



U.S. Department  
of Transportation

**Federal Aviation  
Administration**

# *AERONAUTICAL INFORMATION MANUAL*

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*Change 2  
March 21, 2024*

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**DO NOT DESTROY  
BASIC DATED  
October 23, 2023**



# Aeronautical Information Manual

## Explanation of Changes

**Effective: March 21, 2024**

### **a. 1-1-17. GLOBAL POSITIONING SYSTEM**

This change aligns the AIM with Flight Standards B036 issuance policy that two GPS receivers are considered independent systems for extended overwater operations.

### **b. 2-3-8. MANDATORY INSTRUCTION SIGNS**

This change addresses a change to the mandatory instruction sign to include the departure runway information in the sign legend. The sign for holding positions protecting both the approach area of a runway end and the departure area for the opposite runway end will now display “DEP” in addition to “APCH” (e.g., 15 APCH – 33 DEP). Holding positions signs on taxiways that traverse the approach area but not the departure area (e.g., displaced threshold) will continue to display just the APCH legend. This change does not address changes to the hold line marking or implement conditional holding for protection of approach/departure areas.

### **c. 4-3-20. STANDARD TAXI ROUTES**

This change adds a paragraph to Chapter 4, Air Traffic Control, Section 3, Airport Operations, of the AIM, to provide guidance to pilots about Standard Taxi Routes (STRs). This new paragraph will support the implementation of a new directive, FAA Order JO 7110.664, Standard Taxi Routes. All subsequent paragraphs will be renumbered.

### **d. 7-1-3. USE OF AVIATION PRODUCTS**

#### **7-1-4. GRAPHICAL FORECASTS FOR AVIATION WEATHER (GFA)**

#### **7-1-11. WEATHER RADAR SERVICES**

#### **7-1-18. PILOT WEATHER REPORTS (PIREPS)**

This change updates the references to AC 00-45 to the Aviation Weather Handbook, FAA-H-8083-28.

### **e. 7-1-5. PREFLIGHT BRIEFING**

This change updates the subparagraph to use true north rather than magnetic north.

### **f. 7-6-4. OBSTRUCTIONS TO FLIGHT**

This change provides pilots guidance on the distinctive hazards when flying near wind turbines and their unique marking and lighting. Additionally, other updates were made to improve the readability of the paragraphs addressing other obstruction types.

### **g. 9-1-4. GENERAL DESCRIPTION OF EACH CHART SERIES**

As a result of the Chart Supplement Modernization Initiative, the Chart Supplement U.S. descriptions were revised and expanded creating Chart Supplement, Chart Supplement Alaska, and Chart Supplement Pacific. FIG 9-1-14 was repositioned and renumbered to immediately follow subparagraph d2 for better readability.

### **h. APPENDIX 4. FAA FORM 7233-4 - INTERNATIONAL FLIGHT PLAN**

This change modifies codes used in field 18 of the ICAO flight plan for indication of ADS-B equipage in compliance with international agreements.

### **i. APPENDIX 4. FAA FORM 7233-4 - INTERNATIONAL FLIGHT PLAN**

This change modifies an existing note to identify three Item 18 NAV and PBN codes that require all civil operators to obtain specific operational approval prior to including on their flight plan. Additionally, an identical comment was added to Appendix 2 of the U.S. AIP.

**j. Editorial Changes**

Editorial changes include updates to the term Chart Supplement and Chart Supplement U.S.; the addition of RX Receive/Receiver and edit of REDL to Runway Edge Light in 5-1-3, TBL 5-1-2; a change reconciling the discrepancy between FAA Order JO 7210.3 and the Aeronautical Information Manual by changing the time for requesting Remote Airport Information Service (RAIS) support from 60 days to 30 days; correcting the spelling of “Juliet” to “Juliett” in paragraph 4-1-16; a couple of simple editorial changes in paragraphs 3-2-3 and 5-4-1; correcting non-radar to nonradar in 5-3-2c4; and a simple editorial correcting “four” to “these” in 7-1-10d1(a).

## AIM Change 2

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# Chapter 1. Air Navigation

## Section 1. Navigation Aids

### 1-1-1. General

a. Various types of air navigation aids are in use today, each serving a special purpose. These aids have varied owners and operators, namely: the Federal Aviation Administration (FAA), the military services, private organizations, individual states and foreign governments. The FAA has the statutory authority to establish, operate, maintain air navigation facilities and to prescribe standards for the operation of any of these aids which are used for instrument flight in federally controlled airspace. These aids are tabulated in the Chart Supplement.

b. Pilots should be aware of the possibility of momentary erroneous indications on cockpit displays when the primary signal generator for a ground-based navigational transmitter (for example, a glideslope, VOR, or nondirectional beacon) is inoperative. Pilots should disregard any navigation indication, regardless of its apparent validity, if the particular transmitter was identified by NOTAM or otherwise as unusable or inoperative.

### 1-1-2. Nondirectional Radio Beacon (NDB)

a. A low or medium frequency radio beacon transmits nondirectional signals whereby the pilot of an aircraft properly equipped can determine bearings and “home” on the station. These facilities normally operate in a frequency band of 190 to 535 kilohertz (kHz), according to ICAO Annex 10 the frequency range for NDBs is between 190 and 1750 kHz, and transmit a continuous carrier with either 400 or 1020 hertz (Hz) modulation. All radio beacons except the compass locators transmit a continuous three-letter identification in code except during voice transmissions.

b. When a radio beacon is used in conjunction with the Instrument Landing System markers, it is called a Compass Locator.

c. Voice transmissions are made on radio beacons unless the letter “W” (without voice) is included in the class designator (HW).

d. Radio beacons are subject to disturbances that may result in erroneous bearing information. Such disturbances result from such factors as lightning, precipitation static, etc. At night, radio beacons are vulnerable to interference from distant stations. Nearly all disturbances which affect the Automatic Direction Finder (ADF) bearing also affect the facility’s identification. Noisy identification usually occurs when the ADF needle is erratic. Voice, music or erroneous identification may be heard when a steady false bearing is being displayed. Since ADF receivers do not have a “flag” to warn the pilot when erroneous bearing information is being displayed, the pilot should continuously monitor the NDB’s identification.

### 1-1-3. VHF Omni-directional Range (VOR)

a. VORs operate within the 108.0 to 117.95 MHz frequency band and have a power output necessary to provide coverage within their assigned operational service volume. They are subject to line-of-sight restrictions, and the range varies proportionally to the altitude of the receiving equipment.

**NOTE-**

*Normal service ranges for the various classes of VORs are given in Navigational Aid (NAVAID) Service Volumes, Paragraph 1-1-8.*

b. Most VORs are equipped for voice transmission on the VOR frequency. VORs without voice capability are indicated by the letter “W” (without voice) included in the class designator (VORW).

c. The only positive method of identifying a VOR is by its Morse Code identification or by the recorded automatic voice identification which is always indicated by use of the word “VOR” following the range’s name.

Reliance on determining the identification of an omnirange should never be placed on listening to voice transmissions by the Flight Service Station (FSS) (or approach control facility) involved. Many FSSs remotely operate several omniranges with different names. In some cases, none of the VORs have the name of the “parent” FSS. During periods of maintenance, the facility may radiate a T–E–S–T code (– ● ● ● ● –) or the code may be removed. Some VOR equipment decodes the identifier and displays it to the pilot for verification to charts, while other equipment simply displays the expected identifier from a database to aid in verification to the audio tones. You should be familiar with your equipment and use it appropriately. If your equipment automatically decodes the identifier, it is not necessary to listen to the audio identification.

**d.** Voice identification has been added to numerous VORs. The transmission consists of a voice announcement, “AIRVILLE VOR” alternating with the usual Morse Code identification.

**e.** The effectiveness of the VOR depends upon proper use and adjustment of both ground and airborne equipment.

**1. Accuracy.** The accuracy of course alignment of the VOR is excellent, being generally plus or minus 1 degree.

**2. Roughness.** On some VORs, minor course roughness may be observed, evidenced by course needle or brief flag alarm activity (some receivers are more susceptible to these irregularities than others). At a few stations, usually in mountainous terrain, the pilot may occasionally observe a brief course needle oscillation, similar to the indication of “approaching station.” Pilots flying over unfamiliar routes are cautioned to be on the alert for these vagaries, and in particular, to use the “to/from” indicator to determine positive station passage.

**(a)** Certain propeller revolutions per minute (RPM) settings or helicopter rotor speeds can cause the VOR Course Deviation Indicator to fluctuate as much as plus or minus six degrees. Slight changes to the RPM setting will normally smooth out this roughness. Pilots are urged to check for this modulation phenomenon prior to reporting a VOR station or aircraft equipment for unsatisfactory operation.

**f. The VOR Minimum Operational Network (MON).** As flight procedures and route structure based on VORs are gradually being replaced with Performance–Based Navigation (PBN) procedures, the FAA is removing selected VORs from service. PBN procedures are primarily enabled by GPS and its augmentation systems, collectively referred to as Global Navigation Satellite System (GNSS). Aircraft that carry DME/DME equipment can also use RNAV which provides a backup to continue flying PBN during a GNSS disruption. For those aircraft that do not carry DME/DME, the FAA is retaining a limited network of VORs, called the VOR MON, to provide a basic conventional navigation service for operators to use if GNSS becomes unavailable. During a GNSS disruption, the MON will enable aircraft to navigate through the affected area or to a safe landing at a MON airport without reliance on GNSS. Navigation using the MON will not be as efficient as the new PBN route structure, but use of the MON will provide nearly continuous VOR signal coverage at 5,000 feet AGL across the NAS, outside of the Western U.S. Mountainous Area (WUSMA).

**NOTE–**

*There is no plan to change the NAVAID and route structure in the WUSMA.*

The VOR MON has been retained principally for IFR aircraft that are not equipped with DME/DME avionics. However, VFR aircraft may use the MON as desired. Aircraft equipped with DME/DME navigation systems would, in most cases, use DME/DME to continue flight using RNAV to their destination. However, these aircraft may, of course, use the MON.

**1. Distance to a MON airport.** The VOR MON will ensure that regardless of an aircraft’s position in the contiguous United States (CONUS), a MON airport (equipped with legacy ILS or VOR approaches) will be within 100 nautical miles. These airports are referred to as “MON airports” and will have an ILS approach or a VOR approach if an ILS is not available. VORs to support these approaches will be retained in the VOR MON. MON airports are charted on low–altitude en route charts and are contained in the Chart Supplement U.S. and other appropriate publications.

**NOTE–**

*Any suitable airport can be used to land in the event of a VOR outage. For example, an airport with a DME–required ILS*

*approach may be available and could be used by aircraft that are equipped with DME. The intent of the MON airport is to provide an approach that can be used by aircraft without ADF or DME when radar may not be available.*

**2. Navigating to an airport.** The VOR MON will retain sufficient VORs and increase VOR service volume to ensure that pilots will have nearly continuous signal reception of a VOR when flying at 5,000 feet AGL. A key concept of the MON is to ensure that an aircraft will always be within 100 NM of an airport with an instrument approach that is not dependent on GPS. (See paragraph 1-1-8.) If the pilot encounters a GPS outage, the pilot will be able to proceed via VOR-to-VOR navigation at 5,000 feet AGL through the GPS outage area or to a safe landing at a MON airport or another suitable airport, as appropriate. Nearly all VORs inside of the WUSMA and outside the CONUS are being retained. In these areas, pilots use the existing (Victor and Jet) route structure and VORs to proceed through a GPS outage or to a landing.

### **3. Using the VOR MON.**

(a) In the case of a planned GPS outage (for example, one that is in a published NOTAM), pilots may plan to fly through the outage using the MON as appropriate and as cleared by ATC. Similarly, aircraft not equipped with GPS may plan to fly and land using the MON, as appropriate and as cleared by ATC.

#### **NOTE-**

*In many cases, flying using the MON may involve a more circuitous route than flying GPS-enabled RNAV.*

(b) In the case of an unscheduled GPS outage, pilots and ATC will need to coordinate the best outcome for all aircraft. It is possible that a GPS outage could be disruptive, causing high workload and demand for ATC service. Generally, the VOR MON concept will enable pilots to navigate through the GPS outage or land at a MON airport or at another airport that may have an appropriate approach or may be in visual conditions.

(1) The VOR MON is a reversionary service provided by the FAA for use by aircraft that are unable to continue RNAV during a GPS disruption. The FAA has not mandated that preflight or inflight planning include provisions for GPS- or WAAS-equipped aircraft to carry sufficient fuel to proceed to a MON airport in case of an unforeseen GPS outage. Specifically, flying to a MON airport as a filed alternate will not be explicitly required. Of course, consideration for the possibility of a GPS outage is prudent during flight planning as is maintaining proficiency with VOR navigation.

(2) Also, in case of a GPS outage, pilots may coordinate with ATC and elect to continue through the outage or land. The VOR MON is designed to ensure that an aircraft is within 100 NM of an airport, but pilots may decide to proceed to any appropriate airport where a landing can be made. WAAS users flying under Part 91 are not required to carry VOR avionics. These users do not have the ability or requirement to use the VOR MON. Prudent flight planning, by these WAAS-only aircraft, should consider the possibility of a GPS outage.

#### **NOTE-**

*The FAA recognizes that non-GPS-based approaches will be reduced when VORs are eliminated, and that most airports with an instrument approach may only have GPS- or WAAS-based approaches. Pilots flying GPS- or WAAS-equipped aircraft that also have VOR/ILS avionics should be diligent to maintain proficiency in VOR and ILS approaches in the event of a GPS outage.*

### **1-1-4. VOR Receiver Check**

a. The FAA VOR test facility (VOT) transmits a test signal which provides users a convenient means to determine the operational status and accuracy of a VOR receiver while on the ground where a VOT is located. The airborne use of VOT is permitted; however, its use is strictly limited to those areas/altitudes specifically authorized in the Chart Supplement or appropriate supplement.

b. To use the VOT service, tune in the VOT frequency on your VOR receiver. With the Course Deviation Indicator (CDI) centered, the omni-bearing selector should read 0 degrees with the to/from indication showing "from" or the omni-bearing selector should read 180 degrees with the to/from indication showing "to." Should the VOR receiver operate an RMI (Radio Magnetic Indicator), it will indicate 180 degrees on any omni-bearing selector (OBS) setting. Two means of identification are used. One is a series of dots and the other is a continuous tone. Information concerning an individual test signal can be obtained from the local FSS.

c. Periodic VOR receiver calibration is most important. If a receiver's Automatic Gain Control or modulation circuit deteriorates, it is possible for it to display acceptable accuracy and sensitivity close into the VOR or VOT and display out-of-tolerance readings when located at greater distances where weaker signal areas exist. The likelihood of this deterioration varies between receivers, and is generally considered a function of time. The best assurance of having an accurate receiver is periodic calibration. Yearly intervals are recommended at which time an authorized repair facility should recalibrate the receiver to the manufacturer's specifications.

d. Federal Aviation Regulations (14 CFR Section 91.171) provides for certain VOR equipment accuracy checks prior to flight under instrument flight rules. To comply with this requirement and to ensure satisfactory operation of the airborne system, the FAA has provided pilots with the following means of checking VOR receiver accuracy:

1. VOT or a radiated test signal from an appropriately rated radio repair station.
2. Certified airborne checkpoints and airways.
3. Certified checkpoints on the airport surface.

4. If an airborne checkpoint is not available, select an established VOR airway. Select a prominent ground point, preferably more than 20 NM from the VOR ground facility and maneuver the aircraft directly over the point at a reasonably low altitude above terrain and obstructions.

e. A radiated VOT from an appropriately rated radio repair station serves the same purpose as an FAA VOR signal and the check is made in much the same manner as a VOT with the following differences:

1. The frequency normally approved by the Federal Communications Commission is 108.0 MHz.

2. Repair stations are not permitted to radiate the VOR test signal continuously; consequently, the owner or operator must make arrangements with the repair station to have the test signal transmitted. This service is not provided by all radio repair stations. The aircraft owner or operator must determine which repair station in the local area provides this service. A representative of the repair station must make an entry into the aircraft logbook or other permanent record certifying to the radial accuracy and the date of transmission. The owner, operator or representative of the repair station may accomplish the necessary checks in the aircraft and make a logbook entry stating the results. It is necessary to verify which test radial is being transmitted and whether you should get a "to" or "from" indication.

f. Airborne and ground check points consist of certified radials that should be received at specific points on the airport surface or over specific landmarks while airborne in the immediate vicinity of the airport.

1. Should an error in excess of plus or minus 4 degrees be indicated through use of a ground check, or plus or minus 6 degrees using the airborne check, Instrument Flight Rules (IFR) flight must not be attempted without first correcting the source of the error.

**CAUTION-**

*No correction other than the correction card figures supplied by the manufacturer should be applied in making these VOR receiver checks.*

2. Locations of airborne check points, ground check points and VOTs are published in the Chart Supplement.

3. If a dual system VOR (units independent of each other except for the antenna) is installed in the aircraft, one system may be checked against the other. Turn both systems to the same VOR ground facility and note the indicated bearing to that station. The maximum permissible variations between the two indicated bearings is 4 degrees.

### **1-1-5. Tactical Air Navigation (TACAN)**

a. For reasons peculiar to military or naval operations (unusual siting conditions, the pitching and rolling of a naval vessel, etc.) the civil VOR/Distance Measuring Equipment (DME) system of air navigation was

**TBL 1-1-2**  
**NDB Service Volumes**

Class	Distance (Radius) (NM)
Compass Locator	15
MH	25
H	50*
HH	75
<i>*Service ranges of individual facilities may be less than 50 nautical miles (NM). Restrictions to service volumes are first published as a Notice to Air Missions and then with the alphabetical listing of the NAVAID in the Chart Supplement.</i>	

## 1-1-9. Instrument Landing System (ILS)

### a. General

1. The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.

2. The basic components of an ILS are the localizer, glide slope, and Outer Marker (OM) and, when installed for use with Category II or Category III instrument approach procedures, an Inner Marker (IM).

3. The system may be divided functionally into three parts:

(a) **Guidance information:** localizer, glide slope.

(b) **Range information:** marker beacon, DME.

(c) **Visual information:** approach lights, touchdown and centerline lights, runway lights.

4. The following means may be used to substitute for the OM:

(a) Compass locator; or

(b) Precision Approach Radar (PAR); or

(c) Airport Surveillance Radar (ASR); or

(d) Distance Measuring Equipment (DME), Very High Frequency Omni-directional Range (VOR), or Nondirectional beacon fixes authorized in the Standard Instrument Approach Procedure; or

(e) Very High Frequency Omni-directional Radio Range (VOR); or

(f) Nondirectional beacon fixes authorized in the Standard Instrument Approach Procedure; or

(g) A suitable RNAV system with Global Positioning System (GPS), capable of fix identification on a Standard Instrument Approach Procedure.

5. Where a complete ILS system is installed on each end of a runway; (i.e., the approach end of Runway 4 and the approach end of Runway 22) the ILS systems are not in service simultaneously.

### b. Localizer

1. The localizer transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz. Signals provide the pilot with course guidance to the runway centerline.

2. The approach course of the localizer is called the front course and is used with other functional parts, e.g., glide slope, marker beacons, etc. The localizer signal is transmitted at the far end of the runway. It is adjusted for a course width of (full scale fly-left to a full scale fly-right) of 700 feet at the runway threshold.

3. The course line along the extended centerline of a runway, in the opposite direction to the front course is called the back course.

**CAUTION-**

Unless the aircraft's ILS equipment includes reverse sensing capability, when flying inbound on the back course it is necessary to steer the aircraft in the direction opposite the needle deflection when making corrections from off-course to on-course. This "flying away from the needle" is also required when flying outbound on the front course of the localizer. Do not use back course signals for approach unless a back course approach procedure is published for that particular runway and the approach is authorized by ATC.

4. Identification is in International Morse Code and consists of a three-letter identifier preceded by the letter I (●●) transmitted on the localizer frequency.

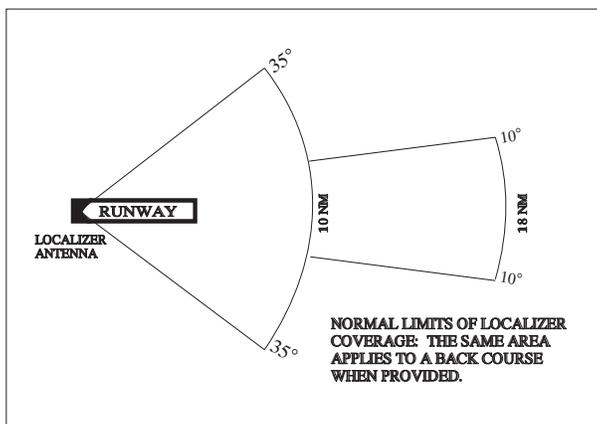
**EXAMPLE-**

I-DIA

5. The localizer provides course guidance throughout the descent path to the runway threshold from a distance of 18 NM from the antenna between an altitude of 1,000 feet above the highest terrain along the course line and 4,500 feet above the elevation of the antenna site. Proper off-course indications are provided throughout the following angular areas of the operational service volume:

- (a) To 10 degrees either side of the course along a radius of 18 NM from the antenna; and
- (b) From 10 to 35 degrees either side of the course along a radius of 10 NM. (See FIG 1-1-6.)

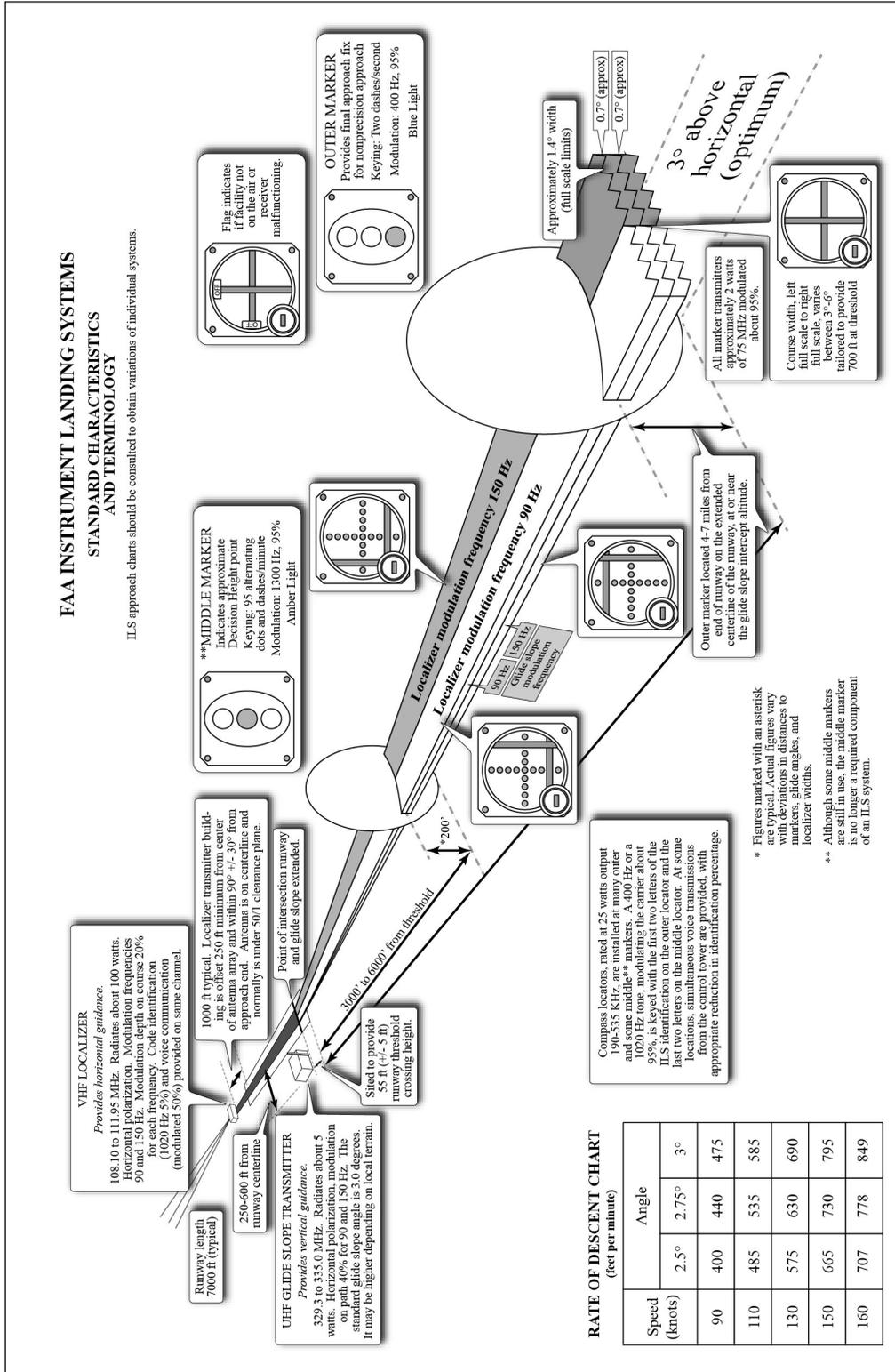
**FIG 1-1-6  
Limits of Localizer Coverage**



6. Unreliable signals may be received outside of these areas. ATC may clear aircraft on procedures beyond the service volume when the controller initiates the action or when the pilot requests, and radar monitoring is provided.

7. The areas described in paragraph 1-1-9 b5 and depicted in FIG 1-1-6 represent a Standard Service Volume (SSV) localizer. All charted procedures with localizer coverage beyond the 18 NM SSV have been through the approval process for Expanded Service Volume (ESV), and have been validated by flight inspection. (See FIG 1-1-7.)

**FIG 1-1-8  
FAA Instrument Landing Systems**



### 1-1-11. NAVAID Identifier Removal During Maintenance

During periods of routine or emergency maintenance, coded identification (or code and voice, where applicable) is removed from certain FAA NAVAIDs. Removal of identification serves as a warning to pilots that the facility is officially off the air for tune-up or repair and may be unreliable even though intermittent or constant signals are received.

**NOTE-**

*During periods of maintenance VHF ranges may radiate a T-E-S-T code (- ●●●-).*

**NOTE-**

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

### 1-1-12. NAVAIDs with Voice

a. Voice equipped en route radio navigational aids are under the operational control of either a Flight Service Station (FSS) or an approach control facility. Facilities with two-way voice communication available are indicated in the Chart Supplement and aeronautical charts.

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

### 1-1-13. User Reports Requested on NAVAID Outages

a. Users of the National Airspace System (NAS) can render valuable assistance in the early correction of NAVAID malfunctions or GNSS problems and are encouraged to report their observations of undesirable avionics performance. Although NAVAIDs are monitored by electronic detectors, adverse effects of electronic interference, new obstructions, or changes in terrain near the NAVAID can exist without detection by the ground monitors. Some of the characteristics of malfunction or deteriorating performance which should be reported are: erratic course or bearing indications; intermittent, or full, flag alarm; garbled, missing or obviously improper coded identification; poor quality communications reception; or, in the case of frequency interference, an audible hum or tone accompanying radio communications or NAVAID identification. GNSS problems are often characterized by navigation degradation or service loss indications. For instance, pilots conducting operations in areas where there is GNSS interference may be unable to use GPS for navigation, and ADS-B may be unavailable for surveillance. Radio frequency interference may affect both navigation for the pilot and surveillance by the air traffic controller. Depending on the equipment and integration, either an advisory light or message may alert the pilot. Air traffic controllers monitoring ADS-B reports may stop receiving ADS-B position messages and associated aircraft tracks.

b. Malfunctioning, faulty, inappropriately installed, operated, or modified GPS re-radiator systems, intended to be used for aircraft maintenance activities, have resulted in unintentional disruption of aviation GPS receivers. This type of disruption could result in unflagged, erroneous position-information output to primary flight displays/indicators and to other aircraft and air traffic control systems. Since Receiver Autonomous Integrity Monitoring (RAIM) is only partially effective against this type of disruption (effectively a “signal spoofing”), the pilot may not be aware of any erroneous navigation indications; ATC may be the only means available to identify these disruptions and detect unexpected aircraft positions while monitoring aircraft for IFR separation.

c. Pilots encountering navigation error events should transition to another source of navigation and request amended clearances from ATC as necessary.

d. Pilots are encouraged to submit detailed reports of NAVAID or GPS anomaly as soon as practical. Pilot reports of navigation error events should contain the following information:

1. Date and time the anomaly was observed, and NAVAID ID (or GPS).

2. Location of the aircraft at the time the anomaly started and ended (e.g., latitude/longitude or bearing/distance from a reference point),

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

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

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

### 1. VFR Operations

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

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

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

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

(2) Database Currency. Check the currency of the database. Databases must be updated for IFR operations and should be updated for all other operations. However, there is no requirement for databases to be updated for VFR navigation. It is not recommended to use a moving map with an outdated database in and around critical airspace. Pilots using an outdated database should verify waypoints using current aeronautical products; for example, Chart Supplement, 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 system that allows the operator to proceed safely to a suitable airport, complete an instrument approach; 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 an 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]** Due to low risk of disruption or manipulation of GPS signals beyond 50 NM offshore, FAA differentiates between extended and non-extended over-water operations. To satisfy the requirement for two independent navigation systems:

**[1]** For all extended over-water operations (defined in 14 CFR Part 1 as greater than 50 NM from the nearest shoreline), operators may consider dual GPS-based systems to meet the “independent” criteria stipulated by regulation, e.g., §121.349, §135.165.

**[2]** For all “non-extended overwater” operations, 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, for example, either DME/DME, IRU, or VOR for en route and terminal operations and VOR and ILS for final approach. Since this system is to be used as a reversionary capability, single equipage is sufficient.

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

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

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

(1) GPS en route IFR operations may be conducted in Alaska outside the operational service volume of ground-based navigation aids when a TSO-C145() or TSO-C146() GPS/wide area augmentation system (WAAS) system is installed and operating. WAAS is the U.S. version of a satellite-based augmentation system (SBAS).

[a] In Alaska, aircraft may operate on GNSS Q-routes with GPS (TSO-C129 () or TSO-C196 ()) equipment while the aircraft remains in Air Traffic Control (ATC) radar surveillance or with GPS/WAAS (TSO-C145 () or TSO-C146 ()) which does not require ATC radar surveillance.

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

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

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

**REFERENCE-**

*AIM, Para 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 ( $\pm 1$  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  $\pm 5$  NM either side of centerline to  $\pm 1$  NM terminal sensitivity. Where the IAWP is inside this 30 mile point, a CDI sensitivity change will occur once the approach mode is armed and the aircraft is inside 30 NM. Where the IAWP is beyond 30 NM from the airport/heliport reference point and the approach is armed, the CDI sensitivity will not change until the aircraft is within 30 miles of the airport/heliport reference point. Feeder route obstacle clearance is predicated on the receiver being in terminal ( $\pm 1$  NM) CDI sensitivity and RAIM within 30 NM of the airport/heliport reference point; therefore, the receiver should always be armed (if required) not later than the 30 NM annunciation.

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

(5) When within 2 NM of the Final Approach Waypoint (FAWP) with the approach mode armed, the approach mode will switch to active, which results in RAIM and CDI changing to approach sensitivity. Beginning 2 NM prior to the FAWP, the full scale CDI sensitivity will smoothly change from  $\pm 1$  NM to  $\pm 0.3$  NM at the FAWP. As sensitivity changes from  $\pm 1$  NM to  $\pm 0.3$  NM approaching the FAWP, with the CDI not centered, the corresponding increase in CDI displacement may give the impression that the aircraft is moving further away from the intended course even though it is on an acceptable intercept heading. Referencing the digital track displacement information (cross track error), if it is available in the approach mode, may help the pilot remain position oriented in this situation. Being established on the final approach course prior to the beginning of the sensitivity change at 2 NM will help prevent problems in interpreting the CDI display during ramp down. Therefore, requesting or accepting vectors which will cause the aircraft to intercept the final approach course within 2 NM of the FAWP is not recommended.

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

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

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

(9) Pilots should pay particular attention to the exact operation of their GPS receivers for performing holding patterns and in the case of overlay approaches, operations such as procedure turns. These procedures

may require manual intervention by the pilot to stop the sequencing of waypoints by the receiver and to resume automatic GPS navigation sequencing once the maneuver is complete. The same waypoint may appear in the route of flight more than once consecutively (for example, IAWP, FAWP, MAHWP on a procedure turn). Care must be exercised to ensure that the receiver is sequenced to the appropriate waypoint for the segment of the procedure being flown, especially if one or more fly–overs are skipped (for example, FAWP rather than IAWP if the procedure turn is not flown). The pilot may have to sequence past one or more fly–overs of the same waypoint in order to start GPS automatic sequencing at the proper place in the sequence of waypoints.

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

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

(12) If a visual descent point (VDP) is published, it will not be included in the sequence of waypoints. Pilots are expected to use normal piloting techniques for beginning the visual descent, such as ATD.

(13) Unnamed stepdown fixes in the final approach segment may or may not be coded in the waypoint sequence of the aircraft's navigation database and must be identified using ATD. Stepdown fixes in the final approach segment of RNAV (GPS) approaches are being named, in addition to being identified by ATD. However, GPS avionics may or may not accommodate waypoints between the FAF and MAP. Pilots must know the capabilities of their GPS equipment and continue to identify stepdown fixes using ATD when necessary.

**(f) Missed Approach**

(1) A GPS missed approach requires pilot action to sequence the receiver past the MAWP to the missed approach portion of the procedure. The pilot must be thoroughly familiar with the activation procedure for the particular GPS receiver installed in the aircraft and must initiate appropriate action after the MAWP. Activating the missed approach prior to the MAWP will cause CDI sensitivity to immediately change to terminal ( $\pm 1\text{NM}$ ) 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 NOTAMs, 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/Categories**

TSO-C129						
Equipment Class	RAIM	Int. Nav. Sys. to Prov. RAIM Equiv.	Oceanic	En Route	Terminal	Non-precision Approach Capable
<b>Class A</b> – GPS sensor and navigation capability.						
A1	yes		yes	yes	yes	yes
A2	yes		yes	yes	yes	no
<b>Class B</b> – GPS sensor data to an integrated navigation system (i.e., FMS, multi-sensor navigation 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
<b>Class C</b> – 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 <sup>1</sup>	Installation Approval Required	Operational Approval Required	IFR En Route <sup>2</sup>	IFR Terminal <sup>2</sup>	IFR Approach <sup>3</sup>	Oceanic Remote	In Lieu of ADF and/or DME <sup>3</sup>
Hand held <sup>4</sup>	X <sup>5</sup>						
VFR Panel Mount <sup>4</sup>	X						
IFR En Route and Terminal	X	X	X	X			X
IFR Oceanic/Remote	X	X	X	X		X	X
IFR En Route, Terminal, and Approach	X	X	X	X	X		X

**NOTE–**

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

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

<sup>3</sup>Requires current database or verification that the procedure has not been amended since the expiration of the database.

<sup>4</sup>VFR and hand-held GPS systems are not authorized for IFR navigation, instrument approaches, or as a primary instrument flight reference. During IFR operations they may be considered only an aid to situational awareness.

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

## 1-1-18. 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  $\frac{1}{2}$  mile, when the terrain and airport infrastructure support the lowest minima. LPV minima is published on the RNAV (GPS) approach charts (see paragraph 5-4-5, Instrument Approach Procedure Charts).

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

#### **NOTE-**

*WAAS receivers certified prior to TSO-C145b and TSO-C146b, even if they have LPV capability, do not contain LP*

capability unless the receiver has been upgraded. Receivers capable of flying LP procedures must contain a statement in the Aircraft Flight Manual (AFM), AFM Supplement, or Approved Supplemental Flight Manual stating that the receiver has LP capability, as well as the capability for the other WAAS and GPS approach procedure types.

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

### c. General Requirements

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

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

3. GPS/WAAS equipment is inherently capable of supporting oceanic and remote operations if the operator obtains a fault detection and exclusion (FDE) prediction program.

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

5. Prior to GPS/WAAS IFR operation, the pilot must review appropriate Notices to Air Missions (NOTAMs) and aeronautical information. This information is available on request from a Flight Service Station. The FAA will provide NOTAMs to advise pilots of the status of the WAAS and level of service available.

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

#### **EXAMPLE-**

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

or

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

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

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

#### **EXAMPLE-**

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

1311191200EST.

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

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

**NOTE-**

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

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

**EXAMPLE-**

*!FDC 4/3406 (PAZA A0173/14) ZAN NAV WAAS SIGNAL MAY NOT BE AVBL NORTH OF LINE FROM 7000N15000W TO 6400N16400W. RMK WAAS USERS SHOULD CONFIRM RAIM AVAILABILITY FOR IFR OPERATIONS IN THIS AREA. T-ROUTES IN THIS SECTOR NOT AVBL. ANY REQUIRED ALTERNATE AIRPORT IN THIS AREA MUST HAVE AN APPROVED INSTRUMENT APPROACH PROCEDURE OTHER THAN GPS THAT IS ANTICIPATED TO BE OPERATIONAL AND AVAILABLE AT THE ESTIMATED TIME OF ARRIVAL AND WHICH THE AIRCRAFT IS EQUIPPED TO FLY. 1406030812-1406050812EST.*

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

**EXAMPLE-**

*Here is an example of a GPS testing NOTAM:*

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

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

**NOTE-**

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

8. GPS/WAAS was developed to be used within GEO coverage over North America without the need for other radio navigation equipment appropriate to the route of flight to be flown. Outside the WAAS coverage or in the event of a WAAS failure, GPS/WAAS equipment reverts to GPS-only operation and satisfies the requirements for basic GPS equipment. (See paragraph 1-1-17 for these requirements).

9. Unlike TSO-C129 avionics, which were certified as a supplement to other means of navigation, WAAS avionics are evaluated without reliance on other navigation systems. As such, installation of WAAS avionics does not require the aircraft to have other equipment appropriate to the route to be flown. (See paragraph 1-1-17 d for more information on equipment requirements.)

(a) Pilots with WAAS receivers may flight plan to use any instrument approach procedure authorized for use with their WAAS avionics as the planned approach at a required alternate, with the following restrictions.

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

**NOTE-**

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

**d. Flying Procedures with WAAS**

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

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

**NOTE-**

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

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

cases this operation will be invisible to the pilot since the receiver will continue to operate with other available satellites after excluding the “bad” signal. This capability increases the reliability of navigation.

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

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

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

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

### **1–1–19. Ground Based Augmentation System (GBAS) Landing System (GLS)**

a. A GBAS ground installation at an airport can provide localized, differential augmentation to the Global Positioning System (GPS) signal–in–space enabling an aircraft’s GLS precision approach capability. Through the GBAS service and the aircraft’s GLS installation a pilot may complete an instrument approach offering three–dimensional angular, lateral, and vertical guidance for exact alignment and descent to a runway. The operational benefits of a GLS approach are similar to the benefits of an ILS or LPV approach operation.

**NOTE—**

*To remain consistent with international terminology, the FAA will use the term GBAS in place of the former term Local Area Augmentation System (LAAS).*

**b.** An aircraft's GLS approach capability relies on the broadcast from a GBAS Ground Facility (GGF) installation. The GGF installation includes at least four ground reference stations near the airport's runway(s), a corrections processor, and a VHF Data Broadcast (VDB) uplink antenna. To use the GBAS GGF output and be eligible to conduct a GLS approach, the aircraft requires eligibility to conduct RNP approach (RNP APCH) operations and must meet the additional, specific airworthiness requirements for installation of a GBAS receiver intended to support GLS approach operations. When the aircraft achieves GLS approach eligibility, the aircraft's onboard navigation database may then contain published GLS instrument approach procedures.

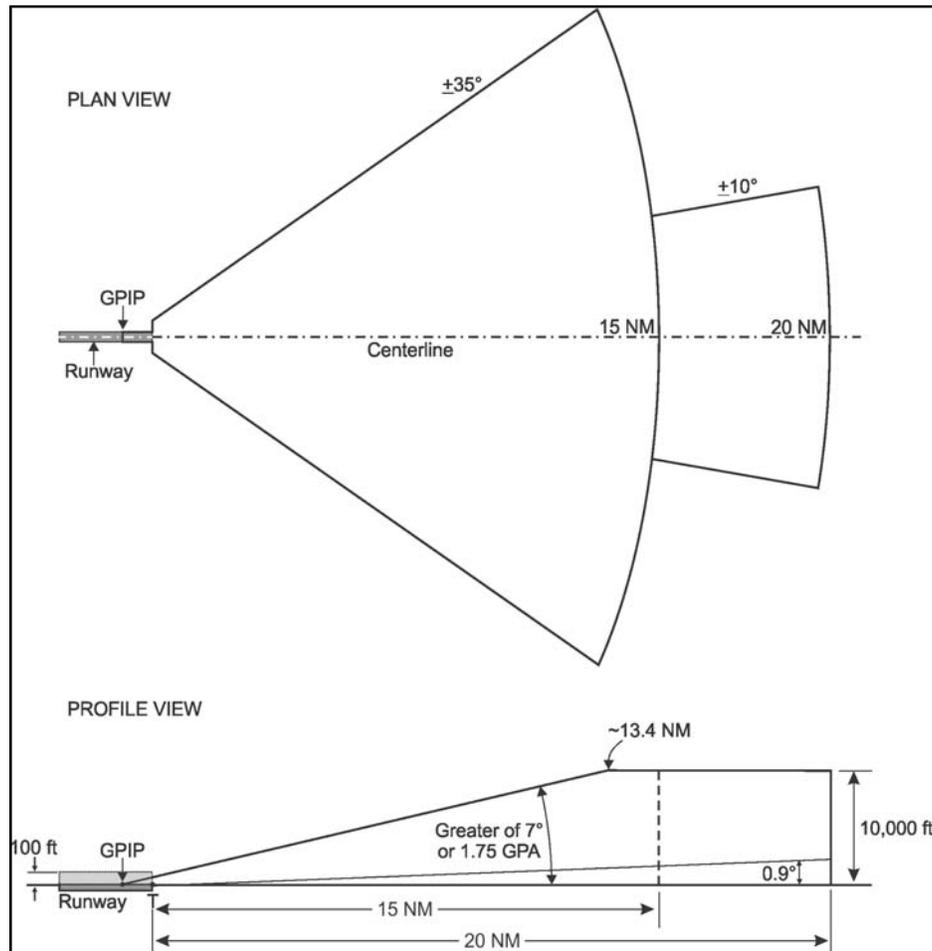
**c.** During a GLS instrument approach procedure, the installation of an aircraft's GLS capability provides the pilot three-dimensional (3D) lateral and vertical navigation guidance much like an ILS instrument approach. GBAS corrections augment the GPS signal-in-space by offering position corrections, ensures the availability of enhanced integrity parameters, and then transmits the actual approach path definition over the VDB uplink antenna. A single GBAS ground station can support multiple GLS approaches to one or more runways.

**d.** Through the GBAS ground station, a GLS approach offers a unique operational service volume distinct from the traditional ILS approach service volume (see FIG 1-1-9). However, despite the unique service volume, in the final approach segment, a GLS approach provides precise 3D angular lateral and vertical guidance mimicking the precision guidance of an ILS approach.

**e.** Transitions to and segments of the published GLS instrument approach procedures may rely on use of RNAV 1 or RNP 1 prior to an IAF. Then, during the approach procedure, prior to the aircraft entering the GLS approach mode, a GLS approach procedure design uses the RNP APCH procedure design criteria to construct the procedural path (the criteria used to publish procedures titled "RNAV (GPS)" in the US). Thus, a GLS approach procedure may include paths requiring turns after the aircraft crosses the IAF, prior to the aircraft's flight guidance entering the GLS approach flight guidance mode. Likewise, the missed approach procedure for a GLS approach procedure relies exclusively on the same missed approach criteria supporting an RNP APCH.

**f.** When maneuvering the aircraft in compliance with an ATC clearance to intercept a GLS approach prior to the final approach segment (e.g. "being vectored"), the pilot should adhere to the clearance and ensure the aircraft intercepts the extended GLS final approach course within the specified service volume. Once on the GLS final approach course, the pilot should ensure the aircraft is in the GLS approach mode prior to reaching the procedure's glidepath intercept point. Once the aircraft is in the GLS flight guidance mode and captures the GLS glidepath, the pilot should fly the GLS final approach segment using the same pilot techniques they use to fly an ILS final approach or the final approach of an RNAV (GPS) approach flown to LPV minimums. See also the Instrument Procedures Handbook for more information on how to conduct a GLS instrument approach procedure.

**FIG 1-1-9**  
**GLS Standard Approach Service Volume**



## 1-1-20. Precision Approach Systems other than ILS and GLS

### a. General

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

### b. Special Instrument Approach Procedure

1. Special instrument approach procedures must be issued to the aircraft operator if pilot training, aircraft equipment, and/or aircraft performance is different than published procedures. Special instrument approach procedures are not distributed for general public use. These procedures are issued to an aircraft operator when the conditions for operations approval are satisfied.

2. General aviation operators requesting approval for special procedures should contact the local Flight Standards District Office to obtain a letter of authorization. Air carrier operators requesting approval for use of special procedures should contact their Certificate Holding District Office for authorization through their Operations Specification.

#### REFERENCE-

AIM, Para 5-4-7, Instrument Approach Procedures, Subpara j.



# Chapter 2. Aeronautical Lighting and Other Airport Visual Aids

## Section 1. Airport Lighting Aids

### 2-1-1. Approach Light Systems (ALS)

a. ALS provide the basic means to transition from instrument flight to visual flight for landing. Operational requirements dictate the sophistication and configuration of the approach light system for a particular runway.

b. ALS are a configuration of signal lights starting at the landing threshold and extending into the approach area a distance of 2400–3000 feet for precision instrument runways and 1400–1500 feet for nonprecision instrument runways. Some systems include sequenced flashing lights which appear to the pilot as a ball of light traveling towards the runway at high speed (twice a second). (See FIG 2-1-1.)

### 2-1-2. Visual Glideslope Indicators

#### a. Visual Approach Slope Indicator (VASI)

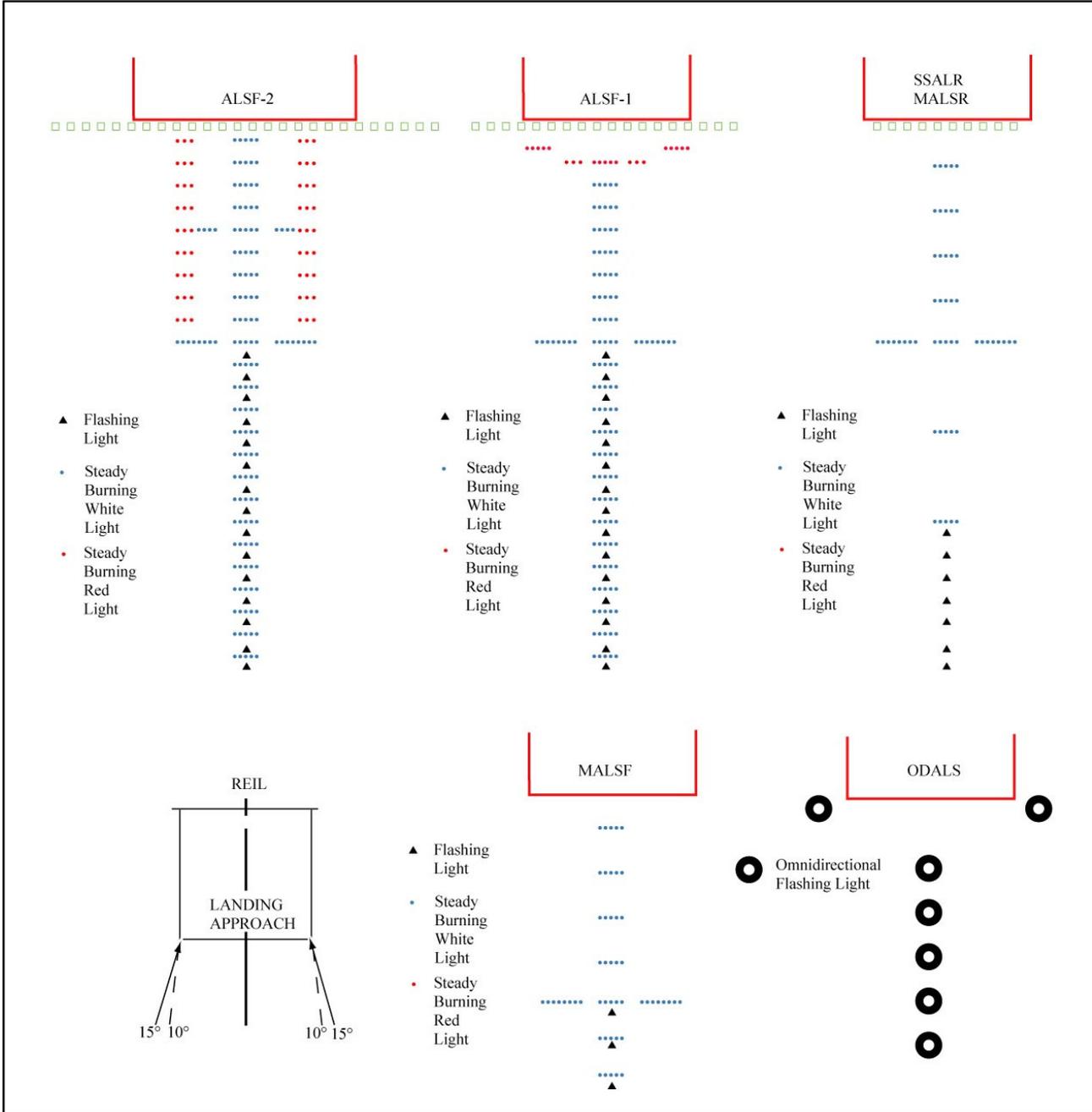
1. VASI installations may consist of either 2, 4, 6, 12, or 16 light units arranged in bars referred to as near, middle, and far bars. Most VASI installations consist of 2 bars, near and far, and may consist of 2, 4, or 12 light units. Some VASIs consist of three bars, near, middle, and far, which provide an additional visual glide path to accommodate high cockpit aircraft. This installation may consist of either 6 or 16 light units. VASI installations consisting of 2, 4, or 6 light units are located on one side of the runway, usually the left. Where the installation consists of 12 or 16 light units, the units are located on both sides of the runway.

2. Two-bar VASI installations provide one visual glide path which is normally set at 3 degrees. Three-bar VASI installations provide two visual glide paths. The lower glide path is provided by the near and middle bars and is normally set at 3 degrees while the upper glide path, provided by the middle and far bars, is normally  $\frac{1}{4}$  degree higher. This higher glide path is intended for use only by high cockpit aircraft to provide a sufficient threshold crossing height. Although normal glide path angles are three degrees, angles at some locations may be as high as 4.5 degrees to give proper obstacle clearance. Pilots of high performance aircraft are cautioned that use of VASI angles in excess of 3.5 degrees may cause an increase in runway length required for landing and rollout.

3. The basic principle of the VASI is that of color differentiation between red and white. Each light unit projects a beam of light having a white segment in the upper part of the beam and red segment in the lower part of the beam. The light units are arranged so that the pilot using the VASIs during an approach will see the combination of lights shown below.

4. The VASI is a system of lights so arranged to provide visual descent guidance information during the approach to a runway. These lights are visible from 3–5 miles during the day and up to 20 miles or more at night. The visual glide path of the VASI provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline and to 4 NM from the runway threshold. Descent, using the VASI, should not be initiated until the aircraft is visually aligned with the runway. Lateral course guidance is provided by the runway or runway lights. In certain circumstances, the safe obstruction clearance area may be reduced by narrowing the beam width or shortening the usable distance due to local limitations, or the VASI may be offset from the extended runway centerline. This will be noted in the Chart Supplement and/or applicable Notices to Air Missions (NOTAMs).

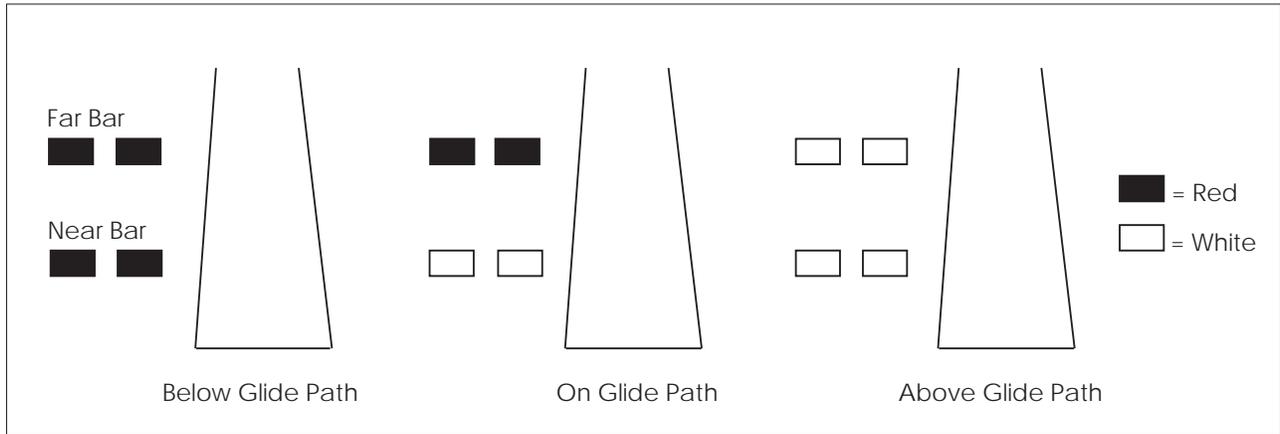
FIG 2-1-1  
Precision & Nonprecision Configurations



**NOTE-**  
Civil ALSF-2 may be operated as SSALR during favorable weather conditions.

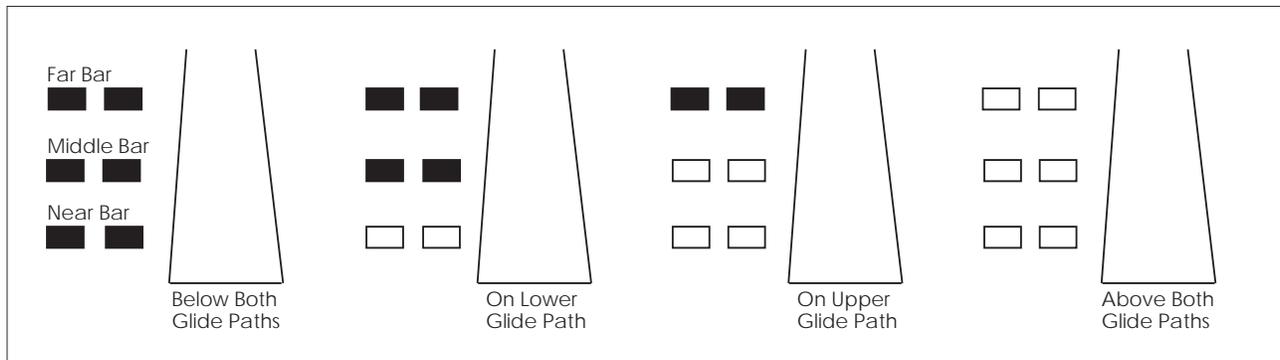
5. For 2-bar VASI (4 light units) see FIG 2-1-2.

**FIG 2-1-2  
2-Bar VASI**



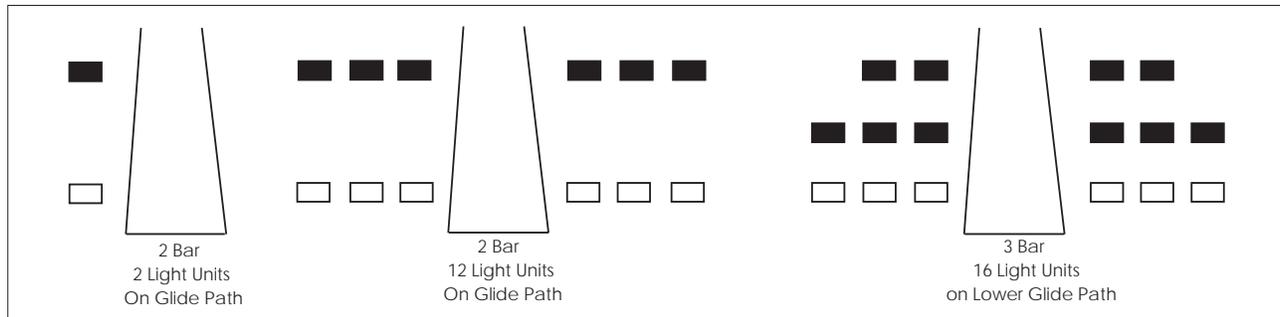
6. For 3-bar VASI (6 light units) see FIG 2-1-3.

**FIG 2-1-3  
3-Bar VASI**



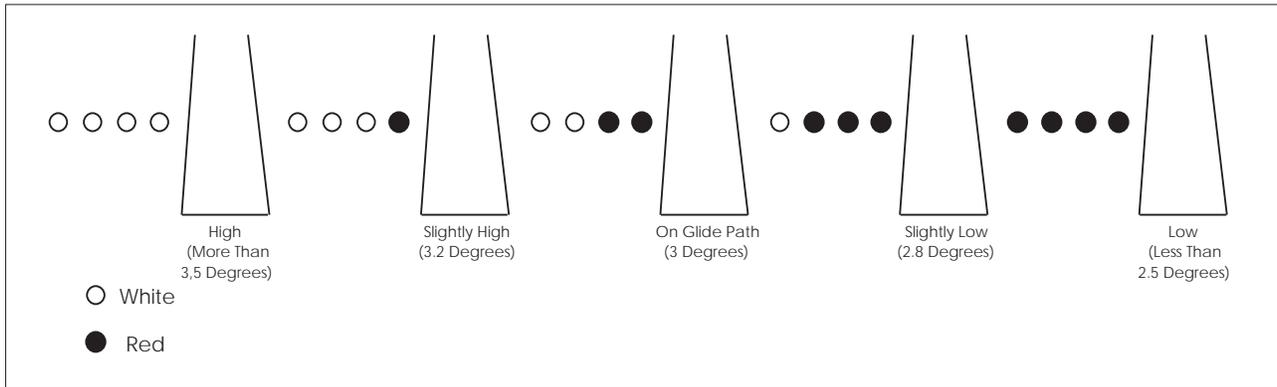
7. For other VASI configurations see FIG 2-1-4.

**FIG 2-1-4  
VASI Variations**



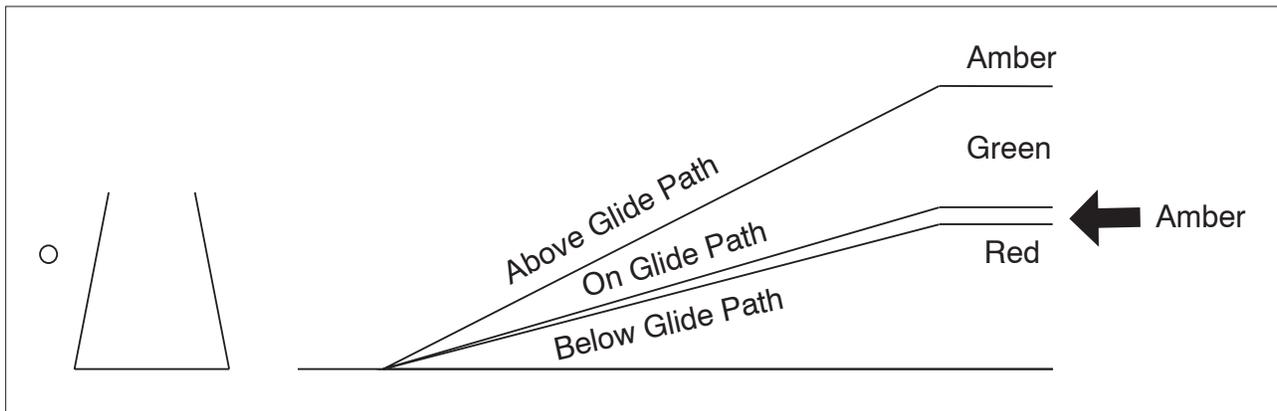
**b. Precision Approach Path Indicator (PAPI).** The precision approach path indicator (PAPI) uses light units similar to the VASI but are installed in a single row of either two or four light units. These lights are visible from about 5 miles during the day and up to 20 miles at night. The visual glide path of the PAPI typically provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline and to 3.4 NM from the runway threshold. Descent, using the PAPI, should not be initiated until the aircraft is visually aligned with the runway. The row of light units is normally installed on the left side of the runway and the glide path indications are as depicted. Lateral course guidance is provided by the runway or runway lights. In certain circumstances, the safe obstruction clearance area may be reduced by narrowing the beam width or shortening the usable distance due to local limitations, or the PAPI may be offset from the extended runway centerline. This will be noted in the Chart Supplement and/or applicable NOTAMS. (See FIG 2-1-5.)

**FIG 2-1-5  
Precision Approach Path Indicator (PAPI)**



**c. Tri-color Systems.** Tri-color visual approach slope indicators normally consist of a single light unit projecting a three-color visual approach path into the final approach area of the runway upon which the indicator is installed. The below glide path indication is red, the above glide path indication is amber, and the on glide path indication is green. These types of indicators have a useful range of approximately one-half to one mile during the day and up to five miles at night depending upon the visibility conditions. (See FIG 2-1-6.)

**FIG 2-1-6  
Tri-Color Visual Approach Slope Indicator**



**NOTE-**

1. Since the tri-color VASI consists of a single light source which could possibly be confused with other light sources, pilots should exercise care to properly locate and identify the light signal.
2. When the aircraft descends from green to red, the pilot may see a dark amber color during the transition from green to red.

**FIG 2-1-12**  
**Taxiway Lead-On Light Configuration**



**TBL 2-1-1**  
**Runways With Approach Lights**

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
Approach Lights (Med. Int.)	2	Off	Low	Low	High
Approach Lights (Med. Int.)	3	Off	Low	Med	High
MIRL	3	Off or Low	◆	◆	◆
HIRL	5	Off or Low	◆	◆	◆
VASI	2	Off	★	★	★

**NOTES:** ◆ Predetermined intensity step.  
★ Low intensity for night use. High intensity for day use as determined by photocell control.

**TBL 2-1-2**  
**Runways Without Approach Lights**

Lighting System	No. of Int. Steps	Status During Nonuse Period	Intensity Step Selected Per No. of Mike Clicks		
			3 Clicks	5 Clicks	7 Clicks
MIRL	3	Off or Low	Low	Med.	High
HIRL	5	Off or Low	Step 1 or 2	Step 3	Step 5
LIRL	1	Off	On	On	On
VASI★	2	Off	◆	◆	◆
REIL★	1	Off	Off	On/Off	On
REIL★	3	Off	Low	Med.	High

**NOTES:** ◆ Low intensity for night use. High intensity for day use as determined by photocell control.  
★ The control of VASI and/or REIL may be independent of other lighting systems.

a. With FAA approved systems, various combinations of medium intensity approach lights, runway lights, taxiway lights, VASI and/or REIL may be activated by radio control. On runways with both approach lighting and runway lighting (runway edge lights, taxiway lights, etc.) systems, the approach lighting system takes precedence for air-to-ground radio control over the runway lighting system which is set at a predetermined intensity step, based on expected visibility conditions. Runways without approach lighting may provide radio controlled intensity adjustments of runway edge lights. Other lighting systems, including VASI, REIL, and taxiway lights may be either controlled with the runway edge lights or controlled independently of the runway edge lights.

b. The control system consists of a 3-step control responsive to 7, 5, and/or 3 microphone clicks. This 3-step control will turn on lighting facilities capable of either 3-step, 2-step or 1-step operation. The 3-step and 2-step lighting facilities can be altered in intensity, while the 1-step cannot. All lighting is illuminated for a period of 15 minutes from the most recent time of activation and may not be extinguished prior to end of the 15 minute period (except for 1-step and 2-step REILs which may be turned off when desired by keying the mike 5 or 3 times respectively).

c. Suggested use is to always initially key the mike 7 times; this assures that all controlled lights are turned on to the maximum available intensity. If desired, adjustment can then be made, where the capability is provided, to a lower intensity (or the REIL turned off) by keying 5 and/or 3 times. Due to the close proximity of airports using the same frequency, radio controlled lighting receivers may be set at a low sensitivity requiring the aircraft to be relatively close to activate the system. Consequently, even when lights are on, always key mike as directed when overflying an airport of intended landing or just prior to entering the final segment of an approach. This will assure the aircraft is close enough to activate the system and a full 15 minutes lighting duration is available. Approved lighting systems may be activated by keying the mike (within 5 seconds) as indicated in TBL 2-1-3.

TBL 2-1-3

**Radio Control System**

Key Mike	Function
7 times within 5 seconds	Highest intensity available
5 times within 5 seconds	Medium or lower intensity (Lower REIL or REIL-off)
3 times within 5 seconds	Lowest intensity available (Lower REIL or REIL-off)

d. For all public use airports with FAA standard systems the Chart Supplement contains the types of lighting, runway and the frequency that is used to activate the system. Airports with IAPs include data on the approach chart identifying the light system, the runway on which they are installed, and the frequency that is used to activate the system.

**NOTE-**

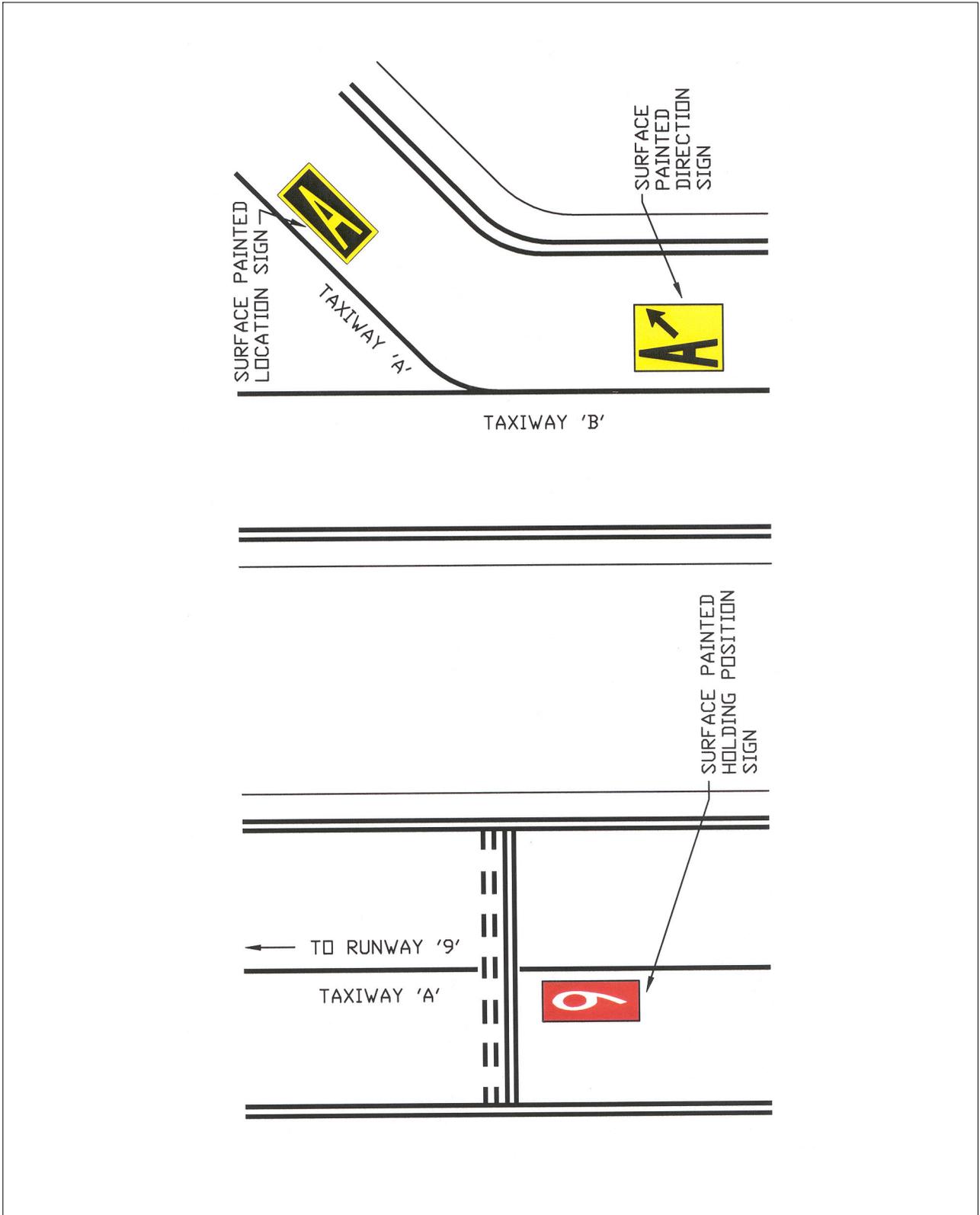
*Although the CTAF is used to activate the lights at many airports, other frequencies may also be used. The appropriate frequency for activating the lights on the airport is provided in the Chart Supplement and the standard instrument approach procedures publications. It is not identified on the sectional charts.*

e. Where the airport is not served by an IAP, it may have either the standard FAA approved control system or an independent type system of different specification installed by the airport sponsor. The Chart Supplement contains descriptions of pilot controlled lighting systems for each airport having other than FAA approved systems, and explains the type lights, method of control, and operating frequency in clear text.

**2-1-9. Airport/Heliport Beacons**

a. Airport and heliport beacons have a vertical light distribution to make them most effective from one to ten degrees above the horizon; however, they can be seen well above and below this peak spread. The beacon may be an omnidirectional capacitor-discharge device, or it may rotate at a constant speed which produces the visual effect of flashes at regular intervals. Flashes may be one or two colors alternately. The total number of flashes are:

FIG 2-3-11  
Surface Painted Signs



## 2-3-5. Holding Position Markings

**a. Runway Holding Position Markings.** For runways, these markings indicate where aircraft MUST STOP when approaching a runway. They consist of four yellow lines, two solid and two dashed, spaced six or twelve inches apart, and extending across the width of the taxiway or runway. The solid lines are always on the side where the aircraft must hold. There are three locations where runway holding position markings are encountered.

**1. Runway Holding Position Markings on Taxiways.** These markings identify the locations on a taxiway where aircraft MUST STOP when a clearance has not been issued to proceed onto the runway. Generally, runway holding position markings also identify the boundary of the runway safety area (RSA) for aircraft exiting the runway. Runway holding position markings are shown in FIG 2-3-13 and FIG 2-3-16. When instructed by ATC, “*Hold short of Runway XX,*” the pilot MUST STOP so that no part of the aircraft extends beyond the runway holding position marking. When approaching runways at airports with an operating control tower, pilots must not cross the runway holding position marking without ATC clearance. Pilots approaching runways at airports without an operating control tower must ensure adequate separation from other aircraft, vehicles, and pedestrians prior to crossing the holding position markings. An aircraft exiting a runway is not clear of the runway until all parts of the aircraft have crossed the applicable holding position marking.

**NOTE-**

*Runway holding position markings identify the beginning of an RSA, and a pilot MUST STOP to get clearance before crossing (at airports with operating control towers).*

**REFERENCE-**

AIM, Para 4-3-21, *Exiting the Runway After Landing.*

**2. Runway Holding Position Markings on Runways.** These markings identify the locations on runways where aircraft MUST STOP. These markings are located on runways used by ATC for Land And Hold Short Operations (for example, see FIG 4-3-8) and Taxiing operations. For taxiing operations, the pilot MUST STOP prior to the holding position markings unless explicitly authorized to cross by ATC. A sign with a white inscription on a red background is located adjacent to these holding position markings. (See FIG 2-3-14.) The holding position markings are placed on runways prior to the intersection with another runway, or some designated point. Pilots receiving and accepting instructions “*Cleared to land Runway XX, hold short of Runway YY*” from ATC must either exit Runway XX prior to the holding position markings, or stop at the holding position markings prior to Runway YY. Otherwise, pilots are authorized to use the entire landing length of the runway and disregard the holding position markings.

**3. Holding Position Markings on Taxiways Located in Runway Approach Areas.** These markings are used at some airports where it is necessary to hold an aircraft on a taxiway located in the approach or departure area of a runway so that the aircraft does not interfere with the operations on that runway. This marking is collocated with the runway approach/departure area holding position sign. When specifically instructed by ATC, “*Hold short of Runway XX approach or Runway XX departure area,*” the pilot MUST STOP so that no part of the aircraft extends beyond the holding position marking. (See Subparagraph 2-3-8b2, Runway Approach Area Holding Position Sign, and FIG 2-3-15.)

**b. Holding Position Markings for Instrument Landing System (ILS).** Holding position markings for ILS critical areas consist of two yellow solid lines spaced two feet apart connected by pairs of solid lines spaced ten feet apart extending across the width of the taxiway as shown. (See FIG 2-3-16.) A sign with an inscription in white on a red background is located adjacent to these hold position markings. When instructed by ATC to hold short of the ILS critical area, pilots MUST STOP so that no part of the aircraft extends beyond the holding position marking. When approaching the holding position marking, pilots must not cross the marking without ATC clearance. The ILS critical area is not clear until all parts of the aircraft have crossed the applicable holding position marking.

**REFERENCE-**

AIM, Para 1-1-9, *Instrument Landing System (ILS).*

**c. Holding Position Markings for Intersecting Taxiways** Holding position markings for intersecting taxiways consist of a single dashed line extending across the width of the taxiway as shown. (See FIG 2-3-17.)

FIG 2-3-14  
Runway Holding Position Markings on Runways

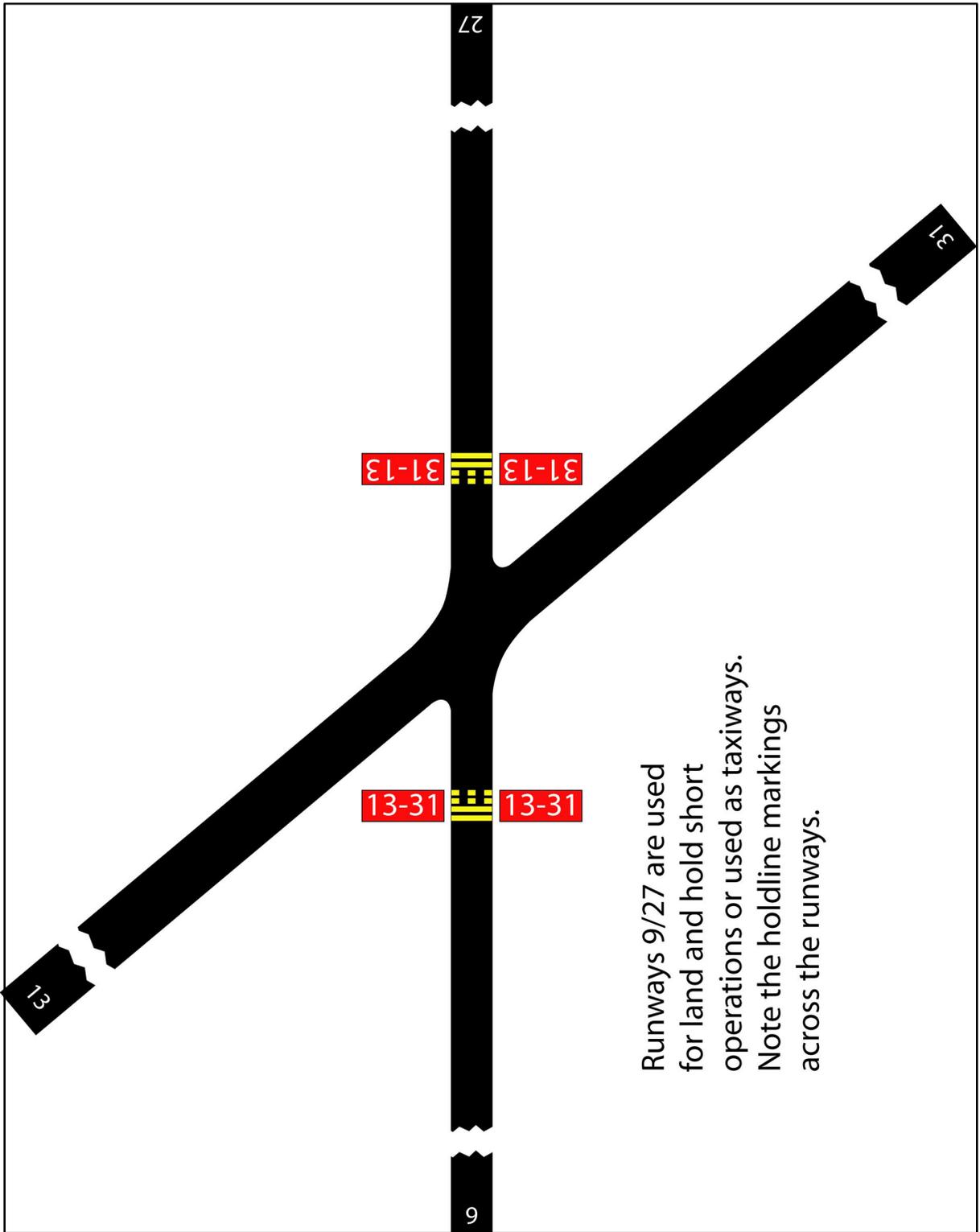
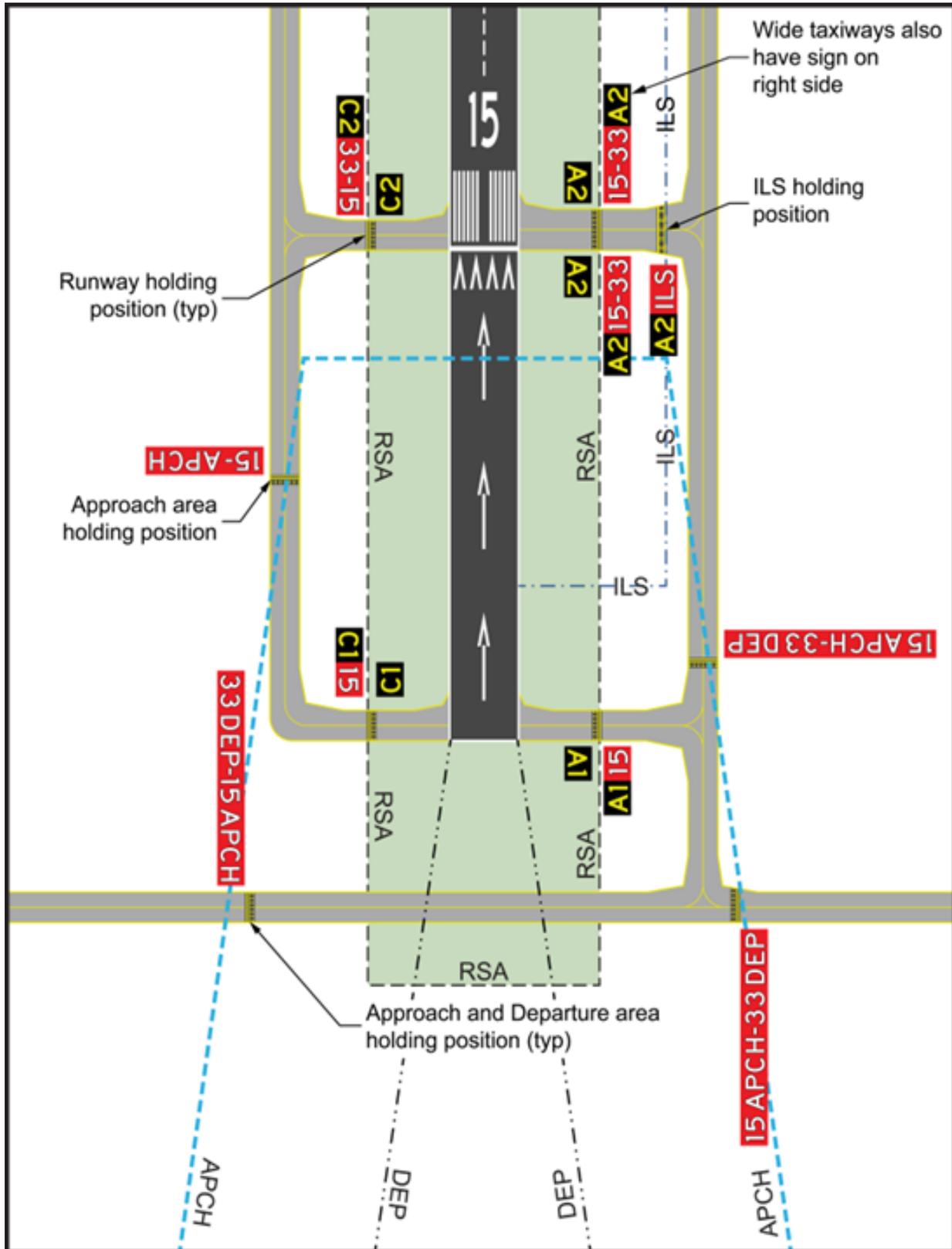


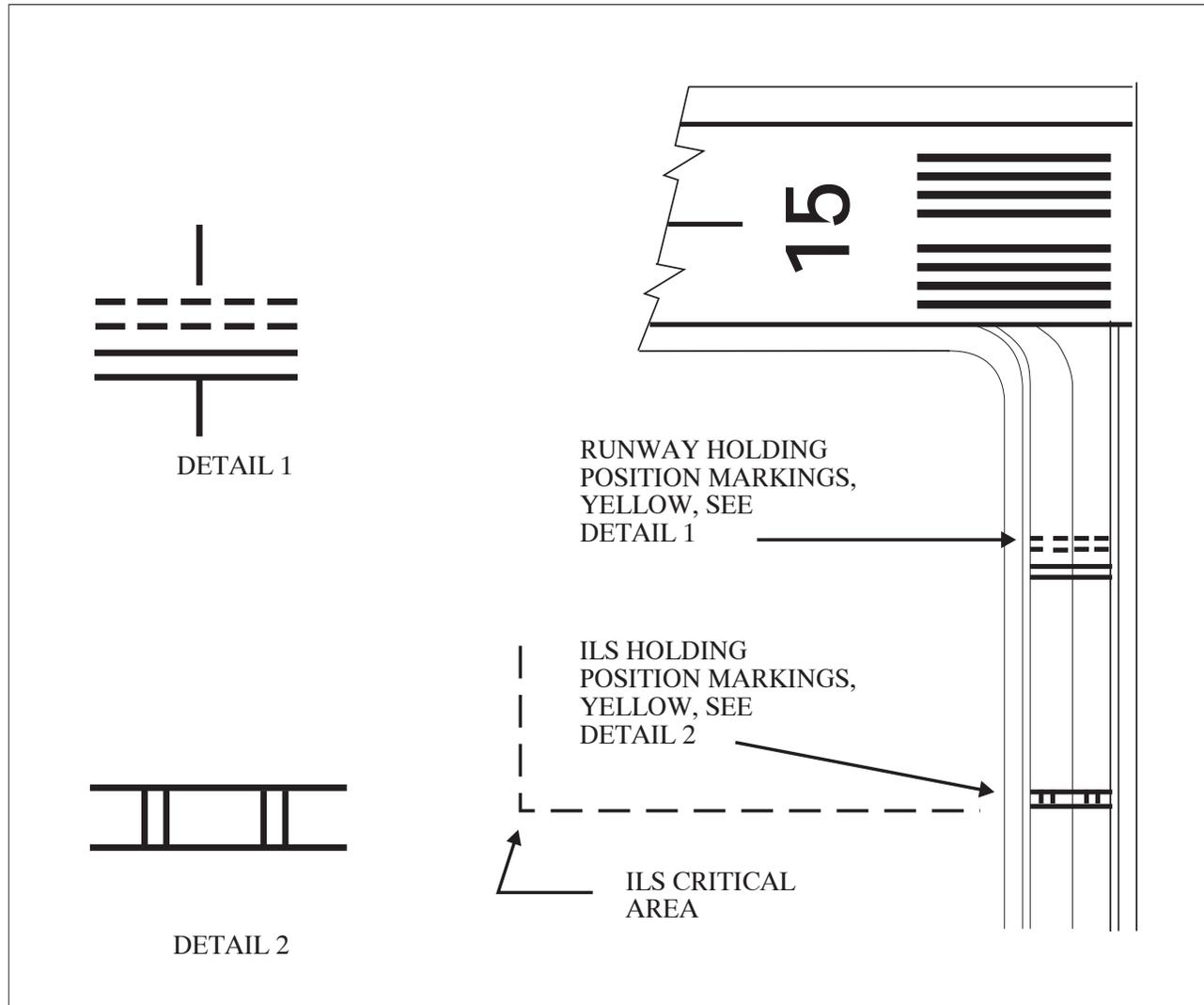
FIG 2-3-15  
Taxiways Located in Runway Approach and Departure Areas



**NOTE—**

1. Refer to Advisory Circular 150/5300-13 for additional information on obstruction surfaces.
2. Because Taxiway C does not enter the departure area of Runway 33, the sign on Taxiway C does not include the “33 DEP” legend.
3. The location of a holding position is relative to the point on the aircraft that infringes the surface; for inclining surfaces such as an approach surface, the location of the holdline position may differ from the location of the infringement point.

FIG 2-3-16

**Holding Position Markings: ILS Critical Area****2-3-6. Other Markings**

**a. Vehicle Roadway Markings.** The vehicle roadway markings are used when necessary to define a pathway for vehicle operations on or crossing areas that are also intended for aircraft. These markings consist of a white solid line to delineate each edge of the roadway and a dashed line to separate lanes within the edges of the roadway. In lieu of the solid lines, zipper markings may be used to delineate the edges of the vehicle roadway. (See FIG 2-3-18.) Details of the zipper markings are shown in FIG 2-3-19.

**b. VOR Receiver Checkpoint Markings.** The VOR receiver checkpoint marking allows the pilot to check aircraft instruments with navigational aid signals. It consists of a painted circle with an arrow in the middle; the arrow is aligned in the direction of the checkpoint azimuth. This marking, and an associated sign, is located on

the airport apron or taxiway at a point selected for easy access by aircraft but where other airport traffic is not to be unduly obstructed. (See FIG 2-3-20.)

**NOTE-**

The associated sign contains the VOR station identification letter and course selected (published) for the check, the words "VOR check course," and DME data (when applicable). The color of the letters and numerals are black on a yellow background.

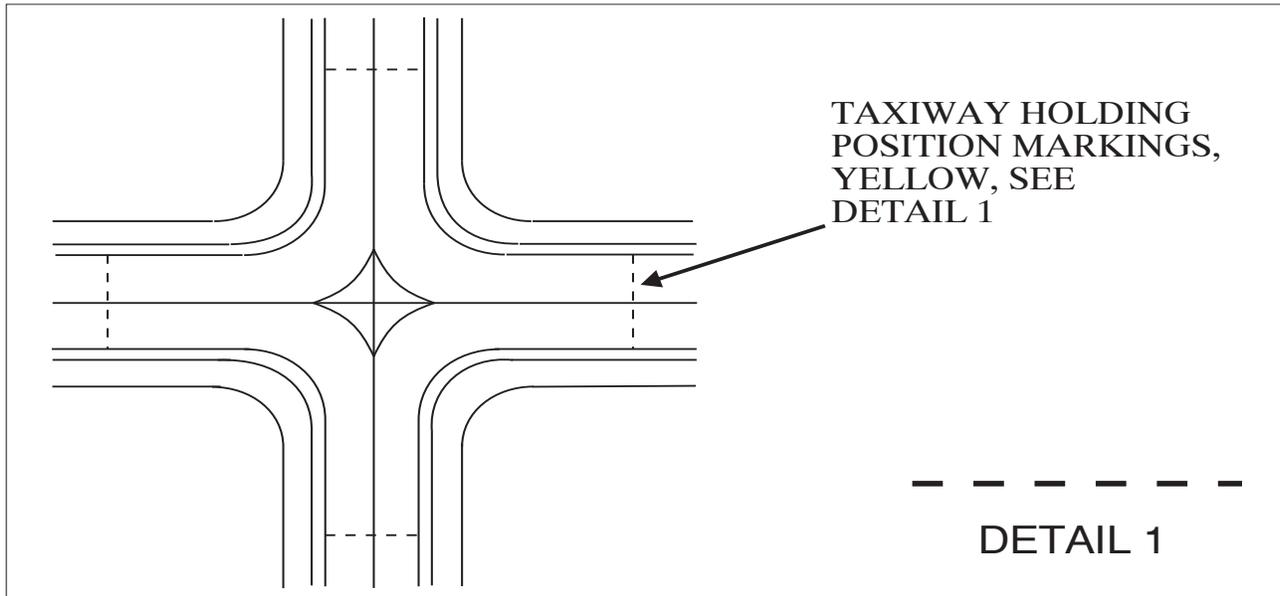
**EXAMPLE-**

DCA 176-356

VOR check course

DME XXX

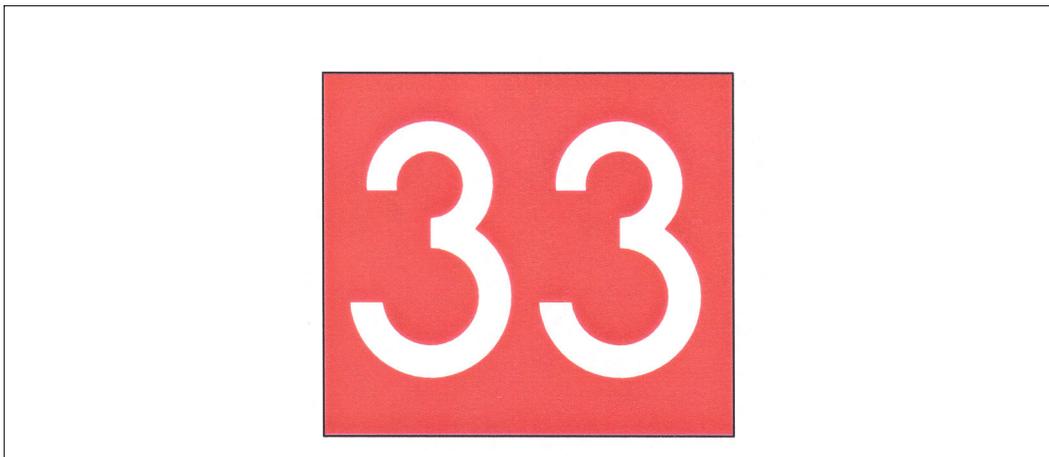
**FIG 2-3-17**  
**Holding Position Markings: Taxiway/Taxiway Intersections**



*FIG 2-3-24*  
**Runway Holding Position Sign**



*FIG 2-3-25*  
**Holding Position Sign at Beginning of Takeoff Runway**



### **2-3-8. Mandatory Instruction Signs**

a. These signs have a red background with a white inscription and are used to denote:

1. An entrance to a runway or critical area; and
2. Areas where an aircraft is prohibited from entering.

b. **Typical mandatory signs and applications are:**

**1. Runway Holding Position Sign.** This sign is located at the holding position on taxiways that intersect a runway or on runways that intersect other runways. The inscription on the sign contains the designation of the intersecting runway, as shown in FIG 2-3-24. The runway numbers on the sign are arranged to correspond to the respective runway threshold. For example, “15-33” indicates that the threshold for Runway 15 is to the left and the threshold for Runway 33 is to the right.

(a) On taxiways that intersect the beginning of the takeoff runway, only the designation of the takeoff runway may appear on the sign (as shown in FIG 2-3-25), while all other signs will have the designation of both runway directions.

FIG 2-3-26

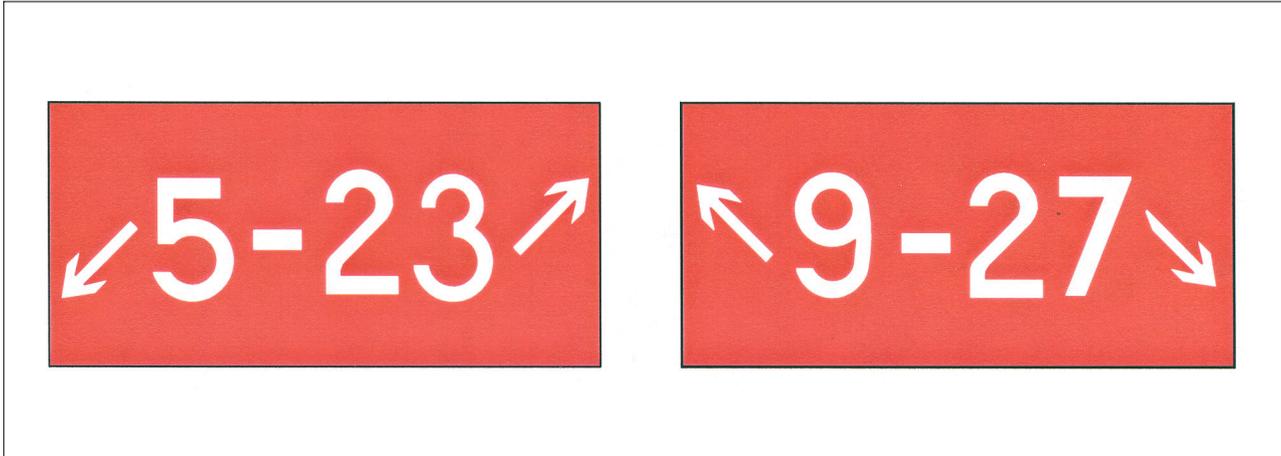
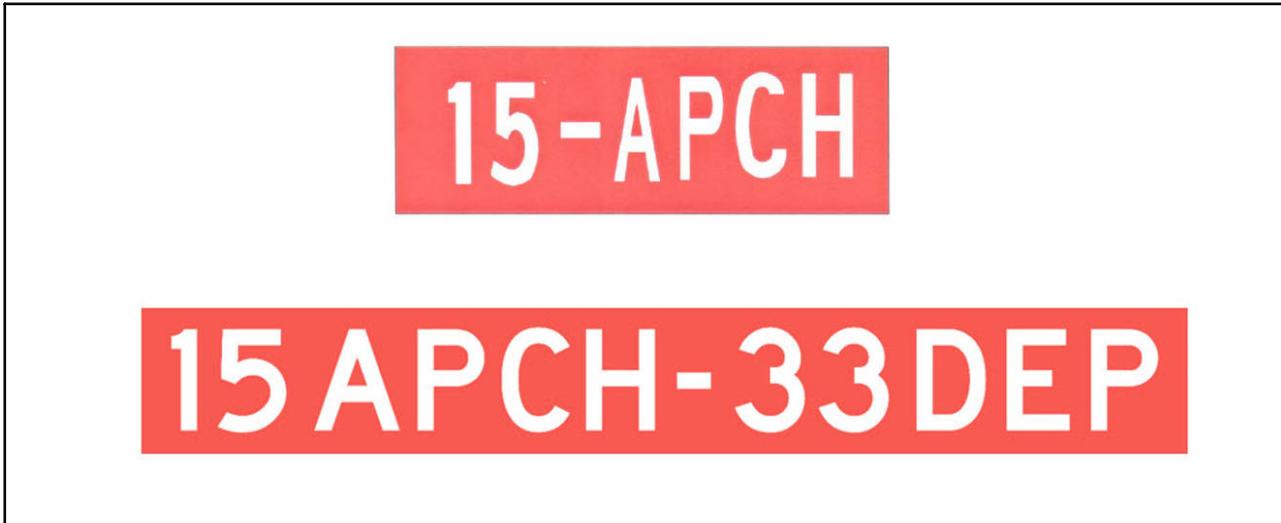
**Holding Position Sign for a Taxiway that Intersects the Intersection of Two Runways**

FIG 2-3-27

**Holding Position Sign for Runway Approach and Departure Areas**

(b) If the sign is located on a taxiway that intersects the intersection of two runways, the designations for both runways will be shown on the sign along with arrows showing the approximate alignment of each runway, as shown in FIG 2-3-26. In addition to showing the approximate runway alignment, the arrow indicates the direction to the threshold of the runway whose designation is immediately next to the arrow.

(c) A runway holding position sign on a taxiway will be installed adjacent to holding position markings on the taxiway pavement. On runways, holding position markings will be located only on the runway pavement adjacent to the sign, if the runway is normally used by ATC for “Land, Hold Short” operations or as a taxiway. The holding position markings are described in paragraph 2-3-5, Holding Position Markings.

**2. Runway Approach Area Holding Position Sign.** At some airports, it is necessary to hold an aircraft on a taxiway located in the approach or departure area for a runway so that the aircraft does not interfere with operations on that runway. FIG 2-3-15 depicts common situations. A sign with the runway designation(s) and the protected area(s) will be located at applicable holding positions on the taxiway. For locations protecting only the approach area, the holding position on the taxiway includes a sign identifying the approach end runway designation (e.g., 15) followed by a dash (-) and the letters “APCH”. For locations protecting both the approach and departure areas, the holding position on the taxiway includes a sign with the approach end runway

designation and letters “APCH” followed by a dash (-), the departure end runway designation and the letters “DEP”. The arrangement of the runway designations and protected areas legend on the sign reflects the orientation of the runway as viewed from the holding position. Holding position markings in accordance with paragraph 2-3-5, Holding Position Markings, are co-located on the taxiway pavement in line with the sign. Examples of these signs are shown in FIG 2-3-27.

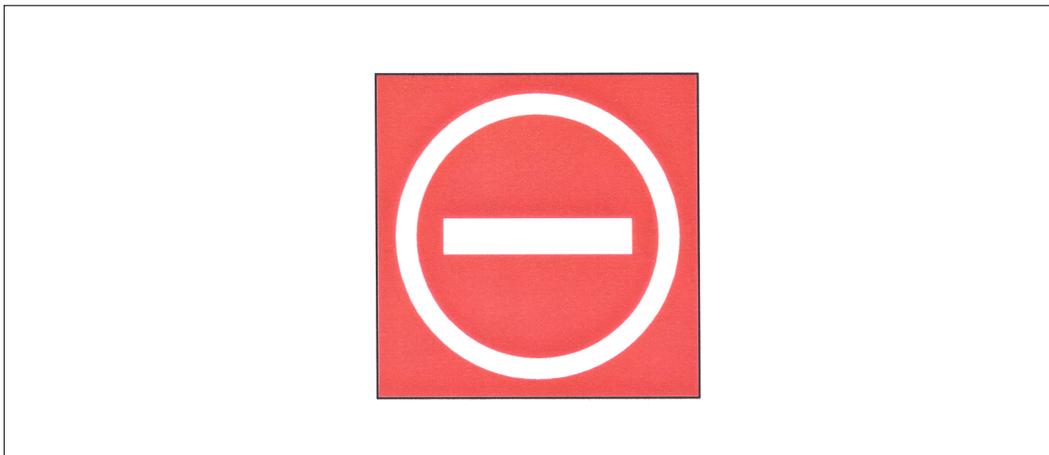
FIG 2-3-28

#### Holding Position Sign for ILS Critical Area



FIG 2-3-29

#### Sign Prohibiting Aircraft Entry into an Area



**3. ILS Critical Area Holding Position Sign.** At some airports, when the instrument landing system is being used, it is necessary to hold an aircraft on a taxiway at a location other than the holding position described in Paragraph 2-3-5, Holding Position Markings. In these situations, the holding position sign for these operations will have the inscription “ILS” and be located adjacent to the holding position marking on the taxiway described in paragraph 2-3-5. An example of this sign is shown in FIG 2-3-28.

**4. No Entry Sign.** This sign, shown in FIG 2-3-29, prohibits an aircraft from entering an area. Typically, this sign would be located on a taxiway intended to be used in only one direction or at the intersection of vehicle roadways with runways, taxiways, or aprons where the roadway may be mistaken as a taxiway or other aircraft movement surface.

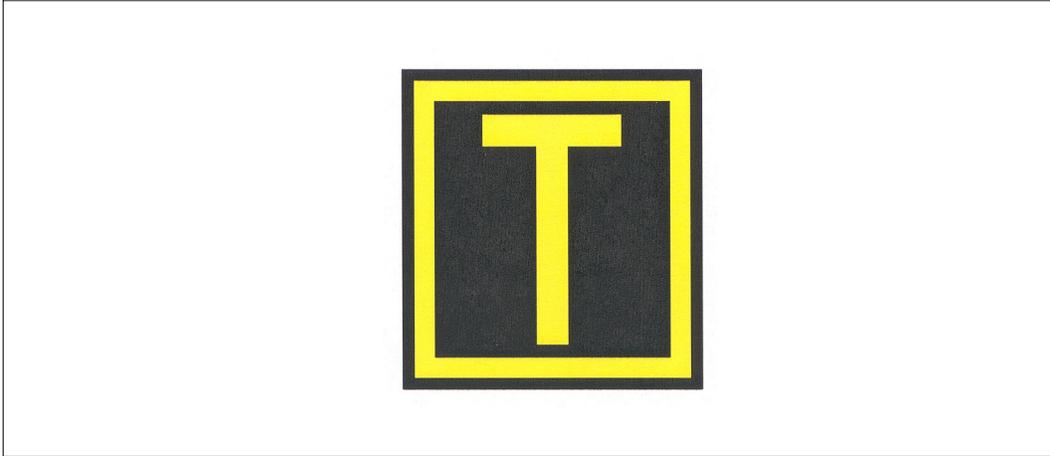
**NOTE-**

*Holding position signs provide the pilot with a visual cue as to the location of the holding position marking.*

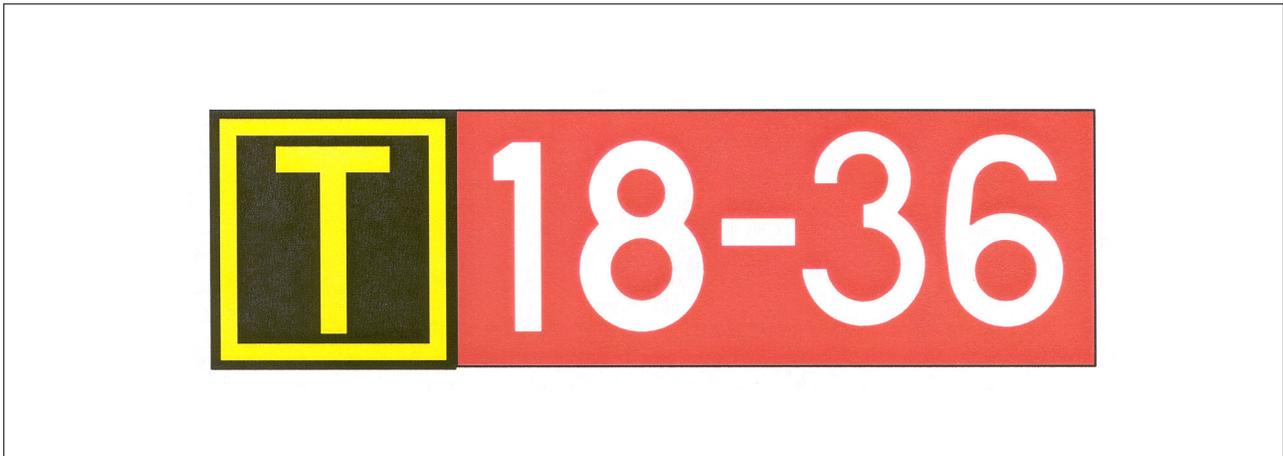
**REFERENCE-**

*AIM, Para 2-3-5, Holding Position Markings.*

*FIG 2-3-30*  
**Taxiway Location Sign**



*FIG 2-3-31*  
**Taxiway Location Sign Collocated with Runway Holding Position Sign**



### **2-3-9. Location Signs**

a. Location signs are used to identify either a taxiway or runway on which the aircraft is located. Other location signs provide a visual cue to pilots to assist them in determining when they have exited an area. The various location signs are described below.

**1. Taxiway Location Sign.** This sign has a black background with a yellow inscription and yellow border, as shown in FIG 2-3-30. The inscription is the designation of the taxiway on which the aircraft is located. These signs are installed along taxiways either by themselves or in conjunction with direction signs or runway holding position signs. (See FIG 2-3-35 and FIG 2-3-31.)

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.

**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 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. 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 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 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 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 30 days in advance. Approval authority rests with the FSS manager and is based on workload and resource availability.*

**REFERENCE-**

*AIM, Para 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, Para 9–1–5, Subpara a, National Geospatial–Intelligence Agency (NGA) Products.*

**e.** DoD FLIP– Department of Defense Flight Information Publications describe IR/VR routes through charts and narratives, and the FAA provides information regarding these routes to all users via IFR and VFR charts.

**NOTE–**

*DoD users that require copies of FLIP should 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/](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

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.

**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.

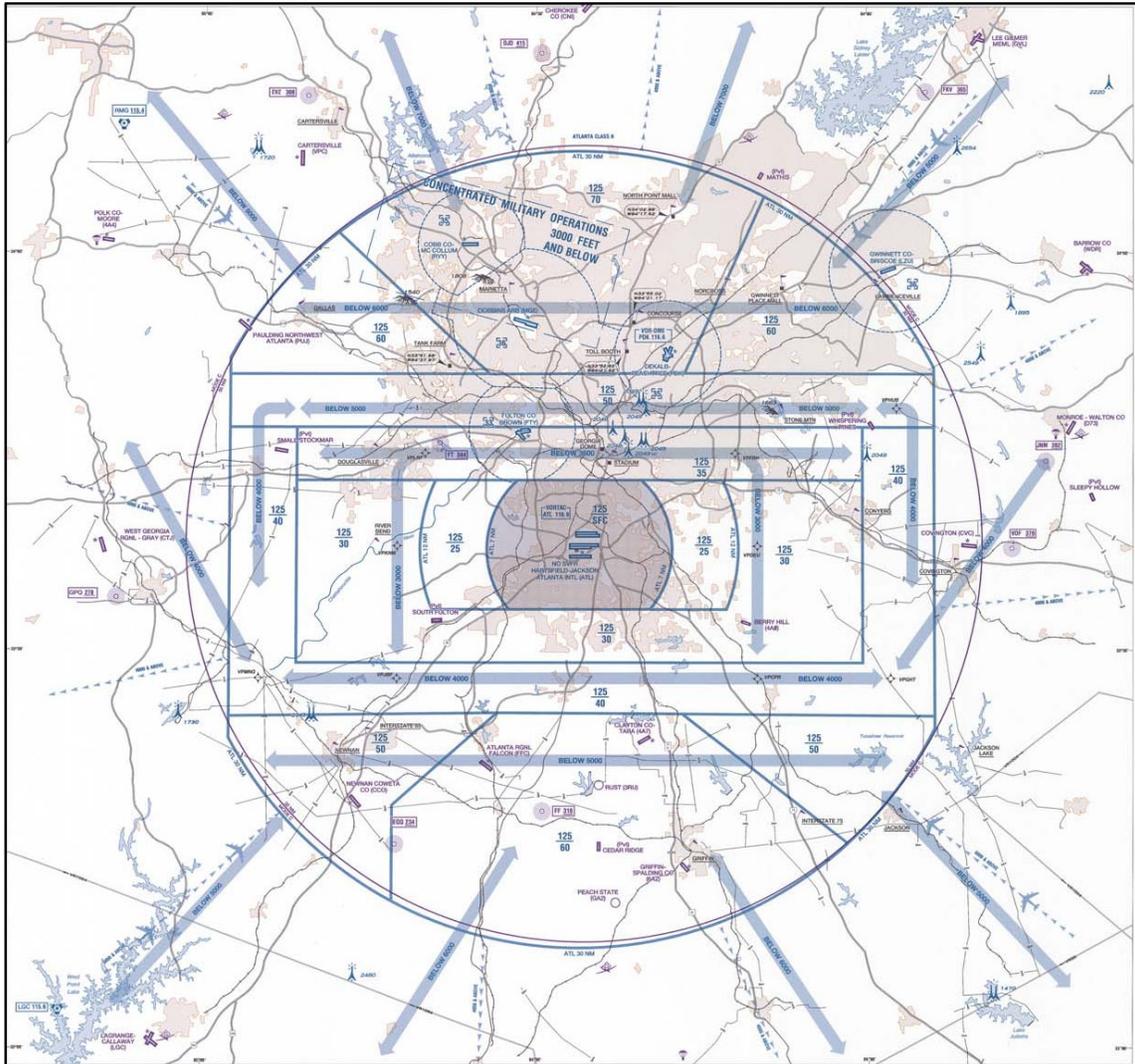
### **3–5–5. Published VFR Routes**

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.

**FIG 3-5-1  
VFR Flyway Planning Chart**



2. VFR Flyways are depicted on the reverse side of some of the VFR Terminal Area Charts (TAC), commonly referred to as Class B airspace charts. (See FIG 3-5-1.) Eventually all TACs will include a VFR Flyway Planning Chart. These charts identify VFR flyways designed to help VFR pilots avoid major controlled traffic flows. They may further depict multiple VFR routings throughout the area which may be used as an alternative to flight within Class B airspace. The ground references provide a guide for improved visual navigation. These routes are not intended to discourage requests for VFR operations within Class B airspace but are designed solely to assist pilots in planning for flights under and around busy Class B airspace without actually entering Class B airspace.

3. It is very important to remember that these suggested routes are not sterile of other traffic. The entire Class B airspace, and the airspace underneath it, may be heavily congested with many different types of aircraft. Pilot

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 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.*

TBL 4-1-1

Summary of Recommended Communication Procedures

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

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

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

**c. Recommended Traffic Advisory Practices**

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

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

*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 Balloon <b>(not to be used for advisory service)</b> .	123.300 123.500
Assignment to flight test land and aircraft stations (not for air-to-air communication except for those aircraft operating in an oceanic FIR).	123.400 <sup>1</sup> 123.450 <sup>2</sup>

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

<sup>2</sup>Mobile 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 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).

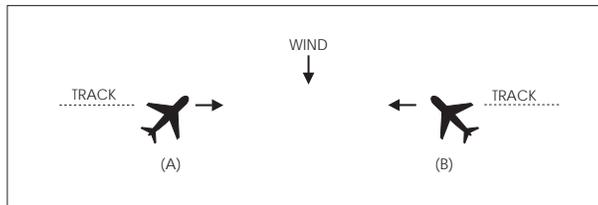
(c) Type of aircraft and altitude if known.

**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.

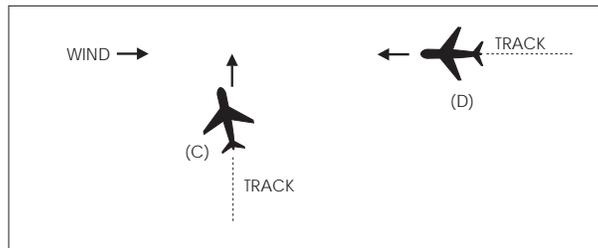
**FIG 4-1-1  
Induced Error in Position of Traffic**



**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 Juliett, 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). 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 INSTRUCTION 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. 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.

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.

#### 4-2-13. Communications with Tower when Aircraft Transmitter or Receiver or Both are Inoperative

##### a. Arriving Aircraft.

##### 1. Receiver inoperative.

(a) If you have reason to believe your receiver is inoperative, remain outside or above the Class D surface area until the direction and flow of traffic has been determined; then, advise the tower of your type aircraft, position, altitude, intention to land, and request that you be controlled with light signals.

**REFERENCE-**

*AIM, Para 4-3-13, Traffic Control Light Signals.*

(b) When you are approximately 3 to 5 miles from the airport, advise the tower of your position and join the airport traffic pattern. From this point on, watch the tower for light signals. Thereafter, if a complete pattern is made, transmit your position downwind and/or turning base leg.

**2. Transmitter inoperative.** Remain outside or above the Class D surface area until the direction and flow of traffic has been determined; then, join the airport traffic pattern. Monitor the primary local control frequency as depicted on Sectional Charts for landing or traffic information, and look for a light signal which may be addressed to your aircraft. During hours of daylight, acknowledge tower transmissions or light signals by rocking your wings. At night, acknowledge by blinking the landing or navigation lights. To acknowledge tower transmissions during daylight hours, hovering helicopters will turn in the direction of the controlling facility and flash the landing light. While in flight, helicopters should show their acknowledgement of receiving a transmission by making shallow banks in opposite directions. At night, helicopters will acknowledge receipt of transmissions by flashing either the landing or the search light.

**3. Transmitter and receiver inoperative.** Remain outside or above the Class D surface area until the direction and flow of traffic has been determined; then, join the airport traffic pattern and maintain visual contact with the tower to receive light signals. Acknowledge light signals as noted above.

**b. Departing Aircraft.** If you experience radio failure prior to leaving the parking area, make every effort to have the equipment repaired. If you are unable to have the malfunction repaired, call the tower by telephone and request authorization to depart without two-way radio communications. If tower authorization is granted, you will be given departure information and requested to monitor the tower frequency or watch for light signals as appropriate. During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

**REFERENCE-**

*14 CFR Section 91.125 and 14 CFR Section 91.129.*

#### 4-2-14. Communications for VFR Flights

a. FSSs and Supplemental Weather Service Locations (SWSL) are allocated frequencies for different functions; for example, in Alaska, certain FSSs provide Local Airport Advisory on 123.6 MHz or other frequencies which can be found in the Chart Supplement. If you are in doubt as to what frequency to use, 122.2 MHz is assigned to the majority of FSSs as a common en route simplex frequency.

**NOTE-**

*In order to expedite communications, state the frequency being used and the aircraft location during initial callup.*

**EXAMPLE-**

*Dayton radio, November One Two Three Four Five on one two two point two, over Springfield V-O-R, over.*

b. Certain VOR voice channels are being utilized for recorded broadcasts; for example, ATIS. These services and appropriate frequencies are listed in the Chart Supplement. On VFR flights, pilots are urged to monitor these frequencies. When in contact with a control facility, notify the controller if you plan to leave the frequency to monitor these broadcasts.



tower controller who may have radar available, do not assume that constant radar monitoring and complete ATC radar services are being provided.

### 4-3-3. Traffic Patterns

a. It is recommended that aircraft enter the airport traffic pattern at one of the following altitudes listed below. These altitudes should be maintained unless another traffic pattern altitude is published in the Chart Supplement or unless otherwise required by the applicable distance from cloud criteria (14 CFR Section 91.155). (See FIG 4-3-2 and FIG 4-3-3):

1. Propeller-driven aircraft enter the traffic pattern at 1,000 feet above ground level (AGL).

2. Large and turbine-powered aircraft enter the traffic pattern at an altitude of not less than 1,500 feet AGL or 500 feet above the established pattern altitude.

3. Helicopters operating in the traffic pattern may fly a pattern similar to the fixed-wing aircraft pattern, but at a lower altitude (500 AGL) and closer to the runway. This pattern may be on the opposite side of the runway from fixed-wing traffic when airspeed requires or for practice power-off landings (autorotation) and if local policy permits. Landings not to the runway must avoid the flow of fixed wing traffic.

b. A pilot may vary the size of the traffic pattern depending on the aircraft's performance characteristics. Pilots of en route aircraft should be constantly alert for aircraft in traffic patterns and avoid these areas whenever possible.

c. Unless otherwise indicated, all turns in the traffic pattern must be made to the left, except for helicopters, as applicable.

d. On Sectional, Aeronautical, and VFR Terminal Area Charts, right traffic patterns are indicated at public-use and joint-use airports with the abbreviation "RP" (for Right Pattern), followed by the appropriate runway number(s) at the bottom of the airport data block.

**EXAMPLE-**  
*RP 9, 18, 22R*

**NOTE-**

1. *Pilots are encouraged to use the standard traffic pattern. However, those pilots who choose to execute a straight-in approach, maneuvering for and execution of the approach should not disrupt the flow of arriving and departing traffic. Likewise, pilots operating in the traffic pattern should be alert at all times for aircraft executing straight-in approaches.*

**REFERENCE-**

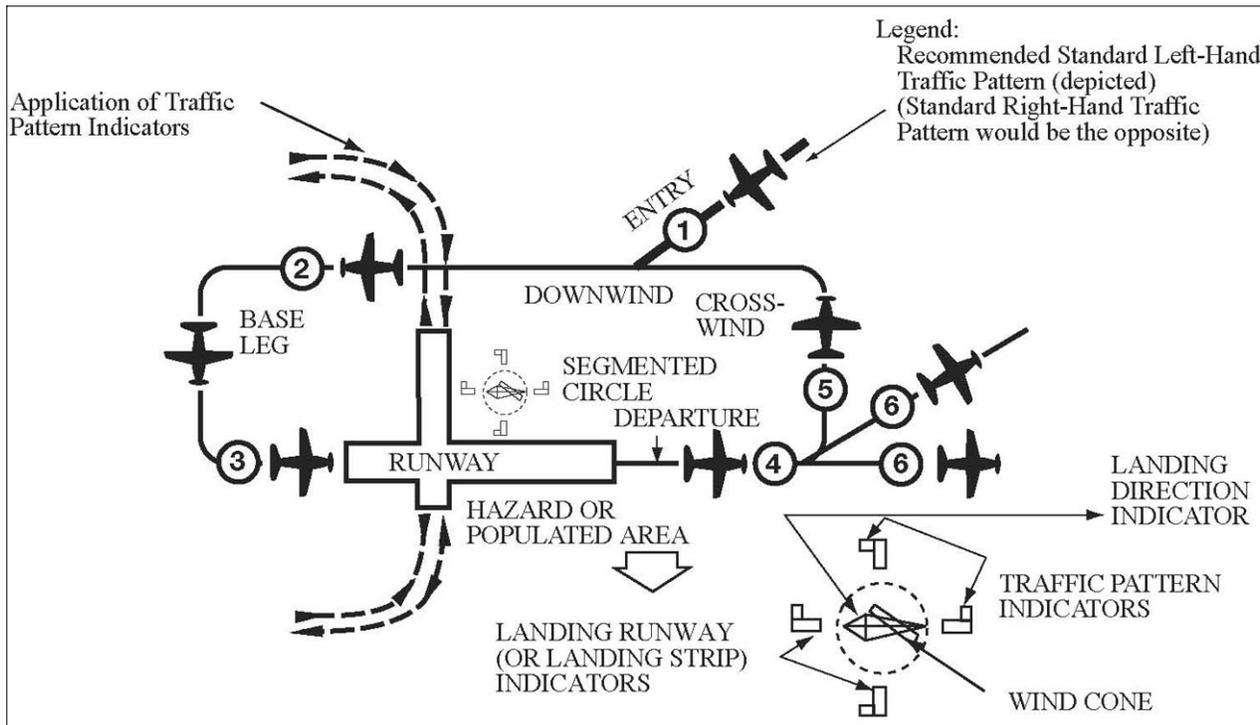
*AC 90-66B, Non-Towered Airport Flight Operations.*

2. *\*RP indicates special conditions exist and refers pilots to the Chart Supplement.*

3. *Right traffic patterns are not shown at airports with full-time control towers.*

e. Wind conditions affect all airplanes in varying degrees. Figure 4-3-4 is an example of a chart used to determine the headwind, crosswind, and tailwind components based on wind direction and velocity relative to the runway. Pilots should refer to similar information provided by the aircraft manufacturer when determining these wind components.

**FIG 4-3-2**  
**Traffic Pattern Operations**  
**Single Runway**



**EXAMPLE-**  
**Key to traffic pattern operations**

1. Enter pattern in level flight, abeam the midpoint of the runway, at pattern altitude.
2. Maintain pattern altitude until abeam approach end of the landing runway on downwind leg.
3. Complete turn to final at least  $\frac{1}{4}$  mile from the runway.
4. Continue straight ahead until beyond departure end of runway.
5. If remaining in the traffic pattern, commence turn to crosswind leg beyond the departure end of the runway within 300 feet of pattern altitude.
6. If departing the traffic pattern, continue straight out, or exit with a 45 degree turn (to the left when in a left-hand traffic pattern; to the right when in a right-hand traffic pattern) beyond the departure end of the runway, after reaching pattern altitude.

Supplement. For runways without published declared distances, the declared distances may be assumed to be equal to the physical length of the runway unless there is a displaced landing threshold, in which case the Landing Distance Available (LDA) is shortened by the amount of the threshold displacement.

**NOTE–**

A symbol **D** is shown on U.S. Government charts to indicate that runway declared distance information is available (See appropriate Chart Supplement, Chart Supplement Alaska or Pacific).

(a) The FAA uses the following definitions for runway declared distances (See FIG 4–3–5):

**REFERENCE–**

*Pilot/Controller Glossary Terms: “Accelerate–Stop Distance Available,” “Landing Distance Available,” “Takeoff Distance Available,” “Takeoff Run Available,” “Stopway,” and “Clearway.”*

(1) Takeoff Run Available (TORA) – The runway length declared available and suitable for the ground run of an airplane taking off.

The TORA is typically the physical length of the runway, but it may be shorter than the runway length if necessary to satisfy runway design standards. For example, the TORA may be shorter than the runway length if a portion of the runway must be used to satisfy runway protection zone requirements.

(2) Takeoff Distance Available (TODA) – The takeoff run available plus the length of any remaining runway or clearway beyond the far end of the takeoff run available.

The TODA is the distance declared available for satisfying takeoff distance requirements for airplanes where the certification and operating rules and available performance data allow for the consideration of a clearway in takeoff performance computations.

**NOTE–**

*The length of any available clearway will be included in the TODA published in the entry for that runway end within the Chart Supplement.*

(3) Accelerate–Stop Distance Available (ASDA) – The runway plus stopway length declared available and suitable for the acceleration and deceleration of an airplane aborting a takeoff.

The ASDA may be longer than the physical length of the runway when a stopway has been designated available by the airport operator, or it may be shorter than the physical length of the runway if necessary to use a portion of the runway to satisfy runway design standards; for example, where the airport operator uses a portion of the runway to achieve the runway safety area requirement. ASDA is the distance used to satisfy the airplane accelerate–stop distance performance requirements where the certification and operating rules require accelerate–stop distance computations.

**NOTE–**

*The length of any available stopway will be included in the ASDA published in the entry for that runway end within the Chart Supplement.*

(4) Landing Distance Available (LDA) – The runway length declared available and suitable for a landing airplane.

The LDA may be less than the physical length of the runway or the length of the runway remaining beyond a displaced threshold if necessary to satisfy runway design standards; for example, where the airport operator uses a portion of the runway to achieve the runway safety area requirement.

Although some runway elements (such as stopway length and clearway length) may be available information, pilots must use the declared distances determined by the airport operator and not attempt to independently calculate declared distances by adding those elements to the reported physical length of the runway.

(b) The airplane operating rules and/or the airplane operating limitations establish minimum distance requirements for takeoff and landing and are based on performance data supplied in the Airplane Flight Manual or Pilot’s Operating Handbook. The minimum distances required for takeoff and landing obtained either in planning prior to takeoff or in performance assessments conducted at the time of landing must fall within the applicable declared distances before the pilot can accept that runway for takeoff or landing.

(c) Runway design standards may impose restrictions on the amount of runway available for use in takeoff and landing that are not apparent from the reported physical length of the runway or from runway markings and lighting. The runway elements of Runway Safety Area (RSA), Runway Object Free Area (ROFA), and Runway Protection Zone (RPZ) may reduce a runway's declared distances to less than the physical length of the runway at geographically constrained airports (See FIG 4-3-6). When considering the amount of runway available for use in takeoff or landing performance calculations, the declared distances published for a runway must always be used in lieu of the runway's physical length.

**REFERENCE-**

*AC 150/5300-13, Airport Design.*

(d) While some runway elements associated with declared distances may be identifiable through runway markings or lighting (for example, a displaced threshold or a stopway), the individual declared distance limits are not marked or otherwise identified on the runway. An aircraft is not prohibited from operating beyond a declared distance limit during the takeoff, landing, or taxi operation provided the runway surface is appropriately marked as usable runway (See FIG 4-3-6). The following examples clarify the intent of this paragraph.

**REFERENCE-**

*AIM, Para 2-3-3, Runway Markings.*

*AC 150/5340-1, Standards for Airport Markings.*

**EXAMPLE-**

**1.** *The declared LDA for runway 9 must be used when showing compliance with the landing distance requirements of the applicable airplane operating rules and/or airplane operating limitations or when making a before landing performance assessment. The LDA is less than the physical runway length, not only because of the displaced threshold, but also because of the subtractions necessary to meet the RSA beyond the far end of the runway. However, during the actual landing operation, it is permissible for the airplane to roll beyond the unmarked end of the LDA.*

**2.** *The declared ASDA for runway 9 must be used when showing compliance with the accelerate-stop distance requirements of the applicable airplane operating rules and/or airplane operating limitations. The ASDA is less than the physical length of the runway due to subtractions necessary to achieve the full RSA requirement. However, in the event of an aborted takeoff, it is permissible for the airplane to roll beyond the unmarked end of the ASDA as it is brought to a full-stop on the remaining usable runway.*

**EXAMPLE–**

*Wind shear alert, airport wind 230 at 8, south boundary wind 170 at 20.*

b. LLWAS “network expansion,” (LLWAS NE) and LLWAS Relocation/Sustainment (LLWAS–RS) are systems integrated with TDWR. These systems provide the capability of detecting microburst alerts and wind shear alerts. Controllers will issue the appropriate wind shear alerts or microburst alerts. In some of these systems controllers also have the ability to issue wind information oriented to the threshold or departure end of the runway.

**EXAMPLE–**

*Runway 17 arrival microburst alert, 40 knot loss 3 mile final.*

**REFERENCE–**

*AIM, Para 7–1–24, Microbursts.*

c. More advanced systems are in the field or being developed such as ITWS. ITWS provides alerts for microbursts, wind shear, and significant thunderstorm activity. ITWS displays wind information oriented to the threshold or departure end of the runway.

d. The WSP provides weather processor enhancements to selected Airport Surveillance Radar (ASR)–9 facilities. The WSP provides Air Traffic with detection and alerting of hazardous weather such as wind shear, microbursts, and significant thunderstorm activity. The WSP displays 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. Controllers will receive and issue alerts based on Areas Noted for Attention (ARENA). An ARENA extends on the runway center line from a 3 mile final to the runway to a 2 mile departure.

e. An airport equipped with the LLWAS, ITWS, or WSP is so indicated in the Chart Supplement under Weather Data Sources for that particular airport.

**4–3–8. Braking Action Reports and Advisories**

a. When available, ATC furnishes pilots the quality of braking action received from pilots. The quality of braking action is described by the terms “good,” “good to medium,” “medium,” “medium to poor,” “poor,” and “nil.” When pilots report the quality of braking action by using the terms noted above, they should use descriptive terms that are easily understood, such as, “braking action poor the first/last half of the runway,” together with the particular type of aircraft.

b. FICON NOTAMs will provide contaminant measurements for paved runways; however, a FICON NOTAM for braking action will only be used for non–paved runway surfaces, taxiways, and aprons. These NOTAMs are classified according to the most critical term (“good to medium,” “medium,” “medium to poor,” and “poor”).

1. FICON NOTAM reporting of a braking condition for paved runway surfaces is not permissible by Federally Obligated Airports or those airports certificated under 14 CFR Part 139.

2. A “NIL” braking condition at these airports must be mitigated by closure of the affected surface. Do not include the type of vehicle in the FICON NOTAM.

c. When tower controllers receive runway braking action reports which include the terms medium, poor, or nil, or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement, “*BRAKING ACTION ADVISORIES ARE IN EFFECT.*”

d. During the time that braking action advisories are in effect, ATC will issue the most recent braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not issued by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

**4–3–9. Runway Condition Reports**

a. Aircraft braking coefficient is dependent upon the surface friction between the tires on the aircraft wheels and the pavement surface. Less friction means less aircraft braking coefficient and less aircraft braking response.

**b.** Runway condition code (RwyCC) values range from 1 (poor) to 6 (dry). For frozen contaminants on runway surfaces, a runway condition code reading of 4 indicates the level when braking deceleration or directional control is between good and medium.

**NOTE–**

*A RwyCC of “0” is used to delineate a braking action report of NIL and is prohibited from being reported in a FICON NOTAM.*

**c.** Airport management should conduct runway condition assessments on wet runways or runways covered with compacted snow and/or ice.

**1.** Numerical readings may be obtained by using the Runway Condition Assessment Matrix (RCAM). The RCAM provides the airport operator with data to complete the report that includes the following:

- (a)** Runway(s) in use
- (b)** Time of the assessment
- (c)** Runway condition codes for each zone (touchdown, mid–point, roll–out)
- (d)** Pilot–reported braking action report (if available)
- (e)** The contaminant (for example, wet snow, dry snow, slush, ice, etc.)

**2.** Assessments for each zone (see 4–3–9c1(c)) will be issued in the direction of takeoff and landing on the runway, ranging from “1” to “6” to describe contaminated surfaces.

**NOTE–**

*A RwyCC of “0” is used to delineate a braking action report of NIL and is prohibited from being reported in a FICON NOTAM.*

**3.** When any 1 or more runway condition codes are reported as less than 6, airport management must notify ATC for dissemination to pilots.

**4.** Controllers will not issue runway condition codes when all 3 segments of a runway are reporting values of 6.

**d.** When runway condition code reports are provided by airport management, the ATC facility providing approach control or local airport advisory must provide the report to all pilots.

**e.** Pilots should use runway condition code information with other knowledge including aircraft performance characteristics, type, and weight, previous experience, wind conditions, and aircraft tire type (such as bias ply vs. radial constructed) to determine runway suitability.

**f.** The Runway Condition Assessment Matrix identifies the descriptive terms “good,” “good to medium,” “medium,” “medium to poor,” “poor,” and “nil” used in braking action reports.

**REFERENCE–**

*Advisory Circular AC 91–79A (Revision 1), Mitigating the Risks of a Runway Overrun Upon Landing, Appendix 1.*

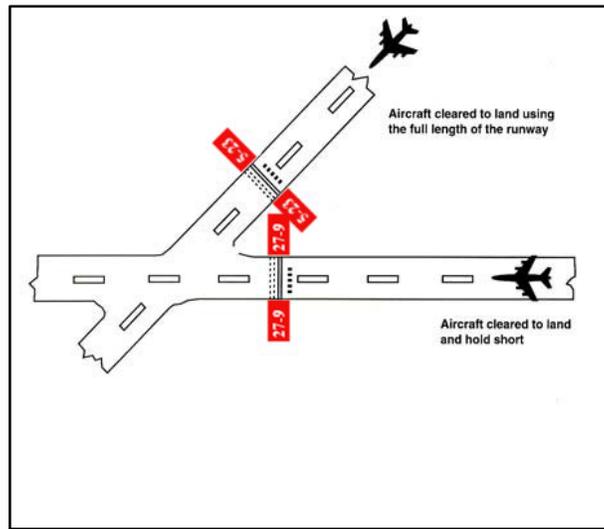
Available Landing Distance (ALD). ALD data are published in the Chart Supplement and in the U.S. Terminal Procedures Publications. Controllers will also provide ALD data upon request. Student pilots or pilots not familiar with LAHSO should not participate in the program.

3. The pilot-in-command has the final authority to accept or decline any land and hold short clearance. The safety and operation of the aircraft remain the responsibility of the pilot. Pilots are expected to decline a LAHSO clearance if they determine it will compromise safety.

4. To conduct LAHSO, pilots should become familiar with all available information concerning LAHSO at their destination airport. Pilots should have, *readily available*, the published ALD and runway slope information for all LAHSO runway combinations at each airport of intended landing. Additionally, knowledge about landing performance data permits the pilot to *readily* determine that the ALD for the assigned runway is sufficient for safe LAHSO. As part of a pilot's preflight planning process, pilots should determine if their destination airport has LAHSO. If so, their preflight planning process should include an assessment of which LAHSO combinations would work for them given their aircraft's required landing distance. Good pilot decision making is knowing in advance whether one can accept a LAHSO clearance if offered.

FIG 4-3-8

#### Land and Hold Short of an Intersecting Runway



#### EXAMPLE-

FIG 4-3-10 – holding short at a designated point may be required to avoid conflicts with the runway safety area/flight path of a nearby runway.

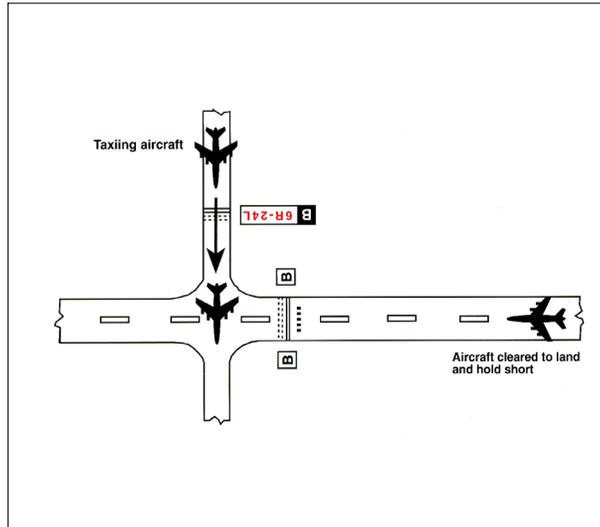
#### NOTE-

Each figure shows the approximate location of LAHSO markings, signage, and in-pavement lighting when installed.

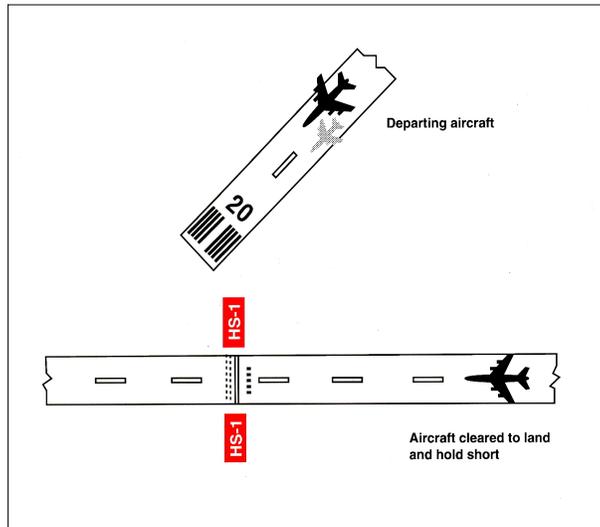
#### REFERENCE-

AIM, Chapter 2, Aeronautical Lighting and Other Airport Visual Aids.

**FIG 4-3-9**  
**Land and Hold Short of an Intersecting Taxiway**



**FIG 4-3-10**  
**Land and Hold Short of a Designated Point on a Runway Other Than an Intersecting Runway or Taxiway**



5. If, for any reason, such as difficulty in discerning the location of a LAHSO intersection, wind conditions, aircraft condition, etc., the pilot elects to request to land on the full length of the runway, to land on another runway, or to decline LAHSO, a pilot is expected to promptly inform air traffic, ideally even before the clearance is issued. A LAHSO clearance, once accepted, must be adhered to, just as any other ATC clearance, unless an amended clearance is obtained or an emergency occurs. A LAHSO clearance does not preclude a rejected landing.

6. A pilot who accepts a LAHSO clearance should land and exit the runway at the first convenient taxiway (unless directed otherwise) before reaching the hold short point. Otherwise, the pilot must stop and hold at the hold short point. If a rejected landing becomes necessary after accepting a LAHSO clearance, the pilot should maintain safe separation from other aircraft or vehicles, and should promptly notify the controller.

7. Controllers need a full read back of all LAHSO clearances. Pilots should read back their LAHSO clearance and include the words, “HOLD SHORT OF (RUNWAY/TAXIWAY/OR POINT)” in their

information, clearances, and other necessary contacts between the tower and aircraft or other vehicles operated on the airport. A pilot who has just landed should not change from the tower frequency to the ground control frequency until directed to do so by the controller. Normally, only one ground control frequency is assigned at an airport; however, at locations where the amount of traffic so warrants, a second ground control frequency and/or another frequency designated as a clearance delivery frequency, may be assigned.

**d.** A controller may omit the ground or local control frequency if the controller believes the pilot knows which frequency is in use. If the ground control frequency is in the 121 MHz bandwidth the controller may omit the numbers preceding the decimal point; e.g., 121.7, “CONTACT GROUND POINT SEVEN.” However, if any doubt exists as to what frequency is in use, the pilot should promptly request the controller to provide that information.

**e.** Controllers will normally avoid issuing a radio frequency change to helicopters, known to be single-piloted, which are hovering, air taxiing, or flying near the ground. At times, it may be necessary for pilots to alert ATC regarding single pilot operations to minimize delay of essential ATC communications. Whenever possible, ATC instructions will be relayed through the frequency being monitored until a frequency change can be accomplished. You must promptly advise ATC if you are unable to comply with a frequency change. Also, you should advise ATC if you must land to accomplish the frequency change unless it is clear the landing will have no impact on other air traffic; e.g., on a taxiway or in a helicopter operating area.

#### **4-3-15. Gate Holding Due to Departure Delays**

**a.** Pilots should contact ground control or clearance delivery prior to starting engines as gate hold procedures will be in effect whenever departure delays exceed or are anticipated to exceed 15 minutes. The sequence for departure will be maintained in accordance with initial call up unless modified by flow control restrictions. Pilots should monitor the ground control or clearance delivery frequency for engine startup advisories or new proposed start time if the delay changes.

**b.** The tower controller will consider that pilots of turbine-powered aircraft are ready for takeoff when they reach the runway or warm-up block unless advised otherwise.

#### **4-3-16. VFR Flights in Terminal Areas**

Use reasonable restraint in exercising the prerogative of VFR flight, especially in terminal areas. The weather minimums and distances from clouds are minimums. Giving yourself a greater margin in specific instances is just good judgment.

**a. Approach Area.** Conducting a VFR operation in a Class B, Class C, Class D, and Class E surface area when the official visibility is 3 or 4 miles is not prohibited, but good judgment would dictate that you keep out of the approach area.

**b. Reduced Visibility.** It has always been recognized that precipitation reduces forward visibility. Consequently, although again it may be perfectly legal to cancel your IFR flight plan at any time you can proceed VFR, it is good practice, when precipitation is occurring, to continue IFR operation into a terminal area until you are reasonably close to your destination.

**c. Simulated Instrument Flights.** In conducting simulated instrument flights, be sure that the weather is good enough to compensate for the restricted visibility of the safety pilot and your greater concentration on your flight instruments. Give yourself a little greater margin when your flight plan lies in or near a busy airway or close to an airport.

#### **4-3-17. VFR Helicopter Operations at Controlled Airports**

##### **a. General.**

**1.** The following ATC procedures and phraseologies recognize the unique capabilities of helicopters and were developed to improve service to all users. Helicopter design characteristics and user needs often require

operations from movement areas and nonmovement areas within the airport boundary. In order for ATC to properly apply these procedures, it is essential that pilots familiarize themselves with the local operations and make it known to controllers when additional instructions are necessary.

2. Insofar as possible, helicopter operations will be instructed to avoid the flow of fixed-wing aircraft to minimize overall delays; however, there will be many situations where faster/larger helicopters may be integrated with fixed-wing aircraft for the benefit of all concerned. Examples would include IFR flights, avoidance of noise sensitive areas, or use of runways/taxiways to minimize the hazardous effects of rotor downwash in congested areas.

3. Because helicopter pilots are intimately familiar with the effects of rotor downwash, they are best qualified to determine if a given operation can be conducted safely. Accordingly, the pilot has the final authority with respect to the specific airspeed/altitude combinations. ATC clearances are in no way intended to place the helicopter in a hazardous position. It is expected that pilots will advise ATC if a specific clearance will cause undue hazards to persons or property.

b. Controllers normally limit ATC ground service and instruction to *movement* areas; therefore, operations from *nonmovement* areas are conducted at pilot discretion and should be based on local policies, procedures, or letters of agreement. In order to maximize the flexibility of helicopter operations, it is necessary to rely heavily on sound pilot judgment. For example, hazards such as debris, obstructions, vehicles, or personnel must be recognized by the pilot, and action should be taken as necessary to avoid such hazards. Taxi, hover taxi, and air taxi operations are considered to be ground movements. Helicopters conducting such operations are expected to adhere to the same conditions, requirements, and practices as apply to other ground taxiing and ATC procedures in the AIM.

1. The phraseology *taxi* is used when it is intended or expected that the helicopter will taxi on the airport surface, either via taxiways or other prescribed routes. *Taxi* is used primarily for helicopters equipped with wheels or in response to a pilot request. Preference should be given to this procedure whenever it is necessary to minimize effects of rotor downwash.

2. Pilots may request a *hover taxi* when slow forward movement is desired or when it may be appropriate to move very short distances. Pilots should avoid this procedure if rotor downwash is likely to cause damage to parked aircraft or if blowing dust/snow could obscure visibility. If it is necessary to operate above 25 feet AGL when hover taxiing, the pilot should initiate a request to ATC.

3. *Air taxi* is the preferred method for helicopter ground movements on airports provided ground operations and conditions permit. Unless otherwise requested or instructed, pilots are expected to remain below 100 feet AGL. However, if a higher than normal airspeed or altitude is desired, the request should be made prior to lift-off. The pilot is solely responsible for selecting a safe airspeed for the altitude/operation being conducted. Use of *air taxi* enables the pilot to proceed at an optimum airspeed/altitude, minimize downwash effect, conserve fuel, and expedite movement from one point to another. Helicopters should avoid overflight of other aircraft, vehicles, and personnel during air-taxi operations. Caution must be exercised concerning active runways and pilots must be certain that air taxi instructions are understood. Special precautions may be necessary at unfamiliar airports or airports with multiple/intersecting active runways. The taxi procedures given in paragraph 4-3-18, Taxiing, paragraph 4-3-19, Taxi During Low Visibility, and paragraph 4-3-21, Exiting the Runway After Landing, also apply.

#### REFERENCE-

Pilot/Controller Glossary Term- Taxi.

Pilot/Controller Glossary Term- Hover Taxi.

Pilot/Controller Glossary Term- Air Taxi.

#### c. Takeoff and Landing Procedures.

1. Helicopter operations may be conducted from a runway, taxiway, portion of a landing strip, or any clear area which could be used as a landing site such as the scene of an accident, a construction site, or the roof of a building. The terms used to describe designated areas from which helicopters operate are: movement area, landing/takeoff area, apron/ramp, heliport and helipad (See Pilot/Controller Glossary). These areas may be

**2. Receipt of ATC clearance.** ARTCC clearances are relayed to pilots by airport traffic controllers in the following manner.

**EXAMPLE–**

**Tower:** “Beechcraft One Three One Five Niner, cleared to the Chicago Midway Airport via Victor Eight, maintain eight thousand.”

**Aircraft:** “Beechcraft One Three One Five Niner, cleared to the Chicago Midway Airport via Victor Eight, maintain eight thousand.”

**NOTE–**

Normally, an ATC IFR clearance is relayed to a pilot by the ground controller. At busy locations, however, pilots may be instructed by the ground controller to “contact clearance delivery” on a frequency designated for this purpose. No surveillance or control over the movement of traffic is exercised by this position of operation.

**3. Request for taxi instructions after landing.** State your aircraft identification, location, and that you request taxi instructions.

**EXAMPLE–**

**Aircraft:** “Dulles ground, Beechcraft One Four Two Six One clearing runway one right on taxiway echo three, request clearance to Page.”

**Tower:** “Beechcraft One Four Two Six One, Dulles ground, taxi to Page via taxiways echo three, echo one, and echo niner.”

or

**Aircraft:** “Orlando ground, Beechcraft One Four Two Six One clearing runway one eight left at taxiway bravo three, request clearance to Page.”

**Tower:** “Beechcraft One Four Two Six One, Orlando ground, hold short of runway one eight right.”

**Aircraft:** “Beechcraft One Four Two Six One, hold short of runway one eight right.”

e. During ground operations, jet blast, prop wash, and rotor wash can cause damage and upsets if encountered at close range. Pilots should consider the effects of jet blast, prop wash, and rotor wash on aircraft, vehicles, and maintenance equipment during ground operations.

#### **4–3–19. Taxi During Low Visibility**

a. Pilots and aircraft operators should be constantly aware that during certain low visibility conditions the movement of aircraft and vehicles on airports may not be visible to the tower controller. This may prevent visual confirmation of an aircraft’s adherence to taxi instructions.

b. Of vital importance is the need for pilots to notify the controller when difficulties are encountered or at the first indication of becoming disoriented. Pilots should proceed with extreme caution when taxiing toward the sun. When vision difficulties are encountered pilots should immediately inform the controller.

c. Advisory Circular 120–57, Low Visibility Operations Surface Movement Guidance and Control System, commonly known as LVOSMGCS (pronounced “LVO SMIGS”) describes an adequate example of a low visibility taxi plan for any airport which has takeoff or landing operations in less than 1,200 feet runway visual range (RVR) visibility conditions. These plans, which affect aircrew and vehicle operators, may incorporate additional lighting, markings, and procedures to control airport surface traffic. They will be addressed at two levels; operations less than 1,200 feet RVR to 500 feet RVR and operations less than 500 feet RVR.

**NOTE–**

Specific lighting systems and surface markings may be found in paragraph 2–1–10, Taxiway Lights, and paragraph 2–3–4, Taxiway Markings.

d. When low visibility conditions exist, pilots should focus their entire attention on the safe operation of the aircraft while it is moving. Checklists and nonessential communication should be withheld until the aircraft is stopped and the brakes set.

#### 4-3-20. Standard Taxi Routes

a. Standard Taxi Routes (STRs) provide a standard, predictable taxi route from an origination point to a termination point on the airport movement area. The use of STRs helps reduce frequency congestion and streamline taxi procedures. STRs may be available at certain airports. Absent an STR Letter of Agreement (LOA), issuance of an STR will be at the request of the pilot and discretion of ATC. STRs used under an LOA are issued by ATC and are not required to be requested by the pilot.

b. STRs are available via two methods, (LOA) or publicly–available via the Domestic Notices website: [https://www.faa.gov/air\\_traffic/publications/domesticnotices/](https://www.faa.gov/air_traffic/publications/domesticnotices/).

c. An LOA for STRs will be revised for updates and changes, including cancellation on an as–needed basis with the operator. It is the responsibility of the operator to distribute changes to their flight crews.

d. An STR may be requested by a pilot or assigned at the discretion of ATC to the pilot of an operator with an LOA STR. It is the responsibility of the pilot to request a full taxi clearance if not fully familiar with the STR.

e. A Letter to Airmen (LTA) will be issued by airport traffic control towers to announce availability, updates, cancelation, or changes of publicly–available STRs with appropriate updates to the Domestic Notices website. An LTA may include an airport diagram. The airport diagram will be labeled “not for navigation” and is not an acceptable substitute for the most up–to–date airport diagrams. LTAs are available via the FAA NOTAM Search website: <https://notams.aim.faa.gov/notamSearch/>.

f. Pilots request publicly–available STRs by stating the desired STR name (e.g., ATC facility, flight or aircraft identification, location, request STR name). By requesting an STR, a pilot acknowledges full familiarity with the STR. The issuance of a pilot–requested STR is at the discretion of ATC.

g. STRs contain the same characteristics and responsibilities:

1. Pilots should not request, and ATC may not issue STR instructions during low visibility Surface Movement Guidance and Control System (SMGCS) operations.

2. It is the pilot’s responsibility to maintain familiarity and awareness of the most current versions of STRs, as well as airport diagrams and charts prior to accepting an STR assignment.

3. If a pilot is unsure about the assigned STR procedure, the pilot is encouraged to either seek clarification from ATC or decline the STR assignment.

4. Pilots who become disoriented during taxi should advise ATC immediately and request detailed taxi instructions or other assistance.

5. An STR instruction does not constitute nor imply a clearance to cross a runway.

6. Unless otherwise stated by ATC, the issuance of an STR does not give an aircraft the right of way over another taxiing aircraft.

7. Unless otherwise instructed by ATC, originating from, and terminating to a non–movement area as part of an STR is at the discretion of the pilot in coordination with ramp control, if required.

8. If ATC instructs the pilot to deviate from an STR, ATC must issue detailed taxi instructions for the remainder of the taxi.

9. Pilots are urged to exercise caution when accepting STR assignments, especially when STRs are used or available at more than one airport in the same terminal area.

h. ATC may cancel, amend, or revise an STR as necessary. Any updates to publicly–available STRs will be communicated via LTA with appropriate updates to the Domestic Notices website.

#### 4-3-21. Exiting the Runway After Landing

The following procedures must be followed after landing and reaching taxi speed.

a. Exit the runway without delay at the first available taxiway or on a taxiway as instructed by ATC. Pilots must not exit the landing runway onto another runway unless authorized by ATC. At airports with an operating control tower, pilots should not stop or reverse course on the runway without first obtaining ATC approval.

b. Taxi clear of the runway unless otherwise directed by ATC. An aircraft is considered clear of the runway when all parts of the aircraft are past the runway edge and there are no restrictions to its continued movement beyond the runway holding position markings. In the absence of ATC instructions, the pilot is expected to taxi clear of the landing runway by taxiing beyond the runway holding position markings associated with the landing runway, even if that requires the aircraft to protrude into or cross another taxiway or ramp area. Once all parts of the aircraft have crossed the runway holding position markings, the pilot must hold unless further instructions have been issued by ATC.

**NOTE–**

1. The tower will issue the pilot instructions which will permit the aircraft to enter another taxiway, runway, or ramp area when required.

2. Guidance contained in subparagraphs a and b above is considered an integral part of the landing clearance and satisfies the requirement of 14 CFR Section 91.129.

c. Immediately change to ground control frequency when advised by the tower and obtain a taxi clearance.

**NOTE–**

1. The tower will issue instructions required to resolve any potential conflicts with other ground traffic prior to advising the pilot to contact ground control.

2. Ground control will issue taxi clearance to parking. That clearance does not authorize the aircraft to “enter” or “cross” any runways. Pilots not familiar with the taxi route should request specific taxi instructions from ATC.

#### **4–3–22. Practice Instrument Approaches**

a. Various air traffic incidents have indicated the necessity for adoption of measures to achieve more organized and controlled operations where practice instrument approaches are conducted. Practice instrument approaches are considered to be instrument approaches made by either a VFR aircraft not on an IFR flight plan or an aircraft on an IFR flight plan. To achieve this and thereby enhance air safety, it is Air Traffic’s policy to provide for separation of such operations at locations where approach control facilities are located and, as resources permit, at certain other locations served by ARTCCs or parent approach control facilities. Pilot requests to practice instrument approaches may be approved by ATC subject to traffic and workload conditions. Pilots should anticipate that in some instances the controller may find it necessary to deny approval or withdraw previous approval when traffic conditions warrant. It must be clearly understood, however, that even though the controller may be providing separation, pilots on VFR flight plans are required to comply with basic VFR weather minimums (14 CFR Section 91.155). Application of ATC procedures or any action taken by the controller to avoid traffic conflicts does not relieve IFR and VFR pilots of their responsibility to see-and-avoid other traffic while operating in VFR conditions (14 CFR Section 91.113). In addition to the normal IFR separation minimums (which includes visual separation) during VFR conditions, 500 feet vertical separation may be applied between VFR aircraft and between a VFR aircraft and the IFR aircraft. Pilots not on IFR flight plans desiring practice instrument approaches should always state ‘practice’ when making requests to ATC. Controllers will instruct VFR aircraft requesting an instrument approach to maintain VFR. This is to preclude misunderstandings between the pilot and controller as to the status of the aircraft. If pilots wish to proceed in accordance with instrument flight rules, they must specifically request and obtain, an IFR clearance.

b. Before practicing an instrument approach, pilots should inform the approach control facility or the tower of the type of practice approach they desire to make and how they intend to terminate it, i.e., full-stop landing, touch-and-go, or missed or low approach maneuver. This information may be furnished progressively when conducting a series of approaches. Pilots on an IFR flight plan, who have made a series of instrument approaches to full stop landings should inform ATC when they make their final landing. The controller will control flights practicing instrument approaches so as to ensure that they do not disrupt the flow of arriving and departing itinerant IFR or VFR aircraft. The priority afforded itinerant aircraft over practice instrument approaches is not

intended to be so rigidly applied that it causes grossly inefficient application of services. A minimum delay to itinerant traffic may be appropriate to allow an aircraft practicing an approach to complete that approach.

**NOTE—**

*A clearance to land means that appropriate separation on the landing runway will be ensured. A landing clearance does not relieve the pilot from compliance with any previously issued restriction.*

**c.** At airports without a tower, pilots wishing to make practice instrument approaches should notify the facility having control jurisdiction of the desired approach as indicated on the approach chart. All approach control facilities and ARTCCs are required to publish a Letter to Airmen depicting those airports where they provide standard separation to both VFR and IFR aircraft conducting practice instrument approaches.

**d.** The controller will provide approved separation between both VFR and IFR aircraft when authorization is granted to make practice approaches to airports where an approach control facility is located and to certain other airports served by approach control or an ARTCC. Controller responsibility for separation of VFR aircraft begins at the point where the approach clearance becomes effective, or when the aircraft enters Class B or Class C airspace, or a TRSA, whichever comes first.

**e.** VFR aircraft practicing instrument approaches are not automatically authorized to execute the missed approach procedure. This authorization must be specifically requested by the pilot and approved by the controller. Where ATC procedures require application of IFR separation to VFR aircraft practicing instrument approaches, separation will be provided throughout the procedure including the missed approach. Where no separation services are provided during the practice approach, no separation services will be provided during the missed approach.

**f.** Except in an emergency, aircraft cleared to practice instrument approaches must not deviate from the approved procedure until cleared to do so by the controller.

**g.** At radar approach control locations when a full approach procedure (procedure turn, etc.) cannot be approved, pilots should expect to be vectored to a final approach course for a practice instrument approach which is compatible with the general direction of traffic at that airport.

**h.** When granting approval for a practice instrument approach, the controller will usually ask the pilot to report to the tower prior to or over the final approach fix inbound (nonprecision approaches) or over the outer marker or fix used in lieu of the outer marker inbound (precision approaches).

**i.** When authorization is granted to conduct practice instrument approaches to an airport with a tower, but where approved standard separation is not provided to aircraft conducting practice instrument approaches, the tower will approve the practice approach, instruct the aircraft to maintain VFR and issue traffic information, as required.

**j.** When an aircraft notifies a FSS providing Local Airport Advisory to the airport concerned of the intent to conduct a practice instrument approach and whether or not separation is to be provided, the pilot will be instructed to contact the appropriate facility on a specified frequency prior to initiating the approach. At airports where separation is not provided, the FSS will acknowledge the message and issue known traffic information but will neither approve or disapprove the approach.

**k.** Pilots conducting practice instrument approaches should be particularly alert for other aircraft operating in the local traffic pattern or in proximity to the airport.

#### ■ 4-3-23. Option Approach

The “Cleared for the Option” procedure will permit an instructor, flight examiner or pilot the option to make a touch-and-go, low approach, missed approach, stop-and-go, or full stop landing. This procedure can be very beneficial in a training situation in that neither the student pilot nor examinee would know what maneuver would be accomplished. The pilot should make a request for this procedure passing the final approach fix inbound on an instrument approach or entering downwind for a VFR traffic pattern. After ATC approval of the option, the pilot should inform ATC as soon as possible of any delay on the runway during their stop-and-go or full stop

landing. The advantages of this procedure as a training aid are that it enables an instructor or examiner to obtain the reaction of a trainee or examinee under changing conditions, the pilot would not have to discontinue an approach in the middle of the procedure due to student error or pilot proficiency requirements, and finally it allows more flexibility and economy in training programs. This procedure will only be used at those locations with an operational control tower and will be subject to ATC approval.

#### **4-3-24. Use of Aircraft Lights**

a. Aircraft position lights are required to be lighted on aircraft operated on the surface and in flight from sunset to sunrise. In addition, aircraft equipped with an anti-collision light system are required to operate that light system during all types of operations (day and night). However, during any adverse meteorological conditions, the pilot-in-command may determine that the anti-collision lights should be turned off when their light output would constitute a hazard to safety (14 CFR Section 91.209). Supplementary strobe lights should be turned off on the ground when they adversely affect ground personnel or other pilots, and in flight when there are adverse reflection from clouds.

b. An aircraft anti-collision light system can use one or more rotating beacons and/or strobe lights, be colored either red or white, and have different (higher than minimum) intensities when compared to other aircraft. Many aircraft have both a rotating beacon and a strobe light system.

c. The FAA has a voluntary pilot safety program, Operation Lights On, to enhance the *see-and-avoid* concept. Pilots are encouraged to turn on their landing lights during takeoff; i.e., either after takeoff clearance has been received or when beginning takeoff roll. Pilots are further encouraged to turn on their landing lights when operating below 10,000 feet, day or night, especially when operating within 10 miles of any airport, or in conditions of reduced visibility and in areas where flocks of birds may be expected, i.e., coastal areas, lake areas, around refuse dumps, etc. Although turning on aircraft lights does enhance the *see-and-avoid* concept, pilots should not become complacent about keeping a sharp lookout for other aircraft. Not all aircraft are equipped with lights and some pilots may not have their lights turned on. Aircraft manufacturer's recommendations for operation of landing lights and electrical systems should be observed.

d. Prop and jet blast forces generated by large aircraft have overturned or damaged several smaller aircraft taxiing behind them. To avoid similar results, and in the interest of preventing upsets and injuries to ground personnel from such forces, the FAA recommends that air carriers and commercial operators turn on their rotating beacons anytime their aircraft engines are in operation. General aviation pilots using rotating beacon equipped aircraft are also encouraged to participate in this program which is designed to alert others to the potential hazard. Since this is a voluntary program, exercise caution and do not rely solely on the rotating beacon as an indication that aircraft engines are in operation.

e. Prior to commencing taxi, it is recommended to turn on navigation, position, anti-collision, and logo lights (if equipped). To signal intent to other pilots, consider turning on the taxi light when the aircraft is moving or intending to move on the ground, and turning it off when stopped or yielding to other ground traffic. Strobe lights should not be illuminated during taxi if they will adversely affect the vision of other pilots or ground personnel.

f. At the discretion of the pilot-in-command, all exterior lights should be illuminated when taxiing on or across any runway. This increases the conspicuousness of the aircraft to controllers and other pilots approaching to land, taxiing, or crossing the runway. Pilots should comply with any equipment operating limitations and consider the effects of landing and strobe lights on other aircraft in their vicinity.

g. When entering the departure runway for takeoff or to "line up and wait," all lights, except for landing lights, should be illuminated to make the aircraft conspicuous to ATC and other aircraft on approach. Landing lights should be turned on when takeoff clearance is received or when commencing takeoff roll at an airport without an operating control tower.

#### **4-3-25. Flight Inspection/'Flight Check' Aircraft in Terminal Areas**

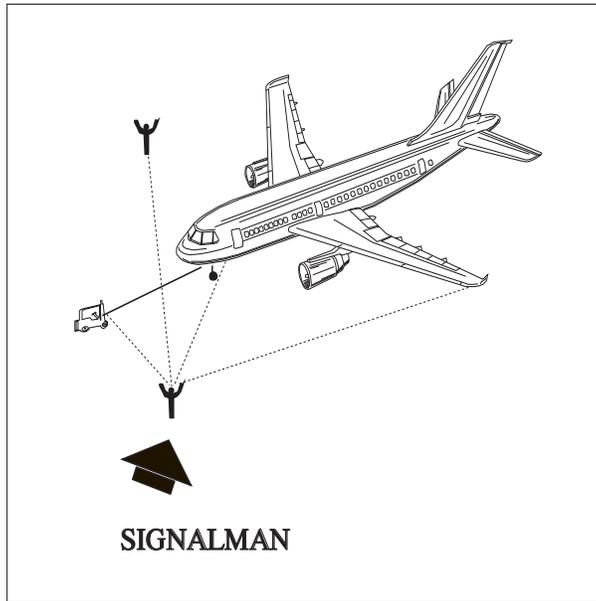
a. *Flight check* is a call sign used to alert pilots and air traffic controllers when a FAA aircraft is engaged in flight inspection/certification of NAVAIDs and flight procedures. Flight check aircraft fly preplanned high/low

altitude flight patterns such as grids, orbits, DME arcs, and tracks, including low passes along the full length of the runway to verify NAVAID performance.

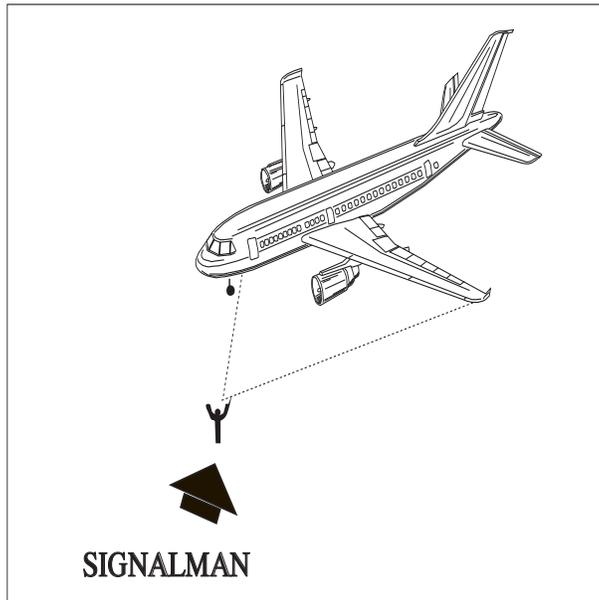
b. Pilots should be especially watchful and avoid the flight paths of any aircraft using the call sign “Flight Check.” These flights will normally receive special handling from ATC. Pilot patience and cooperation in allowing uninterrupted recordings can significantly help expedite flight inspections, minimize costly, repetitive runs, and reduce the burden on the U.S. taxpayer.

■ **4-3-26. Hand Signals**

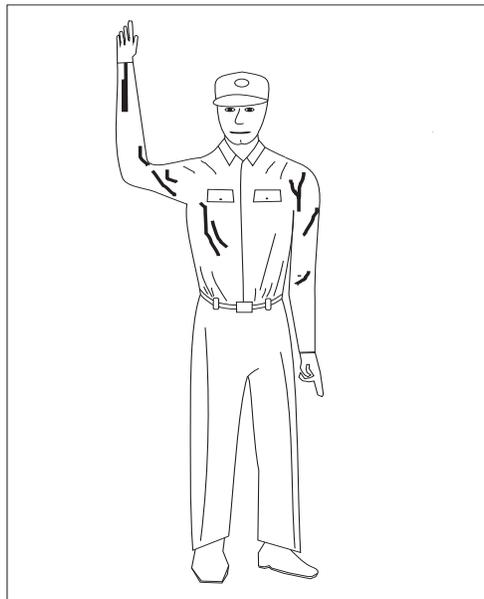
*FIG 4-3-11*  
**Signalman Directs Towing**



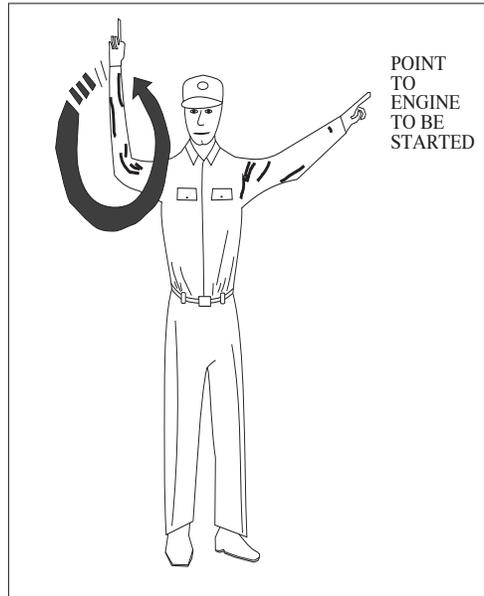
**FIG 4-3-12**  
**Signalman's Position**



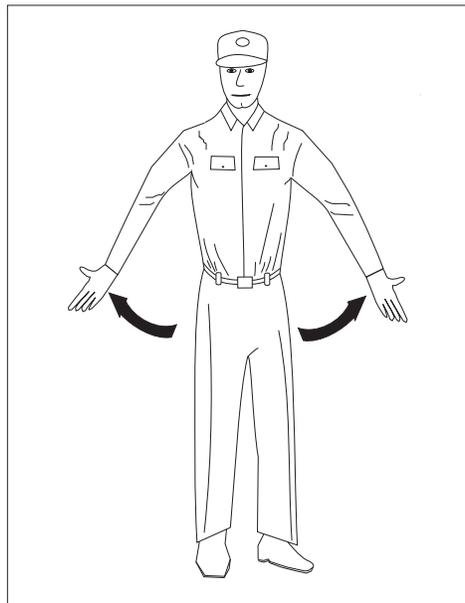
**FIG 4-3-13**  
**All Clear**  
**(O.K.)**



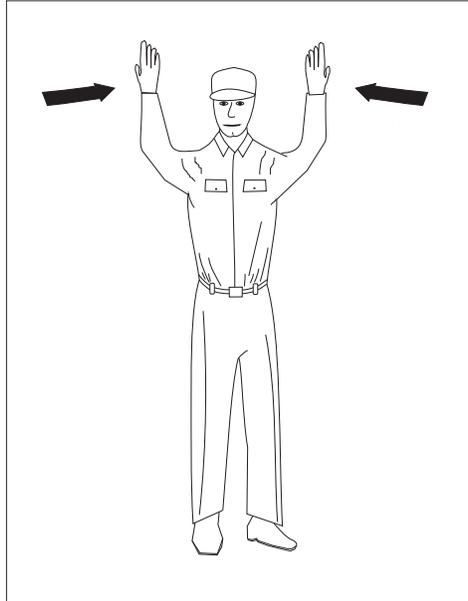
**FIG 4-3-14**  
**Start Engine**



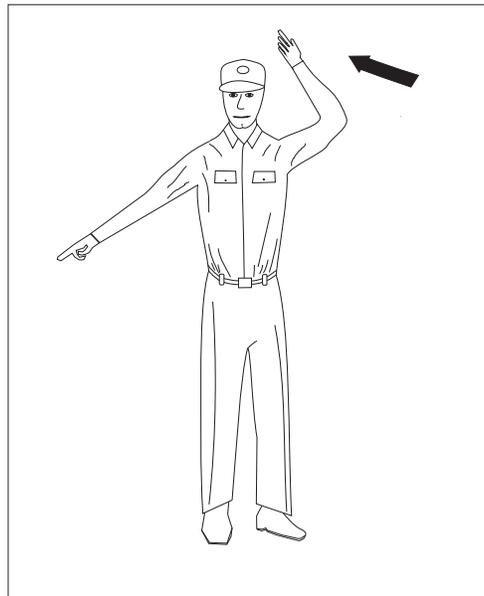
**FIG 4-3-15**  
**Pull Chocks**



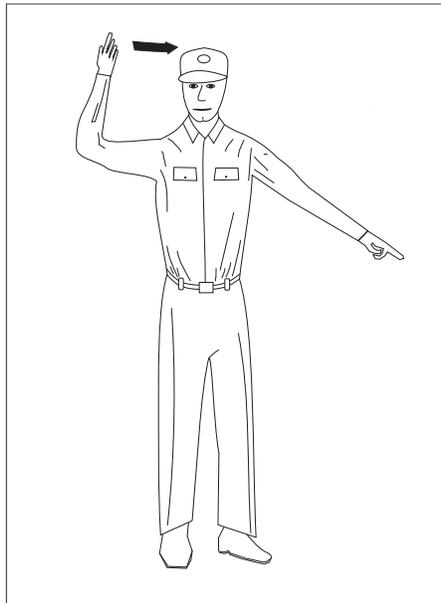
**FIG 4-3-16**  
**Proceed Straight Ahead**



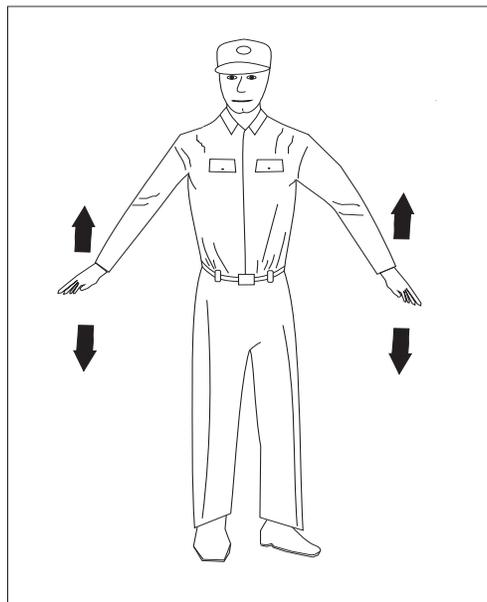
**FIG 4-3-17**  
**Left Turn**



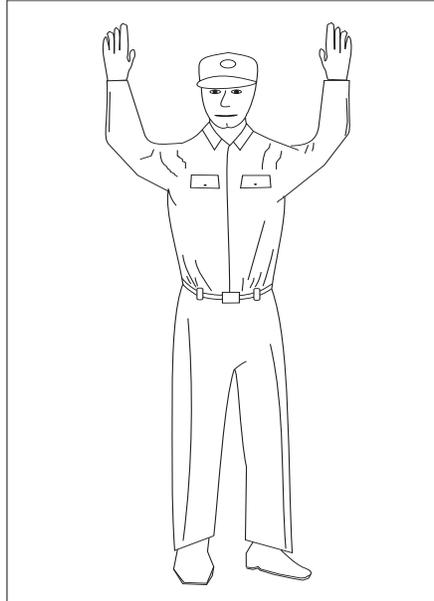
**FIG 4-3-18**  
**Right Turn**



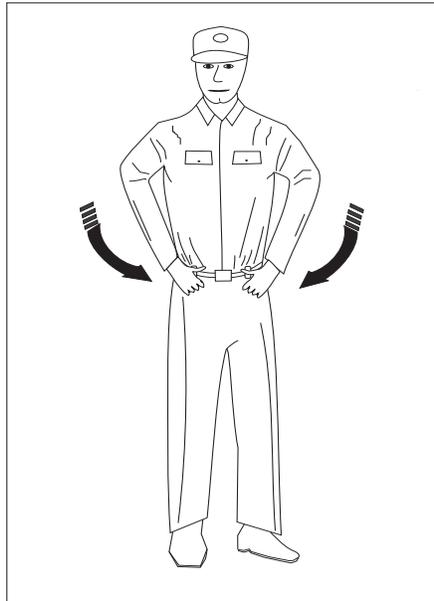
**FIG 4-3-19**  
**Slow Down**



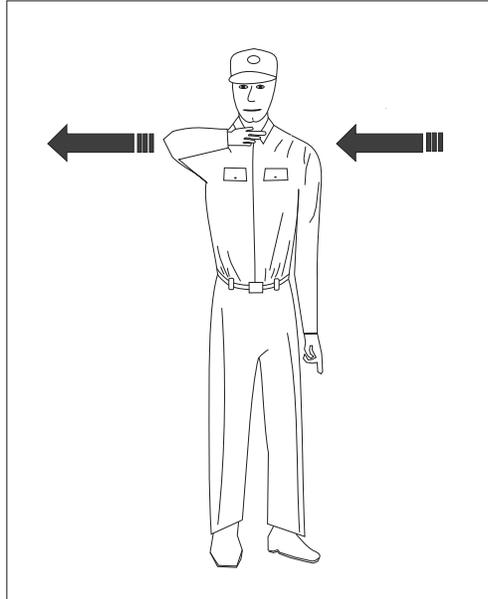
**FIG 4-3-20**  
**Flagman Directs Pilot**



**FIG 4-3-21**  
**Insert Chocks**



**FIG 4-3-22**  
**Cut Engines**



**FIG 4-3-23**  
**Night Operation**

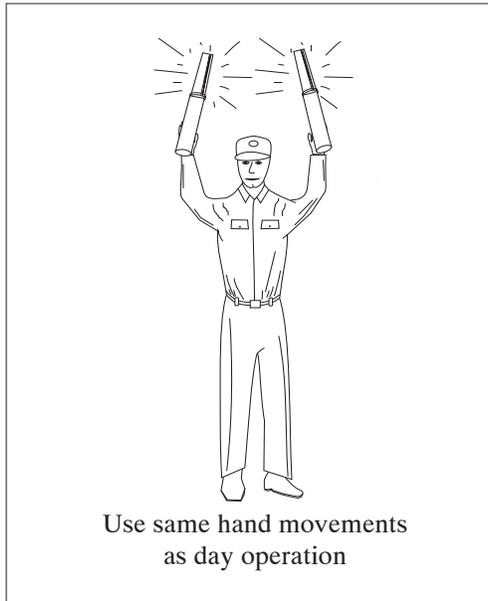
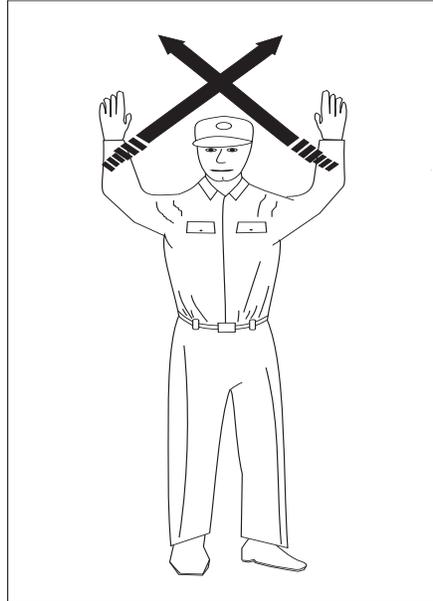


FIG 4-3-24  
Stop



#### 4-3-27. Operations at Uncontrolled Airports With Automated Surface Observing System (ASOS)/Automated Weather Observing System (AWOS)

a. Many airports throughout the National Airspace System are equipped with either ASOS or AWOS. At most airports with an operating control tower or human observer, the weather will be available to you in an Aviation Routine Weather Report (METAR) hourly or special observation format on the Automatic Terminal Information Service (ATIS) or directly transmitted from the controller/observer.

b. At uncontrolled airports that are equipped with ASOS/AWOS with ground-to-air broadcast capability, the one-minute updated airport weather should be available to you within approximately 25 NM of the airport below 10,000 feet. The frequency for the weather broadcast will be published on sectional charts and in the Chart Supplement. Some part-time towered airports may also broadcast the automated weather on their ATIS frequency during the hours that the tower is closed.

c. Controllers issue SVFR or IFR clearances based on pilot request, known traffic and reported weather, i.e., METAR/Nonroutine (Special) Aviation Weather Report (SPECI) observations, when they are available. Pilots have access to more current weather at uncontrolled ASOS/AWOS airports than do the controllers who may be located several miles away. Controllers will rely on the pilot to determine the current airport weather from the ASOS/AWOS. All aircraft arriving or departing an ASOS/AWOS equipped uncontrolled airport should monitor the airport weather frequency to ascertain the status of the airspace. Pilots in Class E airspace must be alert for changing weather conditions which may affect the status of the airspace from IFR/VFR. If ATC service is required for IFR/SVFR approach/departure or requested for VFR service, the pilot should advise the controller that he/she has received the one-minute weather and state his/her intentions.

**EXAMPLE-**

*“I have the (airport) one-minute weather, request an ILS Runway 14 approach.”*

**REFERENCE-**

*AIM, Para 7-1-10, Weather Observing Programs.*



**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, 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 signals 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, Para 4-1-20, Transponder and ADS-B Out Operation.*

# Chapter 5. Air Traffic Procedures

## Section 1. Preflight

### 5-1-1. Preflight Preparation

a. Prior to every flight, pilots should gather all information vital to the nature of the flight, assess whether the flight would be safe, and then file a flight plan. Pilots can receive a regulatory compliant briefing without contacting Flight Service. Pilots are encouraged to use automated resources and review Advisory Circular 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. Pilots may access Flight Service through [www.1800wxbrief.com](http://www.1800wxbrief.com) or by calling 1-800-WX-BRIEF. Flight planning applications are also available for conducting a self-briefing and filing flight plans.

**NOTE-**

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

b. The information required by the FAA to process flight plans is obtained from FAA Form 7233-4, International Flight Plan. Only DoD users, and civilians who file stereo route flight plans, may use FAA Form 7233-1, Flight Plan.

**NOTE-**

*FAA and DoD Flight Plan Forms are equivalent. Where the FAA specifies Form 7233-1, Flight Plan and FAA Form 7233-4, International Flight Plan, the DoD may substitute their Form DD 175, Military Flight Plan and Form DD-1801, DoD International Flight Plan as necessary. NAS automation systems process and convert data in the same manner, although for computer acceptance, input fields may be adjusted to follow FAA format.*

c. FSSs are required to advise of pertinent NOTAMs if a *standard* briefing is requested, but if they are overlooked, do not hesitate to remind the specialist that you have not received NOTAM information. Additionally, FSS briefers do not provide FDC NOTAM information for special instrument approach procedures unless specifically asked. Pilots authorized by the FAA to use special instrument approach procedures must specifically request FDC NOTAM information for these procedures. Pilots who receive the information electronically will receive NOTAMs for special IAPs automatically.

**NOTE-**

*Domestic Notices and International Notices are not provided during a briefing unless specifically requested by the pilot since the FSS specialist has no way of knowing whether the pilot has already checked the Federal NOTAM System (FNS) NOTAM Search website external links prior to calling. Airway NOTAMs, procedural NOTAMs, and NOTAMs that are general in nature and not tied to a specific airport/facility (for example, flight advisories and restrictions, open duration special security instructions, and special flight rules areas) are briefed solely by pilot request. Remember to ask for these notices if you have not already reviewed this information, and to request all pertinent NOTAMs specific to your flight.*

**REFERENCE-**

*AIM, Para 5-1-3, Notice to Air Missions (NOTAM) System.*

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

**REFERENCE-**

*AIM, Para 9-1-4, General Description of Each Chart Series.*

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

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

f. Prior to conducting a briefing, briefers are required to have the background information listed above so that they may tailor the briefing to the needs of the proposed flight. The objective is to communicate a "picture" of meteorological and aeronautical information necessary for the conduct of a safe and efficient flight. Briefers use all available weather and aeronautical information to summarize data applicable to the proposed flight. Pilots who have briefed themselves before calling Flight Service should advise the briefer what information has been obtained from other sources.

**REFERENCE-**

*AIM, Para 7-1-5, Preflight Briefings, contains those items of a weather briefing that should be expected or requested.*

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

**REFERENCE-**

*Chart Supplement, Special Notices Section.*

*AIM, Para 4-1-21, Airport Reservation Operations and Special Traffic Management Programs.*

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

**REFERENCE-**

*AIM, Para 5-1-11, Flights Outside the U.S. and U.S. Territories.*

i. Pilots operating under provisions of 14 CFR Part 135 on a domestic flight without having an FAA assigned 3-letter designator, must prefix the normal registration (N) number with the letter "T" on flight plan filing; for example, TN1234B.

**REFERENCE-**

*AIM, Para 4-2-4, Aircraft Call Signs.*

*FAA Order JO 7110.65, Para 2-3-5, Aircraft Identity, Subpara a.*

*FAA Order JO 7110.10, Appendix B, FAA Form 7233-1, Flight Plan*

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

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

1. Obtain a complete preflight briefing and check NOTAMs. 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. NOTAMs are available online from the Federal NOTAM System (FNS) NOTAM Search website (<https://notams.aim.faa.gov/notamSearch/>), private vendors, or on request from Flight Service.

2. File a flight plan. This is an excellent low cost insurance policy. The cost is the time it takes to fill it out. The insurance includes the knowledge that someone will be looking for you if you become overdue at your destination. Pilots can file flight plans either by using a website or by calling Flight Service. Flight planning applications are also available to file, activate, and close VFR flight plans.

3. Use current charts.
4. Use the navigation aids. Practice maintaining a good course—keep the needle centered.
5. Maintain a constant altitude which is appropriate for the direction of flight.
6. Estimate en route position times.
7. Make accurate and frequent position reports to the FSSs along your route of flight.

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

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

### 5-1-3. Notice to Air Missions (NOTAM) System

a. **General.** The NOTAM system provides pilots with time critical aeronautical information that is temporary, or information to be published on aeronautical charts at a later date, or information from another operational publication. The NOTAM is cancelled when the information in the NOTAM is published on the chart or when the temporary condition is returned to normal status. NOTAMs may be disseminated up to 7 days before the start of activity. Pilots can access NOTAM information online via NOTAM Search at: <https://notams.aim.faa.gov/notamSearch/> or from an FSS.

b. **Preflight.** 14 CFR § 91.103, Preflight Action directs pilots to become familiar with all available information concerning a planned flight prior to departure, including NOTAMs. Pilots may change their flight plan based on available information. Current NOTAM information may affect:

1. Aerodromes.
2. Runways, taxiways, and ramp restrictions.
3. Obstructions.
4. Communications.
5. Airspace.
6. Status of navigational aids or radar service availability.
7. Other information essential to planned en route, terminal, or landing operations.

c. **ARTCC NOTAMs.** Pilots should also review NOTAMs for the ARTCC area (for example, Washington Center (ZDC), Cleveland Center (ZOB), etc.) in which the flight will be operating. You can find the 3 letter code for each ARTCC on the FAA's NOTAM webpage. These NOTAMs may affect the planned flight. Some of the operations include Central Altitude Reservation Function (CARF), Special Use Airspace (SUA), Temporary Flight Restrictions (TFR), Global Positioning System (GPS), Flight Data Center (FDC) changes to routes, wind turbine, and Unmanned Aircraft System (UAS).

**NOTE—**

*NOTAM information is transmitted using ICAO contractions to reduce transmission time. See TBL 5-1-2 for a listing of the most commonly used contractions, or go online to the following URL:*

*<https://www.notams.faa.gov/downloads/contractions.pdf>. For a complete listing of approved NOTAM Contractions, see FAA JO Order 7340.2, Contractions.*

**d. Destination Update.** Pilots should also contact ATC or FSS while en route to obtain updated airfield information for their destination. This is particularly important when flying to the airports without an operating control tower. Snow removal, fire and rescue activities, construction, and wildlife encroachment, may pose hazards to pilots. This information may not be available to pilots prior to arrival/departure.

**e. NAVAID NOTAMs.** Pilots should check NOTAMs to ensure NAVAIDs required for the flight are in service. A NOTAM is published when a NAVAID is out of service or Unserviceable (U/S). Although a NAVAID is deemed U/S and planned for removal from service, it may be a long time before that NAVAID is officially decommissioned and removed from charts. A NOTAM is the primary method of alerting pilots to its unavailability. It is recommended that pilots using VFR charts should regularly consult the Chart Update Bulletin. This bulletin identifies any updates to the chart that have not yet been accounted for.

**f. GPS NOTAMs.** The FAA issues information on the status of GPS through the NOTAM system. Operators may find information on GPS satellite outages, GPS testing, and GPS anomalies by specifically searching for GPS NOTAMS prior to flight.

**1.** The NOTAM system uses the terms UNRELIABLE (UNREL), MAY NOT BE AVAILABLE (AVBL), and NOT AVAILABLE (AVBL) when describing the status of GPS. UNREL indicates the expected level of service of the GPS and/or WAAS may not be available. Pilots must then determine the adequacy of the signal for desired use. Aircraft should have additional navigation equipment for their intended route.

**NOTE-**

*Unless associated with a known testing NOTAM, pilots should report GPS anomalies, including degraded operation and/or loss of service, as soon as possible via radio or telephone, and via the GPS Anomaly Reporting Form. (See 1-1-13.)*

**2.** GPS operations may also be NOTAMed for testing. This is indicated in the NOTAM language with the name of the test in parenthesis. When GPS testing NOTAMS are published and testing is actually occurring, ATC will advise pilots requesting or cleared for a GPS or RNAV (GPS) approach, that GPS may not be available and request the pilot's intentions. TBL 5-1-1 lists an example of a GPS testing NOTAM.

**g. NOTAM Classification.** NOTAM information is classified as Domestic NOTAMs (NOTAM D), Flight Data Center (FDC) NOTAMs, International NOTAMs, or Military NOTAMs.

**1. NOTAM (D)** information is disseminated for all navigational facilities that are part of the National Airspace System (NAS), all public use aerodromes, seaplane bases, and heliports listed in the Chart Supplement. NOTAM (D) information includes taxiway closures, personnel and equipment near or crossing runways, and airport lighting aids that do not affect instrument approach criteria (i.e., VGSI). All NOTAM Ds must have one of the keywords listed in TBL 5-1-1, as the first part of the text after the location identifier. These keywords categorize NOTAM Ds by subject, for example, APRON (ramp), RWY (runway), SVC (Services), etc. There are several types of NOTAM Ds:

(a) Aerodrome activity and conditions, to include field conditions.

(b) Airspace to include CARF, SUA, and general airspace activity like UAS or pyrotechnics.

(c) Visual and radio navigational aids.

(d) Communication and services.

(e) Pointer NOTAMs. NOTAMs issued to point to additional aeronautical information. When pointing to another NOTAM, the keyword in the pointer NOTAM must match the keyword in the original NOTAM. Pointer NOTAMs should be issued for, but are not limited to, TFRs, Airshows, Temporary SUA, major NAS system interruptions, etc.

**2.** FDC NOTAMs are issued when it is necessary to disseminate regulatory information. FDC NOTAMs include:

(a) Amendments to published IAPs and other current aeronautical charts.

(b) Temporary Flight Restrictions (TFR) restrict entrance to a certain airspace at a certain time, however, some TFRs provide relief if ATC permission is given to enter the area when requested. Online preflight resources for TFRs provide graphics and plain language interpretations.

RCLL	Runway Centerline Light
REDL	Runway Edge Light
RLLS	Runway Lead-in Light System
RMK	Remark
RTS	Return to Service
RTZL	Runway Touchdown Zone Light(s)
RVR	Runway Visual Range
RWY	Runway
RX	Receive/Receiver
<b>S</b>	
S	South <i>or</i> southern latitude
SA	Sand
SAT	Saturday
SB	Southbound
SE	Southeast
SEC	Seconds
SFC	Surface
SN	Snow
SR	Sunrise
SS	Sunset
SSR	Secondary surveillance radar
SSW	South-southwest
STD	Standard
SUN	Sunday
SW	Southwest
SWB	Southwest bound
<b>T</b>	
TAR	Terminal area surveillance radar
TAX	Taxing <i>or</i> taxiing
TDZ	Touchdown Zone
TEMPO	Temporary <i>or</i> temporarily
TFC	Traffic

THR	Threshold
THU	Thursday
TKOF	Takeoff
TODA	Take-off Distance Available
TORA	Take-off Run Available
TRG	Training
TUE	Tuesday
TWR	Aerodrome Control Tower
TWY	Taxiway
TX	Taxilane
<b>U</b>	
U/S	Unserviceable
UAS	Unmanned Aircraft System
UNL	Unlimited
UNREL	Unreliable
<b>V</b>	
VIS	Visibility
VOR	VHF Omni-Directional Radio Range
VORTAC	VOR and TACAN (collocated)
VOT	VOR Test Facility
<b>W</b>	
W	West <i>or</i> western longitude
WB	Westbound
WDI	Wind Direction Indicator
WED	Wednesday
WI	Within
WID	Width <i>or</i> wide
WIP	Work in progress
WNW	West-northwest
WS	Wind shear
WSW	West-southwest

#### 5-1-4. Operational Information System (OIS)

a. The FAA's Air Traffic Control System Command Center (ATCSCC) maintains a website with near real-time National Airspace System (NAS) status information. NAS operators are encouraged to access the website at <http://www.fly.faa.gov> prior to filing their flight plan.

b. The website consolidates information from advisories. An advisory is a message that is disseminated electronically by the ATCSCC that contains information pertinent to the NAS.

1. Advisories are normally issued for the following items:

- (a) Ground Stops.
- (b) Ground Delay Programs.
- (c) Route Information.
- (d) Plan of Operations.
- (e) Facility Outages and Scheduled Facility Outages.
- (f) Volcanic Ash Activity Bulletins.
- (g) Special Traffic Management Programs.

2. This list is not all-inclusive. Any time there is information that may be beneficial to a large number of people, an advisory may be sent. Additionally, there may be times when an advisory is not sent due to workload or the short length of time of the activity.

3. Route information is available on the website and in specific advisories. Some route information, subject to the 56-day publishing cycle, is located on the “OIS” under “Products,” Route Management Tool (RMT), and “What’s New” Playbook. The RMT and Playbook contain routings for use by Air Traffic and NAS operators when they are coordinated “real-time” and are then published in an ATCSCC advisory.

4. Route advisories are identified by the word “Route” in the header; the associated action is required (RQD), recommended (RMD), planned (PLN), or for your information (FYI). Operators are expected to file flight plans consistent with the Route RQD advisories.

5. Electronic System Impact Reports are on the intranet at <http://www.atcsc.faa.gov/ois/> under “System Impact Reports.” This page lists scheduled outages/events/projects that significantly impact the NAS; for example, runway closures, air shows, and construction projects. Information includes anticipated delays and traffic management initiatives (TMI) that may be implemented.

### 5-1-5. Flight Plan – VFR Flights

*(See Appendix 4, FAA Form 7233-4 – International Flight Plan)*

a. The requirements for the filing and activation of VFR flight plans can vary depending in which airspace the flight is operating. Pilots are responsible for activating flight plans with a Flight Service Station. Control tower personnel do not automatically activate VFR flight plans.

1. Within the continental U.S., a VFR flight plan is not normally required.

2. VFR flights (except for DoD and law enforcement flights) into an Air Defense Identification Zone (ADIZ) are required to file DVFR flight plans.

**NOTE-**

*Detailed ADIZ procedures are found in Section 6, National Security and Interception Procedures, of this chapter. (See 14 CFR Part 99).*

3. Flights within the Washington, DC Special Flight Rules Area have additional requirements that must be met. Visit <http://www.faasafety.gov> for the required Special Awareness Training that must be completed before flight within this area.

4. VFR flight to an international destination requires a filed and activated flight plan.

**NOTE-**

*ICAO flight plan guidance is published in ICAO Document 4444 PANS-ATM Appendix 2.*

b. It is strongly recommended that a VFR flight plan be filed with a Flight Service Station or equivalent flight plan filing service. When filing, pilots must use FAA Form 7233-4, International Flight Plan or DD Form 1801. Only DoD users, and civilians who file stereo route flight plans, may use FAA Form 7233-1, Flight Plan. Pilots may take advantage of advances in technology by filing their flight plans using any available electronic means. Activating the flight plan will ensure that you receive VFR Search and Rescue services.

c. When a stopover flight is anticipated, it is recommended that a separate flight plan be filed for each leg of the flight.

d. Pilots are encouraged to activate their VFR flight plans with Flight Service by the most expeditious means possible. This may be via radio or other electronic means. VFR flight plan proposals are normally retained for two hours following the proposed time of departure.

e. Pilots may also activate a VFR flight plan by using an assumed departure time. This assumed departure time will cause the flight plan to become active at the designated time. This may negate the need for communication with a flight service station or flight plan filing service upon departure. It is the pilot’s responsibility to revise his actual departure time, time en route, or ETA with flight service.

**NOTE-**

*Pilots are strongly advised to remain mindful when using an assumed departure time. If not updated, search and rescue activities will be based on the assumed departure time.*

**f.** U.S. air traffic control towers do not routinely activate VFR flight plans. Foreign pilots especially must be mindful of the need to communicate directly with a flight service station, or use an assumed departure time procedure clearly communicated with the flight plan filing service.

**g.** Although position reports are not required for VFR flight plans, periodic reports to FSSs along the route are good practice. Such contacts permit significant information to be passed to the transiting aircraft and also serve to check the progress of the flight should it be necessary for any reason to locate the aircraft.

**h.** Pilots flying VFR should fly an appropriate cruising altitude for their direction of flight.

**i.** When filing a VFR Flight plan, indicate the appropriate aircraft equipment capability as prescribed for an IFR flight plan.

**REFERENCE-**

*AIM, Para 5-1-6, IFR Flights.*

**j.** ATC radar history data can be useful in finding a downed or missing aircraft; therefore, surveillance equipment should be listed in Item 18. Pilots using commercial GPS tracking services are encouraged to note the specific service in Item 19 N/ (survival equip remarks) of FAA Form 7233-4 or DD Form 1801.

## **5-1-6. Flight Plan – IFR Flights**

*(See Appendix 4, FAA Form 7233-4 – International Flight Plan)*

### **a. General**

**1.** Use of FAA Form 7233-4 or DD Form 1801 is mandatory for:

- (a)** Assignment of RNAV SIDs and STARs or other PBN routing,
- (b)** All civilian IFR flights that will depart U.S. domestic airspace, and
- (c)** Domestic IFR flights except military/DoD and civilians who file stereo route flight plans.
- (d)** All military/DoD IFR flights that will depart U.S. controlled airspace.

**2.** Military/DoD flights using FAA Form 7233-1, or DD Form 175, may not be eligible for assignment of RNAV SIDs or STARs. Military flights desiring assignment of these procedures should file using FAA Form 7233-4 or DD 1801, as described in this section.

**3.** When filing an IFR flight plan using FAA Form 7233-4 or DD Form 1801, it is recommended that filers include all operable navigation, communication, and surveillance equipment capabilities by adding appropriate equipment qualifiers as shown in Appendix 4, FAA Form 7233-4, International Flight Plan.

**4.** ATC issues clearances based on aircraft capabilities filed in Items 10 and 18 of FAA Form 7233-4 or DD 1801. Operators should file all capabilities for which the aircraft and crew is certified, capable, and authorized. PBN/capability must be filed in Item 18, Other Information. When filing a capability, ATC expects filers to use that capability; for example, answer a SATVOICE call from ATC if code M1 or M3 is filed in Item 10a.

**5.** Prior to departure from within, or prior to entering controlled airspace, a pilot must submit a complete flight plan and receive an air traffic clearance, if weather conditions are below VFR minimums. IFR flight plans may be submitted to an FSS or flight plan filing service.

**6.** Pilots should file IFR flight plans at least 30 minutes prior to estimated time of departure to preclude possible delay in receiving a departure clearance from ATC.

**7.** In order to provide FAA traffic management units' strategic route planning capabilities, nonscheduled operators conducting IFR operations above FL 230 are requested to voluntarily file IFR flight plans at least 4 hours prior to estimated time of departure (ETD).

**8.** To minimize your delay in entering Class B, Class C, Class D, and Class E surface areas at destination when IFR weather conditions exist or are forecast at that airport, an IFR flight plan should be filed before

departure. Otherwise, a 30-minute delay is not unusual in receiving an ATC clearance because of time spent in processing flight plan data.

9. Traffic saturation frequently prevents control personnel from accepting flight plans by radio. In such cases, the pilot is advised to contact a flight plan filing service for the purpose of filing the flight plan.

10. When requesting an IFR clearance, it is highly recommended that the departure airport be identified by stating the city name and state and/or the airport location identifier in order to clarify to ATC the exact location of the intended airport of departure.

11. Multiple versions of flight plans for the same flight may lead to unsafe conditions and errors within the air traffic system. Pilots must not file more than one flight plan for the same flight without ensuring that the previous flight plan has been successfully removed.

12. When a pilot is aware that the possibility for multiple flight plans on the same aircraft may exist, ensuring receipt of a full route clearance will help mitigate chances of error.

**REFERENCE-**

*AIM, Para 5-1-12, Change in Flight Plan.*

*AIM, Para 5-1-13, Change in Proposed Departure Time.*

**b. Airways and Jet Routes Depiction on Flight Plan**

1. It is vitally important that the route of flight be accurately and completely described in the flight plan. To simplify definition of the proposed route, and to facilitate ATC, pilots are requested to file via airways or jet routes established for use at the altitude or flight level planned.

2. If flight is to be conducted via designated airways or jet routes, describe the route by indicating the type and number designators of the airway(s) or jet route(s) requested. If more than one airway or jet route is to be used, clearly indicate points of transition. If the transition is made at an unnamed intersection, show the next succeeding NAVAID or named intersection on the intended route and the complete route from that point. Reporting points may be identified by using authorized name/code as depicted on appropriate aeronautical charts. The following two examples illustrate the need to specify the transition point when two routes share more than one transition fix.

**EXAMPLE-**

1. *ALB J37 BUMPY J14 BHM Spelled out: from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at BUMPY intersection, thence via Jet Route 14 to Birmingham, Alabama.*

2. *ALB J37 ENO J14 BHM Spelled out: from Albany, New York, via Jet Route 37 transitioning to Jet Route 14 at Smyrna VORTAC (ENO) thence via Jet Route 14 to Birmingham, Alabama.*

3. The route of flight may also be described by naming the reporting points or NAVAIDs over which the flight will pass, provided the points named are established for use at the altitude or flight level planned.

**EXAMPLE-**

*BWI V44 SWANN V433 DQO Spelled out: from Baltimore-Washington International, via Victor 44 to Swann intersection, transitioning to Victor 433 at Swann, thence via Victor 433 to Dupont.*

4. When the route of flight is defined by named reporting points, whether alone or in combination with airways or jet routes, and the navigational aids (VOR, VORTAC, TACAN, NDB) to be used for the flight are a combination of different types of aids, enough information should be included to clearly indicate the route requested.

**EXAMPLE-**

*LAX J5 LKV J3 GEG YXC FL 330 J500 VLR J515 YWG Spelled out: from Los Angeles International via Jet Route 5 Lakeview, Jet Route 3 Spokane, direct Cranbrook, British Columbia VOR/DME, Flight Level 330 Jet Route 500 to Langruth, Manitoba VORTAC, Jet Route 515 to Winnipeg, Manitoba.*

5. When filing IFR, it is to the pilot's advantage to file a preferred route.

**REFERENCE-**

*Preferred IFR Routes are described and tabulated in the Chart Supplement.*

Additionally available at U.S.

[http://www.fly.faa.gov/Products/Coded\\_Departure\\_Routes/NFDC\\_Prefered\\_Routes\\_Database/nfdc\\_preferred\\_routes\\_database.html](http://www.fly.faa.gov/Products/Coded_Departure_Routes/NFDC_Prefered_Routes_Database/nfdc_preferred_routes_database.html).

**6.** ATC may issue a SID or a STAR, as appropriate.

**REFERENCE–**

AIM, Para 5–2–9, Instrument Departure Procedures (DP) – Obstacle Departure Procedures (ODP) and Standard Instrument Departures (SID), and Diverse Vector Areas (DVA).

AIM, Para 5–4–1, Standard Terminal Arrival (STAR) Procedures.

**NOTE–**

Pilots not desiring an RNAV SID or RNAV STAR should enter in Item #18, PBN code: NAV/RNV A0 and/or D0.

**c. Direct Flights**

**1.** All or any portions of the route which will not be flown on the radials or courses of established airways or routes, such as direct route flights, must be defined by indicating the radio fixes over which the flight will pass. Fixes selected to define the route must be those over which the position of the aircraft can be accurately determined. Such fixes automatically become compulsory reporting points for the flight, unless advised otherwise by ATC. Only those navigational aids established for use in a particular structure; i.e., in the low or high structures, may be used to define the en route phase of a direct flight within that altitude structure.

**2.** The azimuth feature of VOR aids and the azimuth and distance (DME) features of VORTAC and TACAN aids are assigned certain frequency protected areas of airspace which are intended for application to established airway and route use, and to provide guidance for planning flights outside of established airways or routes. These areas of airspace are expressed in terms of cylindrical service volumes of specified dimensions called “class limits” or “categories.”

**REFERENCE–**

AIM, Para 1–1–8, Navigational Aid (NAVAID) Service Volumes.

**3.** An operational service volume has been established for each class in which adequate signal coverage and frequency protection can be assured. To facilitate use of VOR, VORTAC, or TACAN aids, consistent with their operational service volume limits, pilot use of such aids for defining a direct route of flight in controlled airspace should not exceed the following:

(a) Operations above FL 450 – Use aids not more than 200 NM apart. These aids are depicted on en route high altitude charts.

(b) Operation off established routes from 18,000 feet MSL to FL 450 – Use aids not more than 260 NM apart. These aids are depicted on en route high altitude charts.

(c) Operation off established airways below 18,000 feet MSL – Use aids not more than 80 NM apart. These aids are depicted on en route low altitude charts.

(d) Operation off established airways between 14,500 feet MSL and 17,999 feet MSL in the conterminous U.S. – (H) facilities not more than 200 NM apart may be used.

**4.** Increasing use of self-contained airborne navigational systems which do not rely on the VOR/VORTAC/TACAN system has resulted in pilot requests for direct routes which exceed NAVAID service volume limits.

**5.** At times, ATC will initiate a direct route in a surveillance environment which exceeds NAVAID service volume limits. Pilots must adhere to the altitude specified in the clearance.

**6.** Appropriate airway or jet route numbers may also be included to describe portions of the route to be flown.

**EXAMPLE–**

MDW V262 BDF V10 BRL STJ SLN GCK Spelled out: from Chicago Midway Airport via Victor 262 to Bradford, Victor 10 to Burlington, Iowa, direct St. Joseph, Missouri, direct Salina, Kansas, direct Garden City, Kansas.

**NOTE–**

When route of flight is described by radio fixes, the pilot will be expected to fly a direct course between the points named.

7. Pilots are reminded that they are responsible for adhering to obstruction clearance requirements on those segments of direct routes that are outside of controlled airspace and ATC surveillance capability. The MEAs and other altitudes shown on IFR en route charts pertain to those route segments within controlled airspace, and those altitudes may not meet obstruction clearance criteria when operating off those routes.

**NOTE—**

*Refer to 14 CFR 91.177 for pilot responsibility when flying random point to point routes.*

**d. Area Navigation (RNAV)/Global Navigation Satellite System (GNSS)**

1. When not being radar monitored, GNSS-equipped RNAV aircraft on random RNAV routes must be cleared via or reported to be established on a point-to-point route.

(a) The points must be published NAVAIDs, waypoints, fixes or airports recallable from the aircraft's navigation database. The points must be displayed on controller video maps or depicted on the controller chart displayed at the control position. When applying non-radar separation the maximum distance between points must not exceed 500 miles.

(b) ATC will protect 4 miles either side of the route centerline.

(c) Assigned altitudes must be at or above the highest MIA along the projected route segment being flown, including the protected airspace of that route segment.

2. Pilots of aircraft equipped with approved area navigational equipment may file for RNAV routes throughout the National Airspace System in accordance with the following procedures:

(a) File airport-to-airport flight plans.

(b) File the appropriate indication of RNAV and/or RNP capability in the flight plan.

(c) Plan the random route portion of the flight plan to begin and end over appropriate arrival and departure transition fixes or appropriate navigation aids for the altitude stratum within which the flight will be conducted. The use of normal preferred departure and arrival routes (DP/STAR), where established, is recommended.

(d) File route structure transitions to and from the random route portion of the flight.

(e) Define the random route by waypoints. File route description waypoints by using degree distance fixes based on navigational aids which are appropriate for the altitude stratum.

(f) File a minimum of one route description waypoint for each ARTCC through whose area the random route will be flown. These waypoints must be located within 200 NM of the preceding center's boundary.

(g) File an additional route description waypoint for each turn point in the route.

(h) Plan additional route description waypoints as required to ensure accurate navigation via the filed route of flight. Navigation is the pilot's responsibility unless ATC assistance is requested.

(i) Plan the route of flight so as to avoid prohibited and restricted airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facilities are advised.

**NOTE—**

*To be approved for use in the National Airspace System, RNAV equipment must meet system availability, accuracy, and airworthiness standards. For additional information and guidance on RNAV equipment requirements see Advisory Circular (AC) 20-138 Airworthiness Approval of Positioning and Navigation Systems and AC 90-100 U.S. Terminal and En Route Area Navigation (RNAV) Operations.*

3. Pilots of aircraft equipped with latitude/longitude coordinate navigation capability, independent of VOR/TACAN references, may file for random RNAV using the following procedures:

(a) File airport-to-airport flight plans prior to departure.

(b) File the appropriate RNAV capability certification suffix in the flight plan.

(c) Plan the random route portion of the flight to begin and end over published departure/arrival transition fixes or appropriate navigation aids for airports without published transition procedures. The use of preferred departure and arrival routes, such as DP and STAR, where established, is recommended.

(d) Plan the route of flight so as to avoid prohibited and restricted airspace by 3 NM unless permission has been obtained to operate in that airspace and the appropriate ATC facility is advised.

(e) Define the route of flight after the departure fix, including each intermediate fix (turnpoint) and the arrival fix for the destination airport in terms of latitude/longitude coordinates plotted to the nearest minute or in terms of Navigation Reference System (NRS) waypoints. For latitude/longitude filing the arrival fix must be identified by both the latitude/longitude coordinates and a fix identifier.

**EXAMPLE–**

*MIA*<sup>1</sup> *SRQ*<sup>2</sup> *3407/10615*<sup>3</sup> *3407/11546 TNP*<sup>4</sup> *LAX*<sup>5</sup>

<sup>1</sup> *Departure airport.*

<sup>2</sup> *Departure fix.*

<sup>3</sup> *Intermediate fix (turning point).*

<sup>4</sup> *Arrival fix.*

<sup>5</sup> *Destination airport.*

*or*

*ORD*<sup>1</sup> *IOW*<sup>2</sup> *KP49G*<sup>3</sup> *KD34U*<sup>4</sup> *KL16O*<sup>5</sup> *OAL*<sup>6</sup> *MOD2*<sup>7</sup> *SFO*<sup>8</sup>

<sup>1</sup> *Departure airport.*

<sup>2</sup> *Transition fix.*

<sup>3</sup> *Minneapolis ARTCC waypoint.*

<sup>4</sup> *Denver ARTCC Waypoint.*

<sup>5</sup> *Los Angeles ARTCC waypoint.*

<sup>6</sup> *Transition fix.*

<sup>7</sup> *Arrival.*

<sup>8</sup> *Destination airport.*

(f) Record latitude/longitude coordinates by two or four figures describing latitude in degrees followed by an N or S, followed by 3 or 5 digits longitude, followed by an E or W. Separate latitude and longitude with a solidus “/.” Use leading zeros if necessary.

(g) File at FL 390 or above for the random RNAV portion of the flight.

(h) Fly all routes/route segments on Great Circle tracks.

(i) Make any inflight requests for random RNAV clearances or route amendments to an en route ATC facility.

### **5–1–7. Flight Plans For Military/DoD Use Only**

*(See Appendix 4, FAA Form 7233–1, Flight Plan)*

Within U.S. controlled airspace, FAA Form 7233–1 or DD Form 175 may be used by DoD aircraft. However, use of the DD Form 1801 by DoD aircraft is recommended for IFR flights and is mandatory for:

- a. Any flight that will depart U.S. controlled airspace.
- b. Any flight requesting routing that requires Performance Based Navigation.
- c. Any flight requesting services that require filing of capabilities only supported in the international flight plan.

**NOTE–**

1. *The order of flight plan elements in DD Form 175 is equivalent to that of FAA Form 7233–1.*

2. *Civilians who file stereo route flight plans, may use FAA Form 7233–1, Flight Plan.*

### **5–1–8. Flight Plan – Defense VFR (DVFR) Flights**

VFR flights (except for DoD and law enforcement flights) into an ADIZ are required to file DVFR flight plans for security purposes. Detailed ADIZ procedures are found in Section 6, National Security and Interception Procedures, of this chapter.

**REFERENCE-**

14 CFR Part 99, Security Control for Air Traffic.

- a. DVFR flight plans must be filed using FAA Form 7233-4 or DD Form 1801.
- b. Enter the letter “D” in Item 8, Type of Flight, of FAA Form 7233-4 or DD Form 1801.
- c. DVFR flights where pilots decline search and rescue coverage must clearly indicate “NORIV” in Item 18 following the indicator “RMK/.” This flight plan must still be activated in order to properly notify NORAD, however no flight plan cancellation will be expected.

**EXAMPLE-**

RMK/NORIV

**5-1-9. Single Flights Conducted With Both VFR and IFR Flight Plans**

- a. Flight plans which combine VFR operation on an active VFR flight plan for one portion of a flight, and IFR for another portion, sometimes known as a composite flight plan, cannot be accepted or processed by current en route automation systems.
- b. Pilots are free to operate VFR in VFR conditions prior to accepting an IFR clearance from the appropriate control facility, or may cancel an IFR clearance and proceed VFR as desired. However, if a pilot desires to be on an active VFR flight plan, with search and rescue provisions, for the portion of flight not conducted under an IFR clearance, a separate VFR flight plan must be filed, activated, and closed.
- c. If a pilot desires to be on an active VFR flight plan prior to or following the IFR portion of the flight, that flight plan must be filed and processed as a distinct and separate flight plan. The VFR flight plan must be opened and closed with either a Flight Service Station or other service provider having the capability to open and close VFR flight plans. Air Traffic Control does not have the ability to determine if an aircraft is operating on an active VFR flight plan and cannot process the activation or cancellation of a VFR flight plan.
- d. Pilots may propose to commence the IFR portion of flight at a defined airborne point. This airborne point, or fix, is entered as the departure point in Item 13 of FAA Form 7233-4 or DD Form 1801.
- e. Pilots may indicate in the IFR flight plan the intention to terminate the IFR portion of flight at any defined airborne point. The airborne point, or fix, is entered as the destination point in Item 16 of FAA Form 7233-4 or DD Form 1801.
- f. Prior to beginning the IFR portion of flight, a pilot must receive an IFR clearance from the appropriate control facility.
- g. If the pilot does not desire further clearance after reaching the clearance limit, he or she must advise ATC to cancel the IFR clearance.

**5-1-10. IFR Operations to High Altitude Destinations**

- a. Pilots planning IFR flights to airports located in mountainous terrain are cautioned to consider the necessity for an alternate airport even when the forecast weather conditions would technically relieve them from the requirement to file one.

**REFERENCE-**

14 CFR Section 91.167.

AIM, Para 4-1-19, Tower En Route Control (TEC).

- b. The FAA has identified three possible situations where the failure to plan for an alternate airport when flying IFR to such a destination airport could result in a critical situation if the weather is less than forecast and sufficient fuel is not available to proceed to a suitable airport.

1. An IFR flight to an airport where the Minimum Descent Altitudes (MDAs) or landing visibility minimums for *all instrument approaches* are higher than the forecast weather minimums specified in 14 CFR

Section 91.167(b). For example, there are 3 high altitude airports in the U.S. with approved instrument approach procedures where all of the MDAs are greater than 2,000 feet and/or the landing visibility minimums are greater than 3 miles (Bishop, California; South Lake Tahoe, California; and Aspen–Pitkin Co./Sardy Field, Colorado). In the case of these airports, it is possible for a pilot to elect, on the basis of forecasts, not to carry sufficient fuel to get to an alternate when the ceiling and/or visibility is actually lower than that necessary to complete the approach.

2. A small number of other airports in mountainous terrain have MDAs which are slightly (100 to 300 feet) below 2,000 feet AGL. In situations where there is an option as to whether to plan for an alternate, pilots should bear in mind that just a slight worsening of the weather conditions from those forecast could place the airport below the published IFR landing minimums.

3. An IFR flight to an airport which requires special equipment; i.e., DME, glide slope, etc., in order to make the available approaches to the lowest minimums. Pilots should be aware that all other minimums on the approach charts may require weather conditions better than those specified in 14 CFR Section 91.167(b). An inflight equipment malfunction could result in the inability to comply with the published approach procedures or, again, in the position of having the airport below the published IFR landing minimums for all remaining instrument approach alternatives.

### **5–1–11. Flights Outside U.S. Territorial Airspace**

a. When conducting flights, particularly extended flights, outside the U.S. and its territories, full account should be taken of the amount and quality of air navigation services available in the airspace to be traversed. Every effort should be made to secure information on the location and range of navigational aids, availability of communications and meteorological services, the provision of air traffic services, including alerting service, and the existence of search and rescue services.

b. Pilots should remember that there is a need to continuously guard the VHF emergency frequency 121.5 MHz when on long over-water flights, except when communications on other VHF channels, equipment limitations, or cockpit duties prevent simultaneous guarding of two channels. Guarding of 121.5 MHz is particularly critical when operating in proximity to Flight Information Region (FIR) boundaries, for example, operations on Route R220 between Anchorage and Tokyo, since it serves to facilitate communications with regard to aircraft which may experience in-flight emergencies, communications, or navigational difficulties.

#### **REFERENCE–**

*ICAO Annex 10, Vol II, Paras 5.2.2.1.1.1 and 5.2.2.1.1.2.*

c. The filing of a flight plan, always good practice, takes on added significance for extended flights outside U.S. airspace and is, in fact, usually required by the laws of the countries being visited or overflown. It is also particularly important in the case of such flights that pilots leave a complete itinerary and schedule of the flight with someone directly concerned and keep that person advised of the flight's progress. If serious doubt arises as to the safety of the flight, that person should first contact the appropriate FSS. Round Robin Flight Plans to Canada and Mexico are not accepted.

d. All pilots should review the foreign airspace and entry restrictions published in the appropriate Aeronautical Information Publication (AIP) during the flight planning process. Foreign airspace penetration without official authorization can involve both danger to the aircraft and the imposition of severe penalties and inconvenience to both passengers and crew. A flight plan on file with ATC authorities does not necessarily constitute the prior permission required by certain other authorities. The possibility of fatal consequences cannot be ignored in some areas of the world.

e. Current NOTAMs for foreign locations must also be reviewed. International Notices regarding specific countries may be obtained through the Federal NOTAM System (FNS) NOTAM Search External Links or the Air Traffic Plans and Publications website. For additional flight information at foreign locations, pilots should also review the FAA's Prohibitions, Restrictions, and Notices website at [https://www.faa.gov/air\\_traffic/publications/us\\_restrictions/](https://www.faa.gov/air_traffic/publications/us_restrictions/).

f. When customs notification to foreign locations is required, it is the responsibility of the pilot to arrange for customs notification in a timely manner.

g. Aircraft arriving to locations in U.S. territorial airspace must meet the entry requirements as described in AIM Section 6, National Security and Interception Procedures.

### **5-1-12. Change in Flight Plan**

a. In addition to altitude or flight level, destination and/or route changes, increasing or decreasing the speed of an aircraft constitutes a change in a flight plan. Therefore, at any time the average true airspeed at cruising altitude between reporting points varies or is expected to vary from that given in the flight plan by *plus or minus 5 percent, or 10 knots, whichever is greater*, ATC should be advised.

b. All changes to existing flight plans should be completed more than 46 minutes prior to the proposed departure time. Changes must be made with the initial flight plan service provider. If the initial flight plan's service provider is unavailable, filers may contact an ATC facility or FSS to make the necessary revisions. Any revision 46 minutes or less from the proposed departure time must be coordinated through an ATC facility or FSS.

### **5-1-13. Change in Proposed Departure Time**

a. To prevent computer saturation in the en route environment, parameters have been established to delete proposed departure flight plans which have not been activated. Most centers have this parameter set so as to delete these flight plans a minimum of 2 hours after the proposed departure time or Expect Departure Clearance Time (EDCT). To ensure that a flight plan remains active, pilots whose actual departure time will be delayed 2 hours or more beyond their filed departure time, are requested to notify ATC of their new proposed departure time.

b. Due to traffic saturation, ATC personnel frequently will be unable to accept these revisions via radio. It is recommended that you forward these revisions to a flight plan service provider or FSS.

### **5-1-14. Closing VFR/DVFR Flight Plans**

A pilot is responsible for ensuring that his/her VFR or DVFR flight plan is canceled. You should close your flight plan with the nearest FSS, or if one is not available, you may request any ATC facility to relay your cancellation to the FSS. Control towers do not automatically close VFR or DVFR flight plans since they do not know if a particular VFR aircraft is on a flight plan. If you fail to report or cancel your flight plan within  $\frac{1}{2}$  hour after your ETA, search and rescue procedures are started.

#### **REFERENCE-**

*14 CFR Section 91.153.*

*14 CFR Section 91.169.*

### **5-1-15. Canceling IFR Flight Plan**

a. 14 CFR Sections 91.153 and 91.169 include the statement "When a flight plan has been activated, the pilot-in-command, upon canceling or completing the flight under the flight plan, must notify an FAA Flight Service Station or ATC facility."

b. An IFR flight plan may be canceled at any time the flight is operating in VFR conditions outside Class A airspace by pilots stating "CANCEL MY IFR FLIGHT PLAN" to the controller or air/ground station with which they are communicating. Immediately after canceling an IFR flight plan, a pilot should take the necessary action to change to the appropriate air/ground frequency, VFR radar beacon code and VFR altitude or flight level.

c. ATC separation and information services will be discontinued, including radar services (where applicable). Consequently, if the canceling flight desires VFR radar advisory service, the pilot must specifically request it.

#### **NOTE-**

*Pilots must be aware that other procedures may be applicable to a flight that cancels an IFR flight plan within an area where a special program, such as a designated TRSA, Class C airspace, or Class B airspace, has been established.*

d. If a DVFR flight plan requirement exists, the pilot is responsible for filing this flight plan to replace the canceled IFR flight plan. If a subsequent IFR operation becomes necessary, a new IFR flight plan must be filed and an ATC clearance obtained before operating in IFR conditions.

e. If operating on an IFR flight plan to an airport with a functioning control tower, the flight plan is automatically closed upon landing.

f. If operating on an IFR flight plan to an airport where there is no functioning control tower, the pilot must initiate cancellation of the IFR flight plan. This can be done after landing if there is a functioning FSS or other means of direct communications with ATC. In the event there is no FSS and/or air/ground communications with ATC is not possible below a certain altitude, the pilot should, weather conditions permitting, cancel the IFR flight plan while still airborne and able to communicate with ATC by radio. This will not only save the time and expense of canceling the flight plan by telephone but will quickly release the airspace for use by other aircraft.

### 5-1-16. RNAV and RNP Operations

a. During the pre-flight planning phase the availability of the navigation infrastructure required for the intended operation, including any non-RNAV contingencies, must be confirmed for the period of intended operation. Availability of the onboard navigation equipment necessary for the route to be flown must be confirmed. Pilots are reminded that on composite VFR to IFR flight plan, or on an IFR clearance, while flying unpublished departures via RNAV into uncontrolled airspace, the PIC is responsible for terrain and obstruction clearance until reaching the MEA/MIA/MVA/OROCA.

**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.*

b. If a pilot determines a specified RNP level cannot be achieved, revise the route or delay the operation until appropriate RNP level can be ensured.

c. The onboard navigation database must be current and appropriate for the region of intended operation and must include the navigation aids, waypoints, and coded terminal airspace procedures for the departure, arrival and alternate airfields.

d. During system initialization, pilots of aircraft equipped with a Flight Management System or other RNAV-certified system, must confirm that the navigation database is current, and verify that the aircraft position has been entered correctly. Flight crews should crosscheck the cleared flight plan against charts or other applicable resources, as well as the navigation system textual display and the aircraft map display. This process includes confirmation of the waypoints sequence, reasonableness of track angles and distances, any altitude or speed constraints, and identification of fly-by or fly-over waypoints. A procedure must not be used if validity of the navigation database is in doubt.

e. Prior to commencing takeoff, the flight crew must verify that the RNAV system is operating correctly and the correct airport and runway data have been loaded.

f. During the pre-flight planning phase RAIM prediction must be performed 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) using current GPS satellite information. In the event of a predicted, continuous loss of RAIM of more than five (5) minutes for any part of the intended flight, the flight should be

delayed, canceled, or re-routed where RAIM requirements can be met. Operators may satisfy the predictive RAIM requirement through any one of the following methods:

1. Operators may monitor the status of each satellite in its plane/slot position, by accounting for the latest GPS constellation status (for example, NOTAMs or NANUs), and compute RAIM availability using model-specific RAIM prediction software;
2. Operators may use the Service Availability Prediction Tool (SAPT) on the FAA en route and terminal RAIM prediction website;
3. Operators may contact a Flight Service Station to obtain non-precision approach RAIM;
4. Operators may use a third party interface, incorporating FAA/VOLPE RAIM prediction data without altering performance values, to predict RAIM outages for the aircraft's predicted flight path and times;
5. Operators may use the receiver's installed RAIM prediction capability (for TSO-C129a/Class A1/B1/C1 equipment) to provide non-precision approach RAIM, accounting for the latest GPS constellation status (for example, NOTAMs or NANUs). Receiver non-precision approach RAIM should be checked at airports spaced at intervals not to exceed 60 NM along the RNAV 1 procedure's flight track. "Terminal" or "Approach" RAIM must be available at the ETA over each airport checked; or,
6. Operators not using model-specific software or FAA/VOLPE RAIM data will need FAA operational approval.

**NOTE-**

*If TSO-C145/C146 equipment is used to satisfy the RNAV and RNP requirement, the pilot/operator need not perform the prediction if WAAS coverage is confirmed to be available along the entire route of flight. Outside the U.S. or in areas where WAAS coverage is not available, operators using TSO-C145/C146 receivers are required to check GPS RAIM availability.*

### **5-1-17. Cold Temperature Operations**

**a.** Pilots should begin planning for cold temperature operations during the preflight planning phase. Cold temperatures produce barometric altimetry errors, which affect instrument flight procedures. Currently there are 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 an 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.

**b.** Pilots should request the lowest forecast temperature +/- 1 hour for arrival and departure operations. If the temperature is forecast to be outside of the baro-VNAV or at or below the CTA temperature limitation, consider the following:

1. When using baro-VNAV with an aircraft that does not have an automated temperature compensating function, pilots should plan to use the appropriate minima and/or IAP.

(a) The LNAV/VNAV line of minima on an RNAV (GPS) may not be used without an approved automated temperature compensating function if the temperature is outside of the baro-VNAV temperature range limitation. The LNAV minima may be used.

(b) The RNAV (RNP) procedure may not be accomplished without an approved automated temperature compensating function if the temperature is outside of the baro-VNAV temperature range limitation.

2. If the temperature is forecast to be at or below the published CTA temperature, pilots should calculate a correction for the appropriate segment/s or a correction for all the segments if using the "All Segments Method."

Pilots should review the operating procedures for the aircraft's temperature compensating system when planning

to use the system for any cold temperature corrections. Any planned altitude correction for the intermediate and/or missed approach holding segments must be coordinated with ATC. Pilots do not have to advise ATC of a correction in the final segment.

**NOTE—**

*The charted baro-VNAV temperature range limitation does not apply to pilots operating aircraft with an airworthiness approval to conduct an RNAV (GPS) approach to LNAV/VNAV minimums with the use of SBAS vertical guidance.*

**REFERENCE—**

*AIM, Chapter 7, Section 3, Cold Temperature Barometric Altimeter Errors, Setting Procedures, and Cold Temperature Airports (CTA).*



## Section 2. Departure Procedures

### 5-2-1. Pre-taxi Clearance Procedures

a. Certain airports have established pre-taxi clearance programs whereby pilots of departing instrument flight rules (IFR) aircraft may elect to receive their IFR clearances before they start taxiing for takeoff. The following provisions are included in such procedures:

1. Pilot participation is not mandatory.
2. Participating pilots call clearance delivery or ground control not more than 10 minutes before proposed taxi time.
3. IFR clearance (or delay information, if clearance cannot be obtained) is issued at the time of this initial call-up.
4. When the IFR clearance is received on clearance delivery frequency, pilots call ground control when ready to taxi.
5. Normally, pilots need not inform ground control that they have received IFR clearance on clearance delivery frequency. Certain locations may, however, require that the pilot inform ground control of a portion of the routing or that the IFR clearance has been received.
6. If a pilot cannot establish contact on clearance delivery frequency or has not received an IFR clearance before ready to taxi, the pilot should contact ground control and inform the controller accordingly.

b. Locations where these procedures are in effect are indicated in the Chart Supplement. ■

### 5-2-2. Automated Pre-Departure Clearance Procedures

a. Many airports in the National Airspace System are equipped with the Terminal Data Link System (TDLS) that includes the Pre-Departure Clearance (PDC) and Controller Pilot Data Link Communication-Departure Clearance (CPDLC-DCL) functions. Both the PDC and CPDLC-DCL functions automate the Clearance Delivery operations in the ATCT for participating users. Both functions display IFR clearances from the ARTCC to the ATCT. The Clearance Delivery controller in the ATCT can append local departure information and transmit the clearance via data link to participating airline/service provider computers for PDC. The airline/service provider will then deliver the clearance via the Aircraft Communications Addressing and Reporting System (ACARS) or a similar data link system, or for non-data link equipped aircraft, via a printer located at the departure gate. For CPDLC-DCL, the departure clearance is uplinked from the ATCT via the Future Air Navigation System (FANS) to the aircraft avionics and requires a response from the flight crew. Both PDC and CPDLC-DCL reduce frequency congestion, controller workload, and are intended to mitigate delivery/read back errors.

b. Both services are available only to participating aircraft that have subscribed to the service through an approved service provider.

c. In all situations, the pilot is encouraged to contact clearance delivery if a question or concern exists regarding an automated clearance. Due to technical reasons, the following limitations/differences exist between the two services:

#### 1. PDC

(a) Aircraft filing multiple flight plans are limited to one PDC clearance per departure airport within an 18-hour period. Additional clearances will be delivered verbally.

(b) If the clearance is revised or modified prior to delivery, it will be rejected from PDC and the clearance will need to be delivered verbally.

(c) No acknowledgment of receipt or read back is required for a PDC.

## 2. CPDLC–DCL

- (a) No limitation to the number of clearances received.
- (b) Allows delivery of revised flight data, including revised departure clearances.
- (c) A response from the flight crew is required.
- (d) Requires a logon to the FAA National Single Data Authority – KUSA – utilizing the ATC FANS application.
- (e) To be eligible, operators must have received CPDLC/FANS authorization from the responsible civil aviation authority, and file appropriate equipment information in ICAO field 10a and in the ICAO field 18 DAT (Other Data Applications) of the flight plan.

### 5–2–3. IFR Clearances Off Uncontrolled Airports

- a. Pilots departing on an IFR flight plan should consult the Chart Supplement to determine the frequency or telephone number to use to contact clearance delivery. On initial contact, pilots should advise that the flight is IFR and state the departure and destination airports.
- b. Air traffic facilities providing clearance delivery services via telephone will have their telephone number published in the Chart Supplement of that airport’s entry. This same section may also contain a telephone number to use for cancellation of an IFR flight plan after landing.
- c. Except in Alaska, pilots of MEDEVAC flights may obtain a clearance by calling 1–877–543–4733.

### 5–2–4. Taxi Clearance

Pilots on IFR flight plans should communicate with the control tower on the appropriate ground control or clearance delivery frequency prior to starting engines, to receive engine start time, taxi, and/or clearance information.

### 5–2–5. Line Up and Wait (LUAW)

a. Line up and wait is an air traffic control (ATC) procedure designed to position an aircraft onto the runway for an imminent departure. The ATC instruction “LINE UP AND WAIT” is used to instruct a pilot to taxi onto the departure runway and line up and wait.

**EXAMPLE–**

*Tower: “N234AR Runway 24L, line up and wait.”*

b. This ATC instruction is not an authorization to takeoff. In instances where the pilot has been instructed to line up and wait and has been advised of a reason/condition (wake turbulence, traffic on an intersecting runway, etc.) or the reason/condition is clearly visible (another aircraft that has landed on or is taking off on the same runway), and the reason/condition is satisfied, the pilot should expect an imminent takeoff clearance, unless advised of a delay. If you are uncertain about any ATC instruction or clearance, contact ATC immediately.

c. If a takeoff clearance is not received within a reasonable amount of time after clearance to line up and wait, ATC should be contacted.

**EXAMPLE–**

*Aircraft: Cessna 234AR holding in position Runway 24L.*

*Aircraft: Cessna 234AR holding in position Runway 24L at Bravo.*

**NOTE–**

*FAA analysis of accidents and incidents involving aircraft holding in position indicate that two minutes or more elapsed between the time the instruction was issued to line up and wait and the resulting event (for example, land–over or go–around). Pilots should consider the length of time that they have been holding in position whenever they HAVE NOT been advised of any expected delay to determine when it is appropriate to query the controller.*

**REFERENCE-**

*AIM, Para 5-3-2, Position Reporting.*

**3.** At times controllers will ask pilots to verify that they are at a particular altitude. The phraseology used will be: “VERIFY AT (altitude).” In climbing or descending situations, controllers may ask pilots to “*VERIFY ASSIGNED ALTITUDE AS (altitude).*” Pilots should confirm that they are at the altitude stated by the controller or that the assigned altitude is correct as stated. If this is not the case, they should inform the controller of the actual altitude being maintained or the different assigned altitude.

**CAUTION-**

*Pilots should not take action to change their actual altitude or different assigned altitude to the altitude stated in the controllers verification request unless the controller specifically authorizes a change.*

**c. ARTCC Radio Frequency Outage.** ARTCCs normally have at least one back-up radio receiver and transmitter system for each frequency, which can usually be placed into service quickly with little or no disruption of ATC service. Occasionally, technical problems may cause a delay but switchover seldom takes more than 60 seconds. When it appears that the outage will not be quickly remedied, the ARTCC will usually request a nearby aircraft, if there is one, to switch to the affected frequency to broadcast communications instructions. It is important, therefore, that the pilot wait at least 1 minute before deciding that the ARTCC has actually experienced a radio frequency failure. When such an outage does occur, the pilot should, if workload and equipment capability permit, maintain a listening watch on the affected frequency while attempting to comply with the following recommended communications procedures:

**1.** If two-way communications cannot be established with the ARTCC after changing frequencies, a pilot should attempt to recontact the transferring controller for the assignment of an alternative frequency or other instructions.

**2.** When an ARTCC radio frequency failure occurs after two-way communications have been established, the pilot should attempt to reestablish contact with the center on any other known ARTCC frequency, preferably that of the next responsible sector when practicable, and ask for instructions. However, when the next normal frequency change along the route is known to involve another ATC facility, the pilot should contact that facility, if feasible, for instructions. If communications cannot be reestablished by either method, the pilot is expected to request communications instructions from the FSS appropriate to the route of flight.

**NOTE-**

*The exchange of information between an aircraft and an ARTCC through an FSS is quicker than relay via company radio because the FSS has direct interphone lines to the responsible ARTCC sector. Accordingly, when circumstances dictate a choice between the two, during an ARTCC frequency outage, relay via FSS radio is recommended.*

**d. Oakland Oceanic FIR.** The use of CPDLC and ADS-C in the Oakland Oceanic FIR (KZAK) is only permitted by Inmarsat and Iridium customers. All other forms of data link connectivity are not authorized. Users must ensure that the proper data link code is filed in Item 10a of the ICAO FPL in order to indicate which satellite medium(s) the aircraft is equipped with. The identifier for Inmarsat is J5 and the identifier for Iridium is J7. If J5 or J7 is not included in the ICAO FPL, then the LOGON will be rejected by KZAK and the aircraft will not be able to connect.

**e. New York Oceanic FIR.** The use of CPDLC and ADS-C in the New York Oceanic FIR (KZWY) is only permitted by Inmarsat and Iridium customers. All other forms of data link connectivity are not authorized. Users must ensure that the proper data link code is filed in Item 10a of the ICAO FPL in order to indicate which satellite medium(s) the aircraft is equipped with. The identifier for Inmarsat is J5 and the identifier for Iridium is J7. If J5 or J7 is not included in the ICAO FPL, then the LOGON will be rejected by KZWY and the aircraft will not be able to connect.

**5-3-2. Position Reporting**

The safety and effectiveness of traffic control depends to a large extent on accurate position reporting. In order to provide the proper separation and expedite aircraft movements, ATC must be able to make accurate estimates of the progress of every aircraft operating on an IFR flight plan.

### a. Position Identification.

1. When a position report is to be made passing a VOR radio facility, the time reported should be the time at which the first complete reversal of the “to/from” indicator is accomplished.

2. When a position report is made passing a facility by means of an airborne ADF, the time reported should be the time at which the indicator makes a complete reversal.

3. When an aural or a light panel indication is used to determine the time passing a reporting point, such as a fan marker, Z marker, cone of silence or intersection of range courses, the time should be noted when the signal is first received and again when it ceases. The mean of these two times should then be taken as the actual time over the fix.

4. If a position is given with respect to distance and direction from a reporting point, the distance and direction should be computed as accurately as possible.

5. Except for terminal area transition purposes, position reports or navigation with reference to aids not established for use in the structure in which flight is being conducted will not normally be required by ATC.

**b. Position Reporting Points.** CFRs require pilots to maintain a listening watch on the appropriate frequency and, unless operating under the provisions of subparagraph c, to furnish position reports passing certain reporting points. Reporting points are indicated by symbols on en route charts. The designated compulsory reporting point symbol is a solid triangle  and the “on request” reporting point symbol is the open triangle . Reports passing an “on request” reporting point are only necessary when requested by ATC.

### c. Position Reporting Requirements.

1. **Flights Along Airways or Routes.** A position report is required by all flights regardless of altitude, including those operating in accordance with an ATC clearance specifying “VFR-on-top,” over each designated compulsory reporting point along the route being flown.

2. **Flights Along a Direct Route.** Regardless of the altitude or flight level being flown, including flights operating in accordance with an ATC clearance specifying “VFR-on-top,” pilots must report over each reporting point used in the flight plan to define the route of flight.

3. **Flights in a Radar Environment.** When informed by ATC that their aircraft are in “Radar Contact,” pilots should discontinue position reports over designated reporting points. They should resume normal position reporting when ATC advises “RADAR CONTACT LOST” or “RADAR SERVICE TERMINATED.”

4. **Flights in an Oceanic (Nonradar) Environment.** Pilots must report over each point used in the flight plan to define the route of flight, even if the point is depicted on aeronautical charts as an “on request” (non-compulsory) reporting point. For aircraft providing automatic position reporting via an Automatic Dependent Surveillance-Contract (ADS-C) logon, pilots should discontinue voice position reports.

#### NOTE—

ATC will inform pilots that they are in “radar contact”:

(a) when their aircraft is initially identified in the ATC system; and

(b) when radar identification is reestablished after radar service has been terminated or radar contact lost.

Subsequent to being advised that the controller has established radar contact, this fact will not be repeated to the pilot when handed off to another controller. At times, the aircraft identity will be confirmed by the receiving controller; however, this should not be construed to mean that radar contact has been lost. The identity of transponder equipped aircraft will be confirmed by asking the pilot to “ident,” “squawk standby,” or to change codes. Aircraft without transponders will be advised of their position to confirm identity. In this case, the pilot is expected to advise the controller if in disagreement with the position given. Any pilot who cannot confirm the accuracy of the position given because of not being tuned to the NAVAID referenced by the controller, should ask for another radar position relative to the tuned in NAVAID.

### d. Position Report Items:

#### 1. Position reports should include the following items:

(a) Identification;

## Section 4. Arrival Procedures

### 5-4-1. Standard Terminal Arrival (STAR) Procedures

a. A STAR is an ATC coded IFR arrival route established for application to arriving IFR aircraft destined for certain airports. STARs simplify clearance delivery procedures, and also facilitate transition between en route and instrument approach procedures.

1. STAR procedures may have mandatory speeds and/or crossing altitudes published. Other STARs may have planning information depicted to inform pilots what clearances or restrictions to “**expect**.” “**Expect**” altitudes/speeds are not considered STAR procedures crossing restrictions unless verbally issued by ATC. Published speed restrictions are independent of altitude restrictions and are mandatory unless modified by ATC. Pilots should plan to cross waypoints with a published speed restriction, at the published speed, and should not exceed this speed past the associated waypoint unless authorized by ATC or a published note to do so.

**NOTE-**

*The “expect” altitudes/speeds are published so that pilots may have the information for planning purposes. These altitudes/speeds must not be used in the event of lost communications unless ATC has specifically advised the pilot to expect these altitudes/speeds as part of a further clearance.*

**REFERENCE-**

*14 CFR Section 91.185(c)(2)(iii).*

2. Pilots navigating on, or navigating a published route inbound to, a STAR procedure must maintain last assigned altitude until receiving authorization to descend so as to comply with all published/issued restrictions. This authorization will contain the phraseology “DESCEND VIA.” If vectored or cleared to deviate off a STAR, pilots must consider the STAR canceled, unless the controller adds “expect to resume STAR”; pilots should then be prepared to rejoin the STAR at a subsequent fix or procedure leg. If a descent clearance has been received that included a crossing restriction, pilots should expect the controller to issue an altitude to maintain. If the STAR contains published altitude and/or speed restrictions, those restrictions are canceled and pilots will receive an altitude to maintain and, if necessary, a speed.

(a) Clearance to “descend via” authorizes pilots to:

- (1) Descend at pilot’s discretion to meet published restrictions and laterally navigate on a STAR.
- (2) When cleared to a waypoint depicted on a STAR, to descend from a previously assigned altitude at pilot’s discretion to the altitude depicted at that waypoint.
- (3) Once established on the depicted arrival, to descend and to meet all published or assigned altitude and/or speed restrictions.

**NOTE-**

1. *When otherwise cleared along a route or procedure that contains published speed restrictions, the pilot must comply with those speed restrictions independent of any descend via clearance.*
2. *ATC anticipates pilots will begin adjusting speed the minimum distance necessary prior to a published speed restriction so as to cross the waypoint/fix at the published speed. Once at the published speed, ATC expects pilots will maintain the published speed until additional adjustment is required to comply with further published or ATC assigned speed restrictions or as required to ensure compliance with 14 CFR Section 91.117.*
3. *The “descend via” is used in conjunction with STARs to reduce phraseology by not requiring the controller to restate the altitude at the next waypoint/fix to which the pilot has been cleared.*
4. *Air traffic will assign an altitude to cross the waypoint/ fix, if no altitude is depicted at the waypoint/fix, for aircraft on a direct routing to a STAR. Air traffic must ensure obstacle clearance when issuing a “descend via” instruction to the pilot.*
5. *Minimum en route altitudes (MEA) are not considered restrictions; however, pilots must remain above all MEAs, unless receiving an ATC instruction to descend below the MEA.*

**EXAMPLE-**

1. **Lateral/routing clearance only.**  
*“Cleared Tyler One arrival.”*

**NOTE–**

*In Example 1, pilots are cleared to fly the lateral path of the procedure. Compliance with any published speed restrictions is required. No descent is authorized.*

**2. Routing with assigned altitude.**

*“Cleared Tyler One arrival, descend and maintain flight level two four zero.”*

*“Cleared Tyler One arrival, descend at pilot’s discretion, maintain flight level two four zero.”*

**NOTE–**

*In Example 2, the first clearance requires the pilot to descend to FL 240 as directed, comply with any published speed restrictions, and maintain FL 240 until cleared for further vertical navigation with a newly assigned altitude or a “descend via” clearance.*

*The second clearance authorizes the pilot to descend to FL 240 at his discretion, to comply with any published speed restrictions, and then maintain FL 240 until issued further instructions.*

**3. Lateral/routing and vertical navigation clearance.**

*“Descend via the Eagul Five arrival.”*

*“Descend via the Eagul Five arrival, except, cross Vnmom at or above one two thousand.”*

**NOTE–**

*In Example 3, the first clearance authorized the aircraft to descend at pilot’s discretion on the Eagul Five arrival; the pilot must descend so as to comply with all published altitude and speed restrictions.*

*The second clearance authorizes the same, but requires the pilot to descend so as to cross at Vnmom at or above 12,000.*

**4. Lateral/routing and vertical navigation clearance when assigning altitude not published on procedure.**

*“Descend via the Eagul Five arrival, except after Geeno, maintain one zero thousand.”*

*“Descend via the Eagul Five arrival, except cross Geeno at one one thousand then maintain seven thousand.”*

**NOTE–**

*In Example 4, the first clearance authorized the aircraft to track laterally on the Eagul Five Arrival and to descend at pilot’s discretion so as to comply with all altitude and speed restrictions until reaching Geeno and then maintain 10,000. Upon reaching 10,000, aircraft should maintain 10,000 until cleared by ATC to continue to descend.*

*The second clearance requires the same, except the aircraft must cross Geeno at 11,000 and is then authorized to continue descent to and maintain 7,000.*

**5. Direct routing to intercept a STAR and vertical navigation clearance.**

*“Proceed direct Leoni, descend via the Leoni One arrival.”*

*“Proceed direct Denis, cross Denis at or above flight level two zero zero, then descend via the Mmell One arrival.”*

**NOTE–**

*In Example 5, in the first clearance an altitude is published at Leoni; the aircraft proceeds to Leoni, crosses Leoni at the published altitude and then descends via the arrival. If a speed restriction is published at Leoni, the aircraft will slow to comply with the published speed.*

*In the second clearance, there is no altitude published at Denis; the aircraft must cross Denis at or above FL200, and then descends via the arrival.*

**(b)** Pilots cleared for vertical navigation using the phraseology “descend via” must inform ATC upon initial contact with a new frequency, of the altitude leaving, “descending via (procedure name),” the runway transition or landing direction if assigned, and any assigned restrictions not published on the procedure.

**EXAMPLE–**

**1.** Delta 121 is cleared to descend via the Eagul Five arrival, runway 26 transition: “Delta One Twenty One leaving flight level one niner zero, descending via the Eagul Five arrival runway two-six transition.”

**2.** Delta 121 is cleared to descend via the Eagul Five arrival, but ATC has changed the bottom altitude to 12,000: “Delta One Twenty One leaving flight level one niner zero for one two thousand, descending via the Eagul Five arrival, runway two-six transition.”

**3.** (JetBlue 602 is cleared to descend via the Ivane Two arrival, landing south): “JetBlue six zero two leaving flight level two one zero descending via the Ivane Two arrival landing south.”

**b.** The purpose of this information is to aid the pilot in planning arrival actions; however, it is not an ATC clearance or commitment and is subject to change. Pilots should bear in mind that fluctuating weather, shifting winds, blocked runway, etc., are conditions which may result in changes to approach information previously received. It is important that pilots advise ATC immediately they are unable to execute the approach ATC advised will be used, or if they prefer another type of approach.

**c.** Aircraft destined to uncontrolled airports, which have automated weather data with broadcast capability, should monitor the ASOS/AWOS frequency to ascertain the current weather for the airport. The pilot must advise ATC when he/she has received the broadcast weather and state his/her intentions.

**NOTE–**

**1.** ASOS/AWOS should be set to provide one–minute broadcast weather updates at uncontrolled airports that are without weather broadcast capability by a human observer.

**2.** Controllers will consider the long line disseminated weather from an automated weather system at an uncontrolled airport as trend and planning information only and will rely on the pilot for current weather information for the airport. If the pilot is unable to receive the current broadcast weather, the last long line disseminated weather will be issued to the pilot. When receiving IFR services, the pilot/aircraft operator is responsible for determining if weather/visibility is adequate for approach/landing.

**d.** When making an IFR approach to an airport not served by a tower or FSS, after ATC advises “CHANGE TO ADVISORY FREQUENCY APPROVED” you should broadcast your intentions, including the type of approach being executed, your position, and when over the final approach fix inbound (nonprecision approach) or when over the outer marker or fix used in lieu of the outer marker inbound (precision approach). Continue to monitor the appropriate frequency (UNICOM, etc.) for reports from other pilots.

#### **5–4–5. Instrument Approach Procedure (IAP) Charts**

**a.** 14 CFR Section 91.175(a), Instrument approaches to civil airports, requires the use of SIAPs prescribed for the airport in 14 CFR Part 97 unless otherwise authorized by the Administrator (including ATC). If there are military procedures published at a civil airport, aircraft operating under 14 CFR Part 91 must use the civil procedure(s). Civil procedures are defined with “FAA” in parenthesis; e.g., (FAA), at the top, center of the procedure chart. DoD procedures are defined using the abbreviation of the applicable military service in parenthesis; e.g., (USAF), (USN), (USA). 14 CFR Section 91.175(g), Military airports, requires civil pilots flying into or out of military airports to comply with the IAPs and takeoff and landing minimums prescribed by the authority having jurisdiction at those airports. Unless an emergency exists, civil aircraft operating at military airports normally require advance authorization, commonly referred to as “Prior Permission Required” or “PPR.” Information on obtaining a PPR for a particular military airport can be found in the Chart Supplement. ■

**NOTE–**

*Civil aircraft may conduct practice VFR approaches using DoD instrument approach procedures when approved by the air traffic controller.*

**1.** IAPs (standard and special, civil and military) are based on joint civil and military criteria contained in the U.S. Standard for TERPS. The design of IAPs based on criteria contained in TERPS, takes into account the interrelationship between airports, facilities, and the surrounding environment, terrain, obstacles, noise sensitivity, etc. Appropriate altitudes, courses, headings, distances, and other limitations are specified and, once approved, the procedures are published and distributed by government and commercial cartographers as instrument approach charts.

**2.** Not all IAPs are published in chart form. Radar IAPs are established where requirements and facilities exist but they are printed in tabular form in appropriate U.S. Government Flight Information Publications.

**3.** The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the chart.

**(a)** Straight–in IAPs are identified by the navigational system providing the final approach guidance and the runway to which the approach is aligned (e.g., VOR RWY 13). Circling only approaches are identified by

the navigational system providing final approach guidance and a letter (e.g., VOR A). More than one navigational system separated by a slash indicates that more than one type of equipment must be used to execute the final approach (e.g., VOR/DME RWY 31). More than one navigational system separated by the word “or” indicates either type of equipment may be used to execute the final approach (e.g., VOR or GPS RWY 15).

**(b)** In some cases, other types of navigation systems including radar may be required to execute other portions of the approach or to navigate to the IAF (e.g., an NDB procedure turn to an ILS, an NDB in the missed approach, or radar required to join the procedure or identify a fix). When radar or other equipment is required for procedure entry from the en route environment, a note will be charted in the planview of the approach procedure chart (e.g., RADAR REQUIRED or ADF REQUIRED). When radar or other equipment is required on portions of the procedure outside the final approach segment, including the missed approach, a note will be charted in the notes box of the pilot briefing portion of the approach chart (e.g., RADAR REQUIRED or DME REQUIRED). Notes are not charted when VOR is required outside the final approach segment. Pilots should ensure that the aircraft is equipped with the required NAVAID(s) in order to execute the approach, including the missed approach.

**NOTE–**

Some military (i.e., U.S. Air Force and U.S. Navy) IAPs have these “additional equipment required” notes charted only in the planview of the approach procedure and do not conform to the same application standards used by the FAA.

**(c)** The FAA has initiated a program to provide a new notation for LOC approaches when charted on an ILS approach requiring other navigational aids to fly the final approach course. The LOC minimums will be annotated with the NAVAID required (e.g., “DME Required” or “RADAR Required”). During the transition period, ILS approaches will still exist without the annotation.

**(d)** Many ILS approaches having minima based on RVR are eligible for a landing minimum of RVR 1800. Some of these approaches are to runways that have touchdown zone and centerline lights. For many runways that do not have touchdown and centerline lights, it is still possible to allow a landing minimum of RVR 1800. For these runways, the normal ILS minimum of RVR 2400 can be annotated with a single or double asterisk or the dagger symbol “†”; for example “\*\* 696/24 200 (200/1/2).” A note is included on the chart stating “\*\*RVR 1800 authorized with use of FD or AP or HUD to DA.” The pilot must use the flight director, or autopilot with an approved approach coupler, or head up display to decision altitude or to the initiation of a missed approach. In the interest of safety, single pilot operators should not fly approaches to 1800 RVR minimums on runways without touchdown and centerline lights using only a flight director, unless accompanied by the use of an autopilot with an approach coupler.

**(e)** The naming of multiple approaches of the same type to the same runway is also changing. Multiple approaches with the same guidance will be annotated with an alphabetical suffix beginning at the end of the alphabet and working backwards for subsequent procedures (e.g., ILS Z RWY 28, ILS Y RWY 28, etc.). The existing annotations such as ILS 2 RWY 28 or Silver ILS RWY 28 will be phased out and replaced with the new designation. The Cat II and Cat III designations are used to differentiate between multiple ILSs to the same runway unless there are multiples of the same type.

**(f)** RNAV (GPS) approaches to LNAV, LP, LNAV/VNAV and LPV lines of minima using WAAS and RNAV (GPS) approaches to LNAV and LNAV/VNAV lines of minima using GPS are charted as RNAV (GPS) RWY (Number) (e.g., RNAV (GPS) RWY 21).

**(g)** Performance–Based Navigation (PBN) Box. As charts are updated, a procedure’s PBN requirements and conventional equipment requirements will be prominently displayed in separate, standardized notes boxes. For procedures with PBN elements, the PBN box will contain the procedure’s navigation specification(s); and, if required: specific sensors or infrastructure needed for the navigation solution, any additional or advanced functional requirements, the minimum Required Navigation Performance (RNP) value, and any amplifying remarks. Items listed in this PBN box are REQUIRED for the procedure’s PBN elements. For example, an ILS with an RNAV missed approach would require a specific capability to fly the missed approach portion of the procedure. That required capability will be listed in the PBN box. The separate Equipment Requirements box

2. R & D and controlled testing.
3. Experimental application.
4. Operational application.

f. Pilots and operators should be aware that weather services provided by entities other than FAA, NWS, or their contractors may not meet FAA/NWS quality control standards. Hence, operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (that is, product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar products, or products not supported by FAA/NWS technical specifications.

**NOTE–**

*When in doubt, consult with a FAA Flight Service Station Specialist.*

g. In addition, pilots and operators should be aware there are weather services and products available from government organizations beyond the scope of the AWRP process mentioned earlier in this section. For example, governmental agencies such as the NWS and the Aviation Weather Center (AWC), or research organizations such as the National Center for Atmospheric Research (NCAR) display weather “model data” and “experimental” products which require training and/or expertise to properly interpret and use. These products are developmental prototypes that are subject to ongoing research and can change without notice. Therefore, some data on display by government organizations, or government data on display by independent organizations may be unsuitable for flight planning purposes. Operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar weather products.

**NOTE–**

*When in doubt, consult with a FAA Flight Service Station Specialist.*

h. With increased access to weather products via the public Internet, the aviation community has access to an overwhelming amount of weather information and data that support self-briefing. The *Aviation Weather Handbook*, FAA-H-8083-28 (current edition), describes the weather products distributed by the NWS. Pilots and operators using the public Internet to access weather from a third party vendor should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar weather products and when in doubt, consult with a Flight Service Specialist.

i. The development of new weather products, coupled with the termination of some legacy textual and graphical products may create confusion between regulatory requirements and the new products. All flight-related, aviation weather decisions must be based on all available pertinent weather products. As every flight is unique and the weather conditions for that flight vary hour by hour, day to day, multiple weather products may be necessary to meet aviation weather regulatory requirements. Many new weather products now have a Precautionary Use Statement that details the proper use or application of the specific product.

j. The FAA has identified three distinct types of weather information available to pilots and operators.

**1. Observations.** Raw weather data collected by some type of sensor suite including surface and airborne observations, radar, lightning, satellite imagery, and profilers.

**2. Analysis.** Enhanced depiction and/or interpretation of observed weather data.

**3. Forecasts.** Predictions of the development and/or movement of weather phenomena based on meteorological observations and various mathematical models.

k. Not all sources of aviation weather information are able to provide all three types of weather information. The FAA has determined that operators and pilots may utilize the following approved sources of aviation weather information:

**1. Federal Government.** The FAA and NWS collect raw weather data, analyze the observations, and produce forecasts. The FAA and NWS disseminate meteorological observations, analyses, and forecasts through a variety of systems. In addition, the Federal Government is the only approval authority for sources of weather observations; for example, contract towers and airport operators may be approved by the Federal Government to provide weather observations.

**2. Enhanced Weather Information System (EWINS).** An EWINS is an FAA authorized, proprietary system for tracking, evaluating, reporting, and forecasting the presence or lack of adverse weather phenomena. The FAA authorizes a certificate holder to use an EWINS to produce flight movement forecasts, adverse weather phenomena forecasts, and other meteorological advisories. For more detailed information regarding EWINS, see the Aviation Weather Services Advisory Circular 00–45 and the Flight Standards Information Management System 8900.1.

**3. Commercial Weather Information Providers.** In general, commercial providers produce proprietary weather products based on NWS/FAA products with formatting and layout modifications but no material changes to the weather information itself. This is also referred to as “repackaging.” In addition, commercial providers may produce analyses, forecasts, and other proprietary weather products that substantially alter the information contained in government–produced products. However, those proprietary weather products that substantially alter government–produced weather products or information, may only be approved for use by 14 CFR Part 121 and Part 135 certificate holders if the commercial provider is EWINS qualified.

**NOTE–**

*Commercial weather information providers contracted by FAA to provide weather observations, analyses, and forecasts (e.g., contract towers) are included in the Federal Government category of approved sources by virtue of maintaining required technical and quality assurance standards under Federal Government oversight.*

#### **7–1–4. Graphical Forecasts for Aviation (GFA)**

a. The GFA website is intended to provide the necessary aviation weather information to give users a complete picture of the weather that may affect flight in the continental United States (CONUS). The website includes observational data, forecasts, and warnings that can be viewed from 14 hours in the past to 15 hours in the future, including thunderstorms, clouds, flight category, precipitation, icing, turbulence, and wind. Hourly model data and forecasts, including information on clouds, flight category, precipitation, icing, turbulence, wind, and graphical output from the National Weather Service’s (NWS) National Digital Forecast Data (NDFD) are available. Wind, icing, and turbulence forecasts are available in 3,000 ft increments from the surface up to 30,000 ft MSL, and in 6,000 ft increments from 30,000 ft MSL to 48,000 ft MSL. Turbulence forecasts are also broken into low (below 18,000 ft MSL) and high (at or above 18,000 ft MSL) graphics. A maximum icing graphic and maximum wind velocity graphic (regardless of altitude) are also available. Built with modern geospatial information tools, users can pan and zoom to focus on areas of greatest interest. Target users are commercial and general aviation pilots, operators, briefers, and dispatchers.

**b. Weather Products.**

**1.** The Aviation Forecasts include gridded displays of various weather parameters as well as NWS textual weather observations, forecasts, and warnings. Icing, turbulence, and wind gridded products are three–dimensional. Other gridded products are two–dimensional and may represent a “composite” of a three–dimensional weather phenomenon or a surface weather variable, such as horizontal visibility. The following are examples of aviation forecasts depicted on the GFA:

- (a) Terminal Aerodrome Forecast (TAF)
- (b) Ceiling & Visibility (CIG/VIS)

- (c) Clouds
- (d) Precipitation / Weather (PCPN/WX)
- (e) Thunderstorm (TS)
- (f) Winds
- (g) Turbulence
- (h) Ice

**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 the *Aviation Weather Handbook*, FAA-H-8083-28, Graphical Forecasts for Aviation (GFA) Tool, 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 AIRMETs for mountain obscuration and AIRMETs for icing overlaid. The Aviation Surface Forecast provides visibility, weather phenomena, and winds (including wind gusts) with AIRMETs for instrument flight rules conditions and AIRMETs for sustained surface winds of 30 knots or more overlaid. These images are presented on ten separate maps providing forecast views for the entire contiguous United States (U.S.) 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.)

**NOTE-**

*The contiguous United States (U.S.) refers to the 48 adjoining U.S. states on the continent of North America that are south of Canada and north of Mexico, plus the District of Columbia. The term excludes the states of Alaska and Hawaii, and all off-shore U.S. territories and possessions, such as Puerto Rico.*

FIG 7-1-2  
Aviation Surface Forecast

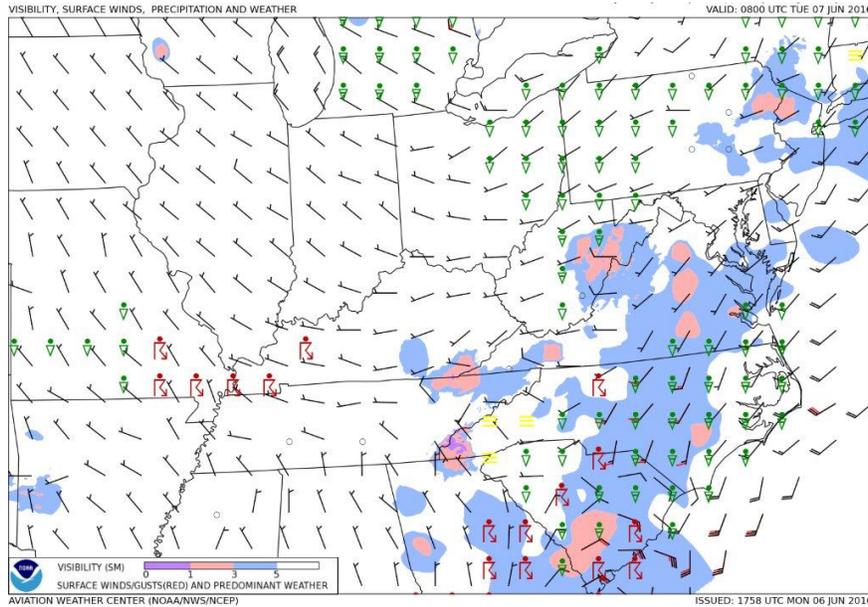
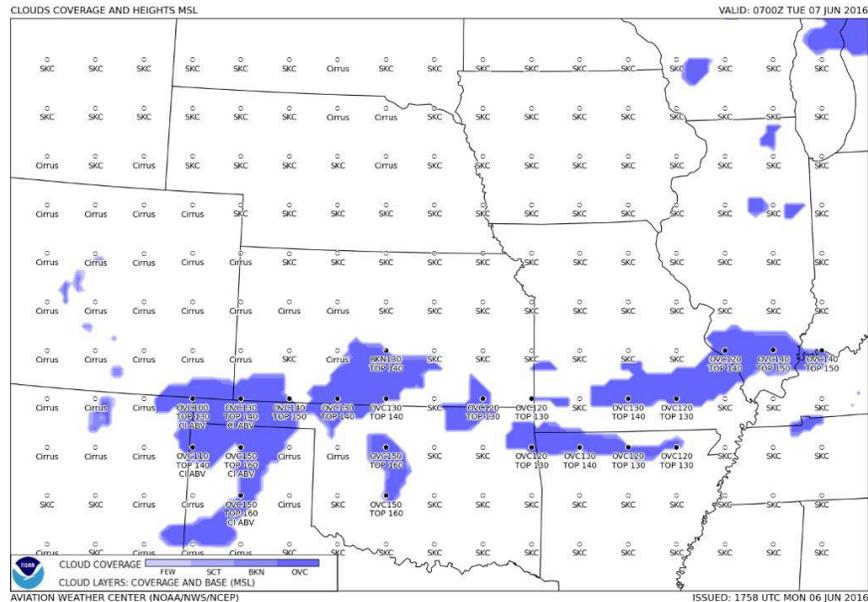


FIG 7-1-3  
Aviation Cloud Forecast



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 for operating in icing conditions. Flying into areas of icing or weather below minimums could have disastrous results.

**2. VFR Flight Not Recommended.** When VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that, in the briefer's judgment, would make flight under VFR doubtful, the briefer will describe the conditions, describe the affected locations, and use the phrase "*VFR flight not recommended.*" This recommendation is advisory in nature. The final decision as to whether the flight can be conducted safely rests solely with the pilot. Upon receiving a "*VFR flight not recommended*" statement, the non-IFR rated pilot will need to make a "go or no go" decision. This decision should be based on weighing the current and forecast weather conditions against the pilot's experience and ratings. The aircraft's equipment, capabilities and limitations should also be considered.

**NOTE-**

*Pilots flying into areas of minimal VFR weather could encounter unforecasted lowering conditions that place the aircraft outside the pilot's ratings and experience level. This could result in spatial disorientation and/or loss of control of the aircraft.*

**3. Synopsis.** A brief statement describing the type, location and movement of weather systems and/or air masses which might affect the proposed flight.

**NOTE-**

*These first 3 elements of a briefing may be combined in any order when the briefer believes it will help to more clearly describe conditions.*

**4. Current Conditions.** Reported weather conditions applicable to the flight will be summarized from all available sources; e.g., METARs/ SPECIs, PIREPs, RAREPs. This element will be omitted if the proposed time of departure is beyond 2 hours, unless the information is specifically requested by the pilot.

**5. En Route Forecast.** Forecast en route conditions for the proposed route are summarized in logical order; i.e., departure/climbout, en route, and descent. (Heights are MSL, unless the contractions "AGL" or "CIG" are denoted indicating that heights are above ground.)

**6. Destination Forecast.** The destination forecast for the planned ETA. Any significant changes within 1 hour before and after the planned arrival are included.

**7. Winds Aloft.** Forecast winds aloft will be provided in knots and degrees, referenced to true north. The briefer will interpolate wind directions and speeds between levels and stations as necessary to provide expected conditions at planned altitudes. (Heights are MSL.) Temperature information will be provided on request.

## 8. Notices to Air Missions (NOTAMs).

(a) Available NOTAM (D) information pertinent to the proposed flight, including special use airspace (SUA) NOTAMs for restricted areas, aerial refueling, and night vision goggles (NVG).

### NOTE–

*Other SUA NOTAMs (D), such as military operations area (MOA), military training route (MTR), and warning area NOTAMs, are considered “upon request” briefing items as indicated in paragraph 7–1–4b10(a).*

(b) Prohibited Areas P–40, P–49, P–56, and the special flight rules area (SFRA) for Washington, DC.

(c) FSS briefers do not provide FDC NOTAM information for special instrument approach procedures unless specifically asked. Pilots authorized by the FAA to use special instrument approach procedures must specifically request FDC NOTAM information for these procedures.

### NOTE–

1. NOTAM information may be combined with current conditions when the briefer believes it is logical to do so.

2. Airway NOTAMs, procedural NOTAMs, and NOTAMs that are general in nature and not tied to a specific airport/facility (for example, flight advisories and restrictions, open duration special security instructions, and special flight rules areas) are briefed solely by pilot request. For complete flight information, pilots are urged to review the Domestic Notices and International Notices found in the External Links section of the Federal NOTAM System (FNS) NOTAM Search System and the Chart Supplement in addition to obtaining a briefing.

9. **ATC Delays.** Any known ATC delays and flow control advisories which might affect the proposed flight.

## 10. Pilots may obtain the following from flight service station briefers upon request:

(a) Information on SUA and SUA–related airspace, except those listed in paragraph 7–1–4b8.

### NOTE–

1. For the purpose of this paragraph, SUA and related airspace includes the following types of airspace: alert area, military operations area (MOA), warning area, and air traffic control assigned airspace (ATCAA). MTR data includes the following types of airspace: IFR training routes (IR), VFR training routes (VR), and slow training routes (SR).

2. Pilots are encouraged to request updated information from ATC facilities while in flight.

(b) A review of airway NOTAMs, procedural NOTAMs, and NOTAMs that are general in nature and not tied to a specific airport/facility (for example, flight advisories and restrictions, open duration special security instructions, and special flight rules areas), Domestic Notices and International Notices. Domestic Notices and International Notices are found in the External Links section of the Federal NOTAM System (FNS) NOTAM Search System.

(c) Approximate density altitude data.

(d) Information regarding such items as air traffic services and rules, customs/immigration procedures, ADIZ rules, search and rescue, etc.

(e) GPS RAIM availability for 1 hour before to 1 hour after ETA or a time specified by the pilot.

(f) Other assistance as required.

**c. Abbreviated Briefing.** Request an Abbreviated Briefing when you need information to supplement mass disseminated data, update a previous briefing, or when you need only one or two specific items. Provide the briefer with appropriate background information, the time you received the previous information, and/or the specific items needed. You should indicate the source of the information already received so that the briefer can limit the briefing to the information that you have not received, and/or appreciable changes in meteorological/aeronautical conditions since your previous briefing. To the extent possible, the briefer will provide the information in the sequence shown for a Standard Briefing. If you request only one or two specific items, the briefer will advise you if adverse conditions are present or forecast. (Adverse conditions contain both meteorological and/or aeronautical information.) Details on these conditions will be provided at your request. International data may be inaccurate or incomplete. If you are planning a flight outside of U.S. controlled

<sup>2</sup> 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%).

<sup>3</sup> 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.

*TBL 7-1-4*  
**Product Parameters for Low/Medium/High Altitude Tier Radios**

<b>Product</b>	<b>Surface Radios</b>	<b>Low Altitude Tier</b>	<b>Medium Altitude Tier</b>	<b>High Altitude Tier</b>
CONUS NEXRAD	N/A	CONUS NEXRAD not provided	CONUS NEXRAD imagery	CONUS NEXRAD imagery
Winds & Temps Aloft	500 NM look-ahead range	500 NM look-ahead range	750 NM look-ahead range	1,000 NM look-ahead range
METAR	100 NM look-ahead range	250 NM look-ahead range	375 NM look-ahead range	CONUS: CONUS Class B & C airport METARs and 500 NM look-ahead range  Outside of CONUS: 500 NM look-ahead range
TAF	100 NM look-ahead range	250 NM look-ahead range	375 NM look-ahead range	CONUS: CONUS Class B & C airport TAFs and 500 NM look-ahead range  Outside of CONUS: 500 NM look-ahead range
AIRMET, SIGMET, PIREP, and SUA/SAA	100 NM look-ahead range. PIREP/SUA/SAA is N/A.	250 NM look-ahead range	375 NM look-ahead range	500 NM look-ahead range
Regional NEXRAD	150 NM look-ahead range	150 NM look-ahead range	200 NM look-ahead range	250 NM look-ahead range
NOTAMs D, FDC, and TFR	100 NM look-ahead range	100 NM look-ahead range	100 NM look-ahead range	100 NM look-ahead range

**7-1-10. Weather Observing Programs**

**a. Manual Observations.** With only a few exceptions, these reports are from airport locations staffed by FAA personnel who manually observe, perform calculations, and enter these observations into the (WMSCR) communication system. The format and coding of these observations are contained in paragraph 7-1-28 , Key to Aviation Routine Weather Report (METAR) and Aerodrome Forecasts (TAF).

**b. Automated Weather Observing System (AWOS).**

1. Automated weather reporting systems are increasingly being installed at airports. These systems consist of various sensors, a processor, a computer-generated voice subsystem, and a transmitter to broadcast local, minute-by-minute weather data directly to the pilot.

**NOTE–**

*When the barometric pressure exceeds 31.00 inches Hg., see AIM, Para 7–2–3, Altimeter Errors.*

2. The AWOS observations will include the prefix “AUTO” to indicate that the data are derived from an automated system. Some AWOS locations will be augmented by certified observers who will provide weather and obstruction to vision information in the remarks of the report when the reported visibility is less than 7 miles. These sites, along with the hours of augmentation, are to be published in the Chart Supplement. Augmentation is identified in the observation as “OBSERVER WEATHER.” The AWOS wind speed, direction and gusts, temperature, dew point, and altimeter setting are exactly the same as for manual observations. The AWOS will also report density altitude when it exceeds the field elevation by more than 1,000 feet. The reported visibility is derived from a sensor near the touchdown of the primary instrument runway. The visibility sensor output is converted to a visibility value using a 10–minute harmonic average. The reported sky condition/ceiling is derived from the ceilometer located next to the visibility sensor. The AWOS algorithm integrates the last 30 minutes of ceilometer data to derive cloud layers and heights. This output may also differ from the observer sky condition in that the AWOS is totally dependent upon the cloud advection over the sensor site.

3. These real-time systems are operationally classified into nine basic levels:

(a) **AWOS–A** only reports altimeter setting;

**NOTE–**

*Any other information is advisory only.*

(b) **AWOS–AV** reports altimeter and visibility;

**NOTE–**

*Any other information is advisory only.*

(c) **AWOS–I** usually reports altimeter setting, wind data, temperature, dew point, and density altitude;

(d) **AWOS–2** provides the information provided by AWOS–1 plus visibility; and

(e) **AWOS–3** provides the information provided by AWOS–2 plus cloud/ceiling data.

(f) **AWOS– 3P** provides reports the same as the AWOS 3 system, plus a precipitation identification sensor.

(g) **AWOS– 3PT** reports the same as the AWOS 3P System, plus thunderstorm/lightning reporting capability.

(h) **AWOS– 3T** reports the same as AWOS 3 system and includes a thunderstorm/lightning reporting capability.

(i) **AWOS– 4** reports the same as the AWOS 3 system, plus precipitation occurrence, type and accumulation, freezing rain, thunderstorm, and runway surface sensors.

4. The information is transmitted over a discrete VHF radio frequency or the voice portion of a local NAVAI. AWOS transmissions on a discrete VHF radio frequency are engineered to be receivable to a maximum of 25 NM from the AWOS site and a maximum altitude of 10,000 feet AGL. At many locations, AWOS signals may be received on the surface of the airport, but local conditions may limit the maximum AWOS reception distance and/or altitude. The system transmits a 20 to 30 second weather message updated each minute. Pilots should monitor the designated frequency for the automated weather broadcast. A description of the broadcast is contained in subparagraph c. There is no two-way communication capability. Most AWOS sites also have a dial-up capability so that the minute-by-minute weather messages can be accessed via telephone.

5. AWOS information (system level, frequency, phone number, etc.) concerning specific locations is published, as the systems become operational, in the Chart Supplement, and where applicable, on published

*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 7-1-8 and FIG 7-1-9.) 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 minute-by-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 these 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).

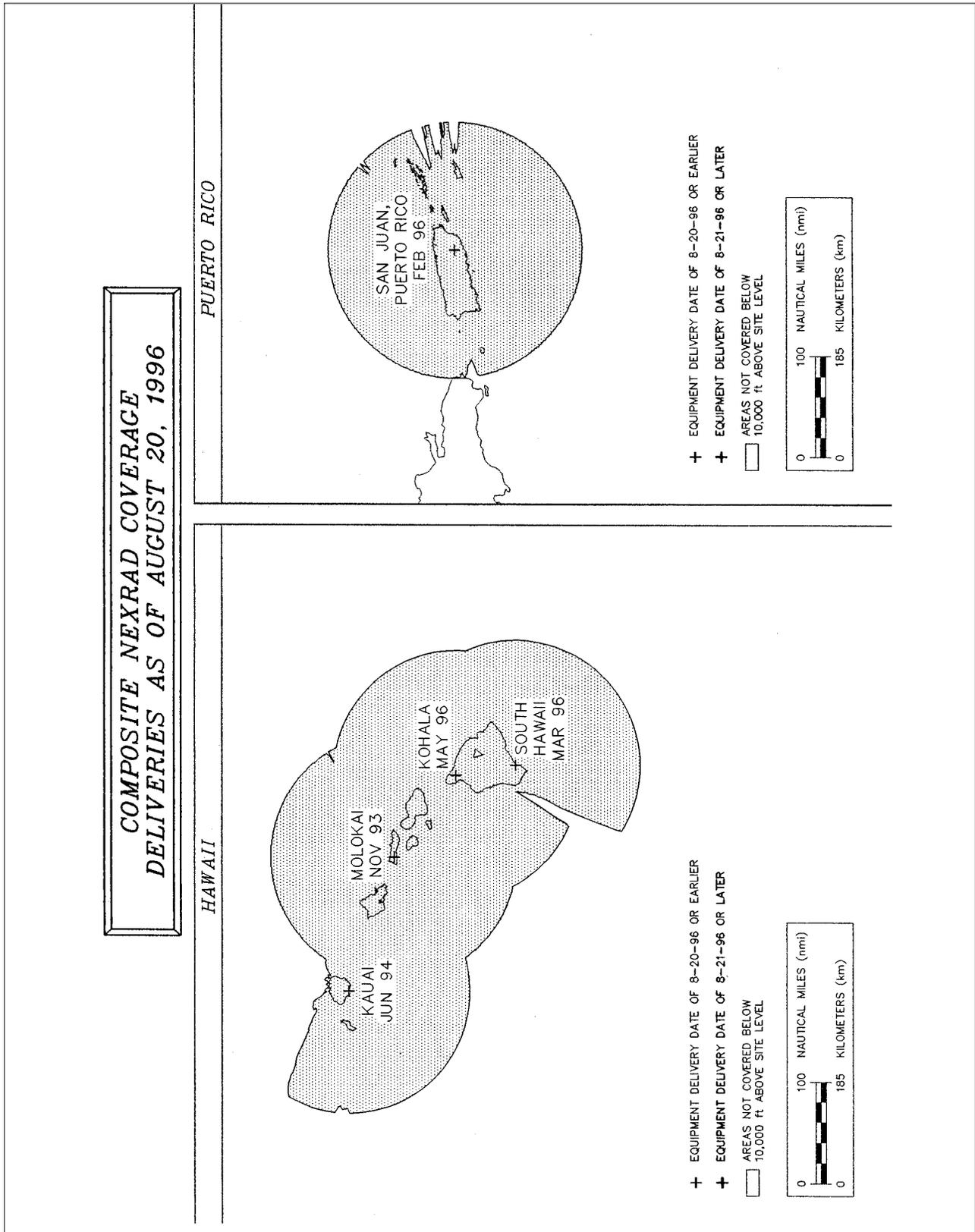
**NOTE—**

■ *To decode an ASOS/AWOS report, refer to FIG 7-1-8 and FIG 7-1-9.*

**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 7-1-12  
NEXRAD Coverage



d. All En Route Flight Advisory Service facilities and FSSs have equipment to directly access the radar displays from the individual weather radar sites. Specialists at these locations are trained to interpret the display for pilot briefing and inflight advisory services. The Center Weather Service Units located in ARTCCs also have access to weather radar displays and provide support to all air traffic facilities within their center's area.

e. For more detailed information on PIREPS, users can refer to the current version of the *Aviation Weather Handbook*, FAA-H-8083-28.

**REFERENCE-**

*Pilot/Controller Glossary Term- Precipitation Radar Weather Descriptions.*

*AIM, Para 7-1-26, Thunderstorms.*

*Chart Supplement, Charts, NWS Upper Air Observing Stations and Weather Network for the location of specific radar sites.*

## 7-1-12. ATC Inflight Weather Avoidance Assistance

### a. ATC Radar Weather Display.

1. ATC radars are able to display areas of precipitation by sending out a beam of radio energy that is reflected back to the radar antenna when it strikes an object or moisture which may be in the form of rain drops, hail, or snow. The larger the object is, or the more dense its reflective surface, the stronger the return will be presented. Radar weather processors indicate the intensity of reflective returns in terms of decibels (dBZ). ATC systems cannot detect the presence or absence of clouds. The ATC systems can often determine the intensity of a precipitation area, but the specific character of that area (snow, rain, hail, VIRGA, etc.) cannot be determined. For this reason, ATC refers to all weather areas displayed on ATC radar scopes as "precipitation."

2. All ATC facilities using radar weather processors with the ability to determine precipitation intensity, will describe the intensity to pilots as:

- (a) "LIGHT" (< 26 dBZ)
- (b) "MODERATE" (26 to 40 dBZ)
- (c) "HEAVY" (> 40 to 50 dBZ)
- (d) "EXTREME" (> 50 dBZ)

**NOTE-**

*En route ATC radar's Weather and Radar Processor (WARP) does not display light precipitation intensity.*

3. ATC facilities that, due to equipment limitations, cannot display the intensity levels of precipitation, will describe the location of the precipitation area by geographic position, or position relative to the aircraft. Since the intensity level is not available, the controller will state "INTENSITY UNKNOWN."

4. ARTCC facilities normally use a Weather and Radar Processor (WARP) to display a mosaic of data obtained from multiple NEXRAD sites. There is a time delay between actual conditions and those displayed to the controller. For example, the precipitation data on the ARTCC controller's display could be up to 6 minutes old. When the WARP is not available, a second system, the narrowband Air Route Surveillance Radar (ARSR) can display two distinct levels of precipitation intensity that will be described to pilots as "MODERATE" (30 to 40 dBZ) and "HEAVY TO EXTREME" (> 40 dBZ). The WARP processor is only used in ARTCC facilities.

5. *ATC radar is not able to detect turbulence.* Generally, turbulence can be expected to occur as the rate of rainfall or intensity of precipitation increases. Turbulence associated with greater rates of rainfall/precipitation will normally be more severe than any associated with lesser rates of rainfall/precipitation. Turbulence should be expected to occur near convective activity, even in clear air. Thunderstorms are a form of convective activity that imply severe or greater turbulence. Operation within 20 miles of thunderstorms should be approached with great caution, as the severity of turbulence can be markedly greater than the precipitation intensity might indicate.

### b. Weather Avoidance Assistance.

1. To the extent possible, controllers will issue pertinent information on weather or chaff areas and assist pilots in avoiding such areas when requested. Pilots should respond to a weather advisory by either

**b.** Pilots are urged to cooperate and promptly volunteer reports of these conditions and other atmospheric data such as: cloud bases, tops and layers; flight visibility; precipitation; visibility restrictions such as haze, smoke and dust; wind at altitude; and temperature aloft.

**c.** PIREPs should be given to the ground facility with which communications are established; i.e., FSS, ARTCC, or terminal ATC. One of the primary duties of the Inflight position is to serve as a collection point for the exchange of PIREPs with en route aircraft.

**d.** If pilots are not able to make PIREPs by radio, reporting upon landing of the inflight conditions encountered to the nearest FSS or Weather Forecast Office will be helpful. Some of the uses made of the reports are:

**1.** The ATCT uses the reports to expedite the flow of air traffic in the vicinity of the field and for hazardous weather avoidance procedures.

**2.** The FSS uses the reports to brief other pilots, to provide inflight advisories, and weather avoidance information to en route aircraft.

**3.** The ARTCC uses the reports to expedite the flow of en route traffic, to determine most favorable altitudes, and to issue hazardous weather information within the center's area.

**4.** The NWS uses the reports to verify or amend conditions contained in aviation forecast and advisories. In some cases, pilot reports of hazardous conditions are the triggering mechanism for the issuance of advisories. They also use the reports for pilot weather briefings.

**5.** The NWS, other government organizations, the military, and private industry groups use PIREPs for research activities in the study of meteorological phenomena.

**6.** All air traffic facilities and the NWS forward the reports received from pilots into the weather distribution system to assure the information is made available to all pilots and other interested parties.

**e.** The FAA, NWS, and other organizations that enter PIREPs into the weather reporting system use the format listed in TBL 7-1-8. Items 1 through 6 are included in all transmitted PIREPs along with one or more of items 7 through 13. Although the PIREP should be as complete and concise as possible, pilots should not be overly concerned with strict format or phraseology. The important thing is that the information is relayed so other pilots may benefit from your observation. If a portion of the report needs clarification, the ground station will request the information. Completed PIREPs will be transmitted to weather circuits as in the following examples:

**EXAMPLE-**

**1.** *KCMH UA /OV APE 230010/TM 1516/FL085/TP BE20/SK BKN065/WX FV03SM HZ FU/TA 20/TB LGT*

**NOTE-**

**1.** *One zero miles southwest of Appleton VOR; time 1516 UTC; altitude eight thousand five hundred; aircraft type BE200; bases of the broken cloud layer is six thousand five hundred; flight visibility 3 miles with haze and smoke; air temperature 20 degrees Celsius; light turbulence.*

**EXAMPLE-**

**2.** *KCRW UV /OV KBKW 360015-KCRW/TM 1815/FL120//TP BE99/SK IMC/WX RA/TA M08 /WV 290030/TB LGT-MDT/IC LGT RIME/RM MDT MXD ICG DURC KROA NWBND FL080-100 1750Z*

**NOTE-**

**2.** *From 15 miles north of Beckley VOR to Charleston VOR; time 1815 UTC; altitude 12,000 feet; type aircraft, BE-99; in clouds; rain; temperature minus 8 Celsius; wind 290 degrees magnetic at 30 knots; light to moderate turbulence; light rime icing during climb northwestbound from Roanoke, VA, between 8,000 and 10,000 feet at 1750 UTC.*

**f.** For more detailed information on PIREPs, users can refer to the current version of the *Aviation Weather Handbook*, FAA-H-8083-28.

*TBL 7-1-8*  
**PIREP Element Code Chart**

	<b>PIREP ELEMENT</b>	<b>PIREP CODE</b>	<b>CONTENTS</b>
1.	3-letter station identifier	XXX	Nearest weather reporting location to the reported phenomenon
2.	Report type	UA or UUA	Routine or Urgent PIREP
3.	Location	/OV	In relation to a VOR
4.	Time	/TM	Coordinated Universal Time
5.	Altitude	/FL	Essential for turbulence and icing reports
6.	Type Aircraft	/TP	Essential for turbulence and icing reports
7.	Sky cover	/SK	Cloud height and coverage (sky clear, few, scattered, broken, or overcast)
8.	Weather	/WX	Flight visibility, precipitation, restrictions to visibility, etc.
9.	Temperature	/TA	Degrees Celsius
10.	Wind	/WV	Direction in degrees magnetic north and speed in knots
11.	Turbulence	/TB	See AIM paragraph 7-1-21
12.	Icing	/IC	See AIM paragraph 7-1-19
13.	Remarks	/RM	For reporting elements not included or to clarify previously reported items

### 7-1-19. PIREPs Relating to Airframe Icing

a. The effects of ice on aircraft are cumulative—thrust is reduced, drag increases, lift lessens, and weight increases. The results are an increase in stall speed and a deterioration of aircraft performance. In extreme cases, 2 to 3 inches of ice can form on the leading edge of the airfoil in less than 5 minutes. It takes but  $\frac{1}{2}$  inch of ice to reduce the lifting power of some aircraft by 50 percent and increases the frictional drag by an equal percentage.

b. A pilot can expect icing when flying in visible precipitation, such as rain or cloud droplets, and the temperature is between +02 and -10 degrees Celsius. When icing is detected, a pilot should do one of two things, particularly if the aircraft is not equipped with deicing equipment; get out of the area of precipitation; or go to an altitude where the temperature is above freezing. This “warmer” altitude may not always be a lower altitude. Proper preflight action includes obtaining information on the freezing level and the above freezing levels in precipitation areas. Report icing to ATC, and if operating IFR, request new routing or altitude if icing will be a hazard. Be sure to give the type of aircraft to ATC when reporting icing. The following describes how to report icing conditions.

**1. Trace.** Ice becomes noticeable. The rate of accumulation is slightly greater than the rate of sublimation. A representative accretion rate for reference purposes is less than  $\frac{1}{4}$  inch (6 mm) per hour on the outer wing. The pilot should consider exiting the icing conditions before they become worse.

**2. Light.** The rate of ice accumulation requires occasional cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is  $\frac{1}{4}$  inch to 1 inch (0.6 to 2.5 cm) per hour on the unprotected part of the outer wing. The pilot should consider exiting the icing condition.

**3. Moderate.** The rate of ice accumulation requires frequent cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is 1 to 3 inches (2.5 to 7.5 cm) per hour on the unprotected part of the outer wing. The pilot should consider exiting the icing condition as soon as possible.

**4. Severe.** The rate of ice accumulation is such that ice protection systems fail to remove the accumulation of ice and ice accumulates in locations not normally prone to icing, such as areas aft of protected surfaces and any other areas identified by the manufacturer. A representative accretion rate for reference purposes is more than 3 inches (7.5 cm) per hour on the unprotected part of the outer wing. By regulation, immediate exit is required.

## Section 5. Bird Hazards and Flight Over National Refuges, Parks, and Forests

### 7-5-1. Migratory Bird Activity

a. Bird strike risk increases because of bird migration during the months of March through April, and August through November.

b. The altitudes of migrating birds vary with winds aloft, weather fronts, terrain elevations, cloud conditions, and other environmental variables. While over 90 percent of the reported bird strikes occur at or below 3,000 feet AGL, strikes at higher altitudes are common during migration. Ducks and geese are frequently observed up to 7,000 feet AGL and pilots are cautioned to minimize en route flying at lower altitudes during migration.

c. Considered the greatest potential hazard to aircraft because of their size, abundance, or habit of flying in dense flocks are gulls, waterfowl, vultures, hawks, owls, egrets, blackbirds, and starlings. Four major migratory flyways exist in the U.S. The Atlantic flyway parallels the Atlantic Coast. The Mississippi Flyway stretches from Canada through the Great Lakes and follows the Mississippi River. The Central Flyway represents a broad area east of the Rockies, stretching from Canada through Central America. The Pacific Flyway follows the west coast and overflies major parts of Washington, Oregon, and California. There are also numerous smaller flyways which cross these major north-south migratory routes.

### 7-5-2. Reducing Bird Strike Risks

a. The most serious strikes are those involving ingestion into an engine (turboprops and turbine jet engines) or windshield strikes. These strikes can result in emergency situations requiring prompt action by the pilot.

b. Engine ingestions may result in sudden loss of power or engine failure. Review engine out procedures, especially when operating from airports with known bird hazards or when operating near high bird concentrations.

c. Windshield strikes have resulted in pilots experiencing confusion, disorientation, loss of communications, and aircraft control problems. Pilots are encouraged to review their emergency procedures before flying in these areas.

d. When encountering birds en route, climb to avoid collision, because birds in flocks generally distribute themselves downward, with lead birds being at the highest altitude.

e. Avoid overflight of known areas of bird concentration and flying at low altitudes during bird migration. Charted wildlife refuges and other natural areas contain unusually high local concentration of birds which may create a hazard to aircraft.

### 7-5-3. Reporting Bird Strikes

Pilots are urged to report any bird or other wildlife strike using FAA Form 5200-7, Bird/Other Wildlife Strike Report (Appendix 1). Additional forms are available at any FSS; at any FAA Regional Office or at [https://www.faa.gov/airports/airport\\_safety/wildlife/](https://www.faa.gov/airports/airport_safety/wildlife/). The data derived from these reports are used to develop standards to cope with this potential hazard to aircraft and for documentation of necessary habitat control on airports.

### 7-5-4. Reporting Bird and Other Wildlife Activities

If you observe birds or other animals on or near the runway, request airport management to disperse the wildlife before taking off. Also contact the nearest FAA ARTCC, FSS, or tower (including non-Federal towers) regarding large flocks of birds and report the:

- a. Geographic location.
- b. Bird type (geese, ducks, gulls, etc.).
- c. Approximate numbers.
- d. Altitude.
- e. Direction of bird flight path.

#### **7-5-5. Pilot Advisories on Bird and Other Wildlife Hazards**

Many airports advise pilots of other wildlife hazards caused by large animals on the runway through the Chart Supplement and the NOTAM system. Collisions of landing and departing aircraft and animals on the runway are increasing and are not limited to rural airports. These accidents have also occurred at several major airports. Pilots should exercise extreme caution when warned of the presence of wildlife on and in the vicinity of airports. If you observe deer or other large animals in close proximity to movement areas, advise the FSS, tower, or airport management.

#### **7-5-6. Flights Over Charted U.S. Wildlife Refuges, Parks, and Forest Service Areas**

a. The landing of aircraft is prohibited on lands or waters administered by the National Park Service, U.S. Fish and Wildlife Service, or U.S. Forest Service without authorization from the respective agency. Exceptions include:

1. When forced to land due to an emergency beyond the control of the operator;
2. At officially designated landing sites; or
3. An approved official business of the Federal Government.

b. Pilots are requested to maintain a minimum altitude of 2,000 feet above the surface of the following: National Parks, Monuments, Seashores, Lakeshores, Recreation Areas and Scenic Riverways administered by the National Park Service, National Wildlife Refuges, Big Game Refuges, Game Ranges and Wildlife Ranges administered by the U.S. Fish and Wildlife Service, and Wilderness and Primitive areas administered by the U.S. Forest Service.

**NOTE-**

*FAA Advisory Circular AC 91-36, Visual Flight Rules (VFR) Flight Near Noise-Sensitive Areas, defines the surface of a national park area (including parks, forests, primitive areas, wilderness areas, recreational areas, national seashores, national monuments, national lakeshores, and national wildlife refuge and range areas) as: the highest terrain within 2,000 feet laterally of the route of flight, or the upper-most rim of a canyon or valley.*

c. Federal statutes prohibit certain types of flight activity and/or provide altitude restrictions over designated U.S. Wildlife Refuges, Parks, and Forest Service Areas. These designated areas, for example: Boundary Waters Canoe Wilderness Areas, Minnesota; Haleakala National Park, Hawaii; Yosemite National Park, California; and Grand Canyon National Park, Arizona, are charted on Sectional Charts.

d. Federal regulations also prohibit airdrops by parachute or other means of persons, cargo, or objects from aircraft on lands administered by the three agencies without authorization from the respective agency. Exceptions include:

1. Emergencies involving the safety of human life; or
2. Threat of serious property loss.

## Section 6. Potential Flight Hazards

### 7-6-1. Accident Cause Factors

a. The 10 most frequent cause factors for general aviation accidents that involve the pilot-in-command are:

1. Inadequate preflight preparation and/or planning.
2. Failure to obtain and/or maintain flying speed.
3. Failure to maintain direction control.
4. Improper level off.
5. Failure to see and avoid objects or obstructions.
6. Mismanagement of fuel.
7. Improper inflight decisions or planning.
8. Misjudgment of distance and speed.
9. Selection of unsuitable terrain.
10. Improper operation of flight controls.

b. This list remains relatively stable and points out the need for continued refresher training to establish a higher level of flight proficiency for all pilots. A part of the FAA's continuing effort to promote increased aviation safety is the Aviation Safety Program. For information on Aviation Safety Program activities contact your nearest Flight Standards District Office.

c. **Alertness.** Be alert at all times, especially when the weather is good. Most pilots pay attention to business when they are operating in full IFR weather conditions, but strangely, air collisions almost invariably have occurred under ideal weather conditions. Unlimited visibility appears to encourage a sense of security which is not at all justified. Considerable information of value may be obtained by listening to advisories being issued in the terminal area, even though controller workload may prevent a pilot from obtaining individual service.

d. **Giving Way.** If you think another aircraft is too close to you, give way instead of waiting for the other pilot to respect the right-of-way to which you may be entitled. It is a lot safer to pursue the right-of-way angle after you have completed your flight.

### 7-6-2. Reporting Radio/Radar Altimeter Anomalies

a. Background.

1. The radio altimeter (also known as radar altimeter or RADALT) is a safety-critical aircraft system used to determine an aircraft's height above terrain. It is the only sensor onboard the aircraft capable of providing a direct measurement of the clearance height above the terrain and obstacles. Information from radio altimeters is essential for flight operations as a main enabler of several safety-critical functions and systems on the aircraft. The receiver on the radio altimeter is highly accurate because it is extremely sensitive, making it susceptible to radio frequency interference (RFI). RFI in the C-band portion of the spectrum could impact the functions of the radio altimeter during any phase of flight—most critically during takeoff, approach, and landing phases. This could pose a serious risk to flight safety.

2. Installed radio altimeters normally supply critical height data to a wide range of automated safety systems, navigation systems, and cockpit displays. Harmful RFI affecting the radio altimeter can cause these safety and navigation systems to operate in unexpected ways and display erroneous information to the pilot. RFI can interrupt, or significantly degrade, radio altimeter functions—precluding radio altimeter-based terrain alerts

and low-visibility approach and landing operations. Systems of concern include Terrain Awareness Warning Systems (TAWS), Enhanced Ground Proximity Warning Systems (EGPWS), and Traffic Collision Avoidance Systems (TCAS), to name a few. Pilots of radio altimeter equipped aircraft should become familiar with the radio altimeter's interdependence with the other aircraft systems and expected failure modes and indications that may be associated with harmful interference.

**b. Actions.** Recognizing interference/anomalies in the radio altimeter can be difficult, as it may present as inoperative or erroneous data. Pilots need to monitor their automation, as well as their radio altimeters for discrepancies, and be prepared to take action. Pilots encountering radio altimeter interference/anomalies should transition to procedures that do not require the radio altimeter, and inform Air Traffic Control (ATC).

**c. Inflight Reporting.** Pilots should report any radio altimeter anomaly to ATC as soon as practical.

**d. Post Flight Reporting.**

**1.** Pilots are encouraged to submit detailed reports of radio altimeter interference/anomalies post flight as soon as practical, by internet via the Radio Altimeter Anomaly Reporting Form at [https://www.faa.gov/air\\_traffic/nas/RADALT\\_reports/](https://www.faa.gov/air_traffic/nas/RADALT_reports/).

**2.** The post flight pilot reports of radio altimeter anomalies should contain as much of the following information as applicable:

- (a) Date and time the anomaly was observed;
- (b) Location of the aircraft at the time the anomaly started and ended (e.g., latitude, longitude or bearing/distance from a reference point or navigational aid);
- (c) Magnetic heading;
- (d) Altitude (MSL/AGL);
- (e) Aircraft Type (make/model);
- (f) Flight Number or Aircraft Registration Number;
- (g) Meteorological conditions;
- (h) Type of radio altimeter in use (e.g., make/model/software series or version), if known;
- (i) Event overview;
- (j) Consequences/operational impact (e.g., impacted equipment, actions taken to mitigate the disruption and/or remedy provided by ATC, required post flight pilot and maintenance actions).

### **7-6-3. VFR in Congested Areas**

A high percentage of near midair collisions occur below 8,000 feet AGL and within 30 miles of an airport. When operating VFR in these highly congested areas, whether you intend to land at an airport within the area or are just flying through, it is recommended that extra vigilance be maintained and that you monitor an appropriate control frequency. Normally the appropriate frequency is an approach control frequency. By such monitoring action you can "get the picture" of the traffic in your area. When the approach controller has radar, radar traffic advisories may be given to VFR pilots upon request.

#### **REFERENCE-**

*AIM, Para 4-1-15, Radar Traffic Information Service.*

### **7-6-4. Obstructions To Flight**

**a. General.** Many structures exist that could significantly affect the safety of your flight when operating below 500 feet above ground level (AGL), and particularly below 200 feet AGL. While 14 CFR Part 91.119 allows flight below 500 feet AGL when over sparsely populated areas or open water, such operations involve increased

safety risks. At and below 200 feet AGL there are numerous power lines, antenna towers, etc., that are not marked and lighted and/or charted as obstructions and, therefore, may not be seen in time to avoid a collision. Notices to Air Missions NOTAM are issued on those lighted structures experiencing temporary light outages. However, some time may pass before the FAA is notified of these outages, and the NOTAM issued, thus pilot vigilance is imperative. Additionally, new obstructions may not be on current charts because the information was not received prior to the FAA publishing the chart.

**b. Antenna Towers.** Extreme caution should be exercised when flying less than 2,000 feet AGL because of numerous skeletal structures, such as radio and television antenna towers, that exceed 1,000 feet AGL with some extending higher than 2,000 feet AGL. Most skeletal structures are supported by guy wires which are very difficult to see in good weather and can be invisible at dusk or during periods of reduced visibility. These wires can extend about 1,500 feet horizontally from a structure; therefore, all skeletal structures should be avoided horizontally by at least 2,000 feet.

**c. Overhead Wires.** Overhead transmission and utility lines often span approaches to runways, natural flyways such as lakes, rivers, gorges, and canyons, and cross other landmarks pilots frequently follow such as highways, railroad tracks, etc. As with antenna towers, these power transmission and/or utility lines and the supporting structures of these lines may not always be readily visible. The wires may be virtually impossible to see under certain conditions. Spherical markers may be used to identify overhead wires and catenary transmission lines and may be lighted. In some locations, the supporting structures of overhead transmission lines are equipped with unique sequence flashing white strobe light systems to indicate that there are wires between the structures. The flash sequence for the wire support structures will be middle, top, and bottom with all lights on the same level flashing simultaneously. However, not all power transmission and/or utility lines require notice to the FAA as they 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 power transmission and/or utility lines and 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. Wind Turbines.** The number, size, and height of individual wind turbines and wind turbine farms have increased over time. The locations of wind turbine farms have also expanded to areas more commonly flown by VFR pilots and to all regions of the United States. VFR pilots should be aware that many wind turbines are exceeding 499 feet AGL in height, which may affect minimum safe VFR altitudes in uncontrolled airspace. In addition, many wind turbines are encroaching on the 700 foot AGL floor of controlled airspace (Class E). Pilots are cautioned to maintain appropriate safe distance (laterally, vertically, or both). Wind turbines are typically charted on Visual Flight Rules (VFR) Sectional Charts and/or Terminal Area Charts. For a description of how wind turbines and wind turbine farms are charted, refer to the [FAA Aeronautical Chart User's Guide](#). Wind turbines are normally painted white or light gray to improve daytime conspicuity. They are typically lit with medium-intensity, flashing red lights, placed as high as possible on the turbine nacelle (not the blade tips), that should be synchronized to flash together; however, not all wind turbine units within a farm need to be lighted, depending on their location and height. Sometimes, only the perimeter of the wind turbine farm and an arrangement of interior wind turbines are lit. Some wind turbine farms use Aircraft Detection Lighting Systems (ADLS), which are proximity sensor-based systems designed to detect aircraft as they approach the obstruction. This system automatically activates the appropriate obstruction lights until they are no longer needed based on the position of the transiting aircraft. This technology reduces the impact of nighttime lighting on nearby communities and migratory birds and extends the life expectancy of the obstruction lights. For more information on how obstructions such as wind turbines are marked and lighted, refer to Advisory Circular 70/7460-1, Obstruction Marking and Lighting. Pilots should be aware that wind turbines in motion could result in limitations of air traffic services in the vicinity of the wind turbine farms.

**REFERENCE-**

*AIM, Para 4-5-1, Radar.*

**e. Meteorological (MET) Evaluation Towers.** MET towers are used by wind energy companies to determine feasible sites for wind turbines. Some of these towers are less than 200 feet AGL. These structures are portable,

erected in a matter of hours, installed with guyed wires, and constructed from a galvanized material often making them difficult to see in certain atmospheric conditions. Markings for these towers include alternating bands of aviation orange and white paint, and high-visibility sleeves installed on the outer guy wires. However, not all MET towers follow these guidelines, and pilots should be vigilant when flying at low altitude in remote or rural areas.

**f. Other Objects/Structures.** There are other objects or structures that could adversely affect your flight such as temporary 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. VFR pilots should carefully review NOTAMs for temporary or permanent obstructions along the planned route of flight during their preflight preparations. Particular emphasis should be given to obstructions in the vicinity of the approach and departure ends of the runway complex or any other areas where flight below 500 feet AGL is planned or likely to occur.

### **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.

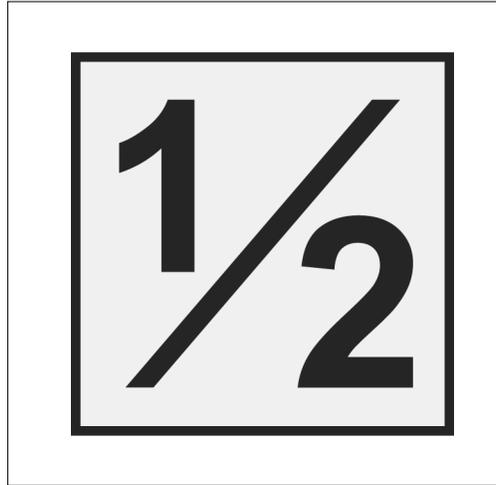
d. Use of this “rule of thumb” does not alleviate the pilot’s responsibility to comply with applicable Federal Aviation Regulations, the limitations and performance data provided in the FAA approved Airplane Flight Manual (AFM), or, in the absence of an FAA approved AFM, other data provided by the aircraft 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.*

FIG 7-6-1  
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.

*TBL 7-6-1*

**Jurisdictions Controlling Navigable Bodies of Water**

<b>Authority to Consult For Use of a Body of Water</b>		
<b>Location</b>	<b>Authority</b>	<b>Contact</b>
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

**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 CO<sub>2</sub> 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 75<sup>th</sup> 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 (SO<sub>2</sub>) 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 SO<sub>2</sub> 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 broadcasted 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 Chart Supplement 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 not 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.

**l. 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.** Advisory Circular (AC) 91-74, Pilot Guide, Flight in Icing Conditions.

**3.** AC 135-17, Pilot Guide Small Aircraft Ground Deicing.

**4.** AC 135-9, FAR Part 135 Icing Limitations.

**5.** AC 120-60, Ground Deicing and Anti-icing Program.

**6.** 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: [https://www.faa.gov/other\\_visit/aviation\\_industry/airline\\_operators/airline\\_safety/deicing/](https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/).

## **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.

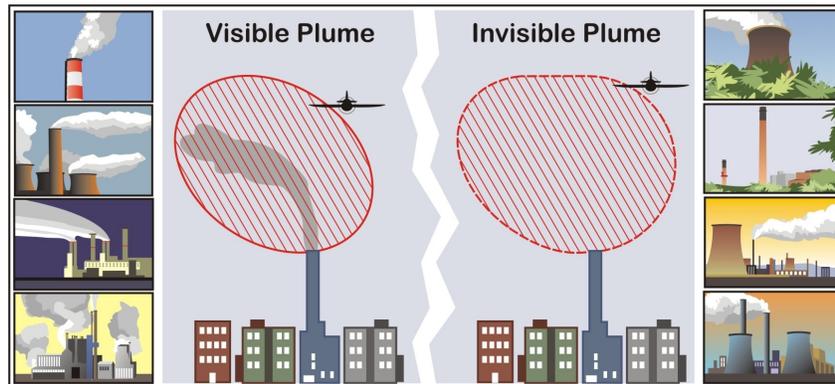
Whether plumes are visible or invisible, the total extent of their turbulent affect is difficult to predict. Some studies do predict that the significant turbulent effects of an exhaust plume can extend to heights of over 1,000 feet above the height of the top of the stack or cooling tower. Any effects 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 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).

FIG 7-6-2  
Plumes



### 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

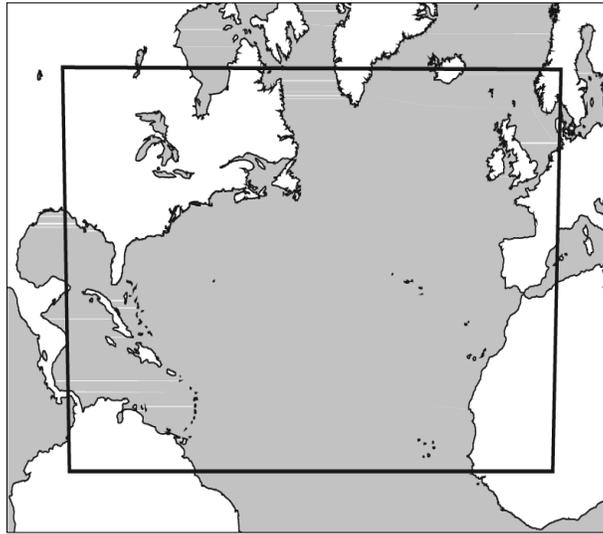
operation. Space launch and reentry areas are not established for amateur rocket operations conducted per 14 CFR Part 101.

*FIG 7-6-3*  
**Space Launch and Reentry Area Depicted on a Sectional Chart**



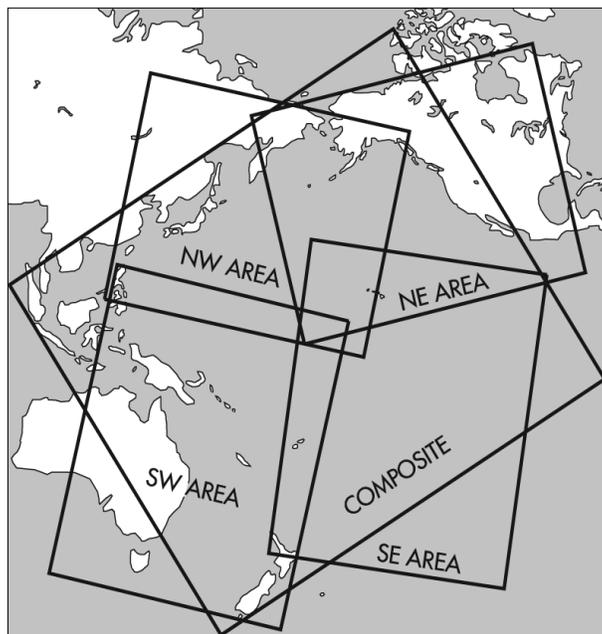


**FIG 9-1-13**  
**North Atlantic Route Charts**



**6. North Pacific Route Charts.** These charts are designed for FAA controllers to monitor transoceanic flights. They show established intercontinental air routes, including reporting points with geographic positions. Composite Chart: Scale 1 inch = 164 nm/1:12,000,000. 48 x 41-1/2 inches. Area Charts: Scale 1 inch = 95.9 nm/1:7,000,000. 52 x 40-1/2 inches. All charts shipped unfolded. Charts revised every 56 days. (See FIG 9-1-14.)

**FIG 9-1-14**  
**North Pacific Oceanic Route Charts**



**7. Airport Obstruction Charts (OC).** The OC is a 1:12,000 scale graphic depicting 14 CFR Part 77, Objects Affecting Navigable Airspace, surfaces, a representation of objects that penetrate these surfaces, aircraft movement and apron areas, navigational aids, prominent airport buildings, and a selection of roads and other planimetric detail in the airport vicinity. Also included are tabulations of runway and other operational data.

**8. FAA Aeronautical Chart User's Guide.** A booklet designed to be used as a teaching aid and reference document. It describes the substantial amount of information provided on FAA's aeronautical charts and publications. It includes explanations and illustrations of chart terms and symbols organized by chart type. The users guide is available for free download at the AIS website.

**e. Digital Products.**

**1. The Digital Aeronautical Information CD (DAICD).** The DAICD is a combination of the NAVAID Digital Data File, the Digital Chart Supplement, and the Digital Obstacle File on one Compact Disk. These three digital products are no longer sold separately. The files are updated every 56 days and are available by subscription only.

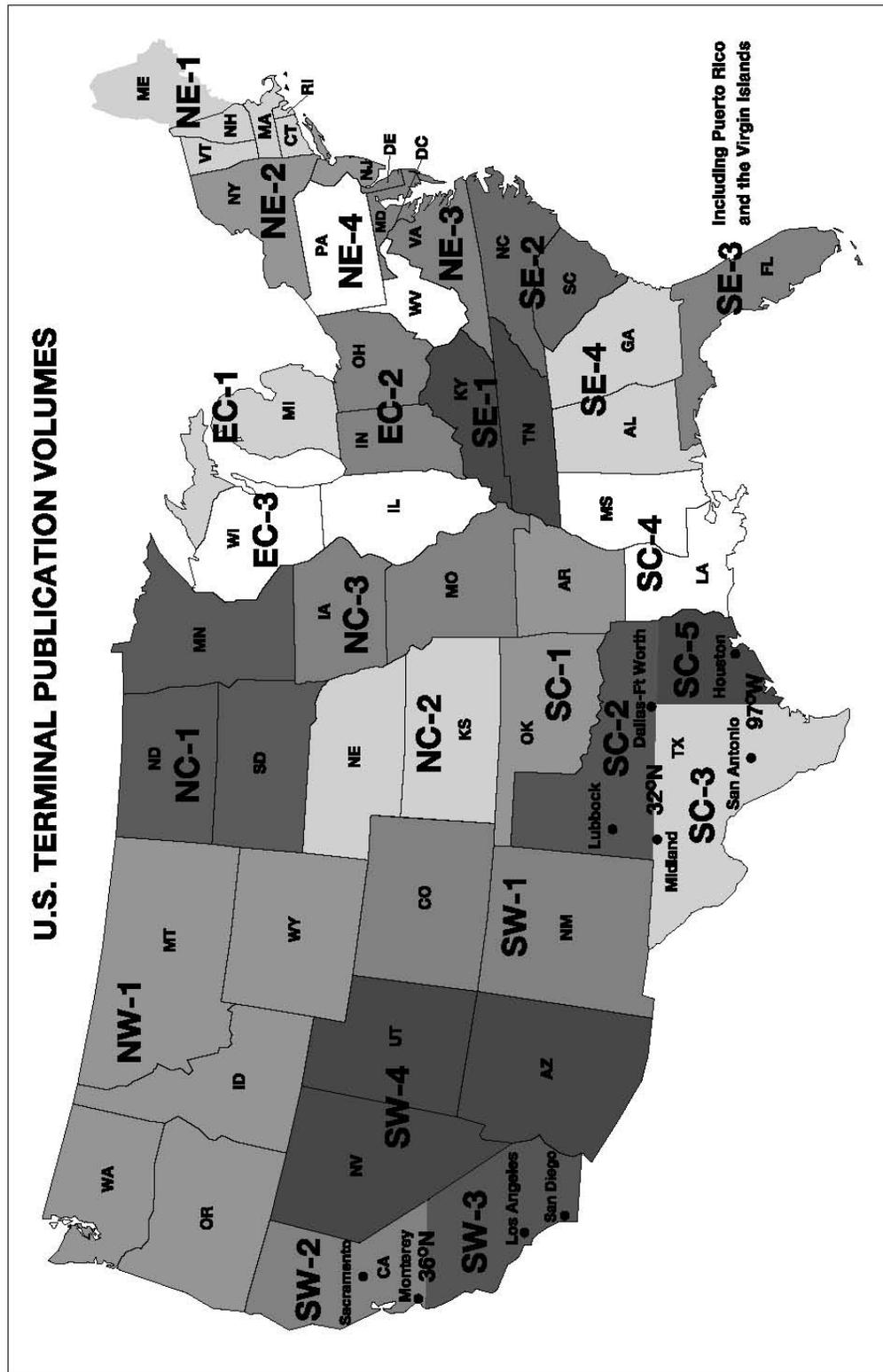
**(a) The NAVAID Digital Data File.** This file contains a current listing of NAVAIDs that are compatible with the National Airspace System. This file contains all NAVAIDs including ILS and its components, in the U.S., Puerto Rico, and the Virgin Islands plus bordering facilities in Canada, Mexico, and the Atlantic and Pacific areas.

**(b) The Digital Obstacle File.** This file describes all obstacles of interest to aviation users in the U.S., with limited coverage of the Pacific, Caribbean, Canada, and Mexico. The obstacles are assigned unique numerical identifiers, accuracy codes, and listed in order of ascending latitude within each state or area.

**2. The Coded Instrument Flight Procedures (CIFP) (ARINC 424 [Ver 13 & 15]).** The CIFP is a basic digital dataset, modeled to an international standard, which can be used as a basis to support GPS navigation. Initial data elements included are: Airport and Helicopter Records, VHF and NDB Navigation aids, en route waypoints and airways. Additional data elements will be added in subsequent releases to include: departure procedures, standard terminal arrivals, and GPS/RNAV instrument approach procedures. The database is updated every 28 days. The data is available by subscription only and is distributed on CD-ROM or by ftp download.

**3. digital-Visual Charts (d-VC).** These digital VFR charts are geo-referenced images of FAA Sectional Aeronautical, TAC, and Helicopter Route charts. Additional digital data may easily be overlaid on the raster image using commonly available Geographic Information System software. Data such as weather, temporary flight restrictions, obstacles, or other geospatial data can be combined with d-VC data to support a variety of needs. The file resolution is 300 dots per inch and the data is 8-bit color. The data is provided as a GeoTIFF and distributed on DVD-R media and on the AIS website. The root mean square error of the transformation will not exceed two pixels. Digital-VCs are updated every 56 days and are available by subscription only.

FIG 9-1-15  
U.S. Terminal Publication Volumes



## 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* One or more of the following descriptors, to a maximum of 20 characters, to describe the serviceable surveillance equipment and/or capabilities on board.

*ENTER* no more than one transponder code (Modes A, C, or S)

**SSR Modes A and C:**

A	Transponder	Mode A (4 digits – 4096 codes)
C	Transponder	Mode A (4 digits – 4096 codes) and Mode C

**SSR Mode S:**

E	Transponder	Mode S, including aircraft identification, pressure–altitude, and extended squitter (ADS–B) capability
H	Transponder	Mode S, including aircraft identification, pressure–altitude, and enhanced surveillance capability
I	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
P	Transponder	Mode S, including pressure–altitude, but no aircraft identification capability
S	Transponder	Mode S, including both pressure–altitude and aircraft identification capability
X	Transponder	Mode S, with neither aircraft identification nor pressure–altitude

**NOTE–**

*Enhanced surveillance capability is the ability of the aircraft to down–link aircraft derived data via Mode S transponder.*

**ADS–B:**

B1	ADS–B with dedicated 1090 MHz ADS–B “out” capability
B2	ADS–B with dedicated 1090 MHz ADS–B “out” and “in” capability
U1	ADS–B with “out” capability using UAT
U2	ADS–B with “out” and “in” capability using UAT
V1	ADS–B with “out” capability using VDL Mode 4
V2	ADS–B with “out” and “in” capability using VDL Mode 4

**NOTE–**

*File no more than one code for each type of capability, e.g., file B1 or B2 and not both*

**ADS–C:**

D1	ADS–C with FANS 1/A capabilities
G1	ADS–C with ATN capabilities

Alphanumeric characters not included above are reserved.

**EXAMPLE–**

**ADE3RV/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/.*

**TBL 4-4  
Item 18 NAV/, COM/, DAT/, and SUR/ capabilities used by FAA**

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 Transitions.
	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 used by FAA	Capability and preference for delivery of pre-departure clearance	Priority number followed by: <ul style="list-style-type: none"> <li>• FANS</li> <li>• FANSP</li> <li>• PDC</li> <li>• VOICE</li> </ul>	Entries are combined with a priority number, for example; 1FANS2PDC means a preference for departure clearance delivered via FANS 1/A; with capability to also receive the clearance via ACARS PDC. FANS = FANS 1/A DCL FANSP = FANS 1/A+ DCL PDC = ACARS PDC VOICE = PDC via voice (no automated delivery)
SUR/ entries used by FAA	Req. Surveillance Performance	RSP180	Aircraft is authorized for Required Surveillance Performance RSP180
		RSP400	Aircraft is authorized for Required Surveillance Performance RSP400
	ADS-B	A2	Aircraft has 1090 MHz Extended Squitter ADS-B compliant with RTCA DO-260B (complies with FAA requirements)
		A2	Aircraft has 978 MHz UAT ADS-B compliant with RTCA DO-282B (complies with FAA requirements)

**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

TBL 4-5

**Item 18. PBN/ Specifications**

(Include as many of the applicable descriptors, up to a maximum of 8 entries (not more than 16 characters).

<b>PBN/</b>	<b>RNAV SPECIFICATIONS</b>
A1	RNAV 10 (RNP 10)
B1	RNAV 5 all permitted sensors
B2	RNAV 5 GNSS
B3	RNAV 5 DME/DME
B4	RNAV 5 VOR/DME
B5	RNAV 5 INS or IRS
B6	RNAV 5 LORAN C
C1	RNAV 2 all permitted sensors
C2	RNAV 2 GNSS
C3	RNAV 2 DME/DME
C4	RNAV 2 DME/DME/IRU
D1	RNAV 1 all permitted sensors
D2	RNAV 1 GNSS
D3	RNAV 1 DME/DME
D4	RNAV 1 DME/DME/IRU
<b>PBN/</b>	<b>RNP SPECIFICATIONS</b>
L1	RNP 4
O1	Basic RNP 1 all permitted sensors
O2	Basic RNP 1 GNSS
O3	Basic RNP 1 DME/DME
O4	Basic RNP 1 DME/DME/IRU
S1	RNP APCH
S2	RNP APCH with BARO-VNAV
T1	RNP AR APCH with RF (special authorization required)
T2	RNP AR APCH without RF (special authorization required)

**NOTE-**

1. PBN Codes B1–B6 indicates RNAV 5 capability. The FAA considers these B codes to be synonymous and qualifying for point-to-point routing but not for assignment to the PBN routes shown in the table.
2. Combinations of alphanumeric characters not included above are reserved.
3. The PBN/ specifications are allowed per ICAO Doc. 4444. The FAA makes use of a subset of these codes as described in the section on filing navigation capability.

(c) The following sections detail what capabilities need to be provided to obtain services from the FAA for:

- IFR flights (general).
- Assignment of Performance-Based Navigation (PBN) routes.
- Automated Departure clearance (via Datacom DCL or PDC).
- Reduced Vertical Separation Minima (if requesting FL 290 or above).
- Reduced Separation in Oceanic Airspace.

(d) Capabilities such as voice communications, required communications performance, approach aids, and ADS-C, are not required in a flight plan that remains entirely within domestic airspace.

(e) Flights that leave domestic United States airspace may be required to include additional capabilities, per requirements for the FIRs being overflown. Consult the appropriate State Aeronautical Information Publications for requirements.

(f) Include the capability only if:

- The requisite equipment is installed and operational;
- The crew is trained as required; and
- Any required Operations Specification, Letter of Authorization, or other approvals are in hand.

**NOTE-**

Do not include a capability solely based on the installed equipment if an operational approval is required. For example, all U.S. civil operators require either Operations Specification, Management Specification, or Letter of Authorization B036, as applicable, in order to include NAV/M2 (RNP 2 (oceanic/remote)), PBN/A1 (RNAV 10 (RNP 10)), or PBN/L1 (RNP 4) in Item 18.

5. Filing equipment and capability in an IFR Flight Plan. This section details the minimum requirements to identify capabilities in an IFR flight plan for flights in the domestic United States. Other requirements to file a capability are associated with obtaining specific services as described in subsequent sections. The basic capabilities that must be addressed include Navigation, Transponder, Voice, and ADS-B Out as described below. A designator for “Standard” capability is also allowed to cover a suite of commonly carried voice, navigation, and approach equipment with one code.

**(a) Standard Capability and No Capability (Item 10a)**

- Use “S” if VHF radio, VOR, and ILS equipment for the route to be flown are carried and serviceable. Use of the ‘S’ removes the need to list these three capabilities separately.
- Use “N” if no communications, navigation, or approach aid equipment for the route to be flown are carried or the equipment is unserviceable.
- When there is no transponder, ADS-B, or ADS-C capability then file only the letter ‘N’ in Item 10b.

**(b) Navigation Capabilities (Item 10a, Item 18 NAV/)**

- Indicate radio navigation capability by filing one or more of the codes in TBL 4–6.
- Indicate Area Navigation (RNAV) capability by filing one or more of the codes in TBL 4–7.

TBL 4-6

**Radio Navigation Capabilities**

Capability	Item 10a	Item 18 NAV/
VOR	O	
DME	D	
TACAN	T	

TBL 4-7

**Area Navigation Capabilities**

Capability	Item 10a	Item 18 NAV/
GNSS	G	SBAS (if WAAS equipped) GBAS (if LAAS equipped)
INS	I	
DME / DME	DR	
VOR / DME	DOR	

**NOTE-**

- 1. SBAS – Space-Based Augmentation System
- GBAS – Ground-Based Augmentation System

- 2. No PBN/ code needs to be filed to indicate the ability to fly point-to-point routes using GNSS or INS.
- 3. Filing one of these four area navigation capabilities as shown does not indicate performance based navigation sufficient for flying Q-Routes, T-Routes, or RNAV SIDs or STARs. To qualify for these routes, see the section on Performance Based Navigation Routes.

**(c) Transponder Capabilities (Item 10b)**

- For domestic flights, it is not necessary to indicate Mode S capability. It is acceptable to simply file one of the following codes in TBL 4-8.

**TBL 4-8  
Mode C**

Capability	Item 10b
Transponder with no Mode C	A
Transponder with Mode C	C

- International flights must file in accordance with relevant AIPs and regional supplements. Include one of the Mode S codes in TBL 4-9, if appropriate.

**NOTE-**

*File only one transponder code.*

**TBL 4-9  
Mode S**

Capability	Aircraft ID	Altitude Encoding	Item 10b
Mode S Transponder	No	No	X
Mode S Transponder	No	Yes	P
Mode S Transponder	Yes	No	I
Mode S Transponder	Yes	Yes	S
Mode S Transponder with Extended Squitter	Yes	Yes	E
Enhanced Mode S Transponder	Yes	Yes	H
Enhanced Mode S Transponder with Extended Squitter	Yes	Yes	L

**(d) ADS-B Capabilities (Item 10b, Item 18 SUR/ and Item 18 CODE/)**

- Indicate ADS-B capability as shown in TBL 4-10. The accompanying entry in Item 18 indicates that the equipment is compliant with 14 CFR §91.227. Some ADS-B equipment used in other countries is based on an earlier standard and does not meet U.S. requirements.
- Do not file an ADS-B code for “in” capability only. There is currently no way to indicate that an aircraft has “in” capability but no “out” capability.
- For aircraft with ADS-B “out” on one frequency and “in” on another, include only the ADS-B “out” code. For example, B1 or U1, (See TBL 4-10).

**TBL 4-10  
ADS-B Capabilities**

Capability	Item 10b	Item 18 SUR/
1090 ES Out Capability	B1	A2
1090 ES Out and In Capability	B2	A2
UAT Out Capability	U1	A2
UAT Out and In Capability	U2	A2

**(e) Voice Communication Capabilities (Item 10a)**

The FAA does not require indication of voice communication capabilities in a flight plan for domestic flights, but it is permissible. For flights outside the domestic United States, all relevant capabilities must be indicated as follows (See TBL 4–11):

**TBL 4–11  
Voice Communication Capabilities**

Capability	Item 10a
VHF Radio	V
UHF Radio	U
HF Radio	H
VHF Radio (8.33 kHz Spacing)	Y
ATC SATVOICE (INMARSAT)	M1
ATC SATVOICE (Iridium)	M3

**(f) Approach Aid Capabilities (Item 10a).**

The FAA does not require filing of approach aid capability in order to request a specific type of approach, however any of the codes indicated in TBL 4–12 in 10a are permissible.

- International flights may be required to indicate approach capability, based on instructions from relevant service providers.

**TBL 4–12  
Approach Aid Capabilities**

Capability	Item 10a
ILS	L
MLS	K
LPV Approach (APV with SBAS) (WAAS)	B
GBAS Landing System (LAAS)	A

**6. Performance–Based Navigation Routes (Item 10a, Item 18 PBN/, Item 18 NAV/)**– When planning to fly routes that require PBN capability, file the appropriate capability as shown in TBL 4–13.

# PILOT/CONTROLLER GLOSSARY

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## 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. Terms used in this glossary that apply to flight service station (FSS) roles are included when they differ from air traffic control functions. These terms are followed by “[FSS].”

d. This Glossary will be revised, as necessary, to maintain a common understanding of the system.

## EXPLANATION OF CHANGES

e. Terms Added:

CHART SUPPLEMENT  
CHART SUPPLEMENT ALASKA  
CHART SUPPLEMENT PACIFIC

f. Terms Modified:

AERONAUTICAL INFORMATION PUBLICATION (AIP)  
AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER (ATCSCC)  
ALPHANUMERIC DISPLAY  
ALTITUDE READOUT  
AUTOMATED UNICOM  
CHART SUPPLEMENT U.S.  
NAVAID CLASSES  
PRECIPITATION RADAR WEATHER DESCRIPTIONS  
ROUTE ACTION NOTIFICATION  
SAFETY LOGIC SYSTEM ALERTS  
TERMINAL VFR RADAR SERVICE  
TIE-IN FACILITY  
UNICOM  
VOT

g. Editorial/format changes were made where necessary. Revision bars were not used due to the insignificant nature of the changes.



ADS [ICAO]–

(See ICAO term AUTOMATIC DEPENDENT SURVEILLANCE.)

ADS–B–

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST.)

ADS–C–

(See AUTOMATIC DEPENDENT SURVEILLANCE–CONTRACT.)

ADVANCED AIR MOBILITY (AAM)–A transportation system that transports people and property by air between two points in the NAS using aircraft with advanced technologies, including electric aircraft or electric vertical takeoff and landing aircraft, in both controlled and uncontrolled airspace.

**ADVISE INTENTIONS**– Tell me what you plan to do.

ADVISORY– Advice and information provided to assist pilots in the safe conduct of flight and aircraft movement.

(See ADVISORY SERVICE.)

ADVISORY CIRCULAR (AC)– An FAA publication, advisory and descriptive in nature, which is not regulatory.

ADVISORY FREQUENCY– The appropriate frequency to be used for Airport Advisory Service.

(See LOCAL AIRPORT ADVISORY.)

(See UNICOM.)

(Refer to ADVISORY CIRCULAR NO. 90-66.)

(Refer to AIM.)

ADVISORY SERVICE– Advice and information provided by a facility to assist pilots in the safe conduct of flight and aircraft movement.

(See ADDITIONAL SERVICES.)

(See LOCAL AIRPORT ADVISORY.)

(See RADAR ADVISORY.)

(See SAFETY ALERT.)

(See TRAFFIC ADVISORIES.)

(Refer to AIM.)

ADW–

(See ARRIVAL DEPARTURE WINDOW)

AERIAL REFUELING– A procedure used by the military to transfer fuel from one aircraft to another during flight.

(Refer to VFR/IFR Wall Planning Charts.)

AERODROME– A defined area on land or water (including any buildings, installations and equipment) intended to be used either wholly or in part for the arrival, departure, and movement of aircraft.

AERODROME BEACON [ICAO]– Aeronautical beacon used to indicate the location of an aerodrome from the air.

AERODROME CONTROL SERVICE [ICAO]– Air traffic control service for aerodrome traffic.

AERODROME CONTROL TOWER [ICAO]– A unit established to provide air traffic control service to aerodrome traffic.

AERODROME ELEVATION [ICAO]– The elevation of the highest point of the landing area.

AERODROME TRAFFIC CIRCUIT [ICAO]– The specified path to be flown by aircraft operating in the vicinity of an aerodrome.

**AERONAUTICAL BEACON**– A visual NAVAID displaying flashes of white and/or colored light to indicate the location of an airport, a heliport, a landmark, a certain point of a Federal airway in mountainous terrain, or an obstruction.

(See AIRPORT ROTATING BEACON.)

(Refer to AIM.)

**AERONAUTICAL CHART**– A map used in air navigation containing all or part of the following: topographic features, hazards and obstructions, navigation aids, navigation routes, designated airspace, and airports. Commonly used aeronautical charts are:

**a. Sectional Aeronautical Charts (1:500,000)**– Designed for visual navigation of slow or medium speed aircraft. Topographic information on these charts features the portrayal of relief and a judicious selection of visual check points for VFR flight. Aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, permanent special use airspace (SUA), obstructions, and related data.

**b. VFR Terminal Area Charts (1:250,000)**– Depict Class B airspace which provides for the control or segregation of all the aircraft within Class B airspace. The chart depicts topographic information and aeronautical information which includes visual and radio aids to navigation, airports, controlled airspace, permanent SUA, obstructions, and related data.

**c. En Route Low Altitude Charts**– Provide aeronautical information for en route instrument navigation (IFR) in the low altitude stratum. Information includes the portrayal of airways, limits of controlled airspace, position identification and frequencies of radio aids, selected airports, minimum en route and minimum obstruction clearance altitudes, airway distances, reporting points, permanent SUA, and related data. Area charts, which are a part of this series, furnish terminal data at a larger scale in congested areas.

**d. En Route High Altitude Charts**– Provide aeronautical information for en route instrument navigation (IFR) in the high altitude stratum. Information includes the portrayal of jet routes, identification and frequencies of radio aids, selected airports, distances, time zones, special use airspace, and related information.

**e. Instrument Approach Procedure (IAP) Charts**– Portray the aeronautical data which is required to execute an instrument approach to an airport. These charts depict the procedures, including all related data, and the airport diagram. Each procedure is designated for use with a specific type of electronic navigation system including NDB, TACAN, VOR, ILS RNAV and GLS. These charts are identified by the type of navigational aid(s)/equipment required to provide final approach guidance.

**f. Instrument Departure Procedure (DP) Charts**– Designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. Each DP is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.

**g. Standard Terminal Arrival (STAR) Charts**– Designed to expedite air traffic control arrival procedures and to facilitate transition between en route and instrument approach operations. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.

**h. Airport Taxi Charts**– Designed to expedite the efficient and safe flow of ground traffic at an airport. These charts are identified by the official airport name; e.g., Ronald Reagan Washington National Airport.

(See ICAO term AERONAUTICAL CHART.)

**AERONAUTICAL CHART [ICAO]**– A representation of a portion of the earth, its culture and relief, specifically designated to meet the requirements of air navigation.

**AERONAUTICAL INFORMATION MANUAL (AIM)**– A primary FAA publication whose purpose is to instruct airmen about operating in the National Airspace System of the U.S. It provides basic flight information, ATC Procedures and general instructional information concerning health, medical facts, factors affecting flight safety, accident and hazard reporting, and types of aeronautical charts and their use.

**AERONAUTICAL INFORMATION PUBLICATION (AIP) [ICAO]**– A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.

(See CHART SUPPLEMENT.)

**AERONAUTICAL INFORMATION SERVICES (AIS)**– A facility in Silver Spring, MD, established by FAA to operate a central aeronautical information service for the collection, validation, and dissemination of

orderly, and expeditious flow of traffic while minimizing delays. The following functions are located at the ATCSCC:

**a.** Central Altitude Reservation Function (CARF). Responsible for coordinating, planning, and approving special user requirements under the Altitude Reservation (ALTRV) concept.

(See ALTITUDE RESERVATION.)

**b.** Airport Reservation Office (ARO). Monitors the operation and allocation of reservations for unscheduled operations at airports designated by the Administrator as High Density Airports. These airports are generally known as slot controlled airports. The ARO allocates reservations on a first come, first served basis determined by the time the request is received at the ARO.

(Refer to 14 CFR Part 93.)

(See CHART SUPPLEMENT.)

**c.** U.S. Notice to Air Missions (NOTAM) Office. Responsible for collecting, maintaining, and distributing NOTAMs for the U.S. civilian and military, as well as international aviation communities.

(See NOTICE TO AIR MISSIONS.)

**d.** Weather Unit. Monitor all aspects of weather for the U.S. that might affect aviation including cloud cover, visibility, winds, precipitation, thunderstorms, icing, turbulence, and more. Provide forecasts based on observations and on discussions with meteorologists from various National Weather Service offices, FAA facilities, airlines, and private weather services.

**e.** Air Traffic Organization (ATO) Space Operations and Unmanned Aircraft System (UAS); the Office of Primary Responsibility (OPR) for all space and upper class E tactical operations in the National Airspace System (NAS).

**AIR TRAFFIC SERVICE**– A generic term meaning:

- a.** Flight Information Service.
- b.** Alerting Service.
- c.** Air Traffic Advisory Service.
- d.** Air Traffic Control Service:
  - 1.** Area Control Service,
  - 2.** Approach Control Service, or
  - 3.** Airport Control Service.

**AIR TRAFFIC ORGANIZATION (ATO)** – The FAA line of business responsible for providing safe and efficient air navigation services in the national airspace system.

**AIR TRAFFIC SERVICE (ATS) ROUTES** – The term “ATS Route” is a generic term that includes “VOR Federal airways,” “colored Federal airways,” “jet routes,” and “RNAV routes.” The term “ATS route” does not replace these more familiar route names, but serves only as an overall title when listing the types of routes that comprise the United States route structure.

**AIRBORNE**– An aircraft is considered airborne when all parts of the aircraft are off the ground.

**AIRBORNE DELAY**– Amount of delay to be encountered in airborne holding.

**AIRBORNE REROUTE (ABRR)**– A capability within the Traffic Flow Management System used for the timely development and implementation of tactical reroutes for airborne aircraft. This capability defines a set of aircraft-specific reroutes that address a certain traffic flow problem and then electronically transmits them to En Route Automation Modernization (ERAM) for execution by the appropriate sector controllers.

**AIRCRAFT**– Device(s) that are used or intended to be used for flight in the air, and when used in air traffic control terminology, may include the flight crew.

(See ICAO term AIRCRAFT.)

**AIRCRAFT [ICAO]**– Any machine that can derive support in the atmosphere from the reactions of the air other than the reactions of the air against the earth’s surface.

**AIRCRAFT APPROACH CATEGORY**– A grouping of aircraft based on a speed of 1.3 times the stall speed in the landing configuration at maximum gross landing weight. An aircraft must fit in only one category. If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the category for that speed must be used. For example, an aircraft which falls in Category A, but is circling to land at a speed in excess of 91 knots, must use the approach Category B minimums when circling to land. The categories are as follows:

- a. Category A– Speed less than 91 knots.
  - b. Category B– Speed 91 knots or more but less than 121 knots.
  - c. Category C– Speed 121 knots or more but less than 141 knots.
  - d. Category D– Speed 141 knots or more but less than 166 knots.
  - e. Category E– Speed 166 knots or more.
- (Refer to 14 CFR Part 97.)

**AIRCRAFT CLASSES**– For the purposes of Wake Turbulence Separation Minima, ATC classifies aircraft as Super, Heavy, Large, and Small as follows:

- a. Super. The Airbus A-380-800 (A388) and the Antonov An-225 (A225) are classified as super.
  - b. Heavy– Aircraft capable of takeoff weights of 300,000 pounds or more whether or not they are operating at this weight during a particular phase of flight.
  - c. Large– Aircraft of more than 41,000 pounds, maximum certificated takeoff weight, up to but not including 300,000 pounds.
  - d. Small– Aircraft of 41,000 pounds or less maximum certificated takeoff weight.
- (Refer to AIM.)

**AIRCRAFT CONFLICT**– Predicted conflict, within EDST of two aircraft, or between aircraft and airspace. A Red alert is used for conflicts when the predicted minimum separation is 5 nautical miles or less. A Yellow alert is used when the predicted minimum separation is between 5 and approximately 12 nautical miles. A Blue alert is used for conflicts between an aircraft and predefined airspace.

(See EN ROUTE DECISION SUPPORT TOOL.)

**AIRCRAFT LIST (ACL)**– A view available with EDST that lists aircraft currently in or predicted to be in a particular sector's airspace. The view contains textual flight data information in line format and may be sorted into various orders based on the specific needs of the sector team.

(See EN ROUTE DECISION SUPPORT TOOL.)

**AIRCRAFT SURGE LAUNCH AND RECOVERY**– Procedures used at USAF bases to provide increased launch and recovery rates in instrument flight rules conditions. ASLAR is based on:

- a. Reduced separation between aircraft which is based on time or distance. Standard arrival separation applies between participants including multiple flights until the DRAG point. The DRAG point is a published location on an ASLAR approach where aircraft landing second in a formation slows to a predetermined airspeed. The DRAG point is the reference point at which MARSAs applies as expanding elements effect separation within a flight or between subsequent participating flights.

- b. ASLAR procedures shall be covered in a Letter of Agreement between the responsible USAF military ATC facility and the concerned Federal Aviation Administration facility. Initial Approach Fix spacing requirements are normally addressed as a minimum.

**AIRCRAFT HAZARD AREA (AHA)**– Used by ATC to segregate air traffic from a launch vehicle, reentry vehicle, amateur rocket, jettisoned stages, hardware, or falling debris generated by failures associated with any of these activities. An AHA is designated via NOTAM as either a TFR or stationary ALTRV. Unless otherwise specified, the vertical limits of an AHA are from the surface to unlimited.

(See CONTINGENCY HAZARD AREA.)

(See REFINED HAZARD AREA.)

(See TRANSITIONAL HAZARD AREA.)

**AIRPORT RESERVATION OFFICE**– Office responsible for monitoring the operation of slot controlled airports. It receives and processes requests for unscheduled operations at slot controlled airports.

**AIRPORT ROTATING BEACON**– A visual NAVAID operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes.

(See INSTRUMENT FLIGHT RULES.)

(See SPECIAL VFR OPERATIONS.)

(See ICAO term AERODROME BEACON.)

(Refer to AIM.)

**AIRPORT SURFACE DETECTION EQUIPMENT (ASDE)**– Surveillance equipment specifically designed to detect aircraft, vehicular traffic, and other objects, on the surface of an airport, and to present the image on a tower display. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways. There are three ASDE systems deployed in the NAS:

a. **ASDE-3**– a Surface Movement Radar.

b. **ASDE-X**– a system that uses an X-band Surface Movement Radar, multilateration, and ADS-B.

c. **Airport Surface Surveillance Capability (ASSC)**– A system that uses Surface Movement Radar, multilateration, and ADS-B.

**AIRPORT SURVEILLANCE RADAR**– Approach control radar used to detect and display an aircraft’s position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 miles.

**AIRPORT TAXI CHARTS**–

(See AERONAUTICAL CHART.)

**AIRPORT TRAFFIC CONTROL SERVICE**– A service provided by a control tower for aircraft operating on the movement area and in the vicinity of an airport.

(See MOVEMENT AREA.)

(See TOWER.)

(See ICAO term AERODROME CONTROL SERVICE.)

**AIRPORT TRAFFIC CONTROL TOWER**–

(See TOWER.)

**AIRSPACE CONFLICT**– Predicted conflict of an aircraft and active Special Activity Airspace (SAA).

**AIRSPACE FLOW PROGRAM (AFP)**– AFP is a Traffic Management (TM) process administered by the Air Traffic Control System Command Center (ATCSCC) where aircraft are assigned an Expect Departure Clearance Time (EDCT) in order to manage capacity and demand for a specific area of the National Airspace System (NAS). The purpose of the program is to mitigate the effects of en route constraints. It is a flexible program and may be implemented in various forms depending upon the needs of the air traffic system.

**AIRSPACE HIERARCHY**– Within the airspace classes, there is a hierarchy and, in the event of an overlap of airspace: Class A preempts Class B, Class B preempts Class C, Class C preempts Class D, Class D preempts Class E, and Class E preempts Class G.

**AIRSPEED**– The speed of an aircraft relative to its surrounding air mass. The unqualified term “airspeed” means one of the following:

a. **Indicated Airspeed**– The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term “airspeed.”

(Refer to 14 CFR Part 1.)

b. **True Airspeed**– The airspeed of an aircraft relative to undisturbed air. Used primarily in flight planning and en route portion of flight. When used in pilot/controller communications, it is referred to as “true airspeed” and not shortened to “airspeed.”

**AIRSPACE RESERVATION**– The term used in oceanic ATC for airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. Airspace reservations must be classified as either “moving” or “stationary.”

(See MOVING AIRSPACE RESERVATION)

(See STATIONARY AIRSPACE RESERVATION.)

(See ALTITUDE RESERVATION.)

**AIRSTART**– The starting of an aircraft engine while the aircraft is airborne, preceded by engine shutdown during training flights or by actual engine failure.

**AIRWAY**– A Class E airspace area established in the form of a corridor, the centerline of which is defined by radio navigational aids.

(See FEDERAL AIRWAYS.)

(See ICAO term AIRWAY.)

(Refer to 14 CFR Part 71.)

(Refer to AIM.)

**AIRWAY [ICAO]**– A control area or portion thereof established in the form of corridor equipped with radio navigational aids.

**AIRWAY BEACON**– Used to mark airway segments in remote mountain areas. The light flashes Morse Code to identify the beacon site.

(Refer to AIM.)

**AIS**–

(See AERONAUTICAL INFORMATION SERVICES.)

**AIT**–

(See AUTOMATED INFORMATION TRANSFER.)

**ALERFA (Alert Phase) [ICAO]**– A situation wherein apprehension exists as to the safety of an aircraft and its occupants.

**ALERT**– A notification to a position that there is an aircraft-to-aircraft or aircraft-to-airspace conflict, as detected by Automated Problem Detection (APD).

**ALERT AREA**–

(See SPECIAL USE AIRSPACE.)

**ALERT NOTICE (ALNOT)**– A request originated by a flight service station (FSS) or an air route traffic control center (ARTCC) for an extensive communication search for overdue, unreported, or missing aircraft.

**ALERTING SERVICE**– A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and assist such organizations as required.

**ALNOT**–

(See ALERT NOTICE.)

**ALONG-TRACK DISTANCE (ATD)**– The horizontal distance between the aircraft’s current position and a fix measured by an area navigation system that is not subject to slant range errors.

**ALPHANUMERIC DISPLAY**– Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a radar display.

**ALTERNATE AERODROME [ICAO]**– An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing.

Note: The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for the flight.

**ALTERNATE AIRPORT**– An airport at which an aircraft may land if a landing at the intended airport becomes inadvisable.

(See ICAO term ALTERNATE AERODROME.)

**ALTIMETER SETTING**– The barometric pressure reading used to adjust a pressure altimeter for variations in existing atmospheric pressure or to the standard altimeter setting (29.92).

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**ALTITUDE**– The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL).

(See FLIGHT LEVEL.)

**a. MSL Altitude**– Altitude expressed in feet measured from mean sea level.

**b. AGL Altitude**– Altitude expressed in feet measured above ground level.

**c. Indicated Altitude**– The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

(See ICAO term ALTITUDE.)

**ALTITUDE [ICAO]**– The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

**ALTITUDE READOUT**– An aircraft’s altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments on a radar scope having readout capability.

(See ALPHANUMERIC DISPLAY.)

(Refer to AIM.)

**ALTITUDE RESERVATION (ALTRV)**– Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility. ALTRVs must be classified as either “moving” or “stationary.”

(See MOVING ALTITUDE RESERVATION.)

(See STATIONARY ALTITUDE RESERVATION.)

(See AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER.)

**ALTITUDE RESTRICTION**– An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

**ALTITUDE RESTRICTIONS ARE CANCELED**– Adherence to previously imposed altitude restrictions is no longer required during a climb or descent.

**ALTRV**–

(See ALTITUDE RESERVATION.)

**AMVER**–

(See AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM.)

**APB**–

(See AUTOMATED PROBLEM DETECTION BOUNDARY.)

**APD**–

(See AUTOMATED PROBLEM DETECTION.)

**APDIA**–

(See AUTOMATED PROBLEM DETECTION INHIBITED AREA.)

**APPROACH CLEARANCE**– Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a clearance and other pertinent information is provided in the approach clearance when required.

(See CLEARED APPROACH.)

(See INSTRUMENT APPROACH PROCEDURE.)

(Refer to AIM.)

(Refer to 14 CFR Part 91.)

**APPROACH CONTROL FACILITY**– A terminal ATC facility that provides approach control service in a terminal area.

(See **APPROACH CONTROL SERVICE**.)

(See **RADAR APPROACH CONTROL FACILITY**.)

**APPROACH CONTROL SERVICE**– Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service.

(See ICAO term **APPROACH CONTROL SERVICE**.)

(Refer to AIM.)

**APPROACH CONTROL SERVICE [ICAO]**– Air traffic control service for arriving or departing controlled flights.

**APPROACH GATE**– An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course. The gate will be established along the final approach course 1 mile from the final approach fix on the side away from the airport and will be no closer than 5 miles from the landing threshold.

**APPROACH/DEPARTURE HOLD AREA**– The locations on taxiways in the approach or departure areas of a runway designated to protect landing or departing aircraft. These locations are identified by signs and markings.

**APPROACH LIGHT SYSTEM**–

(See **AIRPORT LIGHTING**.)

**APPROACH SEQUENCE**– The order in which aircraft are positioned while on approach or awaiting approach clearance.

(See **LANDING SEQUENCE**.)

(See ICAO term **APPROACH SEQUENCE**.)

**APPROACH SEQUENCE [ICAO]**– The order in which two or more aircraft are cleared to approach to land at the aerodrome.

***APPROACH SPEED***– The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

**APPROACH WITH VERTICAL GUIDANCE (APV)**– A term used to describe RNAV approach procedures that provide lateral and vertical guidance but do not meet the requirements to be considered a precision approach.

**APPROPRIATE ATS AUTHORITY [ICAO]**– The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned. In the United States, the “appropriate ATS authority” is the Program Director for Air Traffic Planning and Procedures, ATP-1.

**APPROPRIATE AUTHORITY**–

- a. Regarding flight over the high seas: the relevant authority is the State of Registry.
- b. Regarding flight over other than the high seas: the relevant authority is the State having sovereignty over the territory being overflown.

***APPROPRIATE OBSTACLE CLEARANCE MINIMUM ALTITUDE***– Any of the following:

(See **MINIMUM EN ROUTE IFR ALTITUDE**.)

(See **MINIMUM IFR ALTITUDE**.)

(See **MINIMUM OBSTRUCTION CLEARANCE ALTITUDE**.)

(See **MINIMUM VECTORING ALTITUDE**.)

***APPROPRIATE TERRAIN CLEARANCE MINIMUM ALTITUDE***– Any of the following:

(See **MINIMUM EN ROUTE IFR ALTITUDE**.)

(See **MINIMUM IFR ALTITUDE**.)

(See **MINIMUM OBSTRUCTION CLEARANCE ALTITUDE**.)

(See **MINIMUM VECTORING ALTITUDE**.)

**APRON**– A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

(See ICAO term APRON.)

**APRON [ICAO]**– A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, refueling, parking or maintenance.

**ARC**– The track over the ground of an aircraft flying at a constant distance from a navigational aid by reference to distance measuring equipment (DME).

**AREA CONTROL CENTER [ICAO]**– An air traffic control facility primarily responsible for ATC services being provided IFR aircraft during the en route phase of flight. The U.S. equivalent facility is an air route traffic control center (ARTCC).

**AREA NAVIGATION (RNAV)**– A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground– or space–based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

**Note:** Area navigation includes performance–based navigation as well as other operations that do not meet the definition of performance–based navigation.

**AREA NAVIGATION (RNAV) APPROACH CONFIGURATION:**

**a. STANDARD T**– An RNAV approach whose design allows direct flight to any one of three initial approach fixes (IAF) and eliminates the need for procedure turns. The standard design is to align the procedure on the extended centerline with the missed approach point (MAP) at the runway threshold, the final approach fix (FAF), and the initial approach/intermediate fix (IAF/IF). The other two IAFs will be established perpendicular to the IF.

**b. MODIFIED T**– An RNAV approach design for single or multiple runways where terrain or operational constraints do not allow for the standard T. The “T” may be modified by increasing or decreasing the angle from the corner IAF(s) to the IF or by eliminating one or both corner IAFs.

**c. STANDARD I**– An RNAV approach design for a single runway with both corner IAFs eliminated. Course reversal or radar vectoring may be required at busy terminals with multiple runways.

**d. TERMINAL ARRIVAL AREA (TAA)**– The TAA is controlled airspace established in conjunction with the Standard or Modified T and I RNAV approach configurations. In the standard TAA, there are three areas: straight-in, left base, and right base. The arc boundaries of the three areas of the TAA are published portions of the approach and allow aircraft to transition from the en route structure direct to the nearest IAF. TAAs will also eliminate or reduce feeder routes, departure extensions, and procedure turns or course reversal.

**1. STRAIGHT-IN AREA**– A 30 NM arc centered on the IF bounded by a straight line extending through the IF perpendicular to the intermediate course.

**2. LEFT BASE AREA**– A 30 NM arc centered on the right corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30 NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

**3. RIGHT BASE AREA**– A 30 NM arc centered on the left corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30 NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

**AREA NAVIGATION (RNAV) GLOBAL POSITIONING SYSTEM (GPS) PRECISION RUNWAY MONITORING (PRM) APPROACH**–

A GPS approach, which requires vertical guidance, used in lieu of another type of PRM approach to conduct approaches to parallel runways whose extended centerlines are separated by less than 4,300 feet and at least 3,000 feet, where simultaneous close parallel approaches are permitted. Also used in lieu of an ILS PRM and/or LDA PRM approach to conduct Simultaneous Offset Instrument Approach (SOIA) operations.

**ARMY AVIATION FLIGHT INFORMATION BULLETIN**– A bulletin that provides air operation data covering Army, National Guard, and Army Reserve aviation activities.

ARO–

(See AIRPORT RESERVATION OFFICE.)

ARRESTING SYSTEM– A safety device consisting of two major components, namely, engaging or catching devices and energy absorption devices for the purpose of arresting both tailhook and/or nontailhook-equipped aircraft. It is used to prevent aircraft from overrunning runways when the aircraft cannot be stopped after landing or during aborted takeoff. Arresting systems have various names; e.g., arresting gear, hook device, wire barrier cable.

(See ABORT.)

(Refer to AIM.)

ARRIVAL CENTER– The ARTCC having jurisdiction for the impacted airport.

ARRIVAL DELAY– A parameter which specifies a period of time in which no aircraft will be metered for arrival at the specified airport.

ARRIVAL/DEPARTURE WINDOW (ADW)– A depiction presented on an air traffic control display, used by the controller to prevent possible conflicts between arrivals to, and departures from, a runway. The ADW identifies that point on the final approach course by which a departing aircraft must have begun takeoff.

ARRIVAL SECTOR (En Route)– An operational control sector containing one or more meter fixes on or near the TRACON boundary.

ARRIVAL TIME– The time an aircraft touches down on arrival.

ARSR–

(See AIR ROUTE SURVEILLANCE RADAR.)

ARTCC–

(See AIR ROUTE TRAFFIC CONTROL CENTER.)

ASDA–

(See ACCELERATE-STOP DISTANCE AVAILABLE.)

ASDA [ICAO]–

(See ICAO Term ACCELERATE-STOP DISTANCE AVAILABLE.)

ASDE–

(See AIRPORT SURFACE DETECTION EQUIPMENT.)

ASLAR–

(See AIRCRAFT SURGE LAUNCH AND RECOVERY.)

ASR–

(See AIRPORT SURVEILLANCE RADAR.)

ASR APPROACH–

(See SURVEILLANCE APPROACH.)

ASSOCIATED– A radar target displaying a data block with flight identification and altitude information.

(See UNASSOCIATED.)

ATC–

(See AIR TRAFFIC CONTROL.)

ATC ADVISES– Used to prefix a message of noncontrol information when it is relayed to an aircraft by other than an air traffic controller.

(See ADVISORY.)

ATC ASSIGNED AIRSPACE– Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic.

(See SPECIAL USE AIRSPACE.)

**ATC CLEARANCE–**

(See AIR TRAFFIC CLEARANCE.)

**ATC CLEARS–** Used to prefix an ATC clearance when it is relayed to an aircraft by other than an air traffic controller.

**ATC INSTRUCTIONS–** Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions; e.g., “Turn left heading two five zero,” “Go around,” “Clear the runway.”

(Refer to 14 CFR Part 91.)

**ATC PREFERRED ROUTE NOTIFICATION–** EDST notification to the appropriate controller of the need to determine if an ATC preferred route needs to be applied, based on destination airport.

(See ROUTE ACTION NOTIFICATION.)

(See EN ROUTE DECISION SUPPORT TOOL.)

**ATC PREFERRED ROUTES–** Preferred routes that are not automatically applied by Host.

**ATC REQUESTS–** Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

**ATC SECURITY SERVICES–** Communications and security tracking provided by an ATC facility in support of the DHS, the DoD, or other Federal security elements in the interest of national security. Such security services are only applicable within designated areas. ATC security services do not include ATC basic radar services or flight following.

**ATC SECURITY SERVICES POSITION–** The position responsible for providing ATC security services as defined. This position does not provide ATC, IFR separation, or VFR flight following services, but is responsible for providing security services in an area comprising airspace assigned to one or more ATC operating sectors. This position may be combined with control positions.

**ATC SECURITY TRACKING–** The continuous tracking of aircraft movement by an ATC facility in support of the DHS, the DoD, or other security elements for national security using radar (i.e., radar tracking) or other means (e.g., manual tracking) without providing basic radar services (including traffic advisories) or other ATC services not defined in this section.

**ATS SURVEILLANCE SERVICE [ICAO]–** A term used to indicate a service provided directly by means of an ATS surveillance system.

**ATC SURVEILLANCE SOURCE–** Used by ATC for establishing identification, control and separation using a target depicted on an air traffic control facility’s video display that has met the relevant safety standards for operational use and received from one, or a combination, of the following surveillance sources:

- a. Radar (See RADAR.)
  - b. ADS-B (See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST.)
  - c. WAM (See WIDE AREA MULTILATERATION.)
- (See INTERROGATOR.)  
(See TRANSPONDER.)  
(See ICAO term RADAR.)  
(Refer to AIM.)

**ATS SURVEILLANCE SYSTEM [ICAO]–** A generic term meaning variously, ADS–B, PSR, SSR or any comparable ground–based system that enables the identification of aircraft.

Note: A comparable ground–based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.

**ATCAA–**

(See ATC ASSIGNED AIRSPACE.)

**ATCRBS–**

(See RADAR.)

**ATCSCC–**

(See AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER.)

**ATCT–**

(See TOWER.)

**ATD–**

(See ALONG–TRACK DISTANCE.)

**ATIS–**

(See AUTOMATIC TERMINAL INFORMATION SERVICE.)

**ATIS [ICAO]–**

(See ICAO Term AUTOMATIC TERMINAL INFORMATION SERVICE.)

**ATO–**

(See AIR TRAFFIC ORGANIZATION.)

**ATPA–**

(See AUTOMATED TERMINAL PROXIMITY ALERT.)

**ATS ROUTE [ICAO]–** A specified route designed for channeling the flow of traffic as necessary for the provision of air traffic services.

Note: The term “ATS Route” is used to mean variously, airway, advisory route, controlled or uncontrolled route, arrival or departure, etc.

**ATTENTION ALL USERS PAGE (AAUP)–** The AAUP provides the pilot with additional information relative to conducting a specific operation, for example, PRM approaches and RNAV departures.

**AUTOLAND APPROACH–**An autoland system aids by providing control of aircraft systems during a precision instrument approach to at least decision altitude and possibly all the way to touchdown, as well as in some cases, through the landing rollout. The autoland system is a sub-system of the autopilot system from which control surface management occurs. The aircraft autopilot sends instructions to the autoland system and monitors the autoland system performance and integrity during its execution.

**AUTOMATED EMERGENCY DESCENT–**

(See EMERGENCY DESCENT MODE.)

**AUTOMATED INFORMATION TRANSFER (AIT)–** A precoordinated process, specifically defined in facility directives, during which a transfer of altitude control and/or radar identification is accomplished without verbal coordination between controllers using information communicated in a full data block.

**AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM–** A facility which can deliver, in a matter of minutes, a surface picture (SURPIC) of vessels in the area of a potential or actual search and rescue incident, including their predicted positions and their characteristics.

(See FAA Order JO 7110.65, Para 10–6–4, INFLIGHT CONTINGENCIES.)

**AUTOMATED PROBLEM DETECTION (APD)–** An Automation Processing capability that compares trajectories in order to predict conflicts.

**AUTOMATED PROBLEM DETECTION BOUNDARY (APB)–** The adapted distance beyond a facilities boundary defining the airspace within which EDST performs conflict detection.

(See EN ROUTE DECISION SUPPORT TOOL.)

**AUTOMATED PROBLEM DETECTION INHIBITED AREA (APDIA)–** Airspace surrounding a terminal area within which APD is inhibited for all flights within that airspace.

**AUTOMATED SERVICES–**Services delivered via an automated system (that is, without human interaction). For example, flight plans, Notices to Air Missions (NOTAM), interactive maps, computer-generated text-to-speech messages, short message service, or email.

**AUTOMATED TERMINAL PROXIMITY ALERT (ATPA)**– Monitors the separation of aircraft on the Final Approach Course (FAC), displaying a graphical notification (cone and/or mileage) when a potential loss of separation is detected. The warning cone (Yellow) will display at 45 seconds and the alert cone (Red) will display at 24 seconds prior to predicted loss of separation. Current distance between two aircraft on final will be displayed in line 3 of the full data block of the trailing aircraft in corresponding colors.

**AUTOMATED WEATHER SYSTEM**– Any of the automated weather sensor platforms that collect weather data at airports and disseminate the weather information via radio and/or landline. The systems currently consist of the Automated Surface Observing System (ASOS) and Automated Weather Observation System (AWOS).

**AUTOMATED UNICOM**– Provides completely automated weather, radio check capability and airport advisory information on an Automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the UNICOM frequency. Availability will be published in the Chart Supplement and approach charts.

**AUTOMATIC ALTITUDE REPORT**–  
(See ALTITUDE READOUT.)

**AUTOMATIC ALTITUDE REPORTING**– That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

**AUTOMATIC CARRIER LANDING SYSTEM**– U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

**AUTOMATIC DEPENDENT SURVEILLANCE (ADS) [ICAO]**– A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position fixing systems, including aircraft identification, four dimensional position and additional data as appropriate.

**AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST (ADS-B)**– A surveillance system in which an aircraft or vehicle to be detected is fitted with cooperative equipment in the form of a data link transmitter. The aircraft or vehicle periodically broadcasts its GNSS-derived position and other required information such as identity and velocity, which is then received by a ground-based or space-based receiver for processing and display at an air traffic control facility, as well as by suitably equipped aircraft.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT.)

(See COOPERATIVE SURVEILLANCE.)

(See GLOBAL POSITIONING SYSTEM.)

(See SPACE–BASED ADS–B.)

**AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN (ADS–B In)**– Aircraft avionics capable of receiving ADS–B Out transmissions directly from other aircraft, as well as traffic or weather information transmitted from ground stations.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–REBROADCAST.)

(See FLIGHT INFORMATION SERVICE–BROADCAST.)

(See TRAFFIC INFORMATION SERVICE–BROADCAST.)

**AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT (ADS–B Out)**– The transmitter onboard an aircraft or ground vehicle that periodically broadcasts its GNSS-derived position along with other required information, such as identity, altitude, and velocity.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN.)

**AUTOMATIC DEPENDENT SURVEILLANCE–CONTRACT (ADS–C)**– A data link position reporting system, controlled by a ground station, that establishes contracts with an aircraft's avionics that occur automatically whenever specific events occur, or specific time intervals are reached.

**AUTOMATIC DEPENDENT SURVEILLANCE- REBROADCAST (ADS-R)**– A datalink translation function of the ADS-B ground system required to accommodate the two separate operating frequencies (978 MHz and 1090 MHz). 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.

**AUTOMATIC DIRECTION FINDER**– An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum.

(See BEARING.)

(See NONDIRECTIONAL BEACON.)

**AUTOMATIC FLIGHT INFORMATION SERVICE (AFIS) – ALASKA FSSs ONLY**– The continuous broadcast of recorded non-control information at airports in Alaska where a FSS provides local airport advisory service. The AFIS broadcast automates the repetitive transmission of essential but routine information such as weather, wind, altimeter, favored runway, braking action, airport NOTAMs, and other applicable information. The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS/AWOS frequency).

**AUTOMATIC TERMINAL INFORMATION SERVICE**– The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g., “Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa.”

(See ICAO term AUTOMATIC TERMINAL INFORMATION SERVICE.)

(Refer to AIM.)

**AUTOMATIC TERMINAL INFORMATION SERVICE [ICAO]**– The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

**AUTOROTATION**– A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

**a. Autorotative Landing/Touchdown Autorotation.** Used by a pilot to indicate that the landing will be made without applying power to the rotor.

**b. Low Level Autorotation.** Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.

**c. 180 degrees Autorotation.** Initiated from a downwind heading and is commenced well inside the normal traffic pattern. “Go around” may not be possible during the latter part of this maneuver.

**AVAILABLE LANDING DISTANCE (ALD)**– The portion of a runway available for landing and roll-out for aircraft cleared for LAHSO. This distance is measured from the landing threshold to the hold-short point.

**AVIATION WATCH NOTIFICATION MESSAGE**– The Storm Prediction Center (SPC) issues Aviation Watch Notification Messages (SAW) to provide an area threat alert for the aviation meteorology community to forecast organized severe thunderstorms that may produce tornadoes, large hail, and/or convective damaging winds as indicated in Public Watch Notification Messages within the Continental U.S. A SAW message provides a description of the type of watch issued by SPC, a valid time, an approximation of the area in a watch, and primary hazard(s).

**AVIATION WEATHER SERVICE**– A service provided by the National Weather Service (NWS) and FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS.

(See TRANSCRIBED WEATHER BROADCAST.)

(See WEATHER ADVISORY.)

(Refer to AIM.)



# 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 PERFORMANCE 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.

**CBO**–

(See COMMUNITY-BASED ORGANIZATION.)

**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**–

(See AIR ROUTE TRAFFIC CONTROL CENTER.)

**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 GRAPHICAL AIRMEN’S METEOROLOGICAL INFORMATION.)

(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 AUTHORIZATION (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**– A series of civil/military flight information publications issued by FAA every 56 days consisting of the Chart Supplement U.S., Chart Supplement Alaska, and Chart Supplement Pacific.

**CHART SUPPLEMENT ALASKA**– A flight information publication designed for use with appropriate IFR or VFR charts which contains data on all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, airport diagrams, certain special notices, and non-regulatory procedures. Also included in this publication are selected entries needed to support the unique geographical operational conditions of Alaska. This publication is issued in one volume for the state of Alaska.

**CHART SUPPLEMENT PACIFIC**– A flight information publication designed for use with appropriate IFR or VFR charts which contains data on all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, airport diagrams, certain special notices, and non-regulatory procedures. Also included in this publication are Instrument Approach Procedures (IAP), Departure Procedures (DP), and Standard Terminal Arrival (STAR) charts, along with selected entries needed to support the unique geographical operational conditions of the Pacific Oceanic region. This publication is issued in one volume for the Hawaiian Islands and other selected Pacific Islands.

**CHART SUPPLEMENT U.S.**– A flight information publication designed for use with appropriate IFR or VFR charts which contains data on all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, airport diagrams, certain special notices, and non-regulatory procedures. This publication is issued for the conterminous U.S., Puerto Rico, and the Virgin Islands 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 CONTROLLED AIRSPACE.)

**CIVIL AIRCRAFT OPERATION (CAO)–** Aircraft operations other than public use.

**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.

(See CLEARED (Type of) APPROACH.)

(See INSTRUMENT APPROACH PROCEDURE.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**CLEARED (Type of) APPROACH**– ATC authorization for an aircraft to execute a specific instrument approach procedure to an airport; e.g., “Cleared ILS Runway Three Six Approach.”

(See APPROACH CLEARANCE.)

(See INSTRUMENT APPROACH PROCEDURE.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**CLEARED AS FILED**– Means the aircraft is cleared to proceed in accordance with the route of flight filed in the flight plan. This clearance does not include the altitude, DP, or DP Transition.

(See REQUEST FULL ROUTE CLEARANCE.)

(Refer to AIM.)

**CLEARED FOR TAKEOFF**– ATC authorization for an aircraft to depart. It is predicated on known traffic and known physical airport conditions.

**CLEARED FOR THE OPTION**– ATC authorization for an aircraft to make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student’s performance under changing situations. 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.)

**COMMUNITY-BASED ORGANIZATION (CBO)**– A membership-based entity, described under Section 501(a,c), whose mission is the furtherance of model aviation. (see also, 49 United States Code (USC) §44809 (h) and Advisory Circular (AC) 91-57).

**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-to-point 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 conflicts 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.

**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 GRAPHICAL AIRMEN'S METEOROLOGICAL INFORMATION.)

(See SAW.)

(See SIGMET.)

(Refer to AIM.)

**CONVECTIVE SIGNIFICANT METEOROLOGICAL 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.  
(See BEARING.)  
(See INSTRUMENT LANDING SYSTEM.)  
(See RADIAL.)

**CPDLC**–

(See CONTROLLER PILOT DATA LINK COMMUNICATIONS.)

**CPL [ICAO]**–

(See ICAO term CURRENT FLIGHT PLAN.)

**CREWMEMBER (UAS)**– A person assigned to perform an operational duty. A UAS crewmember includes the remote pilot in command, the person manipulating the controls, and visual observers but may also include other persons as appropriate or required to ensure the safe operation of the UAS (e.g., sensor operator, ground control station operator).

**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 in the block, he/she may not return to that 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 AUTHORIZATION 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.

**CVFP APPROACH**–

(See CHARTED VISUAL FLIGHT PROCEDURE APPROACH.)

**CWA**–

(See CENTER WEATHER ADVISORY and WEATHER ADVISORY.)

**CWT**–

(See CONSOLIDATED WAKE TURBULENCE.)

# G

**GATE HOLD PROCEDURES**– Procedures at selected airports to hold aircraft at the gate or other ground location whenever departure delays exceed or are anticipated to exceed 15 minutes. The sequence for departure will be maintained in accordance with initial call–up unless modified by flow control restrictions. Pilots should monitor the ground control/clearance delivery frequency for engine start/taxi advisories or new proposed start/taxi time if the delay changes.

**GCA**–

(See **GROUND CONTROLLED APPROACH**.)

**GDP**–

(See **GROUND DELAY PROGRAM**.)

**GENERAL AVIATION**– That portion of civil aviation that does not include scheduled or unscheduled air carriers or commercial space operations.

(See ICAO term **GENERAL AVIATION**.)

**GENERAL AVIATION [ICAO]**– All civil aviation operations other than scheduled air services and nonscheduled air transport operations for remuneration or hire.

**GEO MAP**– The digitized map markings associated with the ASR-9 Radar System.

**GLIDEPATH**–

(See **GLIDESLOPE**.)

**GLIDEPATH [ICAO]**– A descent profile determined for vertical guidance during a final approach.

**GLIDEPATH INTERCEPT ALTITUDE**–

(See **GLIDESLOPE INTERCEPT ALTITUDE**.)

**GLIDESLOPE**– Provides vertical guidance for aircraft during approach and landing. The glideslope/glidepath is based on the following:

- a. Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or,
- b. Visual ground aids, such as VASI, which provide vertical guidance for a VFR approach or for the visual portion of an instrument approach and landing.
- c. PAR. Used by ATC to inform an aircraft making a PAR approach of its vertical position (elevation) relative to the descent profile.

(See ICAO term **GLIDEPATH**.)

**GLIDESLOPE INTERCEPT ALTITUDE**– The published minimum altitude to intercept the glideslope in the intermediate segment of an instrument approach. Government charts use the lightning bolt symbol to identify this intercept point. This intersection is called the Precise Final Approach fix (PFAF). ATC directs a higher altitude, the resultant intercept becomes the PFAF.

(See **FINAL APPROACH FIX**.)

(See **SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE**.)

**GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)**– GNSS refers collectively to the worldwide positioning, navigation, and timing determination capability available from one or more satellite constellations. A GNSS constellation may be augmented by ground stations and/or geostationary satellites to improve integrity and position accuracy.

(See **GROUND–BASED AUGMENTATION SYSTEM**.)

(See **SATELLITE–BASED AUGMENTATION SYSTEM**.)

**GLOBAL NAVIGATION SATELLITE SYSTEM MINIMUM EN ROUTE IFR ALTITUDE (GNSS MEA)**– The minimum en route IFR altitude on a published ATS route or route segment which assures acceptable Global Navigation Satellite System reception and meets obstacle clearance requirements.

(Refer to 14 CFR Part 91.)

(Refer to 14 CFR Part 95.)

**GLOBAL POSITIONING SYSTEM (GPS)**– GPS refers to the worldwide positioning, navigation and timing determination capability available from the U.S. satellite constellation. The service provided by GPS for civil use is defined in the GPS Standard Positioning System Performance Standard. GPS is composed of space, control, and user elements.

**GNSS [ICAO]**–

(See GLOBAL NAVIGATION SATELLITE SYSTEM.)

**GNSS MEA**–

(See GLOBAL NAVIGATION SATELLITE SYSTEM MINIMUM EN ROUTE IFR ALTITUDE.)

**GO AHEAD**– Proceed with your message. Not to be used for any other purpose.

**GO AROUND**– Instructions for a pilot to abandon his/her approach to landing. Additional instructions may follow. Unless otherwise advised by ATC, a VFR aircraft or an aircraft conducting visual approach should overfly the runway while climbing to traffic pattern altitude and enter the traffic pattern via the crosswind leg. A pilot on an IFR flight plan making an instrument approach should execute the published missed approach procedure or proceed as instructed by ATC; e.g., “Go around” (additional instructions if required).

(See LOW APPROACH.)

(See MISSED APPROACH.)

**GPD**–

(See GRAPHIC PLAN DISPLAY.)

**GPS**–

(See GLOBAL POSITIONING SYSTEM.)

**GRAPHICAL AIRMEN’S METEOROLOGICAL INFORMATION**– A graphical depiction of weather that may be hazardous to aircraft, but are less severe than SIGMETs. G-AIRMETS are issued 3 hours apart for a period of up to 12 hours into the future for the lower 48 states and coastal waters. The weather hazards depicted can be:

- a. Moderate turbulence
- b. Low-level windshear
- c. Strong surface winds greater than 30 knots
- d. Moderate icing
- e. Freezing level
- f. Mountain obscuration

g. IFR

(See AIRMET.)

(See CONVECTIVE SIGMET.)

(See CWA.)

(See SAW.)

(See SIGMET.)

(Refer to AIM.)

**GRAPHIC PLAN DISPLAY (GPD)**– A view available with EDST that provides a graphic display of aircraft, traffic, and notification of predicted conflicts. Graphic routes for Current Plans and Trial Plans are displayed upon controller request.

(See EN ROUTE DECISION SUPPORT TOOL.)

# M

**MAA–**

(See MAXIMUM AUTHORIZED ALTITUDE.)

**MACH NUMBER–** The ratio of true airspeed to the speed of sound; e.g., MACH .82, MACH 1.6.

(See AIRSPEED.)

**MACH TECHNIQUE [ICAO]–** Describes a control technique used by air traffic control whereby turbojet aircraft operating successively along suitable routes are cleared to maintain appropriate MACH numbers for a relevant portion of the en route phase of flight. The principal objective is to achieve improved utilization of the airspace and to ensure that separation between successive aircraft does not decrease below the established minima.

**MAHWP–** Missed Approach Holding Waypoint

**MAINTAIN–**

**a.** Concerning altitude/flight level, the term means to remain at the altitude/flight level specified. The phrase “climb and” or “descend and” normally precedes “maintain” and the altitude assignment; e.g., “descend and maintain 5,000.”

**b.** Concerning other ATC instructions, the term is used in its literal sense; e.g., maintain VFR.

**MAINTENANCE PLANNING FRICTION LEVEL–** The friction level specified in AC 150/5320-12, Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces, which represents the friction value below which the runway pavement surface remains acceptable for any category or class of aircraft operations but which is beginning to show signs of deterioration. This value will vary depending on the particular friction measurement equipment used.

**MAKE SHORT APPROACH–** Used by ATC to inform a pilot to alter his/her traffic pattern so as to make a short final approach.

(See TRAFFIC PATTERN.)

**MAN PORTABLE AIR DEFENSE SYSTEMS (MANPADS)–** MANPADS are lightweight, shoulder-launched, missile systems used to bring down aircraft and create mass casualties. The potential for MANPADS use against airborne aircraft is real and requires familiarity with the subject. Terrorists choose MANPADS because the weapons are low cost, highly mobile, require minimal set-up time, and are easy to use and maintain. Although the weapons have limited range, and their accuracy is affected by poor visibility and adverse weather, they can be fired from anywhere on land or from boats where there is unrestricted visibility to the target.

**MANDATORY ALTITUDE–** An altitude depicted on an instrument Approach Procedure Chart requiring the aircraft to maintain altitude at the depicted value.

**MANPADS–**

(See MAN PORTABLE AIR DEFENSE SYSTEMS.)

**MAP–**

(See MISSED APPROACH POINT.)

**MARKER BEACON–** An electronic navigation facility transmitting a 75 MHz vertical fan or boneshaped radiation pattern. Marker beacons are identified by their modulation frequency and keying code, and when received by compatible airborne equipment, indicate to the pilot, both aurally and visually, that he/she is passing over the facility.

(See INNER MARKER.)

(See MIDDLE MARKER.)

(See OUTER MARKER.)

(Refer to AIM.)

**MARSA–**

(See MILITARY AUTHORITY ASSUMES RESPONSIBILITY FOR SEPARATION OF AIRCRAFT.)

**MAWP– Missed Approach Waypoint**

**MAXIMUM AUTHORIZED ALTITUDE–** A published altitude representing the maximum usable altitude or flight level for an airspace structure or route segment. It is the highest altitude on a Federal airway, jet route, area navigation low or high route, or other direct route for which an MEA is designated in 14 CFR Part 95 at which adequate reception of navigation aid signals is assured.

**MAXIMUM GROSS OPERATING WEIGHT (MGOW)–** The maximum gross weight of an aircraft, including fuel and any external objects, at any point during the flight.

**MAYDAY–** The international radiotelephony distress signal. When repeated three times, it indicates imminent and grave danger and that immediate assistance is requested.

(See PAN-PAN.)

(Refer to AIM.)

**MCA–**

(See MINIMUM CROSSING ALTITUDE.)

**MDA–**

(See MINIMUM DESCENT ALTITUDE.)

**MEA–**

(See MINIMUM EN ROUTE IFR ALTITUDE.)

**MEARTS–**

(See MICRO-EN ROUTE AUTOMATED RADAR TRACKING SYSTEM.)

**METEOROLOGICAL IMPACT STATEMENT–** An unscheduled planning forecast describing conditions expected to begin within 4 to 12 hours which may impact the flow of air traffic in a specific center's (ARTCC) area.

**METER FIX ARC–** A semicircle, equidistant from a meter fix, usually in low altitude relatively close to the meter fix, used to help TBFM/ERAM calculate a meter time, and determine appropriate sector meter list assignments for aircraft not on an established arrival route or assigned a meter fix.

**METER REFERENCE ELEMENT (MRE)–** A constraint point through which traffic flows are managed. An MRE can be the runway threshold, a meter fix, or a meter arc.

**METER REFERENCE POINT LIST (MRP)–** A list of TBFM delay information conveyed to the controller on the situation display via the Meter Reference Point View, commonly known as the "Meter List."

**METERING–**A method of time-regulating traffic flows in the en route and terminal environments.

**METERING AIRPORTS–** Airports adapted for metering and for which optimum flight paths are defined. A maximum of 15 airports may be adapted.

**METERING FIX–** A fix along an established route from over which aircraft will be metered prior to entering terminal airspace. Normally, this fix should be established at a distance from the airport which will facilitate a profile descent 10,000 feet above airport elevation (AAE) or above.

**MGOW–**

(See MAXIMUM GROSS OPERATING WEIGHT.)

**MHA–**

(See MINIMUM HOLDING ALTITUDE.)

**MIA–**

(See MINIMUM IFR ALTITUDES.)

# N

**NAS–**

(See NATIONAL AIRSPACE SYSTEM.)

**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 the Chart Supplement. ■

**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**– Author-izes 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.

**POINT-TO-POINT (PTP)**– A level of NRR service for aircraft that is based on traditional waypoints in their FMSs or RNAV equipage.

**POLAR TRACK STRUCTURE**– A system of organized routes between Iceland and Alaska which overlie Canadian MNPS Airspace.

**POSITION REPORT**– A report over a known location as transmitted by an aircraft to ATC.

(Refer to AIM.)

**POSITION SYMBOL**– A computer-generated indication shown on a radar display to indicate the mode of tracking.

**POSITIVE CONTROL**– The separation of all air traffic within designated airspace by air traffic control.

**PRACTICE INSTRUMENT APPROACH**– An instrument approach procedure conducted by a VFR or an IFR aircraft for the purpose of pilot training or proficiency demonstrations.

**PRE-DEPARTURE CLEARANCE**– An application with the Terminal Data Link System (TDLS) that provides clearance information to subscribers, through a service provider, in text to the cockpit or gate printer.

**PRE-DEPARTURE REROUTE (PDRR)**– A capability within the Traffic Flow Management System that enables ATC to quickly amend and execute revised departure clearances that mitigate en route constraints or balance en route traffic flows.

**PREARRANGED COORDINATION**– A standardized procedure which permits an air traffic controller to enter the airspace assigned to another air traffic controller without verbal coordination. The procedures are defined in a facility directive which ensures approved separation between aircraft.

**PREARRANGED COORDINATION PROCEDURES**– A facility's standardized procedure that describes the process by which one controller shall allow an aircraft to penetrate or transit another controller's airspace in a manner that assures approved separation without individual coordination for each aircraft.

**PRECIPITATION**– Any or all forms of water particles (rain, sleet, hail, or snow) that fall from the atmosphere and reach the surface.

**PRECIPITATION RADAR WEATHER DESCRIPTIONS**– Existing radar systems cannot detect turbulence. However, there is a direct correlation between the degree of turbulence and other weather features associated with thunderstorms and the weather radar precipitation intensity. Controllers will issue (where capable) precipitation intensity as observed by radar when using weather and radar processor (WARP) or NAS ground-based digital radars with weather capabilities. When precipitation intensity information is not available, the intensity will be described as UNKNOWN. When intensity levels can be determined, they shall be described as:

- a. LIGHT (< 26 dBZ)
- b. MODERATE (26 to 40 dBZ)
- c. HEAVY (> 40 to 50 dBZ)
- d. EXTREME (> 50 dBZ)

(Refer to the Aviation Weather Handbook, FAA-H-8083-28.)

**PRECISION APPROACH**–

(See PRECISION APPROACH PROCEDURE.)

**PRECISION APPROACH PROCEDURE**– A standard instrument approach procedure in which an electronic glideslope or other type of glidepath is provided; e.g., ILS, PAR, and GLS.

(See INSTRUMENT LANDING SYSTEM.)

(See PRECISION APPROACH RADAR.)

**PRECISION APPROACH RADAR**– Radar equipment in some ATC facilities operated by the FAA and/or the military services at joint-use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used

to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach (PAR) wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), the glidepath (elevation), and the distance (range) from the touchdown point on the runway as displayed on the radar scope.

(See GLIDEPATH.)

(See PAR.)

(See ICAO term PRECISION APPROACH RADAR.)

(Refer to AIM.)

**PRECISION APPROACH RADAR [ICAO]**– Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

**PRECISION OBSTACLE FREE ZONE (POFZ)**– An 800 foot wide by 200 foot long area centered on the runway centerline adjacent to the threshold designed to protect aircraft flying precision approaches from ground vehicles and other aircraft when ceiling is less than 250 feet or visibility is less than 3/4 statute mile (or runway visual range below 4,000 feet.)

**PRECISION RUNWAY MONITOR (PRM) SYSTEM**– Provides air traffic controllers monitoring the NTZ during simultaneous close parallel PRM approaches with precision, high update rate secondary surveillance data. The high update rate surveillance sensor component of the PRM system is only required for specific runway or approach course separation. The high resolution color monitoring display, Final Monitor Aid (FMA) of the PRM system, or other FMA with the same capability, presents NTZ surveillance track data to controllers along with detailed maps depicting approaches and no transgression zone and is required for all simultaneous close parallel PRM NTZ monitoring operations.

(Refer to AIM.)

**PREDICTIVE WIND SHEAR ALERT SYSTEM (PWS)**– A self-contained system used on board some aircraft to alert the flight crew to the presence of a potential wind shear. PWS systems typically monitor 3 miles ahead and 25 degrees left and right of the aircraft's heading at or below 1200' AGL. Departing flights may receive a wind shear alert after they start the takeoff roll and may elect to abort the takeoff. Aircraft on approach receiving an alert may elect to go around or perform a wind shear escape maneuver.

**PREFERRED IFR ROUTES**– Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals. IFR clearances are issued on the basis of these routes except when severe weather avoidance procedures or other factors dictate otherwise. Preferred IFR Routes are listed in the Chart Supplement U.S., and are also available at [https://www.fly.faa.gov/rmt/nfdc\\_preferred\\_routes\\_database.jsp](https://www.fly.faa.gov/rmt/nfdc_preferred_routes_database.jsp). If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Chart Supplement U.S., pilots may use that part of a Preferred IFR Route which is appropriate for the departure or arrival point that is listed. Preferred IFR Routes may be defined by DPs, SIDs, or STARs; NAVAIDs, Waypoints, etc.; high or low altitude airways; or any combinations thereof. Because they often share elements with adapted routes, pilots' use of preferred IFR routes can minimize flight plan route amendments.

(See ADAPTED ROUTES.)

(See CENTER'S AREA.)

(See INSTRUMENT APPROACH PROCEDURE.)

(See INSTRUMENT DEPARTURE PROCEDURE.)

(See STANDARD TERMINAL ARRIVAL.)

(Refer to CHART SUPPLEMENT U.S.)

**PRE-FLIGHT PILOT BRIEFING**–

(See PILOT BRIEFING.)

**PREVAILING VISIBILITY**–

(See VISIBILITY.)

**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.)

RID–

(See REMOTE IDENTIFICATION.)

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.)

**RNAV VISUAL FLIGHT PROCEDURE (RVFP)**– An RVFP is a special visual flight procedure flown on an IFR flight plan. It is flown in visual conditions and clear of clouds must be maintained. An RVFP is flown using an approved RNAV system to maintain published lateral and vertical paths to runways without an instrument approach procedure. It requires an ATC clearance and may begin at other points along the path of the charted procedure when approved by ATC. An RVFP is not published in the Federal Register for public use and the operator is required to have a specific Operations Specification approval. Required ceiling and visibility minima are published on the procedure chart. An RVFP does not have a missed approach procedure and is not evaluated for obstacle protection.

**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 an ADR/ADAR/AAR has been applied to the flight plan.

(See ATC PREFERRED ROUTE NOTIFICATION.)

(See EN ROUTE DECISION SUPPORT TOOL.)

# S

## SAA–

(See SENSE AND AVOID.)

(See SPECIAL ACTIVITY AIRSPACE.)

**SAFETY ALERT–** A safety alert issued by ATC to aircraft under their control if ATC 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 controller may discontinue the issuance of further alerts if the pilot advises he/she is taking action to correct the situation or has the other aircraft in sight.

**a. Terrain/Obstruction Alert–** A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller’s judgment, places the aircraft in unsafe proximity to terrain/obstructions; e.g., “Low Altitude Alert, check your altitude immediately.”

**b. Aircraft Conflict Alert–** A safety alert issued by ATC to aircraft under their control if ATC is aware of an aircraft that 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, ATC will offer the pilot an alternate course of action when feasible; e.g., “Traffic Alert, advise you turn right heading zero niner zero or climb to eight thousand immediately.”

**Note:** The issuance of a safety alert is contingent upon the capability of the controller to have an awareness of an unsafe condition. The course of action provided will be predicated on other traffic under ATC control. Once the alert is issued, it is solely the pilot’s prerogative to determine what course of action, if any, he/she will take.

**SAFETY LOGIC SYSTEM–** A software enhancement to ASDE–3, ASDE–X, and ASSC, that predicts the path of aircraft landing and/or departing, and/or vehicular movements on runways. Visual and aural alarms are activated when the safety logic projects a potential collision. The Airport Movement Area Safety System (AMASS) is a safety logic system enhancement to the ASDE–3. The Safety Logic System for ASDE–X and ASSC is an integral part of the software program.

## SAFETY LOGIC SYSTEM ALERTS–

### a. ALERT–

**1.** An actual situation involving two real Safety Logic tracks (aircraft/aircraft, aircraft/vehicle, or aircraft/other tangible object) that the Safety Logic System has predicted will result in an imminent collision, based upon the Safety Logic parameters.

**2.** An actual situation involving a single Safety Logic track arriving to, or departing from, a closed runway.

**3.** An actual situation involving a single Safety Logic track arriving to a taxiway.

### b. FALSE ALERT–

**1.** Alerts generated by one or more false surface radar or cooperative surveillance targets, that the ASDE system has interpreted as real tracks and placed into Safety Logic.

**2.** Alerts in which the Safety Logic System did not perform correctly, based upon the design specifications and Safety Logic parameters.

**3.** Alerts generated by surface radar targets caused by moderate or greater precipitation.

### c. NUISANCE ALERT–

An alert in which one or more of the following is true:

**1.** The alert is generated by a known situation that is not considered an unsafe operation, such as LAHSO or other approved operations.

**2.** The alert is generated by inaccurate cooperative surveillance data received by the Safety Logic System.

**3.** One or more of the aircraft involved in the alert is not intending to use a runway/taxiway (helicopter, pipeline patrol, non–Mode C overflight, etc.).

**d. VALID NON–ALERT–** A situation in which the Safety Logic System correctly determines that an alert is not required, based upon the design specifications and Safety Logic parameters.

**e. INVALID NON-ALERT-** A situation in which the Safety Logic System did not issue an alert when an alert was required, based upon the design specifications and Safety Logic parameters.

**SAIL BACK-** A maneuver during high wind conditions (usually with power off) where float plane movement is controlled by water rudders/opening and closing cabin doors.

**SAME DIRECTION AIRCRAFT-** Aircraft are operating in the same direction when:

- a. They are following the same track in the same direction; or
- b. Their tracks are parallel and the aircraft are flying in the same direction; or
- c. Their tracks intersect at an angle of less than 45 degrees.

**SAR-**

(See **SEARCH AND RESCUE**.)

**SATELLITE-BASED AUGMENTATION SYSTEM (SBAS) -** A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter.

(See **WIDE-AREA AUGMENTATION SYSTEM (WAAS)**.)

**SAW-**

(See **AVIATION WATCH NOTIFICATION MESSAGE**.)

**SAY AGAIN-** Used to request a repeat of the last transmission. Usually specifies transmission or portion thereof not understood or received; e.g., "Say again all after **ABRAM VOR**."

**SAY ALTITUDE-** Used by ATC to ascertain an aircraft's specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet.

**SAY HEADING-** Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft.

**SCHEDULED TIME OF ARRIVAL (STA)-** A STA is the desired time that an aircraft should cross a certain point (landing or metering fix). It takes other traffic and airspace configuration into account. A STA time shows the results of the TBFM scheduler that has calculated an arrival time according to parameters such as optimized spacing, aircraft performance, and weather.

**SDF-**

(See **SIMPLIFIED DIRECTIONAL FACILITY**.)

**SE SAR-**

(See **SURVEILLANCE ENHANCED SEARCH AND RESCUE**.)

**SEA LANE-** A designated portion of water outlined by visual surface markers for and intended to be used by aircraft designed to operate on water.

**SEARCH AND RESCUE-** A service which seeks missing aircraft and assists those found to be in need of assistance. It is a cooperative effort using the facilities and services of available Federal, state and local agencies. The U.S. Coast Guard is responsible for coordination of search and rescue for the Maritime Region, and the U.S. Air Force is responsible for search and rescue for the Inland Region. Information pertinent to search and rescue should be passed through any air traffic facility or be transmitted directly to the Rescue Coordination Center by telephone.

(See **FLIGHT SERVICE STATION**.)

(See **RESCUE COORDINATION CENTER**.)

(Refer to **AIM**.)

**SEARCH AND RESCUE FACILITY-** A facility responsible for maintaining and operating a search and rescue (SAR) service to render aid to persons and property in distress. It is any SAR unit, station, NET, or other operational activity which can be usefully employed during an SAR Mission; e.g., a Civil Air Patrol Wing, or a Coast Guard Station.

(See **SEARCH AND RESCUE**.)

**SECNOT–**

(See SECURITY NOTICE.)

**SECONDARY RADAR TARGET–** A target derived from a transponder return presented on a radar display.

**SECTIONAL AERONAUTICAL CHARTS–**

(See AERONAUTICAL CHART.)

**SECTOR LIST DROP INTERVAL–** A parameter number of minutes after the meter fix time when arrival aircraft will be deleted from the arrival sector list.

**SECURITY NOTICE (SECNOT) –** A SECNOT is a request originated by the Air Traffic Security Coordinator (ATSC) for an extensive communications search for aircraft involved, or suspected of being involved, in a security violation, or are considered a security risk. A SECNOT will include the aircraft identification, search area, and expiration time. The search area, as defined by the ATSC, could be a single airport, multiple airports, a radius of an airport or fix, or a route of flight. Once the expiration time has been reached, the SECNOT is considered to be canceled.

**SECURITY SERVICES AIRSPACE –** Areas established through the regulatory process or by NOTAM, issued by the Administrator under title 14, CFR, sections 99.7, 91.141, and 91.139, which specify that ATC security services are required; i.e., ADIZ or temporary flight rules areas.

**SEE AND AVOID–** When weather conditions permit, pilots operating IFR or VFR are required to observe and maneuver to avoid other aircraft. Right-of-way rules are contained in 14 CFR Part 91.

**SEGMENTED CIRCLE–** A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

(Refer to AIM.)

**SEGMENTS OF A SID/STAR–**

**a. En Route Transition–** The segment(s) of a SID/STAR that connect to/from en route flight. Not all SIDs/STARs will contain an en route transition.

**b. En Route Transition Waypoint–** The NAVAID/fix/waypoint that defines the beginning of the SID/STAR en route transition.

**c. Common Route–** The segment(s) of a SID/STAR procedure that provides a single route serving an airport/runway or multiple airports/runways. The common route may consist of a single point. Not all conventional SIDs will contain a common route.

**d. Runway Transition–** The segment(s) of a SID/STAR between the common route/point and the runway(s). Not all SIDs/STARs will contain a runway transition.

**e. Runway Transition Waypoint (RTW)–** On a STAR, the NAVAID/fix/waypoint that defines the end of the common route or en route transition and the beginning of a runway transition (In the arrival route description found on the STAR chart, the last fix of the common route and the first fix of the runway transition(s)).

**SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE–** An instrument approach procedure may have as many as four separate segments depending on how the approach procedure is structured.

**a. Initial Approach–** The segment between the initial approach fix and the intermediate fix or the point where the aircraft is established on the intermediate course or final approach course.

(See ICAO term INITIAL APPROACH SEGMENT.)

**b. Intermediate Approach–** The segment between the intermediate fix or point and the final approach fix.

(See ICAO term INTERMEDIATE APPROACH SEGMENT.)

**c. Final Approach–** The segment between the final approach fix or point and the runway, airport, or missed approach point.

(See ICAO term FINAL APPROACH SEGMENT.)

**d. Missed Approach–** The segment between the missed approach point or the point of arrival at decision height and the missed approach fix at the prescribed altitude.

(Refer to 14 CFR Part 97.)

(See ICAO term MISSED APPROACH PROCEDURE.)

**SELF-BRIEFING**– A self-briefing is a review, using automated tools, of all meteorological and aeronautical information that may influence the pilot in planning, altering, or canceling a proposed route of flight.

**SENSE AND AVOID (SAA)** – The capability of an unmanned aircraft to detect (sense) and avoid collisions with other aircraft and all obstacles, whether airborne or on the ground while operating in the NAS.

**SEPARATION**– In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off.

(See SEPARATION MINIMA.)

(See ICAO term SEPARATION.)

**SEPARATION [ICAO]**– Spacing between aircraft, levels or tracks.

**SEPARATION MINIMA**– The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures.

(See SEPARATION.)

**SERVICE**– A generic term that designates functions or assistance available from or rendered by air traffic control. For example, Class C service would denote the ATC services provided within a Class C airspace area.

**SEVERE WEATHER AVOIDANCE PLAN (SWAP)**– An approved plan to minimize the affect of severe weather on traffic flows in impacted terminal and/or ARTCC areas. A SWAP is normally implemented to provide the least disruption to the ATC system when flight through portions of airspace is difficult or impossible due to severe weather.

**SEVERE WEATHER FORECAST ALERTS**– Preliminary messages issued in order to alert users that a Severe Weather Watch Bulletin (WW) is being issued. These messages define areas of possible severe thunderstorms or tornado activity. The messages are unscheduled and issued as required by the Storm Prediction Center (SPC) at Norman, Oklahoma.

(See AIRMET.)

(See CONVECTIVE SIGMET.)

(See CWA.)

(See GRAPHICAL AIRMEN'S METEOROLOGICAL INFORMATION.)

(See SIGMET.)

**SFA**–

(See SINGLE FREQUENCY APPROACH.)

**SFO**–

(See SIMULATED FLAMEOUT.)

**SFI**

(See SPECIAL GOVERNMENT INTEREST.)

**SHF**–

(See SUPER HIGH FREQUENCY.)

**SHORT RANGE CLEARANCE**– A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while air traffic control facilities are coordinating and obtaining the complete clearance.

**SHORT TAKEOFF AND LANDING AIRCRAFT (STOL)**– An aircraft which, at some weight within its approved operating weight, is capable of operating from a runway in compliance with the applicable STOL characteristics, airworthiness, operations, noise, and pollution standards.

(See VERTICAL TAKEOFF AND LANDING AIRCRAFT.)

**SIAP**–

(See STANDARD INSTRUMENT APPROACH PROCEDURE.)

**SID**–

(See STANDARD INSTRUMENT DEPARTURE.)

**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 GOVERNMENT INTEREST (SGI)**– A near real-time airspace authorization for Part 91 or Part 107 UAS, which supports activities that answer significant and urgent governmental interests. These include: national defense, homeland security, law enforcement, and emergency operations objectives.

**SPECIAL ACTIVITY AIRSPACE (SAA)**– Airspace with defined dimensions within the National Airspace System wherein limitations may be imposed upon operations for national defense, homeland security, public interest, or public safety. Special activity airspace includes but is not limited to the following: Air Traffic Control Assigned Airspace (ATCAA), Altitude Reservations (ALTRV), Military Training Routes (MTR), Air Refueling Tracks and Anchors, Temporary Flight Restrictions (TFR), Special Security Instructions (SSI), etc. Special Use Airspace (SUA) is a subset of Special Activity Airspace.

(See SPECIAL USE AIRSPACE.)

**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 PROCEDURE**–

(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.)

**SPECIALIST–PROVIDED SERVICES**–

Services delivered directly by a flight service specialist via ground/ground communication, air/ground communication, in-person, or technology (for example, speech-to-text, email, or short message service).

**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 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.

**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 hazardingly misleading, position, navigation, and/or date/time information in addition to loss of GNSS use.

**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.)

**STA**–

(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 PROCEDURE (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 REPLACEMENT 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.

**TEMPORARY FLIGHT RESTRICTION (TFR)**– A TFR is a regulatory action issued by the FAA via the U.S. NOTAM System, under the authority of United States Code, Title 49. TFRs are issued within the sovereign airspace of the United States and its territories to restrict certain aircraft from operating within a defined area on a temporary basis to protect persons or property in the air or on the ground. While not all inclusive, TFRs may be issued for disaster or hazard situations such as: toxic gas leaks or spills, fumes from flammable agents, aircraft accident/incident sites, aviation or ground resources engaged in wildfire suppression, or aircraft relief activities following a disaster. TFRs may also be issued in support of VIP movements, for reasons of national security; or when determined necessary for the management of air traffic in the vicinity of aerial demonstrations or major sporting events. NAS users or other interested parties should contact a FSS for TFR information. Additionally, TFR information can be found in automated briefings, NOTAM publications, and on the internet at <http://www.faa.gov>. The FAA also distributes TFR information to aviation user groups for further dissemination.

**TERMINAL AREA**– A general term used to describe airspace in which approach control service or airport traffic control service is provided.

**TERMINAL AREA FACILITY**– A facility providing air traffic control service for arriving and departing IFR, VFR, Special VFR, and on occasion en route aircraft.

(See APPROACH CONTROL FACILITY.)

(See TOWER.)

**TERMINAL AUTOMATION SYSTEMS (TAS)**– TAS is used to identify the numerous automated tracking systems including STARS and MEARTS.

**TERMINAL DATA LINK SYSTEM (TDLS)**– A system that provides Digital Automatic Terminal Information Service (D-ATIS) both on a specified radio frequency and also, for subscribers, in a text message via data link to the cockpit or to a gate printer. TDLS also provides Pre-departure Clearances (PDC), at selected airports, to subscribers, through a service provider, in text to the cockpit or to a gate printer. In addition, TDLS will emulate the Flight Data Input/Output (FDIO) information within the control tower.

**TERMINAL FLIGHT DATA MANAGER (TFDM)**– An integrated tower flight data automation system to provide improved airport surface and terminal airspace management. TFDM enhances traffic flow management data integration with Time-Based Flow Management (TBFM) and Traffic Flow Management System (TFMS) to enable airlines, controllers, and airports to share and exchange real-time data. This improves surface traffic management and enhances capabilities of TFMS and TBFM. TFDM assists the Tower personnel with surface Traffic Flow Management (TFM) and Collaborative Decision Making (CDM) and enables a fundamental change in the Towers from a local airport-specific operation to a NAS-connected metering operation. The single platform consolidates multiple Tower automation systems, including: Departure Spacing Program (DSP), Airport Resource Management Tool (ARMT), Electronic Flight Strip Transfer System (EFSTS), and Surface Movement Advisor (SMA). TFDM data, integrated with other FAA systems such as TBFM and TFMS, allows airlines, controllers, and airports to manage the flow of aircraft more efficiently through all phases of flight from departure to arrival gate.

**TERMINAL RADAR SERVICE AREA**– Airspace surrounding designated airports wherein ATC provides radar vectoring, sequencing, and separation on a full-time basis for all IFR and participating VFR aircraft. The AIM contains an explanation of TRSA. TRSAs are depicted on VFR aeronautical charts. Pilot participation is urged but is not mandatory.

**TERMINAL SEQUENCING AND SPACING (TSAS)**– Extends scheduling and metering capabilities into the terminal area and provides metering automation tools to terminal controllers and terminal traffic management personnel. Those controllers and traffic management personnel become active participants in time-based metering operations as they work to deliver aircraft accurately to Constraint Satisfaction Points within terminal airspace to include the runway in accordance with scheduled times at those points. Terminal controllers are better able to utilize efficient flight paths, such as Standard Instrument Approach Procedures (SIAPs) that require a Navigational Specification (NavSpec) of RNP APCH with Radius-to-Fix (RF) legs, or Advanced RNP

(A-RNP), through tools that support the merging of mixed-equipage traffic flows. For example, merging aircraft flying RNP APCH AR with RF, A-RNP, and non-RNP approach procedures. Additional fields in the flight plan will identify those flights capable of flying the RNP APCH with RF or A-RNP procedures, and those flights will be scheduled for those types of procedures when available. TSAS will schedule these and the non-RNP aircraft to a common merge point. Terminal traffic management personnel have improved situation awareness using displays that allow for the monitoring of terminal metering operations, similar to the displays used today by center traffic management personnel to monitor en route metering operations.

**TERMINAL VFR RADAR SERVICE**– A national program instituted to extend the terminal radar services provided instrument flight rules (IFR) aircraft to visual flight rules (VFR) aircraft. The program is divided into four types service referred to as basic radar service, terminal radar service area (TRSA) service, Class B service and Class C service. The type of service provided at a particular location is contained in the Chart Supplement.

**a. Basic Radar Service**– These services are provided for VFR aircraft by all commissioned terminal radar facilities. Basic radar service includes safety alerts, traffic advisories, limited radar vectoring when requested by the pilot, and sequencing at locations where procedures have been established for this purpose and/or when covered by a letter of agreement. The purpose of this service is to adjust the flow of arriving IFR and VFR aircraft into the traffic pattern in a safe and orderly manner and to provide traffic advisories to departing VFR aircraft.

**b. TRSA Service**– This service provides, in addition to basic radar service, sequencing of all IFR and participating VFR aircraft to the primary airport and separation between all participating VFR aircraft. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the area defined as a TRSA.

**c. Class C Service**– This service provides, in addition to basic radar service, approved separation between IFR and VFR aircraft, and sequencing of 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).

(See CONTROLLED AIRSPACE.)

(See TERMINAL RADAR SERVICE AREA.)

(Refer to AIM.)

(Refer to CHART SUPPLEMENT U.S.)

**TERMINAL-VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION (TVOR)**– A very high frequency terminal omnirange station located on or near an airport and used as an approach aid.

(See NAVIGATIONAL AID.)

(See VOR.)

**TERRAIN AWARENESS WARNING SYSTEM (TAWS)**– An on-board, terrain proximity alerting system providing the aircrew ‘Low Altitude warnings’ to allow immediate pilot action.

**TERRAIN FOLLOWING**– The flight of a military aircraft maintaining a constant AGL altitude above the terrain or the highest obstruction. The altitude of the aircraft will constantly change with the varying terrain and/or obstruction.

**TETRAHEDRON**– A device normally located on uncontrolled airports and used as a landing direction indicator. The small end of a tetrahedron points in the direction of landing. At controlled airports, the tetrahedron, if installed, should be disregarded because tower instructions supersede the indicator.

(See SEGMENTED CIRCLE.)

(Refer to AIM.)

**TF**–

(See TERRAIN FOLLOWING.)

**TFDM**–

(See TERMINAL FLIGHT DATA MANAGER.)

**TGUI**–

(See TIMELINE GRAPHICAL USER INTERFACE.)

**THAT IS CORRECT**– The understanding you have is right.

**THA**–

(See TRANSITIONAL HAZARD AREA.)

**THE RECREATIONAL UAS SAFETY TEST (TRUST)**– The electronically administered free test required for all recreational UAS operators referred to as the aeronautical knowledge and safety test, under 49 USC §44809 (g).

**THREE-HOUR TARMAC RULE**– Rule that relates to Department of Transportation (DOT) requirements placed on airlines when tarmac delays are anticipated to reach 3 hours.

**360 OVERHEAD**–

(See OVERHEAD MANEUVER.)

**THRESHOLD**– The beginning of that portion of the runway usable for landing.

(See AIRPORT LIGHTING.)

(See DISPLACED THRESHOLD.)

**THRESHOLD CROSSING HEIGHT**– The theoretical height above the runway threshold at which the aircraft's glideslope antenna would be if the aircraft maintains the trajectory established by the mean ILS glideslope or the altitude at which the calculated glidepath of an RNAV or GPS approaches.

(See GLIDESLOPE.)

(See THRESHOLD.)

**THRESHOLD LIGHTS**–

(See AIRPORT LIGHTING.)

**TIE-IN FACILITY**– The FSS primarily responsible for providing FSS services, including telecommunication services for landing facilities or navigational aids located within the boundaries of a flight plan area (FPA). Three-letter identifiers are assigned to each FSS/FPA and are annotated as tie-in facilities in the Chart Supplement and FAA Order JO 7350.9, Location Identifiers. Large consolidated FSS facilities may have many tie-in facilities or FSS sectors within one facility.

(See FLIGHT PLAN AREA.)

(See FLIGHT SERVICE STATION.)

**TIME-BASED FLOW MANAGEMENT (TBFM)**– A foundational Decision Support Tool for time-based management in the en route and terminal environments. TBFM's core function is the ability to schedule aircraft within a stream of traffic to reach a defined constraint point (e.g., meter fix/meter arc) at specified times, creating a time-ordered sequence of traffic. The scheduled times allow for merging of traffic flows, efficiently utilizing airport and airspace capacity while minimizing coordination and reducing the need for vectoring/holding. The TBFM schedule is calculated using current aircraft estimated time of arrival at key defined constraint points based on wind forecasts, aircraft flight plan, the desired separation at the constraint point and other parameters. The schedule applies spacing only when needed to maintain the desired separation at one or more constraint points. This includes, but is not limited to, Single Center Metering (SCM), Adjacent Center Metering (ACM), En Route Departure Capability (EDC), Integrated Departure/Arrival Capability (IDAC), Ground-based Interval Management–Spacing (GIM–S), Departure Scheduling, and Extended/Coupled Metering.

**TIME-BASED MANAGEMENT (TBM)**– A methodology for managing the flow of air traffic through the assignment of time at specific points for an aircraft. TBM applies time to manage and condition air traffic flows to mitigate demand/capacity imbalances and enhance efficiency and predictability of the NAS. Where implemented, TBM tools will be used to manage traffic even during periods when demand does not exceed capacity. This will sustain operational predictability and assure the regional/national strategic plan is maintained. TBM uses capabilities within TFMS, TBFM, and TFDM. These programs are designed to achieve a specified interval between aircraft. Different types of programs accommodate different phases of flight.

**TIME GROUP**– Four digits representing the hour and minutes from the Coordinated Universal Time (UTC) clock. FAA uses UTC for all operations. The term “ZULU” may be used to denote UTC. The word “local” or

the time zone equivalent shall be used to denote local when local time is given during radio and telephone communications. When written, a time zone designator is used to indicate local time; e.g., “0205M” (Mountain). The local time may be based on the 24-hour clock system. The day begins at 0000 and ends at 2359.

**TIMELINE GRAPHICAL USER INTERFACE (TGUI)**– A TBFM display that uses timelines to display the Estimated Time of Arrival and Scheduled Time of Arrival of each aircraft to specified constraint points. The TGUI can also display pre-departure and scheduled aircraft.

**TIS-B**–

(See **TRAFFIC INFORMATION SERVICE–BROADCAST**.)

**TMI**–

(See **TRAFFIC MANAGEMENT INITIATIVE**.)

**TMPA**–

(See **TRAFFIC MANAGEMENT PROGRAM ALERT**.)

**TMU**–

(See **TRAFFIC MANAGEMENT UNIT**.)

**TOD**–

(See **TOP OF DESCENT**.)

**TODA**–

(See **TAKEOFF DISTANCE AVAILABLE**.)

(See ICAO term **TAKEOFF DISTANCE AVAILABLE**.)

**TOI**–

(See **TRACK OF INTEREST**.)

**TOP ALTITUDE**– In reference to SID published altitude restrictions, the charted “maintain” altitude contained in the procedure description or assigned by ATC.

**TOP OF DESCENT (TOD)**– The point at which an aircraft begins the initial descent.

**TORA**–

(See **TAKEOFF RUN AVAILABLE**.)

(See ICAO term **TAKEOFF RUN AVAILABLE**.)

**TORCHING**– The burning of fuel at the end of an exhaust pipe or stack of a reciprocating aircraft engine, the result of an excessive richness in the fuel air mixture.

**TOS**–

(See **TRAJECTORY OPTIONS SET**.)

**TOTAL ESTIMATED ELAPSED TIME [ICAO]**– For IFR flights, the estimated time required from takeoff to arrive over that designated point, defined by reference to navigation aids, from which it is intended that an instrument approach procedure will be commenced, or, if no navigation aid is associated with the destination aerodrome, to arrive over the destination aerodrome. For VFR flights, the estimated time required from takeoff to arrive over the destination aerodrome.

(See ICAO term **ESTIMATED ELAPSED TIME**.)

**TOUCH-AND-GO**– An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway.

**TOUCH-AND-GO LANDING**–

(See **TOUCH-AND-GO**.)

**TOUCHDOWN**–

a. The point at which an aircraft first makes contact with the landing surface.

**b.** Concerning a precision radar approach (PAR), it is the point where the glide path intercepts the landing surface.

(See ICAO term TOUCHDOWN.)

**TOUCHDOWN [ICAO]**– The point where the nominal glide path intercepts the runway.

Note: Touchdown as defined above is only a datum and is not necessarily the actual point at which the aircraft will touch the runway.

**TOUCHDOWN RVR**–

(See VISIBILITY.)

**TOUCHDOWN ZONE**– The first 3,000 feet of the runway beginning at the threshold. The area is used for determination of Touchdown Zone Elevation in the development of straight-in landing minimums for instrument approaches.

(See ICAO term TOUCHDOWN ZONE.)

**TOUCHDOWN ZONE [ICAO]**– The portion of a runway, beyond the threshold, where it is intended landing aircraft first contact the runway.

**TOUCHDOWN ZONE ELEVATION**– The highest elevation in the first 3,000 feet of the landing surface. TDZE is indicated on the instrument approach procedure chart when straight-in landing minimums are authorized.

(See TOUCHDOWN ZONE.)

**TOUCHDOWN ZONE LIGHTING**–

(See AIRPORT LIGHTING.)

**TOWER**– A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the Class D airspace area regardless of flight plan or weather conditions (IFR or VFR). A tower may also provide approach control services (radar or nonradar).

(See AIRPORT TRAFFIC CONTROL SERVICE.)

(See APPROACH CONTROL FACILITY.)

(See APPROACH CONTROL SERVICE.)

(See MOVEMENT AREA.)

(See TOWER EN ROUTE CONTROL SERVICE.)

(See ICAO term AERODROME CONTROL TOWER.)

(Refer to AIM.)

**TOWER EN ROUTE CONTROL SERVICE**– The control of IFR en route traffic within delegated airspace between two or more adjacent approach control facilities. This service is designed to expedite traffic and reduce control and pilot communication requirements.

**TOWER TO TOWER**–

(See TOWER EN ROUTE CONTROL SERVICE.)

**TRACEABLE PRESSURE STANDARD**– The facility station pressure instrument, with certification/calibration traceable to the National Institute of Standards and Technology. Traceable pressure standards may be mercurial barometers, commissioned ASOS or dual transducer AWOS, or portable pressure standards or DASI.

**TRACK**– The actual flight path of an aircraft over the surface of the earth.

(See COURSE.)

(See FLIGHT PATH.)

(See ROUTE.)

(See ICAO term TRACK.)

**TRACK [ICAO]**– The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from North (True, Magnetic, or Grid).

**TRACK OF INTEREST (TOI)**– Displayed data representing an airborne object that threatens or has the potential to threaten North America or National Security. Indicators may include, but are not limited to: noncompliance with air traffic control instructions or aviation regulations; extended loss of communications; unusual transmissions or unusual flight behavior; unauthorized intrusion into controlled airspace or an ADIZ; noncompliance with issued flight restrictions/security procedures; or unlawful interference with airborne flight crews, up to and including hijack. In certain circumstances, an object may become a TOI based on specific and credible intelligence pertaining to that particular aircraft/object, its passengers, or its cargo.

**TRACK OF INTEREST RESOLUTION**– A TOI will normally be considered resolved when: the aircraft/object is no longer airborne; the aircraft complies with air traffic control instructions, aviation regulations, and/or issued flight restrictions/security procedures; radio contact is re-established and authorized control of the aircraft is verified; the aircraft is intercepted and intent is verified to be nonthreatening/nonhostile; TOI was identified based on specific and credible intelligence that was later determined to be invalid or unreliable; or displayed data is identified and characterized as invalid.

***TRAFFIC***–

**a.** A term used by a controller to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally issued:

1. In response to a handoff or point out,
2. In anticipation of a handoff or point out, or
3. In conjunction with a request for control of an aircraft.

**b.** A term used by ATC to refer to one or more aircraft.

**TRAFFIC ADVISORIES**– Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant their attention. Such advisories may be based on:

- a.** Visual observation.
- b.** Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or
- c.** Verbal reports from pilots or other facilities.

Note 1: The word “traffic” followed by additional information, if known, is used to provide such advisories; e.g., “Traffic, 2 o’clock, one zero miles, southbound, eight thousand.”

Note 2: Traffic advisory service will be provided to the extent possible depending on higher priority duties of the controller or other limitations; e.g., radar limitations, volume of traffic, frequency congestion, or controller workload. Radar/ nonradar traffic advisories do not relieve the pilot of his/her responsibility to see and avoid other aircraft. Pilots are cautioned that there are many times when the controller is not able to give traffic advisories concerning all traffic in the aircraft’s proximity; in other words, when a pilot requests or is receiving traffic advisories, he/she should not assume that all traffic will be issued.

(Refer to AIM.)

***TRAFFIC ALERT (aircraft call sign), TURN (left/right) IMMEDIATELY, (climb/descend) AND MAINTAIN (altitude).***

(See SAFETY ALERT.)

**TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)**– An airborne collision avoidance system based on radar beacon signals which operates independent of ground-based equipment. TCAS-I generates traffic advisories only. TCAS-II generates traffic advisories, and resolution (collision avoidance) advisories in the vertical plane.

**TRAFFIC INFORMATION**–

(See TRAFFIC ADVISORIES.)

**TRAFFIC INFORMATION SERVICE–BROADCAST (TIS–B)**– The broadcast of ATC derived traffic information to ADS–B equipped (1090ES or UAT) aircraft. The source of this traffic information is derived from

# U

**UAM–**

(See URBAN AIR MOBILITY.)

**UAS FACILITY MAP (UASFM)–** Defined grid squares showing maximum altitudes around airports where the FAA may authorize Part 107 sUAS operations without additional safety analysis. The maps should be consulted prior to conducting UAS operations (Part 91, Part 107 or Section 44809) in controlled airspace. The UASFM will aid in determining if the airspace authorization or waivers are necessary. UASFM(s) are charted on the UAS Data Delivery System (UDDS) at the following website address: <https://faa.maps.arcgis.com/apps/webappviewer/index.html?id=9c2e4406710048e19806ebf6a06754ad>.

**UAS TEST SITE–** Independently owned UAS test & research sites, recognized by the FAA.

**UAS TRAFFIC MANAGEMENT (UTM)–**The unmanned aircraft traffic management ecosystem that will allow multiple low altitude BVLOS operations and which is separate from, but complementary to, FAA’s Air Traffic Control System.

**UASFM–**

(See UAS FACILITY MAP.)

**UHF–**

(See ULTRAHIGH FREQUENCY.)

**ULTRAHIGH FREQUENCY (UHF)–** The frequency band between 300 and 3,000 MHz. The bank of radio frequencies used for military air/ground voice communications. In some instances this may go as low as 225 MHz and still be referred to as UHF.

**ULTRALIGHT VEHICLE–** A single-occupant aeronautical vehicle operated for sport or recreational purposes which does not require FAA registration, an airworthiness certificate, or pilot certification. Operation of an ultralight vehicle in certain airspace requires authorization from ATC.

(Refer to 14 CFR Part 103.)

**UNABLE–** Indicates inability to comply with a specific instruction, request, or clearance.

**UNASSOCIATED–** A radar target that does not display a data block with flight identification and altitude information.

(See ASSOCIATED.)

**UNCONTROLLED AIRSPACE–** Airspace in which aircraft are not subject to controlled airspace (Class A, B, C, D, or E) separation criteria.

**UNDER THE HOOD–** Indicates that the pilot is using a hood to restrict visibility outside the cockpit while simulating instrument flight. An appropriately rated pilot is required in the other control seat while this operation is being conducted.

(Refer to 14 CFR Part 91.)

**UNFROZEN–** The Scheduled Time of Arrival (STA) tags, which are still being rescheduled by the time-based flow management (TBFM) calculations. The aircraft will remain unfrozen until the time the corresponding estimated time of arrival (ETA) tag passes the preset freeze horizon for that aircraft’s stream class. At this point the automatic rescheduling will stop, and the STA becomes “frozen.”

**UNICOM–** A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOMs are shown on aeronautical charts and publications.

(See CHART SUPPLEMENT.)

(Refer to AIM.)

**UNMANNED AIRCRAFT (UA)**- A device used or intended to be used for flight that has no onboard pilot. This device can be any type of airplane, helicopter, airship, or powered-lift aircraft. Unmanned free balloons, moored balloons, tethered aircraft, gliders, and unmanned rockets are not considered to be a UA.

**UNMANNED AIRCRAFT SYSTEM (UAS)**- An unmanned aircraft and its associated elements related to safe operations, which may include control stations (ground, ship, or air based), control links, support equipment, payloads, flight termination systems, and launch/recovery equipment. It consists of three elements: unmanned aircraft, control station, and data link.

**UNPUBLISHED ROUTE**- A route for which no minimum altitude is published or charted for pilot use. It may include a direct route between NAVAIDs, a radial, a radar vector, or a final approach course beyond the segments of an instrument approach procedure.

(See PUBLISHED ROUTE.)

(See ROUTE.)

**UNRELIABLE (GPS/WAAS)**- An advisory to pilots indicating the expected level of service of the GPS and/or WAAS may not be available. Pilots must then determine the adequacy of the signal for desired use.

**UNSERVICEABLE (U/S)**

(See OUT OF SERVICE/UNSERVICEABLE.)

**UPWIND LEG**-

(See TRAFFIC PATTERN.)

**URBAN AIR MOBILITY (UAM)**- A subset of Advanced Air Mobility (AAM), referring to an air transportation system utilizing highly automated aircraft to transport passengers or cargo in urban/suburban areas.

**URGENCY**- A condition of being concerned about safety and of requiring timely but not immediate assistance; a potential distress condition.

(See ICAO term URGENCY.)

**URGENCY [ICAO]**- A condition concerning the safety of an aircraft or other vehicle, or of person on board or in sight, but which does not require immediate assistance.

**USAFIB**-

(See ARMY AVIATION FLIGHT INFORMATION BULLETIN.)

**UTM**-

(See UAS TRAFFIC MANAGEMENT.)

**VORTICES**– Circular patterns of air created by the movement of an airfoil through the air when generating lift. As an airfoil moves through the atmosphere in sustained flight, an area of area of low pressure is created above it. The air flowing from the high pressure area to the low pressure area around and about the tips of the airfoil tends to roll up into two rapidly rotating vortices, cylindrical in shape. These vortices are the most predominant parts of aircraft wake turbulence and their rotational force is dependent upon the wing loading, gross weight, and speed of the generating aircraft. The vortices from medium to super aircraft can be of extremely high velocity and hazardous to smaller aircraft.

(See AIRCRAFT CLASSES.)

(See WAKE TURBULENCE.)

(Refer to AIM.)

**VOT**– A ground facility which emits a test signal to check VOR receiver accuracy. Some VOTs are available to the user while airborne, and others are limited to ground use only.

(See CHART SUPPLEMENT.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**VR**–

(See VFR MILITARY TRAINING ROUTES.)

**VSCS**–

(See VOICE SWITCHING AND CONTROL SYSTEM.)

**VTOL AIRCRAFT**–

(See VERTICAL TAKEOFF AND LANDING AIRCRAFT.)



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