument error. Calibrated airspeed is equal to true airspeed in standard atmosphere at sea level.

CALL FOR RELEASE– Wherein the overlying ARTCC requires a terminal facility to initiate verbal coordination to secure ARTCC approval for release of a departure into the en route environment.

CALL UP– Initial voice contact between a facility and an aircraft, using the identification of the unit being called and the unit initiating the call.

(Refer to AIM.)

CANADIAN MINIMUM NAVIGATION PERFOR-MANCE SPECIFICATION AIRSPACE– That portion of Canadian domestic airspace within which MNPS separation may be applied.

CARDINAL ALTITUDES- "Odd" or "Even" thousand-foot altitudes or flight levels; e.g., 5,000, 6,000, 7,000, FL 250, FL 260, FL 270.

(See ALTITUDE.) (See FLIGHT LEVEL.)

CARDINAL FLIGHT LEVELS-(See CARDINAL ALTITUDES.)

CAT-

(See CLEAR-AIR TURBULENCE.)

CATCH POINT- A fix/waypoint that serves as a transition point from the high altitude waypoint navigation structure to an arrival procedure (STAR) or the low altitude ground-based navigation structure.

CEILING- The heights above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration," and not classified as "thin" or "partial."

(See ICAO term CEILING.)

CEILING [ICAO]– The height above the ground or water of the base of the lowest layer of cloud below

6,000 meters (20,000 feet) covering more than half the sky.

CENTER-

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(See AIR ROUTE TRAFFIC CONTROL CENTER.)
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CENTER'S AREA- The specified airspace within which an air route traffic control center (ARTCC) provides air traffic control and advisory service.

(See AIR ROUTE TRAFFIC CONTROL CENTER.) (Refer to AIM.)

CENTER WEATHER ADVISORY– An unscheduled weather advisory issued by Center Weather Service Unit meteorologists for ATC use to alert pilots of existing or anticipated adverse weather conditions within the next 2 hours. A CWA may modify or redefine a SIGMET.

(See AIRMET.) (See CONVECTIVE SIGMET.) (See SAW.) (See SIGMET.) (Refer to AIM.)

CENTRAL EAST PACIFIC- An organized route system between the U.S. West Coast and Hawaii.

CEP-

(See CENTRAL EAST PACIFIC.)

CERAP-

(See COMBINED CENTER-RAPCON.)

CERTIFICATE OF WAIVER OR AUTHORIZA-TION (COA)– An FAA grant of approval for a specific flight operation or airspace authorization or waiver.

CERTIFIED TOWER RADAR DISPLAY (CTRD)– An FAA radar display certified for use in the NAS.

CFR-

(See CALL FOR RELEASE.)

CHA

(See CONTINGENCY HAZARD AREA)

CHAFF– Thin, narrow metallic reflectors of various lengths and frequency responses, used to reflect radar energy. These reflectors, when dropped from aircraft and allowed to drift downward, result in large targets on the radar display. CHART SUPPLEMENT U.S.– A publication designed primarily as a pilot's operational manual containing all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, and certain special notices and procedures. This publication is issued in seven volumes according to geographical area.

CHARTED VFR FLYWAYS– Charted VFR Flyways are flight paths recommended for use to bypass areas heavily traversed by large turbine-powered aircraft. Pilot compliance with recommended flyways and associated altitudes is strictly voluntary. VFR Flyway Planning charts are published on the back of existing VFR Terminal Area charts.

CHARTED VISUAL FLIGHT PROCEDURE APPROACH– An approach conducted while operating on an instrument flight rules (IFR) flight plan which authorizes the pilot of an aircraft to proceed visually and clear of clouds to the airport via visual landmarks and other information depicted on a charted visual flight procedure. This approach must be authorized and under the control of the appropriate air traffic control facility. Weather minimums required are depicted on the chart.

CHASE – An aircraft flown in proximity to another aircraft normally to observe its performance during training or testing.

CHASE AIRCRAFT-(See CHASE.)

CHOP- A form of turbulence.

a. Light Chop– Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude.

b. Moderate Chop– Turbulence similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude.

(See TURBULENCE.)

CIRCLE-TO-LAND MANEUVER- A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable. At tower controlled airports, this maneuver is made only after ATC authorization has been obtained and the pilot has established required visual reference to the airport.

(See CIRCLE TO RUNWAY.) (See LANDING MINIMUMS.) (Refer to AIM.)

CIRCLE TO RUNWAY (RUNWAY NUMBER)– Used by ATC to inform the pilot that he/she must circle to land because the runway in use is other than the runway aligned with the instrument approach procedure. When the direction of the circling maneuver in relation to the airport/runway is required, the controller will state the direction (eight cardinal compass points) and specify a left or right downwind or base leg as appropriate; e.g., "Cleared VOR Runway Three Six Approach circle to Runway Two Two," or "Circle northwest of the airport for a right downwind to Runway Two Two."

(See CIRCLE-TO-LAND MANEUVER.) (See LANDING MINIMUMS.) (Refer to AIM.)

CIRCLING APPROACH-(See CIRCLE-TO-LAND MANEUVER.)

CIRCLING MANEUVER-(See CIRCLE-TO-LAND MANEUVER.)

CIRCLING MINIMA– (See LANDING MINIMUMS.)

CLASS A AIRSPACE– (See CONTROLLED AIRSPACE.)

- CLASS B AIRSPACE-(See CONTROLLED AIRSPACE.)
- CLASS C AIRSPACE-(See CONTROLLED AIRSPACE.)
- CLASS D AIRSPACE-(See CONTROLLED AIRSPACE.)

CLASS E AIRSPACE– (See CONTROLLED AIRSPACE.)

CLASS G AIRSPACE– Airspace that is not designated in 14 CFR Part 71 as Class A, Class B, Class C, Class D, or Class E controlled airspace is Class G (uncontrolled) airspace.

(See UNCONTROLLED AIRSPACE.)

CLEAR AIR TURBULENCE (CAT)– Turbulence encountered in air where no clouds are present. This term is commonly applied to high-level turbulence associated with wind shear. CAT is often encountered in the vicinity of the jet stream.

(See WIND SHEAR.) (See JET STREAM.)

CLEAR OF THE RUNWAY-

a. Taxiing aircraft, which is approaching a runway, is clear of the runway when all parts of the 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 judgment 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 release is automatically canceled if takeoff is not made prior to a specified time. The expiration of a clearance void time does not cancel the departure clearance or IFR flight plan. It withdraws the pilot's authority to depart IFR until a new departure release/release time has been issued by ATC. Pilots who choose to depart VFR after their clearance void time has expired should not depart using the previously assigned IFR transponder code.

(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.

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(See CLEARED (Type of) APPROACH.)
(See INSTRUMENT APPROACH
PROCEDURE.)
(Refer to 14 CFR Part 91.)
(Refer to AIM.)
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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. Pilots should advise ATC if they decide to remain on the runway, of any delay in their stop and go, delay clearing the runway, or are unable to comply with the instruction(s).

(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) for which ATC is 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 LOOP CLEARANCE- A vector or reroute clearance that includes a return to route point and updates ERAM to accurately reflect the anticipated route (e.g., a QU route pick that anticipates length of vector and includes the next fix that ties into the route of flight.)

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.)

COA-

(See CERTIFICATE OF WAIVER OR AUTHORIZATION.)

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.)

COLD TEMPERATURE CORRECTION- A correction in feet, based on height above airport and temperature, that is added to the aircraft's indicated altitude to offset the effect of cold temperature on true altitude.

COLLABORATIVE TRAJECTORY OPTIONS PROGRAM (CTOP)– CTOP is a traffic management program administered by the Air Traffic Control System Command Center (ATCSCC) that manages demand through constrained airspace, while considering operator preference with regard to both route and delay as defined in a Trajectory Options Set (TOS).

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-(See SEGMENTS OF A SID/STAR)

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 90-66, Non–Towered Airport Flight Operations.)

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.)

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."

COMPUTER NAVIGATION FIX (CNF)- A Computer Navigation Fix is a point defined by a latitude/longitude coordinate and is required to support Performance-Based Navigation (PBN) operations. A five-letter identifier denoting a CNF can be found next to an "x" on en route charts and on some approach charts. Eventually, all CNFs will be labeled and begin with the letters "CF" followed by three consonants (e.g., 'CFWBG'). CNFs are not recognized by ATC, are not contained in ATC fix or automation databases, and are not used for ATC purposes. Pilots should not use CNFs for point-topoint navigation (e.g., proceed direct), filing a flight plan, or in aircraft/ATC communications. Use of CNFs has not been adopted or recognized by the International Civil Aviation Organization (ICAO).

(REFER to AIM 1–1–17b5(i)(2), Global Positioning System (GPS).

CONDITIONS NOT MONITORED- When an airport operator cannot monitor the condition of the movement area or airfield surface area, this information is issued as a NOTAM. Usually necessitated due to staffing, operating hours or other mitigating factors associated with airport operations.

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.

CONSOLIDATED WAKE TURBULENCE (CWT)– A version of RECAT that has nine categories, A through I, that refines the grouping of aircraft while optimizing wake turbulence separation.

CONSTRAINT SATISFACTION POINT (CSP)– Meter Reference Elements (MREs) that are actively scheduled by TBFM. Constraint satisfaction occurs when the Scheduled Time of Arrival generated for each metered flight conforms to all the scheduling constraints specified at all the applicable CSPs.

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.

CONTINGENCY HAZARD AREA (CHA)– Used by ATC. Areas of airspace that are defined and distributed in advance of a launch or reentry operation and are activated in response to a failure.

(See AIRCRAFT HAZARD AREA.) (See REFINED HAZARD AREA.) (See TRANSITIONAL HAZARD AREA.)

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.

Pilot/Controller Glossary

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 airspace 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 consists of a surface area with a 5 NM radius, a circle with a 10 NM 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 CWA.) (See SAW.) (See SIGMET.) (Refer to AIM.)

CONVECTIVE SIGNIFICANT METEOROLOG-ICAL INFORMATION-

(See CONVECTIVE SIGMET.)

COOPERATIVE SURVEILLANCE– Any surveillance system, such as secondary surveillance radar (SSR), wide–area multilateration (WAM), or ADS– B, that is dependent upon the presence of certain equipment onboard the aircraft or vehicle to be detected.

(See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST.) (See NON-COOPERATIVE SURVEILLANCE.) (See RADAR.) (See WIDE AREA MULTILATERATION.)

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.

COUPLED SCHEDULING (CS)/ EXTENDED METERING (XM)– Adds additional Constraint Satisfaction Points for metered aircraft along their route. This provides the ability to merge flows upstream from the meter fix and results in a more optimal distribution of delays over a greater distance from the airport, increased meter list accuracy, and more accurate delivery to the meter fix.

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.

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(See BEARING.)
(See INSTRUMENT LANDING SYSTEM.)
(See RADIAL.)
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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; 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.

CSP-

(See CONSTRAINT SATISFACTION POINT)

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.)

CTOP-

(See COLLABORATIVE TRAJECTORY OPTIONS PROGRAM)

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.)

CWT-

(See CONSOLIDATED WAKE TURBULENCE.)

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NAS-

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(See NATIONAL AIRSPACE SYSTEM.)
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NAT HLA-

(See NORTH ATLANTIC HIGH LEVEL AIRSPACE.)

NATIONAL AIRSPACE SYSTEM– The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE (NBCAP)– Airspace over United States territory located within the North American continent between Canada and Mexico, including adjacent territorial waters outward to about boundaries of oceanic control areas (CTA)/Flight Information Regions (FIR).

(See FLIGHT INFORMATION REGION.)

NATIONAL FLIGHT DATA DIGEST (NFDD)– A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Air Missions, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

NATIONAL SEARCH AND RESCUE PLAN– An interagency agreement which provides for the effective utilization of all available facilities in all types of search and rescue missions.

NATIONAL SECURITY AREA (NSA)-(See SPECIAL USE AIRSPACE.)

NAVAID-

(See NAVIGATIONAL AID.)

NAVAID CLASSES– VOR, VORTAC, and TACAN aids are classed according to their operational use. The three classes of NAVAIDs are:

- **a.** T– Terminal.
- **b.** L– Low altitude.
- **c.** H– High altitude.

Note: The normal service range for T, L, and H class aids is found in the AIM. Certain operational

requirements make it necessary to use some of these aids at greater service ranges than specified. Extended range is made possible through flight inspection determinations. Some aids also have lesser service range due to location, terrain, frequency protection, etc. Restrictions to service range are listed in Chart Supplement U.S.

NAVIGABLE AIRSPACE– Airspace at and above the minimum flight altitudes prescribed in the CFRs including airspace needed for safe takeoff and landing.

(Refer to 14 CFR Part 91.)

NAVIGATION REFERENCE SYSTEM (NRS)– The NRS is a system of waypoints developed for use within the United States for flight planning and navigation without reference to ground based navigational aids. The NRS waypoints are located in a grid pattern along defined latitude and longitude lines. The initial use of the NRS will be in the high altitude environment. The NRS waypoints are intended for use by aircraft capable of point–to–point navigation.

NAVIGATION SPECIFICATION [ICAO] – A set of aircraft and flight crew requirements needed to support performance–based navigation operations within a defined airspace. There are two kinds of navigation specifications:

a. RNP specification. A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP; e.g., RNP 4, RNP APCH.

b. RNAV specification. A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV; e.g., RNAV 5, RNAV 1.

Note: The Performance–based Navigation Manual (Doc 9613), Volume II contains detailed guidance on navigation specifications.

NAVIGATIONAL AID– Any visual or electronic device airborne or on the surface which provides point-to-point guidance information or position data to aircraft in flight.

(See AIR NAVIGATION FACILITY.)

NAVSPEC-

(See NAVIGATION SPECIFICATION [ICAO].)

NBCAP AIRSPACE-

(See NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE.)

NDB-

(See NONDIRECTIONAL BEACON.)

NEGATIVE- "No," or "permission not granted," or "that is not correct."

NEGATIVE CONTACT– Used by pilots to inform ATC that:

a. Previously issued traffic is not in sight. It may be followed by the pilot's request for the controller to provide assistance in avoiding the traffic.

b. They were unable to contact ATC on a particular frequency.

NFDD-

(See NATIONAL FLIGHT DATA DIGEST.)

NIGHT– The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.

(See ICAO term NIGHT.)

NIGHT [ICAO]– The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be specified by the appropriate authority.

Note: Civil twilight ends in the evening when the center of the sun's disk is 6 degrees below the horizon and begins in the morning when the center of the sun's disk is 6 degrees below the horizon.

NO GYRO APPROACH– A radar approach/vector provided in case of a malfunctioning gyro-compass or directional gyro. Instead of providing the pilot with headings to be flown, the controller observes the radar track and issues control instructions "turn right/left" or "stop turn" as appropriate.

(Refer to AIM.)

NO GYRO VECTOR-

(See NO GYRO APPROACH.)

NO TRANSGRESSION ZONE (NTZ)– The NTZ is a 2,000 foot wide zone, located equidistant between parallel runway or SOIA final approach courses, in which flight is normally not allowed. NONAPPROACH CONTROL TOWER- Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the Class D airspace. The primary function of a nonapproach control tower is the sequencing of aircraft in the traffic pattern and on the landing area. Nonapproach control towers also separate aircraft operating under instrument flight rules clearances from approach controls and centers. They provide ground control services to aircraft, vehicles, personnel, and equipment on the airport movement area.

NONCOMMON ROUTE/PORTION– That segment of a North American Route between the inland navigation facility and a designated North American terminal.

NON-COOPERATIVE SURVEILLANCE- Any surveillance system, such as primary radar, that is not dependent upon the presence of any equipment on the aircraft or vehicle to be tracked.

(See COOPERATIVE SURVEILLANCE.) (See RADAR.)

NONDIRECTIONAL BEACON– An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his/her bearing to or from the radio beacon and "home" on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

(See AUTOMATIC DIRECTION FINDER.) (See COMPASS LOCATOR.)

NONMOVEMENT AREAS- Taxiways and apron (ramp) areas not under the control of air traffic.

NONPRECISION APPROACH– (See NONPRECISION APPROACH PROCEDURE.)

NONPRECISION APPROACH PROCEDURE- A standard instrument approach procedure in which no electronic glideslope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDA, or SDF approaches.

NONRADAR- Precedes other terms and generally means without the use of radar, such as:

a. Nonradar Approach. Used to describe instrument approaches for which course guidance on final approach is not provided by ground-based precision or surveillance radar. Radar vectors to the

final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, ILS, RNAV, and GLS approaches.

(See FINAL APPROACH COURSE.) (See FINAL APPROACH-IFR.) (See INSTRUMENT APPROACH PROCEDURE.) (See RADAR APPROACH.)

b. Nonradar Approach Control. An ATC facility providing approach control service without the use of radar.

(See APPROACH CONTROL FACILITY.) (See APPROACH CONTROL SERVICE.)

c. Nonradar Arrival. An aircraft arriving at an airport without radar service or at an airport served by a radar facility and radar contact has not been established or has been terminated due to a lack of radar service to the airport.

(See RADAR ARRIVAL.) (See RADAR SERVICE.)

d. Nonradar Route. A flight path or route over which the pilot is performing his/her own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route.

(See RADAR ROUTE.)

e. Nonradar Separation. The spacing of aircraft in accordance with established minima without the use of radar; e.g., vertical, lateral, or longitudinal separation.

(See RADAR SEPARATION.)

NON-RESTRICTIVE ROUTING (NRR)- Portions of a proposed route of flight where a user can flight plan the most advantageous flight path with no requirement to make reference to ground-based NAVAIDs.

NOPAC-

(See NORTH PACIFIC.)

NORDO (No Radio)– Aircraft that cannot or do not communicate by radio when radio communication is required are referred to as "NORDO."

(See LOST COMMUNICATIONS.)

NORMAL OPERATING ZONE (NOZ)– The NOZ is the operating zone within which aircraft flight remains during normal independent simultaneous parallel ILS approaches.

NORTH AMERICAN ROUTE- A numerically coded route preplanned over existing airway and route systems to and from specific coastal fixes serving the North Atlantic. North American Routes consist of the following:

a. Common Route/Portion. That segment of a North American Route between the inland navigation facility and the coastal fix.

b. Noncommon Route/Portion. That segment of a North American Route between the inland navigation facility and a designated North American terminal.

c. Inland Navigation Facility. A navigation aid on a North American Route at which the common route and/or the noncommon route begins or ends.

d. Coastal Fix. A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

NORTH AMERICAN ROUTE PROGRAM (NRP)– The NRP is a set of rules and procedures which are designed to increase the flexibility of user flight planning within published guidelines.

NORTH ATLANTIC HIGH LEVEL AIRSPACE (NAT HLA)– That volume of airspace (as defined in ICAO Document 7030) between FL 285 and FL 420 within the Oceanic Control Areas of Bodo Oceanic, Gander Oceanic, New York Oceanic East, Reykjavik, Santa Maria, and Shanwick, excluding the Shannon and Brest Ocean Transition Areas. ICAO Doc 007 *North Atlantic Operations and Airspace Manual* provides detailed information on related aircraft and operational requirements.

NORTH PACIFIC- An organized route system between the Alaskan west coast and Japan.

NOT STANDARD– Varying from what is expected or published. For use in NOTAMs only.

NOT STD-

(See NOT STANDARD.)

NOTAM-

(See NOTICE TO AIR MISSIONS.)

NOTAM [ICAO]– A notice containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

a. I Distribution – Distribution by means of telecommunication.

b. II Distribution – Distribution by means other than telecommunications.

NOTICE TO AIR MISSIONS (NOTAM)– A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

NOTAM(D)– A NOTAM given (in addition to local dissemination) distant dissemination beyond the area of responsibility of the Flight Service Station. These NOTAMs will be stored and available until canceled.

c. FDC NOTAM- A NOTAM regulatory in

nature, transmitted by USNOF and given system wide dissemination.

(See ICAO term NOTAM.)

NRR-

(See NON-RESTRICTIVE ROUTING.)

NRS-

(See NAVIGATION REFERENCE SYSTEM.)

NUMEROUS TARGETS VICINITY (LOCA-TION)– A traffic advisory issued by ATC to advise pilots that targets on the radar scope are too numerous to issue individually.

(See TRAFFIC ADVISORIES.)

RADAR ROUTE- A flight path or route over which an aircraft is vectored. Navigational guidance and altitude assignments are provided by ATC.

(See FLIGHT PATH.) (See ROUTE.)

RADAR SEPARATION-(See RADAR SERVICE.)

RADAR SERVICE– A term which encompasses one or more of the following services based on the use of radar which can be provided by a controller to a pilot of a radar identified aircraft.

a. Radar Monitoring– The radar flight-following of aircraft, whose primary navigation is being performed by the pilot, to observe and note deviations from its authorized flight path, airway, or route. When being applied specifically to radar monitoring of instrument approaches; i.e., with precision approach radar (PAR) or radar monitoring of simultaneous ILS,RNAV and GLS approaches, it includes advice and instructions whenever an aircraft nears or exceeds the prescribed PAR safety limit or simultaneous ILS RNAV and GLS no transgression zone.

(See ADDITIONAL SERVICES.)

(See TRAFFIC ADVISORIES.)

b. Radar Navigational Guidance– Vectoring aircraft to provide course guidance.

c. Radar Separation– Radar spacing of aircraft in accordance with established minima.

(See ICAO term RADAR SERVICE.)

RADAR SERVICE [ICAO] – Term used to indicate a service provided directly by means of radar.

a. Monitoring– The use of radar for the purpose of providing aircraft with information and advice relative to significant deviations from nominal flight path.

b. Separation– The separation used when aircraft position information is derived from radar sources.

RADAR SERVICE TERMINATED– Used by ATC to inform a pilot that he/she will no longer be provided any of the services that could be received while in radar contact. Radar service is automatically terminated, and the pilot is not advised in the following cases:

a. An aircraft cancels its IFR flight plan, except within Class B airspace, Class C airspace, a TRSA, or where Basic Radar service is provided.

b. An aircraft conducting an instrument, visual, or contact approach has landed or has been instructed to change to advisory frequency.

c. An arriving VFR aircraft, receiving radar service to a tower-controlled airport within Class B airspace, Class C airspace, a TRSA, or where sequencing service is provided, has landed; or to all other airports, is instructed to change to tower or advisory frequency.

d. An aircraft completes a radar approach.

RADAR SURVEILLANCE– The radar observation of a given geographical area for the purpose of performing some radar function.

RADAR TRAFFIC ADVISORIES- Advisories issued to alert pilots to known or observed radar traffic which may affect the intended route of flight of their aircraft.

(See TRAFFIC ADVISORIES.)

RADAR TRAFFIC INFORMATION SERVICE– (See TRAFFIC ADVISORIES.)

RADAR VECTORING [ICAO]– Provision of navigational guidance to aircraft in the form of specific headings, based on the use of radar.

RADIAL- A magnetic bearing extending from a VOR/VORTAC/TACAN navigation facility.

RADIO-

a. A device used for communication.

b. Used to refer to a flight service station; e.g., "Seattle Radio" is used to call Seattle FSS.

RADIO ALTIMETER– Aircraft equipment which makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.

RADIO BEACON-

(See NONDIRECTIONAL BEACON.)

RADIO DETECTION AND RANGING-(See RADAR.)

RADIO MAGNETIC INDICATOR– An aircraft navigational instrument coupled with a gyro compass or similar compass that indicates the direction of a selected NAVAID and indicates bearing with respect to the heading of the aircraft.

RAIS-

(See REMOTE AIRPORT INFORMATION SERVICE.)

RAMP-(See APRON.) RANDOM ALTITUDE– An altitude inappropriate for direction of flight and/or not in accordance with FAA Order JO 7110.65, paragraph 4–5–1, VER-TICAL SEPARATION MINIMA.

RANDOM ROUTE- Any route not established or charted/published or not otherwise available to all users.

RC-

(See ROAD RECONNAISSANCE.)

RCAG-

(See REMOTE COMMUNICATIONS AIR/GROUND FACILITY.)

RCC-

(See RESCUE COORDINATION CENTER.)

RCO-

(See REMOTE COMMUNICATIONS OUTLET.)

RCR-

(See RUNWAY CONDITION READING.)

READ BACK- Repeat my message back to me.

RECEIVER AUTONOMOUS INTEGRITY MON-ITORING (RAIM)– A technique whereby a civil GNSS receiver/processor determines the integrity of the GNSS navigation signals without reference to sensors or non-DoD integrity systems other than the receiver itself. This determination is achieved by a consistency check among redundant pseudorange measurements.

RECEIVING CONTROLLER- A controller/facility receiving control of an aircraft from another controller/facility.

RECEIVING FACILITY-(See RECEIVING CONTROLLER.)

RECONFORMANCE– The automated process of bringing an aircraft's Current Plan Trajectory into conformance with its track.

REDUCE SPEED TO (SPEED) – (See SPEED ADJUSTMENT.)

REFINED HAZARD AREA (RHA)– Used by ATC. Airspace that is defined and distributed after a failure of a launch or reentry operation to provide a more concise depiction of the hazard location than a Contingency Hazard Area.

(See AIRCRAFT HAZARD AREA.) (See CONTINGENCY HAZARD AREA.) (See TRANSITIONAL HAZARD AREA.) REDUCED VERTICAL SEPARATION MINI-MUM (RVSM) AIRSPACE– RVSM airspace is defined as any airspace between FL 290 and FL 410 inclusive, where eligible aircraft are separated vertically by 1,000 feet. Authorization guidance for operations in this airspace is provided in Advisory Circular AC 91–85.

REIL-

(See RUNWAY END IDENTIFIER LIGHTS.)

RELEASE TIME- A departure time restriction issued to a pilot by ATC (either directly or through an authorized relay) when necessary to separate a departing aircraft from other traffic.

(See ICAO term RELEASE TIME.)

RELEASE TIME [ICAO] – Time prior to which an aircraft should be given further clearance or prior to which it should not proceed in case of radio failure.

REMOTE AIRPORT INFORMATION SERVICE (RAIS)– A temporary service provided by facilities, which are not located on the landing airport, but have communication capability and automated weather reporting available to the pilot at the landing airport.

REMOTE COMMUNICATIONS AIR/GROUND FACILITY– An unmanned VHF/UHF transmitter/ receiver facility which is used to expand ARTCC air/ground communications coverage and to facilitate direct contact between pilots and controllers. RCAG facilities are sometimes not equipped with emergency frequencies 121.5 MHz and 243.0 MHz.

(Refer to AIM.)

REMOTE COMMUNICATIONS OUTLET (RCO)- An unmanned communications facility remotely controlled by air traffic personnel. RCOs serve FSSs. Remote Transmitter/Receivers (RTR) serve terminal ATC facilities. An RCO or RTR may be UHF or VHF and will extend the communication range of the air traffic facility. There are several classes of RCOs and RTRs. The class is determined by the number of transmitters or receivers. Classes A through G are used primarily for air/ground purposes. RCO and RTR class O facilities are nonprotected outlets subject to undetected and prolonged outages. RCO (O's) and RTR (O's) were established for the express purpose of providing ground-to-ground communications between air traffic control specialists and pilots located at a satellite airport for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times. As a secondary function, they may be used for advisory purposes whenever the aircraft is below the coverage of the primary air/ground frequency.

REMOTE PILOT IN COMMAND (RPIC)– The RPIC is directly responsible for and is the final authority as to the operation of the unmanned aircraft system.

REMOTE TRANSMITTER/RECEIVER (RTR)-(See REMOTE COMMUNICATIONS OUTLET.)

REPORT– Used to instruct pilots to advise ATC of specified information; e.g., "Report passing Hamilton VOR."

REPORTING POINT- A geographical location in relation to which the position of an aircraft is reported.

(See COMPULSORY REPORTING POINTS.) (See ICAO term REPORTING POINT.) (Refer to AIM.)

REPORTING POINT [ICAO]– A specified geographical location in relation to which the position of an aircraft can be reported.

REQUEST FULL ROUTE CLEARANCE– Used by pilots to request that the entire route of flight be read verbatim in an ATC clearance. Such request should be made to preclude receiving an ATC clearance based on the original filed flight plan when a filed IFR flight plan has been revised by the pilot, company, or operations prior to departure.

REQUIRED NAVIGATION PERFORMANCE (RNP)– A statement of the navigational performance necessary for operation within a defined airspace. The following terms are commonly associated with RNP:

a. Required Navigation Performance Level or Type (RNP-X). A value, in nautical miles (NM), from the intended horizontal position within which an aircraft would be at least 95-percent of the total flying time.

b. Advanced – Required Navigation Performance (A–RNP). A navigation specification based on RNP that requires advanced functions such as scalable RNP, radius–to–fix (RF) legs, and tactical parallel offsets. This sophisticated Navigation Specification (NavSpec) is designated by the abbreviation "A–RNP".

c. Required Navigation Performance (RNP) Airspace. A generic term designating airspace, route(s), leg(s), operation(s), or procedure(s) where minimum required navigational performance (RNP) have been established.

d. Actual Navigation Performance (ANP). A measure of the current estimated navigational performance. Also referred to as Estimated Position Error (EPE).

e. Estimated Position Error (EPE). A measure of the current estimated navigational performance. Also referred to as Actual Navigation Performance (ANP).

f. Lateral Navigation (LNAV). A function of area navigation (RNAV) equipment which calculates, displays, and provides lateral guidance to a profile or path.

g. Vertical Navigation (VNAV). A function of area navigation (RNAV) equipment which calculates, displays, and provides vertical guidance to a profile or path.

REROUTE IMPACT ASSESSMENT (RRIA)– A capability within the Traffic Flow Management System that is used to define and evaluate a potential reroute prior to implementation, with or without miles–in–trail (MIT) restrictions. RRIA functions estimate the impact on demand (e.g., sector loads) and performance (e.g., flight delay). Using RRIA, traffic management personnel can determine whether the reroute will sufficiently reduce demand in the Flow Constraint Area and not create excessive "spill over" demand in the adjacent airspace on a specific route segment or point of interest (POI).

RESCUE COORDINATION CENTER (RCC)– A search and rescue (SAR) facility equipped and manned to coordinate and control SAR operations in an area designated by the SAR plan. The U.S. Coast Guard and the U.S. Air Force have responsibility for the operation of RCCs.

(See ICAO term RESCUE CO-ORDINATION CENTRE.)

RESCUE CO-ORDINATION CENTRE [ICAO]– A unit responsible for promoting efficient organization of search and rescue service and for coordinating the conduct of search and rescue operations within a search and rescue region.

RESOLUTION ADVISORY– A display indication given to the pilot by the Traffic alert and Collision Avoidance System (TCAS II) recommending a maneuver to increase vertical separation relative to an intruding aircraft. Positive, negative, and vertical speed limit (VSL) advisories constitute the resolution advisories. A resolution advisory is also classified as corrective or preventive.

RESTRICTED AREA-(See SPECIAL USE AIRSPACE.) (See ICAO term RESTRICTED AREA.)

RESTRICTED AREA [ICAO]– An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

RESUME NORMAL SPEED– Used by ATC to advise a pilot to resume an aircraft's normal operating speed. It is issued to terminate a speed adjustment where no published speed restrictions apply. It does not delete speed restrictions in published procedures of upcoming segments of flight. This does not relieve the pilot of those speed restrictions that are applicable to 14 CFR Section 91.117.

RESUME OWN NAVIGATION– Used by ATC to advise a pilot to resume his/her own navigational responsibility. It is issued after completion of a radar vector or when radar contact is lost while the aircraft is being radar vectored.

(See RADAR CONTACT LOST.) (See RADAR SERVICE TERMINATED.)

RESUME PUBLISHED SPEED– Used by ATC to advise a pilot to resume published speed restrictions that are applicable to a SID, STAR, or other instrument procedure. It is issued to terminate a speed adjustment where speed restrictions are published on a charted procedure.

RHA-

(See REFINED HAZARD AREA.)

RMI-

(See RADIO MAGNETIC INDICATOR.)

RNAV-

(See AREA NAVIGATION (RNAV).)

RNAV APPROACH– An instrument approach procedure which relies on aircraft area navigation equipment for navigational guidance.

(See AREA NAVIGATION (RNAV).) (See INSTRUMENT APPROACH PROCEDURE.)

ROAD RECONNAISSANCE (RC)- Military activity requiring navigation along roads, railroads, and rivers. Reconnaissance route/route segments are seldom along a straight line and normally require a lateral route width of 10 NM to 30 NM and an altitude range of 500 feet to 10,000 feet AGL.

ROGER – I have received all of your last transmission. It should not be used to answer a question requiring a yes or a no answer.

(See AFFIRMATIVE.) (See NEGATIVE.)

ROLLOUT RVR-(See VISIBILITY.)

ROTOR WASH– A phenomenon resulting from the vertical down wash of air generated by the main rotor(s) of a helicopter.

ROUND–ROBIN FLIGHT PLAN– A single flight plan filed from the departure airport to an intermediary destination(s) and then returning to the original departure airport.

ROUTE- A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth.

(See AIRWAY.) (See JET ROUTE.) (See PUBLISHED ROUTE.) (See UNPUBLISHED ROUTE.)

ROUTE ACTION NOTIFICATION- EDST notification that a PAR/PDR/PDAR has been applied to the flight plan.

(See ATC PREFERRED ROUTE NOTIFICATION.) (See EN ROUTE DECISION SUPPORT TOOL.)

ROUTE AMENDMENT DIALOG (RAD)– A capability within the Traffic Flow Management System that allows traffic management personnel to submit or edit a route amendment for one or more flights.

ROUTE SEGMENT– As used in Air Traffic Control, a part of a route that can be defined by two navigational fixes, two NAVAIDs, or a fix and a NAVAID.

(See FIX.) (See ROUTE.) (See ICAO term ROUTE SEGMENT.)

ROUTE SEGMENT [ICAO]– A portion of a route to be flown, as defined by two consecutive significant points specified in a flight plan.

RPIC-

(See REMOTE PILOT IN COMMAND.)

RRIA-

(See REROUTE IMPACT ASSESSMENT.)

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RSA-
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(See RUNWAY SAFETY AREA.)

RTR-

(See REMOTE TRANSMITTER/RECEIVER.)

RUNWAY- A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees; e.g., Runway 1, Runway 25.

(See PARALLEL RUNWAYS.) (See ICAO term RUNWAY.)

RUNWAY [ICAO] – A defined rectangular area on a land aerodrome prepared for the landing and takeoff of aircraft.

RUNWAY CENTERLINE LIGHTING-(See AIRPORT LIGHTING.)

RUNWAY CONDITION CODES (RwyCC)– Numerical readings, provided by airport operators, that indicate runway surface contamination (for example, slush, ice, rain, etc.). These values range from "1" (poor) to "6" (dry) and must be included on the ATIS when the reportable condition is less than 6 in any one or more of the three runway zones (touchdown, midpoint, rollout).

RUNWAY CONDITION READING– Numerical decelerometer readings relayed by air traffic controllers at USAF and certain civil bases for use by the pilot in determining runway braking action. These readings are routinely relayed only to USAF and Air National Guard Aircraft.

(See BRAKING ACTION.)

RUNWAY CONDITION REPORT (RwyCR)– A data collection worksheet used by airport operators that correlates the runway percentage of coverage along with the depth and type of contaminant for the purpose of creating a FICON NOTAM.

(See RUNWAY CONDITION CODES.)

RUNWAY END IDENTIFIER LIGHTS (REIL)– (See AIRPORT LIGHTING.) RUNWAY ENTRANCE LIGHTS (REL)–An array of red lights which include the first light at the hold line followed by a series of evenly spaced lights to the runway edge aligned with the taxiway centerline, and one additional light at the runway centerline in line with the last two lights before the runway edge.

RUNWAY GRADIENT– The average slope, measured in percent, between two ends or points on a runway. Runway gradient is depicted on Government aerodrome sketches when total runway gradient exceeds 0.3%.

RUNWAY HEADING– The magnetic direction that corresponds with the runway centerline extended, not the painted runway number. When cleared to "fly or maintain runway heading," pilots are expected to fly or maintain the heading that corresponds with the extended centerline of the departure runway. Drift correction shall not be applied; e.g., Runway 4, actual magnetic heading of the runway centerline 044, fly 044.

RUNWAY IN USE/ACTIVE RUNWAY/DUTY RUNWAY– Any runway or runways currently being used for takeoff or landing. When multiple runways are used, they are all considered active runways. In the metering sense, a selectable adapted item which specifies the landing runway configuration or direction of traffic flow. The adapted optimum flight plan from each transition fix to the vertex is determined by the runway configuration for arrival metering processing purposes.

RUNWAY LIGHTS-(See AIRPORT LIGHTING.)

RUNWAY MARKINGS-(See AIRPORT MARKING AIDS.)

RUNWAY OVERRUN– In military aviation exclusively, a stabilized or paved area beyond the end of a runway, of the same width as the runway plus shoulders, centered on the extended runway centerline.

RUNWAY PROFILE DESCENT- An instrument flight rules (IFR) air traffic control arrival procedure to a runway published for pilot use in graphic and/or textual form and may be associated with a STAR. Runway Profile Descents provide routing and may depict crossing altitudes, speed restrictions, and headings to be flown from the en route structure to the point where the pilot will receive clearance for and execute an instrument approach procedure. A Runway Profile Descent may apply to more than one runway if so stated on the chart.

(Refer to AIM.)

RUNWAY SAFETY AREA- A defined surface surrounding the runway prepared, or suitable, for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The dimensions of the RSA vary and can be determined by using the criteria contained within AC 150/5300-13, Airport Design, Chapter 3. Figure 3–1 in AC 150/5300-13 depicts the RSA. The design standards dictate that the RSA shall be:

a. Cleared, graded, and have no potentially hazardous ruts, humps, depressions, or other surface variations;

b. Drained by grading or storm sewers to prevent water accumulation;

c. Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and,

d. Free of objects, except for objects that need to be located in the runway safety area because of their function. These objects shall be constructed on low impact resistant supports (frangible mounted structures) to the lowest practical height with the frangible point no higher than 3 inches above grade.

(Refer to AC 150/5300-13, Airport Design, Chapter 3.)

RUNWAY STATUS LIGHTS (RWSL) SYSTEM– The RWSL is a system of runway and taxiway lighting to provide pilots increased situational awareness by illuminating runway entry lights (REL) when the runway is unsafe for entry or crossing, and take-off hold lights (THL) when the runway is unsafe for departure. RUNWAY TRANSITION– (See SEGMENTS OF A SID/STAR)

RUNWAY TRANSITION WAYPOINT-(See SEGMENTS OF A SID/STAR.)

RUNWAY USE PROGRAM– A noise abatement runway selection plan designed to enhance noise abatement efforts with regard to airport communities for arriving and departing aircraft. These plans are developed into runway use programs and apply to all turbojet aircraft 12,500 pounds or heavier; turbojet aircraft less than 12,500 pounds are included only if the airport proprietor determines that the aircraft creates a noise problem. Runway use programs are coordinated with FAA offices, and safety criteria used in these programs are developed by the Office of Flight Operations. Runway use programs are administered by the Air Traffic Service as "Formal" or "Informal" programs.

a. Formal Runway Use Program– An approved noise abatement program which is defined and acknowledged in a Letter of Understanding between Flight Operations, Air Traffic Service, the airport proprietor, and the users. Once established, participation in the program is mandatory for aircraft operators and pilots as provided for in 14 CFR Section 91.129.

b. Informal Runway Use Program– An approved noise abatement program which does not require a Letter of Understanding, and participation in the program is voluntary for aircraft operators/pilots.

RUNWAY VISUAL RANGE (RVR)-(See VISIBILITY.)

RwyCC-

(See RUNWAY CONDITION CODES.)

RwyCR-

(See RUNWAY CONDITION REPORT.)
SIMULTANEOUS (CONVERGING) INDEPEND-

ENT APPROACHES- An approach operation permitting ILS/RNAV/GLS approaches to non-parallel runways where approach procedure design maintains the required aircraft spacing throughout the approach and missed approach and hence the operations may be conducted independently.

SIMULTANEOUS ILS APPROACHES- An approach system permitting simultaneous ILS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS, radar, communications, ATC procedures, and appropriate airborne equipment.

(See PARALLEL RUNWAYS.) (Refer to AIM.)

SIMULTANEOUS OFFSET INSTRUMENT APPROACH (SOIA)– An instrument landing system comprised of an ILS PRM, RNAV PRM or GLS PRM approach to one runway and an offset LDA PRM with glideslope or an RNAV PRM or GLS PRM approach utilizing vertical guidance to another where parallel runway spaced less than 3,000 feet and at least 750 feet apart. The approach courses converge by 2.5 to 3 degrees. Simultaneous close parallel PRM approach procedures apply up to the point where the approach course separation becomes 3,000 feet, at the offset MAP. From the offset MAP to the runway threshold, visual separation by the aircraft conducting the offset approach is utilized.

(Refer to AIM)

SIMULTANEOUS (PARALLEL) DEPENDENT APPROACHES- An approach operation permitting ILS/RNAV/GLS approaches to adjacent parallel runways where prescribed diagonal spacing must be maintained. Aircraft are not permitted to pass each other during simultaneous dependent operations. Integral parts of a total system ATC procedures, and appropriate airborne and ground based equipment.

SINGLE DIRECTION ROUTES– Preferred IFR Routes which are sometimes depicted on high altitude en route charts and which are normally flown in one direction only.

(See PREFERRED IFR ROUTES.) (Refer to CHART SUPPLEMENT U.S.)

SINGLE FREQUENCY APPROACH- A service provided under a letter of agreement to military single-piloted turbojet aircraft which permits use of

a single UHF frequency during approach for landing. Pilots will not normally be required to change frequency from the beginning of the approach to touchdown except that pilots conducting an en route descent are required to change frequency when control is transferred from the air route traffic control center to the terminal facility. The abbreviation "SFA" in the DOD FLIP IFR Supplement under "Communications" indicates this service is available at an aerodrome.

SINGLE-PILOTED AIRCRAFT– A military turbojet aircraft possessing one set of flight controls, tandem cockpits, or two sets of flight controls but operated by one pilot is considered single-piloted by ATC when determining the appropriate air traffic service to be applied.

(See SINGLE FREQUENCY APPROACH.)

SKYSPOTTER- A pilot who has received specialized training in observing and reporting inflight weather phenomena.

SLASH- A radar beacon reply displayed as an elongated target.

SLDI-

(See SECTOR LIST DROP INTERVAL.)

SLOW TAXI– To taxi a float plane at low power or low RPM.

SMALL UNMANNED AIRCRAFT SYSTEM (sUAS)–An unmanned aircraft weighing less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft.

SN-

(See SYSTEM STRATEGIC NAVIGATION.)

SPACE–BASED ADS–B (SBA)– A constellation of satellites that receives ADS–B Out broadcasts and relays that information to the appropriate surveillance facility. The currently deployed SBA system is only capable of receiving broadcasts from 1090ES–equipped aircraft, and not from those equipped with only a universal access transceiver (UAT). Also, aircraft with a top–of–fuselage–mounted transponder antenna (required for TCAS II installations) will be better received by SBA, especially at latitudes below 45 degrees.

(See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST.) (See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST OUT.)

SPACE LAUNCH AND REENTRY AREA-Locations where commercial space launch and/or reentry operations occur. For pilot awareness, a rocket–shaped symbol is used to depict space launch and reentry areas on sectional aeronautical charts.

SPEAK SLOWER– Used in verbal communications as a request to reduce speech rate.

SPECIAL ACTIVITY AIRSPACE (SAA)– Any airspace with defined dimensions within the National Airspace System wherein limitations may be imposed upon aircraft operations. This airspace may be restricted areas, prohibited areas, military operations areas, air ATC assigned airspace, and any other designated airspace areas. The dimensions of this airspace are programmed into EDST and can be designated as either active or inactive by screen entry. Aircraft trajectories are constantly tested against the dimensions of active areas and alerts issued to the applicable sectors when violations are predicted.

(See EN ROUTE DECISION SUPPORT TOOL.)

SPECIAL AIR TRAFFIC RULES (SATR)– Rules that govern procedures for conducting flights in certain areas listed in 14 CFR Part 93. The term "SATR" is used in the United States to describe the rules for operations in specific areas designated in the Code of Federal Regulations.

(Refer to 14 CFR Part 93.)

SPECIAL EMERGENCY- A condition of air piracy or other hostile act by a person(s) aboard an aircraft which threatens the safety of the aircraft or its passengers.

SPECIAL FLIGHT RULES AREA (SFRA)– An area in the NAS, described in 14 CFR Part 93, wherein the flight of aircraft is subject to special traffic rules, unless otherwise authorized by air traffic control. Not all areas listed in 14 CFR Part 93 are designated SFRA, but special air traffic rules apply to all areas described in 14 CFR Part 93.

SPECIAL INSTRUMENT APPROACH PROCE-DURE-

(See INSTRUMENT APPROACH PROCEDURE.)

SPECIAL USE AIRSPACE– Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Types of special use airspace are:

a. Alert Area– Airspace which may contain a high volume of pilot training activities or an unusual type

of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of nonparticipating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations, and pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.

b. Controlled Firing Area– Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.

c. Military Operations Area (MOA)– Permanent and temporary MOAs are airspace established outside of Class A airspace area to separate or segregate certain nonhazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. Permanent MOAs are depicted on Sectional Aeronautical, VFR Terminal Area, and applicable En Route Low Altitude Charts.

Note: Temporary MOAs are not charted.

(Refer to AIM.)

d. National Security Area (NSA)– Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When a greater level of security is required, flight through an NSA may be temporarily prohibited by establishing a TFR under the provisions of 14 CFR Section 99.7. Such prohibitions will be issued by FAA Headquarters and disseminated via the U.S. NOTAM System.

(Refer to AIM)

e. Prohibited Area– Airspace designated under 14 CFR Part 73 within which no person may operate an aircraft without the permission of the using agency.

(Refer to AIM.)

(Refer to En Route Charts.)

f. Restricted Area– Permanent and temporary restricted areas are airspace designated under 14 CFR Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Permanent restricted areas are depicted on Sectional Aeronautical, VFR Terminal

Area, and applicable En Route charts. Where joint use is authorized, the name of the ATC controlling facility is also shown.

Note: Temporary restricted areas are not charted.

(Refer to 14 CFR Part 73.) (Refer to AIM.)

g. Warning Area– A warning area is airspace of defined dimensions extending from 3 nautical miles outward from the coast of the United States, that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning area is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both.

SPECIAL VFR CONDITIONS– Meteorological conditions that are less than those required for basic VFR flight in Class B, C, D, or E surface areas and in which some aircraft are permitted flight under visual flight rules.

(See SPECIAL VFR OPERATIONS.) (Refer to 14 CFR Part 91.)

SPECIAL VFR FLIGHT [ICAO]– A VFR flight cleared by air traffic control to operate within Class B, C, D, and E surface areas in meteorological conditions below VMC.

SPECIAL VFR OPERATIONS– Aircraft operating in accordance with clearances within Class B, C, D, and E surface areas in weather conditions less than the basic VFR weather minima. Such operations must be requested by the pilot and approved by ATC.

(See SPECIAL VFR CONDITIONS.) (See ICAO term SPECIAL VFR FLIGHT.)

SPEED-

(See AIRSPEED.) (See GROUND SPEED.)

SPEED ADJUSTMENT– An ATC procedure used to request pilots to adjust aircraft speed to a specific value for the purpose of providing desired spacing. Pilots are expected to maintain a speed of plus or minus 10 knots or 0.02 Mach number of the specified speed. Examples of speed adjustments are:

a. "Increase/reduce speed to Mach point (number)."

b. "Increase/reduce speed to (speed in knots)" or "Increase/reduce speed (number of knots) knots."

SPEED BRAKES– Moveable aerodynamic devices on aircraft that reduce airspeed during descent and landing.

SPEED SEGMENTS– Portions of the arrival route between the transition point and the vertex along the optimum flight path for which speeds and altitudes are specified. There is one set of arrival speed segments adapted from each transition point to each vertex. Each set may contain up to six segments.

SPOOFING– Denotes emissions of GNSS–like signals that may be acquired and tracked in combination with or instead of the intended signals by civil receivers. The onset of spoofing effects can be instantaneous or delayed, and effects can persist after the spoofing has ended. Spoofing can result in false and potentially confusing, or hazardously misleading, position, navigation, and/or date/time information in addition to loss of GNSS use.

SPEED ADVISORY– Speed advisories that are generated within Time–Based Flow Management to assist controllers to meet the Scheduled Time of Arrival (STA) at the meter fix/meter arc. See also Ground–Based Interval Management–Spacing (GIM–S) Speed Advisory.

SQUAWK (Mode, Code, Function)– Used by ATC to instruct a pilot to activate the aircraft transponder and ADS–B Out with altitude reporting enabled, or (military) to activate only specific modes, codes, or functions. Examples: "Squawk five seven zero seven;" "Squawk three/alpha, two one zero five."

(See TRANSPONDER.)

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STA-
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(See SCHEDULED TIME OF ARRIVAL.)

STAGING/QUEUING– The placement, integration, and segregation of departure aircraft in designated movement areas of an airport by departure fix, EDCT, and/or restriction.

STAND BY– Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait as in "stand by for clearance." The caller should reestablish contact if a delay is lengthy. "Stand by" is not an approval or denial.

STANDARD INSTRUMENT APPROACH PRO-CEDURE (SIAP)–

(See INSTRUMENT APPROACH PROCEDURE.)

STANDARD INSTRUMENT DEPARTURE (SID)– A preplanned instrument flight rule (IFR) air traffic control (ATC) departure procedure printed for pilot/controller use in graphic form to provide obstacle clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement to expedite traffic flow and to reduce pilot/controller workload. ATC clearance must always be received prior to flying a SID.

(See IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES.) (See OBSTACLE DEPARTURE PROCEDURE.) (Refer to AIM.)

STANDARD RATE TURN- A turn of three degrees per second.

STANDARD TERMINAL ARRIVAL (STAR)– A preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STARs provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

STANDARD TERMINAL ARRIVAL CHARTS-(See AERONAUTICAL CHART.)

STANDARD TERMINAL AUTOMATION RE-PLACEMENT SYSTEM (STARS)-(See DTAS.)

STAR-

(See STANDARD TERMINAL ARRIVAL.)

STATE AIRCRAFT– Aircraft used in military, customs and police service, in the exclusive service of any government or of any political subdivision thereof, including the government of any state, territory, or possession of the United States or the District of Columbia, but not including any government-owned aircraft engaged in carrying persons or property for commercial purposes.

STATIC RESTRICTIONS- Those restrictions that are usually not subject to change, fixed, in place, and/or published.

STATIONARY AIRSPACE RESERVATION– The term used in oceanic ATC for airspace that encompasses activities in a fixed volume of airspace to be occupied for a specified time period. Stationary Airspace Reservations may include activities such as special tests of weapons systems or equipment; certain U.S. Navy carrier, fleet, and anti–submarine operations; rocket, missile, and drone operations; and certain aerial refueling or similar operations.

(See STATIONARY ALTITUDE RESERVATION.)

STATIONARY ALTITUDE RESERVATION (STATIONARY ALTRV)– An altitude reservation which encompasses activities in a fixed volume of airspace to be occupied for a specified time period. Stationary ALTRVs may include activities such as special tests of weapons systems or equipment; certain U.S. Navy carrier, fleet, and anti–submarine operations; rocket, missile, and drone operations; and certain aerial refueling or similar operations.

STEP TAXI– To taxi a float plane at full power or high RPM.

STEP TURN– A maneuver used to put a float plane in a planing configuration prior to entering an active sea lane for takeoff. The STEP TURN maneuver should only be used upon pilot request.

STEPDOWN FIX- A fix permitting additional descent within a segment of an instrument approach procedure by identifying a point at which a controlling obstacle has been safely overflown.

STEREO ROUTE– A routinely used route of flight established by users and ARTCCs identified by a coded name; e.g., ALPHA 2. These routes minimize flight plan handling and communications.

STNR ALT RESERVATION– An abbreviation for Stationary Altitude Reservation commonly used in NOTAMs.

(See STATIONARY ALTITUDE RESERVATION.)

STOL AIRCRAFT– (See SHORT TAKEOFF AND LANDING AIRCRAFT.)

STOP ALTITUDE SQUAWK– Used by ATC to instruct a pilot to turn off the automatic altitude reporting feature of the aircraft transponder and ADS–B Out. It is issued when a verbally reported altitude varies by 300 feet or more from the automatic altitude report.

(See ALTITUDE READOUT.) (See TRANSPONDER.)

STOP AND GO– A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point.

(See LOW APPROACH.) (See OPTION APPROACH.)

STOP BURST-(See STOP STREAM.)

STOP BUZZER-

(See STOP STREAM.)

STOP SQUAWK (Mode or Code)– Used by ATC to instruct a pilot to stop transponder and ADS–B transmissions, or to turn off only specified functions of the aircraft transponder (military).

(See STOP ALTITUDE SQUAWK.) (See TRANSPONDER.)

STOP STREAM– Used by ATC to request a pilot to suspend electronic attack activity.

(See JAMMING.)

STOPOVER FLIGHT PLAN– A flight plan format which permits in a single submission the filing of a sequence of flight plans through interim full-stop destinations to a final destination.

STOPWAY– An area beyond the takeoff runway no less wide than the runway and centered upon the extended centerline of the runway, able to support the airplane during an aborted takeoff, without causing structural damage to the airplane, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff.

STRAIGHT-IN APPROACH IFR- An instrument approach wherein final approach is begun without first having executed a procedure turn, not necessarily completed with a straight-in landing or made to straight-in landing minimums.

(See LANDING MINIMUMS.) (See STRAIGHT-IN APPROACH VFR.) (See STRAIGHT-IN LANDING.)

STRAIGHT-IN APPROACH VFR– Entry into the traffic pattern by interception of the extended runway centerline (final approach course) without executing any other portion of the traffic pattern.

(See TRAFFIC PATTERN.)

STRAIGHT-IN LANDING– A landing made on a runway aligned within 30° of the final approach course following completion of an instrument approach.

(See STRAIGHT-IN APPROACH IFR.)

STRAIGHT-IN LANDING MINIMUMS– (See LANDING MINIMUMS.) STRAIGHT-IN MINIMUMS-(See STRAIGHT-IN LANDING MINIMUMS.)

STRATEGIC PLANNING– Planning whereby solutions are sought to resolve potential conflicts.

sUAS-

(See SMALL UNMANNED AIRCRAFT SYSTEM.)

SUBSTITUTE ROUTE- A route assigned to pilots when any part of an airway or route is unusable because of NAVAID status. These routes consist of:

a. Substitute routes which are shown on U.S. Government charts.

b. Routes defined by ATC as specific NAVAID radials or courses.

c. Routes defined by ATC as direct to or between NAVAIDs.

SUNSET AND SUNRISE– The mean solar times of sunset and sunrise as published in the Nautical Almanac, converted to local standard time for the locality concerned. Within Alaska, the end of evening civil twilight and the beginning of morning civil twilight, as defined for each locality.

SUPPLEMENTAL WEATHER SERVICE LOCA-TION– Airport facilities staffed with contract personnel who take weather observations and provide current local weather to pilots via telephone or radio. (All other services are provided by the parent FSS.)

SUPPS- Refers to ICAO Document 7030 Regional Supplementary Procedures. SUPPS contain procedures for each ICAO Region which are unique to that Region and are not covered in the worldwide provisions identified in the ICAO Air Navigation Plan. Procedures contained in Chapter 8 are based in part on those published in SUPPS.

SURFACE AREA– The airspace contained by the lateral boundary of the Class B, C, D, or E airspace designated for an airport that begins at the surface and extends upward.

SURFACE METERING PROGRAM– A capability within Terminal Flight Data Manager that provides the user with the ability to tactically manage surface traffic flows through adjusting desired minimum and maximum departure queue lengths to balance surface demand with capacity. When a demand/capacity imbalance for a surface resource is predicted, a metering procedure is recommended. SURFACE VIEWER– A capability within the Traffic Flow Management System that provides situational awareness for a user–selected airport. The Surface Viewer displays a top–down view of an airport depicting runways, taxiways, gate areas, ramps, and buildings. The display also includes icons representing aircraft and vehicles currently on the surface, with identifying information. In addition, the display includes current airport configuration information such as departure/arrival runways and airport departure/arrival rates.

SURPIC- A description of surface vessels in the area of a Search and Rescue incident including their predicted positions and their characteristics.

(Refer to FAA Order JO 7110.65, Para 10–6–4, INFLIGHT CONTINGENCIES.)

SURVEILLANCE APPROACH– An instrument approach wherein the air traffic controller issues instructions, for pilot compliance, based on aircraft position in relation to the final approach course (azimuth), and the distance (range) from the end of the runway as displayed on the controller's radar scope. The controller will provide recommended altitudes on final approach if requested by the pilot.

(Refer to AIM.)

SUSPICIOUS UAS– Suspicious UAS operations may include operating without authorization, loitering in the vicinity of sensitive locations, (e.g., national security, law enforcement facilities, and critical infrastructure), or disrupting normal air traffic operations resulting in runway changes, ground stops, pilot evasive action, etc. The report of a UAS operation alone does not constitute suspicious activity. Development of a comprehensive list of suspicious activities is not possible due to the vast number of situations that could be considered suspicious. ATC must exercise sound judgment when identifying situations that could constitute or indicate a suspicious activity.

SWAP-

(See SEVERE WEATHER AVOIDANCE PLAN.)

SWSL-

(See SUPPLEMENTAL WEATHER SERVICE LOCATION.)

SYSTEM STRATEGIC NAVIGATION– Military activity accomplished by navigating along a preplanned route using internal aircraft systems to maintain a desired track. This activity normally requires a lateral route width of 10 NM and altitude range of 1,000 feet to 6,000 feet AGL with some route segments that permit terrain following.

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