Aeronautical Information Manual
Explanation of Changes
Effective: March 10, 2011

a. 1–1–15. LORAN
This change explains the termination of the transmission of all U.S. LORAN–C signals and the continuation of international operation.

b. 1–1–19. Global Positioning System (GPS)
This change clarifies the time period for a RAIM check.

c. 1–2–3. Use of Suitable Area Navigation (RNAV) Systems on Conventional Procedures and Routes
This change reflects the new policies and procedures related to RNAV operations.

d. 2–1–1. Approach Light Systems (ALS)
This change updates the graphic illustration to show correct color and proper light alignment.

e. 2–1–6. Runway Status Light (RWSL) System
This change explains the new implementation of RWSL equipment and procedures, specifically Runway Intersection Lights (RIL) and Final Approach Runway Occupancy Signal (FAROS).

f. 2–1–6. Runway Status Light (RWSL) System
4–3–18. Taxing
5–2–4. Line Up and Wait (LUAW)
Appendix 4. Acronyms/Abbreviations

In accordance with the Runway Safety Call-to-Action Committee Recommendations and the SRM Document, dated May 19, 2009, this change replaces all references of “Taxi Into Position and Hold (TIPH)” with “Line Up and Wait (LUAW).”

g. 2–3–15. Security Identification Display Area
(Airport Ramp Area)
This change adds information regarding the use of security identification display areas at certain airports as required by Code of Federal Regulations 49 part 1542.

h. 4–1–18. Terminal Radar Services for VFR Aircraft
This change removes the condition requiring a broadband radar system.

i. 4–1–20. Transponder Operation
This change explains how to operate transponders on the airport surface in the presence of ASDE–X equipment, and how to operate ADS–B equipment on the airport surface.

j. 4–3–6. Use of Runways/Declared Distances
This change is added to improve pilots’ knowledge of declared distances.

k. 4–3–10. Intersection Takeoffs
This change clarifies the fact that the concept of “declared distances” used by the Airport Service has no bearing on air traffic control operations. This provides symmetry to FAA Order JO 7210.3, Facility Operation and Administration.

l. 4–4–18. Automatic Dependent Surveillance–Broadcast (ADS–B)
4–4–19. Traffic Information Service–Broadcast (TIS–B)
These paragraphs are deleted because the description of ADS–B and TIS–B is provided in paragraphs 4–5–7 and 4–5–8 of this manual.

m. 4–5–5. Airport Surface Detection Equipment–Model X (ASDE–X)
This change is added to reflect the implementation of ASDE–X.

n. 4–5–7. Automatic Dependent Surveillance–Broadcast (ADS–B) Services
4–5–8. Traffic Information Service–Broadcast (TIS–B)
This change is added to clarify system description, describe changes resulting from the ADS–B Out rule, describe system enhancements resulting from nationwide ADS–B implementation, and provide an update to new terminology. The graphic illustration is also updated to reflect that TIS–B is now available on 1090ES at operational sites (see FIG 4–5–7).

o. 4–5–10. Automatic Dependent Surveillance–Rebroadcast (ADS–R)
This change is added to explain the ADS–R system in United States airspace.

p. 5–1–3. Notice to Airmen (NOTAM) System
This change is added to describe the issuance of Special Use Airspace (SUA) NOTAMs and their published times.
It also describes pilots’ and other users’ responsibilities concerning SUA NOTAMs.

q. 5–3–4. Airways and Route Systems
This change clarifies guidance regarding enroute charting.

r. 5–4–5. Instrument Approach Procedure Charts
This change explains glide slope intercept altitudes on ILS parallel approaches.

s. 5–4–20. Approach and Landing Minimums
This change explains how to execute a circling to land approach without an MDA.

t. 5–4–21. Missed Approach
This change provides more details on using an ODP in lieu of the published missed approach procedure.

This change introduces EFVS to pilots and brings this manual in line with the EFVS Advisory Circular.

v. 5–5–10. Traffic Advisories (Traffic Information)
This change adds the controller requirement to issue traffic information to each aircraft operating on converging runways where projected flight paths will cross.

w. 7–1–12. Weather Observing Programs
This change adds a ninth classification level. It also adds AWSS, the new AWOS types, and additional “element reported” categories to TBL 7–1–2. The table has been reorganized to match the order of reported elements in the METAR order.

x. 9–1–4. General Description of each Chart Series
This change updates the graphic illustration for the U.S. Terminal Publication Volumes.

y. 10–1–4. The Gulf of Mexico Grid System
This change explains how the introduction of ADS–B in the Gulf of Mexico has improved operations in the grid system and lays out the requirements for operators to participate.

z. Appendix 4. Abbreviations/Acronyms
This change was added to support the material updated in this manual.

aa. Entire publication.
Editorial/format changes were made where necessary. Revision bars were not used because of the insignificant nature of these changes.
# AIM Change 2
## Page Control Chart
### March 10, 2011

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

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Chapter 5. Air Traffic Procedures

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### Chapter 6. Emergency Procedures

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

1–1–13. NAVAIDs with Voice

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

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

1–1–14. User Reports on NAVAID Performance

a. Users of the National Airspace System (NAS) can render valuable assistance in the early correction of NAVAID malfunctions by reporting their observations of undesirable NAVAID 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.

b. Reporters should identify the NAVAID, location of the aircraft, time of the observation, type of aircraft and describe the condition observed; the type of receivers in use is also useful information. Reports can be made in any of the following ways:

1. Immediate report by direct radio communication to the controlling Air Route Traffic Control Center (ARTCC), Control Tower, or FSS. This method provides the quickest result.
2. By telephone to the nearest FAA facility.
3. By FAA Form 8740–5, Safety Improvement Report, a postage-paid card designed for this purpose. These cards may be obtained at FAA FSSs, Flight Standards District Offices, and General Aviation Fixed Base Operations.

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

1–1–15. LORAN

a. Introduction

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

1. The LOng RAnge Navigation–C (LORAN) system is a hyperbolic, terrestrial–based navigation system operating in the 90–110 kHz frequency band. LORAN, operated by the U.S. Coast Guard (USCG), has been in service for over 50 years and is used for navigation by the various transportation modes, as well as, for precise time and frequency applications. The system is configured to provide reliable, all weather navigation for marine users along the U.S. coasts and in the Great Lakes.

2. In the 1980’s, responding to aviation user and industry requests, the USCG and FAA expanded LORAN coverage to include the entire continental U.S. This work was completed in late 1990, but the LORAN system failed to gain significant user acceptance and primarily due to transmitter and user equipment performance limitations, attempts to
obtain FAA certification of nonprecision approach capable receivers were unsuccessful. More recently, concern regarding the vulnerability of Global Positioning System (GPS) and the consequences of losing GPS on the critical U.S. infrastructure (e.g., NAS) has renewed and refocused attention on LORAN.

3. LORAN is also supported in the Canadian airspace system. Currently, LORAN receivers are only certified for en route navigation.

4. Additional information can be found in the “LORAN–C User Handbook,” COMDT PUB−P16562.6, or the website http://www.navcen.uscg.gov.

b. LORAN Chain

1. The locations of the U.S. and Canadian LORAN transmitters and monitor sites are illustrated in FIG 1−1−11. Station operations are organized into subgroups of four to six stations called “chains.” One station in the chain is designated the “Master” and the others are “secondary” stations. The resulting chain based coverage is seen in FIG 1−1−12.

2. The LORAN navigation signal is a carefully structured sequence of brief radio frequency pulses centered at 100 kHz. The sequence of signal transmissions consists of a pulse group from the Master (M) station followed at precise time intervals by groups from the secondary stations, which are designated by the U.S. Coast Guard with the letters V, W, X, Y and Z. All secondary stations radiate pulses in groups of eight, but for identification the Master signal has an additional ninth pulse. (See FIG 1−1−13.) The timing of the LORAN system is tightly controlled and synchronized to Coordinated Universal Time (UTC). Like the GPS, this is a Stratum 1 timing standard.

3. The time interval between the reoccurrence of the Master pulse group is called the Group Repetition Interval (GRI). The GRI is the same for all stations in a chain and each LORAN chain has a unique GRI. Since all stations in a particular chain operate on the same radio frequency, the GRI is the key by which a LORAN receiver can identify and isolate signal groups from a specific chain.

EXAMPLE−
Transmitters in the Northeast U.S. chain (FIG 1−1−14) operate with a GRI of 99,600 microseconds which is shortened to 9960 for convenience. The master station (M) at Seneca, New York, controls secondary stations (W) at Caribou, Maine; (X) at Nantucket, Massachusetts; (Y) at Carolina Beach, North Carolina, and (Z) at Dana, Indiana. In order to keep chain operations precise, monitor receivers are located at Cape Elizabeth, ME; Sandy Hook, NJ; Dunbar Forest, MI, and Plumbook, OH. Monitor receivers continuously measure various aspects of the quality (e.g., pulse shape) and accuracy (e.g., timing) of LORAN signals and report system status to a control station.

4. The line between the Master and each secondary station is the “baseline” for a pair of stations. Typical baselines are from 600 to 1,000 nautical miles in length. The continuation of the baseline in either direction is a “baseline extension.”

5. At the LORAN transmitter stations there are cesium oscillators, transmitter time and control equipment, a transmitter, primary power (e.g., commercial or generator) and auxiliary power equipment (e.g., uninterruptible power supplies and generators), and a transmitting antenna (configurations may either have 1 or 4 towers) with the tower heights ranging from 700 to 1350 feet tall. Depending on the coverage area requirements a LORAN station transmits from 400 to 1,600 kilowatts of peak signal power.

6. The USCG operates the LORAN transmitter stations under a reduced staffing structure that is made possible by the remote control and monitoring of the critical station and signal parameters. The actual control of the transmitting station is accomplished remotely at Coast Guard Navigation Center (NAVCEN) located in Alexandria, Virginia. East Coast and Midwest stations are controlled by the NAVCEN. Stations on the West Coast and in Alaska are controlled by the NAVCEN Detachment (Det), located in Petaluma, California. In the event of a problem at one of these two 24 hour−a−day staffed sites, monitoring and control of the entire LORAN system can be done at either location. If both NACEN and NAVCEN Det are down or if there is an equipment problem at a specific station, local station personnel are available to operate and perform repairs at each LORAN station.
7. The transmitted signal is also monitored in the service areas (i.e., area of published LORAN coverage) and its status provided to NAVCEN and NAVCEN Det. The System Area Monitor (SAM) is a single site used to observe the transmitted signal (signal strength, time difference, and pulse shape). If an out-of-tolerance situation that could affect navigation accuracy is detected, an alert signal called “Blink” is activated. Blink is a distinctive change in the group of eight pulses that can be recognized automatically by a receiver so the user is notified instantly that the LORAN system should not be used for navigation. Out-of-tolerance situations which only the local station can detect are also monitored. These situations when detected cause signal transmissions from a station to be halted.
8. Each individual LORAN chain provides navigation-quality signal coverage over an identified area as shown in FIG 1–1–15 for the West Coast chain, GRI 9940. The chain Master station is at Fallon, Nevada, and secondary stations are at George, Washington; Middletown, California, and Searchlight, Nevada. In a signal coverage area the signal strength relative to the normal ambient radio noise must be adequate to assure successful reception. Similar coverage area charts are available for all chains.

FIG 1–1–13
The LORAN Pulse and Pulse Group
c. The LORAN Receiver

1. For a currently certified LORAN aviation receiver to provide navigation information for a pilot, it must successfully receive, or “acquire,” signals from three or more stations in a chain. Acquisition involves the time synchronization of the receiver with the chain GRI, identification of the Master station signals from among those checked, identification of secondary station signals, and the proper selection of the tracking point on each signal at which measurements are made. However, a new generation of receivers has been developed that use pulses from all stations that can be received at the pilot’s location. Use of “all-in-view” stations by a receiver is made possible due to the synchronization of LORAN stations signals to UTC. This new generation of receivers, along with improvements at the transmitting stations and changes in system policy and operations doctrine may allow for LORAN’s use in nonprecision approaches. At this time these receivers are available for purchase, but none have been certified for aviation use.

2. The basic measurements made by certified LORAN receivers are the differences in time of arrival between the Master signal and the signals from each of the secondary stations of a chain. Each “time difference” (TD) value is measured to a precision of about 0.1 microseconds. As a rule of thumb, 0.1 microsecond is equal to about 100 feet.

3. An aircraft’s LORAN receiver must recognize three signal conditions:

   (a) Usable signals;
   (b) Absence of signals, and
   (c) Signal blink.

4. The most critical phase of flight is during the approach to landing at an airport. During the approach phase the receiver must detect a lost signal, or a signal Blink, within 10 seconds of the occurrence and warn the pilot of the event. At this time there are no receivers that are certified for nonprecision approaches.

5. Most certified receivers have various internal tests for estimating the probable accuracy of the current TD values and consequent navigation solutions. Tests may include verification of the timing alignment of the receiver clock with the LORAN pulse, or a continuous measurement of the signal–to–noise ratio (SNR). SNR is the relative strength of the LORAN signals compared to the local ambient noise level. If any of the tests fail, or if the quantities measured are out of the limits set for reliable navigation, then an alarm will be activated to alert the pilot.

6. LORAN signals operate in the low frequency band (90–110 kHz) that has been reserved for marine navigation signals. Adjacent to the band, however, are numerous low frequency communications transmitters. Nearby signals can distort the LORAN signals and must be eliminated by the receiver to assure proper operation. To eliminate interfering signals, LORAN receivers have selective internal filters. These filters, commonly known as “notch filters,” reduce the effect of interfering signals.

7. Careful installation of antennas, good metal–to–metal electrical bonding, and provisions for precipitation noise discharge on the aircraft are essential for the successful operation of LORAN receivers. A LORAN antenna should be installed on an aircraft in accordance with the manufacturer’s instructions. Corroded bonding straps should be replaced, and static discharge devices installed at points indicated by the aircraft manufacturer.


d. LORAN Navigation

1. An airborne LORAN receiver has four major parts:

   (a) Signal processor;
   (b) Navigation computer;
   (c) Control/display, and
   (d) Antenna.

2. The signal processor acquires LORAN signals and measures the difference between the time–of–arrival of each secondary station pulse group and the Master station pulse group. The measured TDs depend on the location of the receiver in relation to the three or more transmitters.
(a) The first TD will locate an aircraft somewhere on a line-of-position (LOP) on which the receiver will measure the same TD value.

(b) A second LOP is defined by a TD measurement between the Master station signal and the signal from another secondary station.

3. The navigation computer converts TD values to corresponding latitude and longitude. Once the time and position of the aircraft are established at two points, distance to destination, cross track error, ground speed, estimated time of arrival, etc., can be determined. Cross track error can be displayed as the vertical needle of a course deviation indicator, or digitally, as decimal parts of a mile left or right of course.

e. Notices to Airmen (NOTAMs) are issued for LORAN chain or station outages. Domestic NOTAM (D)s are issued under the identifier “LRN.” International NOTAMs are issued under the KNMH series. Pilots may obtain these NOTAMs from FSS briefers upon request.

f. LORAN status information. To find out more information on the LORAN system and its operational status you can visit [http://www.navcen.uscg.gov/oran/default.htm](http://www.navcen.uscg.gov/oran/default.htm) or contact NAVCEN’s Navigation Information Service (NIS) watchstander, phone (703) 313-5900, fax (703) 313-5920.

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

g. LORAN’s future. The U.S. will continue to operate the LORAN system in the short term. During this time, the FAA LORAN evaluation program, being conducted with the support of a team comprising government, academia, and industry, will identify and assess LORAN’s potential contributions to required navigation services for the National Airspace System (NAS), and support decisions regarding continued operation of the system. If the government concludes LORAN should not be kept as part of the mix of federally provided radio navigation systems, it will give the users of LORAN reasonable notice so that they will have the opportunity to transition to alternative navigation aids.

1–1–16. VHF Direction Finder

a. The VHF Direction Finder (VHF/DF) is one of the common systems that helps pilots without their being aware of its operation. It is a ground–based radio receiver used by the operator of the ground station. FAA facilities that provide VHF/DF service are identified in the A/FD.

b. The equipment consists of a directional antenna system and a VHF radio receiver.

c. The VHF/DF receiver display indicates the magnetic direction of the aircraft from the ground station each time the aircraft transmits.

d. DF equipment is of particular value in locating lost aircraft and in helping to identify aircraft on radar.

REFERENCE—AIM, Direction Finding Instrument Approach Procedure, Paragraph 6–2–3

1–1–17. Inertial Reference Unit (IRU), Inertial Navigation System (INS), and Attitude Heading Reference System (AHRS)

a. IRUs are self–contained systems comprised of gyroscopes and accelerometers that provide aircraft attitude (pitch, roll, and heading), position, and velocity information in response to signals resulting from inertial effects on system components. Once aligned with a known position, IRUs continuously calculate position and velocity. IRU position accuracy decays with time. This degradation is known as “drift.”

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

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

1–1–18. Doppler Radar

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

1–1–19. Global Positioning System (GPS)

a. System Overview

1. System Description. The Global Positioning System is a satellite–based radio navigation system, which broadcasts a signal that is used by receivers to determine precise position anywhere in the world. The receiver tracks multiple satellites and determines a pseudorange measurement that is then used to determine the user location. A minimum of four satellites is necessary to establish an accurate three–dimensional position. The Department of Defense (DOD) is responsible for operating the GPS satellite constellation and monitors the GPS satellites to ensure proper operation. Every satellite’s orbital parameters (ephemeris data) are sent to each satellite for broadcast as part of the data message embedded in the GPS signal. The GPS coordinate system is the Cartesian earth–centered earth–fixed coordinates as specified in the World Geodetic System 1984 (WGS–84).
2. System Availability and Reliability

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

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

3. Receiver Autonomous Integrity Monitoring (RAIM). When GNSS equipment is not using integrity information from WAAS or LAAS, the GPS navigation receiver using RAIM provides GPS signal integrity monitoring. RAIM is necessary since delays of up to two hours can occur before an erroneous satellite transmission can be detected and corrected by the satellite control segment. The RAIM function is also referred to as fault detection. Another capability, fault exclusion, refers to the ability of the receiver to exclude a failed satellite from the position solution and is provided by some GPS receivers and by WAAS receivers.

4. The GPS receiver verifies the integrity (usability) of the signals received from the GPS constellation through receiver autonomous integrity monitoring (RAIM) to determine if a satellite is providing corrupted information. At least one satellite, in addition to those required for navigation, must be in view for the receiver to perform the RAIM function; thus, RAIM needs a minimum of 5 satellites in view, or 4 satellites and a barometric altimeter (baro–aiding) to detect an integrity anomaly. [Baro–aiding satisfies the RAIM requirement in lieu of a fifth satellite.] For receivers capable of doing so, RAIM needs 6 satellites in view (or 5 satellites with baro–aiding) to isolate the corrupt satellite signal and remove it from the navigation solution. Baro–aiding is a method of augmenting the GPS integrity solution by using a nonsatellite input source. GPS derived altitude should not be relied upon to determine aircraft altitude since the vertical error can be quite large and no integrity is provided. To ensure that baro–aiding is available, the current altimeter setting must be entered into the receiver as described in the operating manual.

5. RAIM messages vary somewhat between receivers; however, generally there are two types. One type indicates that there are not enough satellites available to provide RAIM integrity monitoring and another type indicates that the RAIM integrity monitor has detected a potential error that exceeds the limit for the current phase of flight. Without RAIM capability, the pilot has no assurance of the accuracy of the GPS position.

6. Selective Availability. Selective Availability (SA) is a method by which the accuracy of GPS is intentionally degraded. This feature is 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, and do not need to be designed to operate outside of that performance.

7. The GPS constellation of 24 satellites is designed so that a minimum of five is always observable by a user anywhere on earth. The receiver uses data from a minimum of four satellites above the mask angle (the lowest angle above the horizon at which it can use a satellite).

8. The DOD declared initial operational capability (IOC) of the U.S. GPS on December 8, 1993. The FAA has granted approval for U.S. civil operators to use properly certified GPS equipment as a primary means of navigation in oceanic airspace and certain remote areas. Properly certified GPS equipment may be used as a supplemental means of IFR navigation for domestic en route, terminal operations, and certain instrument approach procedures (IAPs). This approval permits the use of GPS in a manner that is consistent with current navigation requirements as well as approved air carrier operations specifications.

b. VFR Use of GPS

1. GPS navigation has become a great asset to VFR pilots, providing increased navigation capability and enhanced situational awareness, while reducing operating costs due to greater ease in flying direct routes. While GPS has many benefits to the VFR pilot, care must be exercised to ensure that system capabilities are not exceeded.
2. Types of receivers used for GPS navigation under VFR are varied, from a full IFR installation being used to support a VFR flight, to a VFR only installation (in either a VFR or IFR capable aircraft) to a hand-held receiver. The limitations of each type of receiver installation or use must be understood by the pilot to avoid misusing navigation information. (See TBL 1–1–6.) In all cases, VFR pilots should never rely solely on one system of navigation. GPS navigation must be integrated with other forms of electronic navigation (when possible), as well as pilotage and dead reckoning. Only through the integration of these techniques can the VFR pilot ensure accuracy in navigation.

3. Some critical concerns in VFR use of GPS include RAIM capability, database currency and antenna location.

(a) RAIM Capability. Many VFR GPS receivers and all hand-held units have no RAIM alerting capability. Loss of the required number of satellites in view, or the detection of a position error, cannot be displayed to the pilot by such receivers. In receivers with no RAIM capability, no alert would be provided to the pilot that the navigation solution had deteriorated, and an undetected navigation error could occur. A systematic cross-check with other navigation techniques would identify this failure, and prevent a serious deviation. See subparagraphs a4 and a5 for more information on RAIM.

(b) Database Currency

(1) In many receivers, an updatable database is used for navigation fixes, airports, and instrument procedures. These databases must be maintained to the current update for IFR operation, but no such requirement exists for VFR use.

(2) However, in many cases, the database drives a moving map display which indicates Special Use Airspace and various classes of airspace, in addition to other operational information. Without a current database the moving map display may be outdated and offer erroneous information to VFR pilots wishing to fly around critical airspace areas, such as a Restricted Area or a Class B airspace segment. Numerous pilots have ventured into airspace they were trying to avoid by using an outdated database. If you don’t have a current database in the receiver, disregard the moving map display for critical navigation decisions.

(c) Antenna Location

(1) In many VFR installations of GPS receivers, antenna location is more a matter of convenience than performance. In IFR installations, care is exercised to ensure that an adequate clear view is provided for the antenna to see satellites. If an alternate location is used, some portion of the aircraft may block the view of the antenna, causing a greater opportunity to lose navigation signal.

(2) This is especially true in the case of hand-helds. The use of hand-held receivers for VFR operations is a growing trend, especially among rental pilots. 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 only and is rarely optimized to provide a clear view of available satellites. Consequently, signal losses may occur in certain situations of aircraft–satellite geometry, causing a loss of navigation signal. These losses, coupled with a lack of RAIM capability, could present erroneous position and navigation information with no warning to the pilot.

(3) In addition, waypoints are added, removed, relocated, or re-named as required to meet operational needs. When using GPS to navigate relative to a named fix, a current database must be used to properly locate a named waypoint. Without the update, it is the pilot’s responsibility to verify the waypoint location referencing to an official current source, such as the Airport/Facility Directory, Sectional Chart, or En Route Chart.

As a result of these and other concerns, here are some tips for using GPS for VFR operations:

(a) Always check to see if your unit has RAIM capability. If no RAIM capability exists, be suspicious of your GPS position when any disagreement exists with the position derived from other radio navigation systems, pilotage, or dead reckoning.

(b) Check the currency of the database, if any. If expired, update the database using the current
revision. If an update of an expired database is not possible, disregard any moving map display of airspace for critical navigation decisions. Be aware that named waypoints may no longer exist or may have been relocated since the database expired. At a minimum, the waypoints planned to be used should be checked against a current official source, such as the Airport/Facility Directory, or a Sectional Aeronautical Chart.

(c) While hand–helds can provide excellent navigation capability to VFR pilots, be prepared for intermittent loss of navigation signal, possibly with no RAIM warning to the pilot. If mounting the receiver in the aircraft, be sure to comply with 14 CFR Part 43.

(d) Plan flights carefully before taking off. If you wish to navigate to user–defined waypoints, enter them before flight, not on–the–fly. Verify your planned flight against a current source, such as a current sectional chart. There have been cases in which one pilot used waypoints created by another pilot that were not where the pilot flying was expecting. This generally resulted in a navigation error. Minimize head–down time in the aircraft and keep a sharp lookout for traffic, terrain, and obstacles. Just a few minutes of preparation and planning on the ground will make a great difference in the air.

(e) Another way to minimize head–down time is to become very familiar with your receiver’s operation. Most receivers are not intuitive. The pilot must take the time to 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. Take the time to learn about your particular unit before you try to use it in flight.

5. In summary, be careful not to rely on GPS to solve all your VFR navigational problems. Unless an IFR receiver is installed in accordance with IFR requirements, no standard of accuracy or integrity has been assured. While the practicality of GPS is compelling, the fact remains that only the pilot can navigate the aircraft, and GPS is just one of the pilot’s tools to do the job.

c. VFR Waypoints

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

2. VFR waypoint names (for 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 identifiable by small magenta flag symbols. VFR waypoints collocated with visual check points will be pronounceable based on the name of the visual check point and may be used for ATC communications. Each VFR waypoint name will appear in parentheses adjacent to the geographic location on the chart. Latitude/longitude data for all established VFR waypoints may be found in the appropriate regional Airport/Facility Directory (A/FD).

3. VFR waypoints shall not be used to plan flights under IFR. VFR waypoints will not be recognized by the IFR system and will be rejected for IFR routing purposes.

4. When filing VFR flight plans, pilots may use the five letter identifier as a waypoint in the route of flight section if there is an intended course change at that point or if used to describe the planned route of flight. This VFR filing would be similar to how a VOR would be used in a route of flight. Pilots must use the VFR waypoints only when operating under VFR conditions.

5. Any VFR waypoints intended for use during a flight should be loaded into the receiver while on the ground and prior to departure. Once airborne, pilots
should avoid programming routes or VFR waypoint chains into their receivers.

6. Pilots should be especially vigilant for other traffic while operating near VFR waypoints. The same effort to see and avoid other aircraft near VFR waypoints will be necessary, as was the case with VORs and NDBs in the past. In fact, the increased accuracy of navigation through the use of GPS will demand even greater vigilance, as off-course deviations among different pilots and receivers will be less. When operating near a VFR waypoint, use whatever ATC services are available, even if outside a class of airspace where communications are required. Regardless of the class of airspace, monitor the available ATC frequency closely for information on other aircraft operating in the vicinity. It is also a good idea to turn on your landing light(s) when operating near a VFR waypoint to make your aircraft more conspicuous to other pilots, especially when visibility is reduced. See paragraph 7–5–2, VFR in Congested Areas, for more information.

d. General Requirements

1. Authorization to conduct any GPS operation under IFR requires that:

   (a) GPS navigation equipment used must be approved in accordance with the requirements specified in Technical Standard Order (TSO) TSO–C129, or equivalent, and the installation must be done in accordance with Advisory Circular AC 20–138, Airworthiness Approval of Global Positioning System (GPS) Navigation Equipment for Use as a VFR and IFR Supplemental Navigation System, or Advisory Circular AC 20–130A, Airworthiness Approval of Navigation or Flight Management Systems Integrating Multiple Navigation Sensors, or equivalent. 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. During IFR operations they may be considered only an aid to situational awareness.

   (b) Aircraft using GPS navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation appropriate to the flight. Active monitoring of alternative navigation equipment is not required if the GPS receiver uses RAIM for integrity monitoring. Active monitoring of an alternate means of navigation is required when the RAIM capability of the GPS equipment is lost.

   (c) Procedures must be established for use in the event that the loss of RAIM capability is predicted to occur. In situations where this is encountered, the flight must rely on other approved equipment, delay departure, or cancel the flight.

   (d) 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. Unlike ILS and VOR, the basic operation, receiver presentation to the pilot, and some capabilities of the equipment can vary greatly. Due to these differences, operation of different brands, or even models of the same brand, of GPS receiver under IFR should not be attempted without thorough study of the operation of that particular receiver and installation. Most receivers have a built–in simulator mode which will allow the pilot to become familiar with operation prior to attempting operation in the aircraft. Using the equipment in flight under VFR conditions prior to attempting IFR operation will allow further familiarization.

   (e) Aircraft navigating by IFR approved GPS are considered to be area navigation (RNAV) aircraft and have special equipment suffixes. File the appropriate equipment suffix in accordance with TBL 5–1–2, on the ATC flight plan. If GPS avionics become inoperative, the pilot should advise ATC and amend the equipment suffix.

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

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

e. Use of GPS for IFR Oceanic, Domestic En Route, and Terminal Area Operations

1. GPS IFR operations in oceanic areas can be conducted as soon as the proper avionics systems are installed, provided all general requirements are met. A GPS installation with TSO–C129 authorization in
class A1, A2, B1, B2, C1, or C2 may be used to replace one of the other approved means of long–range navigation, such as dual INS. (See TBL 1–1–5 and TBL 1–1–6.) A single GPS installation with these classes of equipment which provide RAIM for integrity monitoring may also be used on short oceanic routes which have only required one means of long–range navigation.

2. GPS domestic en route and terminal IFR operations can be conducted as soon as proper avionics systems are installed, provided all general requirements are met. 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 also be operational.

(a) GPS en route IFR RNAV operations may be conducted in Alaska outside the operational service volume of ground–based navigation aids when a TSO–C145a or TSO–C146a GPS/WAAS system is installed and operating. Ground–based navigation equipment is not required to be installed and operating for en route IFR RNAV 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.

| TBL 1–1–5 |
| GPS IFR Equipment Classes/Categories |

<table>
<thead>
<tr>
<th>Equipment Class</th>
<th>RAIM</th>
<th>Int. Nav. Sys. to Prov. RAIM Equiv.</th>
<th>Oceanic</th>
<th>En Route</th>
<th>Terminal</th>
<th>Nonprecision Approach Capable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A – GPS sensor and navigation capability.</td>
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<tr>
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<td>Class C – GPS sensor data to an integrated navigation system (as in Class B) which provides enhanced guidance to an autopilot, or flight director, to reduce flight tech. errors. Limited to 14 CFR Part 121 or equivalent criteria.</td>
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</tr>
</tbody>
</table>
3. Civilian pilots may obtain GPS RAIM availability information for nonprecision approach procedures by specifically requesting GPS aeronautical information from an Automated 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 time frame 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 time frame is requested by the pilot. If flying a published GPS departure, a RAIM prediction should also be requested for the departure airport.

4. The military provides airfield specific GPS RAIM NOTAMs for 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.

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

i. Receiver Autonomous Integrity Monitoring (RAIM)

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

2. If RAIM is not available, another type of navigation and approach system must be used, another destination selected, or the trip delayed 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 early indications that an unscheduled satellite outage has occurred since takeoff.

3. If a RAIM failure/status annunciation occurs prior to the final approach waypoint (FAWP), the approach should not be completed since GPS may no longer provide the required accuracy. The receiver performs a RAIM prediction by 2 NM prior to the FAWP to ensure that RAIM is available at the FAWP as a condition for entering the approach mode. The pilot should ensure that 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 completing the approach.

4. If the receiver does not sequence into the approach mode or a RAIM failure/status annunciation occurs prior to the FAWP, the pilot should not descend to Minimum Descent Altitude (MDA), but should proceed to the missed approach waypoint (MAWP) via the FAWP, perform a missed approach, and contact ATC as soon as practical. Refer to the receiver operating manual for specific indications and instructions associated with loss of RAIM prior to the FAF.

5. If a RAIM failure occurs after the FAWP, the receiver is allowed to continue operating without an annunciation for up to 5 minutes to allow completion of the approach (see receiver operating manual). If the RAIM flag/status annunciation appears after the FAWP, the missed approach should be executed immediately.

j. Waypoints

1. GPS approaches make use of both fly−over and fly−by waypoints. Fly−by waypoints are used when an aircraft should begin a turn to the next course prior to reaching the waypoint separating the two route segments. This is known as turn anticipation and is compensated for in the airspace and terrain clearances. Approach way points, except for the MAWP and the missed approach holding waypoint (MAHWP), are normally fly−by waypoints. Fly−over waypoints are used when the aircraft must fly over the point prior to starting a turn. New approach charts depict fly−over waypoints as a circled waypoint symbol. Overlay approach charts and some early stand alone GPS approach charts may not
2. Since GPS receivers are basically “To−To” navigators, they must always be navigating to a defined point. On overlay approaches, if no pronounceable five−character name is published for an approach waypoint or fix, it was given a database identifier consisting of letters and numbers. These points will appear in the list of waypoints in the approach procedure database, but may not appear on the approach chart. A point used for the purpose of defining the navigation track for an airborne computer system (i.e., GPS or FMS) is called a Computer Navigation Fix (CNF). CNFs include unnamed DME fixes, beginning and ending points of DME arcs and sensor final approach fixes (FAFs) on some GPS overlay approaches. To aid in the approach chart/database correlation process, the FAA has begun a program to assign five−letter names to CNFs and to chart CNFs on various National Oceanic Service aeronautical products. These CNFs are not to be used for any air traffic control (ATC) application, such as holding for which the fix has not already been assessed. CNFs will be charted to distinguish them from conventional reporting points, fixes, intersections, and waypoints. The CNF name will be enclosed in parenthesis, e.g., (MABEE), and the name will be placed next to the CNF it defines. If the CNF is not at an existing point defined by means such as crossing radials or radial/DME, the point will be indicated by an “X.” The CNF name will not be used in filing a flight plan or in aircraft/ATC communications. Use current phraseology, e.g., facility name, radial, distance, to describe these fixes.

3. Unnamed waypoints in the database will be uniquely identified for each airport but may be repeated for another airport (e.g., RW36 will be used at each airport with a runway 36 but will be at the same location for all approaches at a given airport).

4. The runway threshold waypoint, which is normally the MAWP, may have a five letter identifier (e.g., SNEEZ) or be coded as RW## (e.g., RW36, RW36L). Those thresholds which are coded as five letter identifiers are being changed to the RW## designation. This may cause the approach chart and database to differ 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. MAWPs not located at the threshold will have a five letter identifier.

**k. Position Orientation**

As with most RNAV systems, 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 nonsequencing mode. When the receiver is in the nonsequencing 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. On overlay approaches, the pilot may have to compute the along−track distance to stepdown fixes and other points due to the receiver showing along−track distance to the next waypoint rather than DME to the VOR or ILS ground station.

**l. Conventional Versus GPS Navigation Data**

There may be slight differences between the course information portrayed on navigational charts and a GPS navigation display when flying authorized GPS instrument procedures or along an airway. All magnetic tracks defined by any conventional navigation aids are determined by the application of the station magnetic variation. In contrast, GPS RNAV systems may use an algorithm, which applies the local magnetic variation and may produce small differences in the displayed course. However, both methods of navigation should produce the same desired ground track when using approved, IFR navigation system. Should significant differences between the approach chart and the GPS avionics’ application of the navigation database arise, the published approach chart, supplemented by NOTAMs, holds precedence.

Due to the GPS avionics’ computation of great circle courses, and the variations in magnetic variation, the bearing to the next waypoint and the course from the last waypoint (if available) may not be exactly 180° apart when long distances are involved. Variations in distances will occur since GPS distance−to−waypoint values are along−track distances (ATD) computed to the next waypoint and the DME values published on underlying procedures are slant−range distances.
### RNP Levels Supported for International Operations

<table>
<thead>
<tr>
<th>RNP Level</th>
<th>Typical Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Projected for oceanic/remote areas where 30 NM horizontal separation is applied</td>
</tr>
<tr>
<td>10</td>
<td>Oceanic/remote areas where 50 NM lateral separation is applied</td>
</tr>
</tbody>
</table>

**c. Other RNP Applications Outside the U.S.**
The FAA and ICAO member states have led initiatives in implementing the RNP concept to oceanic operations. For example, RNP–10 routes have been established in the northern Pacific (NOPAC) which has increased capacity and efficiency by reducing the distance between tracks to 50 NM. (See TBL 1–2–2.)

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

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

### Use of Suitable Area Navigation (RNAV) Systems on Conventional Procedures and Routes

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

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

2. Use of a suitable RNAV system as an Alternate Means of Navigation when a VOR, DME, VORTAC, VOR/DME, TACAN, NDB, or compass locator facility including locator outer marker and locator middle marker is operational and the respective aircraft is equipped with operational navigation equipment that is compatible with conventional navaids. For example, if equipped with a suitable RNAV system, a pilot may fly a procedure or route based on operational VOR using that RNAV system without monitoring the VOR.

**NOTE—**
1. Additional information and associated requirements are available via a 90–series Advisory Circular titled “Use of Suitable RNAV Systems on Conventional Routes and Procedures.”

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

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

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

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

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

2. An RNAV system with DME/DME/IRU inputs that is compliant with the equipment provisions of AC 90–100A, U.S. Terminal and En Route Area Navigation (RNAV) Operations, for RNAV routes. A table of compliant equipment is available at the following website: http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs470/policy_guidance/

**NOTE**

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

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

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

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

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

4. Fly an arc based upon DME.

**NOTE**

1. The allowances described in this section apply even when a facility is identified as required on a procedure (for example, “Note ADF required”).

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

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

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

5. For the purpose of paragraph c, “VOR” includes VOR, VOR/DME, and VORTAC facilities and “compass locator” includes locator outer marker and locator middle marker.
d. Alternate Airport Considerations. For the purposes of flight planning, any required alternate airport must have an available instrument approach procedure that does not require the use of GPS. This restriction includes conducting a conventional approach at the alternate airport using a substitute means of navigation that is based upon the use of GPS. For example, these restrictions would apply when planning to use GPS equipment as a substitute means of navigation for an out-of-service VOR that supports an ILS missed approach procedure at an alternate airport. In this case, some other approach not reliant upon the use of GPS must be available. This restriction does not apply to RNAV systems using TSO-C145/C146 WAAS equipment. For further WAAS guidance see AIM 1–1–20.
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 due to local limitations, or the VASI may be offset from the extended runway centerline. This will be noted in the Airport/ Facility Directory.
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

![Diagram of 2-Bar VASI](image)

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

**FIG 2–1–3**

3-Bar VASI

![Diagram of 3-Bar VASI](image)

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

**FIG 2–1–4**

VASI Variations

![Diagram of VASI Variations](image)
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 4 SM 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 due to local limitations, or the PAPI may be offset from the extended runway centerline. This will be noted in the Airport/ Facility Directory. (See FIG 2–1–5.)

**FIG 2–1–5**

Precision Approach Path Indicator (PAPI)

![Diagram of PAPI indications](image)

<table>
<thead>
<tr>
<th>Light Configuration</th>
<th>Glide Path Indication</th>
</tr>
</thead>
<tbody>
<tr>
<td>High (More Than 3.5 Degrees)</td>
<td>Slightly High (3.2 Degrees)</td>
</tr>
</tbody>
</table>

White Red

![Diagram of PAPI indications](image)

**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

![Diagram of tri-color VASI indications](image)

- Amber
- Green
- Red

**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.
LAHSO is in effect. These lights will be off when LAHSO is not in effect.

REFERENCE—
AIM, Pilot Responsibilities When Conducting Land and Hold Short Operations (LAHSO), Paragraph 4−3−11.

2−1−6. Runway Status Light (RWSL) System

a. Introduction.

RWSL is a fully automated system that provides runway status information to pilots and surface vehicle operators to clearly indicate when it is unsafe to enter, cross, takeoff from, or land on a runway. The RWSL system processes information from surveillance systems and activates Runway Entrance Lights (REL), Takeoff Hold Lights (THL), Runway Intersection Lights (RIL), and Final Approach Runway Occupancy Signal (FAROS) in accordance with the position and velocity of the detected traffic. REL, THL, and RIL are in-pavement light fixtures that are directly visible to pilots and surface vehicle operators. The FAROS annunciation is by means of flashing the Precision Approach Path Indicator (PAPI). RWSL is an independent safety enhancement that does not substitute for an ATC clearance. Clearance to enter, cross, takeoff from, land on, or operate on a runway must be issued by ATC. Although ATC has limited control over the system, personnel do not directly use, and may not be able to view, light fixture output in their operations.

b. Runway Entrance Lights (REL): The REL system is composed of flush mounted, in-pavement, unidirectional fixtures that are parallel to and focused along the taxiway centerline and directed toward the pilot at the hold line. An array of REL lights include the first light at the hold line followed by a series of evenly spaced lights to the runway edge; one additional light at the runway centerline is in line with the last two lights before the runway edge (see FIG 2−1−9 and FIG 2−1−10). When activated, the red lights indicate that there is high speed traffic on the runway or there is an aircraft on final approach within the activation area.

1. Operating Characteristics – Departing Aircraft:

When a departing aircraft reaches 30 knots, all taxiway intersections with REL arrays along the runway ahead of the aircraft will illuminate (see FIG 2−1−9). As the aircraft approaches an REL equipped taxiway intersection, the lights at that intersection extinguish approximately 3 to 4 seconds before the aircraft reaches it. This allows controllers to apply “anticipated separation” to permit ATC to move traffic more expeditiously without compromising safety. After the aircraft is declared “airborne” by the system, all REL lights associated with this runway will extinguish.

2. Operating Characteristics – Arriving Aircraft:

When an aircraft on final approach is approximately 1 mile from the runway threshold, all sets of REL light arrays along the runway illuminate. The distance is adjustable and can be configured for specific operations at particular airports. Lights extinguish at each equipped taxiway intersection approximately 3 to 4 seconds before the aircraft reaches it to apply anticipated separation until the aircraft has slowed to approximately 80 knots (site adjustable parameter). Below 80 knots, all arrays that are not within 30 seconds of the aircraft’s forward path are extinguished. Once the arriving aircraft slows to approximately 34 knots (site adjustable parameter), it is declared to be in a taxi state, and all lights extinguish.

3. What a pilot would observe: A pilot at or approaching the hold line to a runway will observe REL illumination and extinguishing in reaction to an aircraft or vehicle operating on the runway, or an arriving aircraft operating less than 1 mile from the runway threshold.

4. Whenever a pilot observes the red lights of the REL, that pilot will stop at the hold line or remain stopped. The pilot will then contact ATC for resolution if the clearance is in conflict with the lights. Should pilots note illuminated lights under circumstances when remaining clear of the runway is impractical for safety reasons (for example, aircraft is already on the runway), the crew should proceed according to their best judgment while understanding the illuminated lights indicate the runway is unsafe to enter or cross. Contact ATC at the earliest possible opportunity.
c. Takeoff Hold Lights (THL): The THL system is composed of flush mounted, in-pavement, unidirectional fixtures in a double longitudinal row aligned either side of the runway centerline lighting. Fixtures are focused toward the arrival end of the runway at the “line up and wait” point, and they extend for 1,500 feet in front of the holding aircraft starting at a point 375 feet from the departure threshold (see FIG 2–1–11). Illuminated red lights provide a signal, to an aircraft in position for takeoff or rolling, that it is unsafe to takeoff because the runway is occupied or about to be occupied by another aircraft or ground vehicle. Two aircraft, or a surface vehicle and an aircraft, are required for the lights to illuminate. The departing aircraft must be in position for takeoff or beginning takeoff roll. Another aircraft or a surface vehicle must be on or about to cross the runway.

1. Operating Characteristics – Departing Aircraft:

THLs will illuminate for an aircraft in position for departure or departing when there is another aircraft or vehicle on the runway or about to enter the runway (see FIG 2–1–9.) Once that aircraft or vehicle exits the runway, the THLs extinguish. A pilot may notice lights extinguish prior to the downfield aircraft or vehicle being completely clear of the runway but still moving. Like RELs, THLs have an “anticipated separation” feature.

**NOTE**–
When the THLs extinguish, this is not clearance to begin a takeoff roll. All takeoff clearances will be issued by ATC.

2. What a pilot would observe: A pilot in position to depart from a runway, or has begun takeoff roll, will observe THLs illuminate in reaction to an aircraft or vehicle on the runway or entering or crossing it. Lights will extinguish when the runway is clear. A pilot may observe several cycles of illumination and extinguishing depending on the amount of crossing traffic.

3. Whenever a pilot observes the red light of the THLs, the pilot will stop or remain stopped. The pilot will contact ATC for resolution if any clearance is in conflict with the lights. Should pilots note illuminated lights while in takeoff roll and under circumstances when stopping is impractical for safety reasons, the crew should proceed according to their best judgment while understanding the illuminated lights indicate that continuing the takeoff is unsafe. Contact ATC at the earliest possible opportunity.
d. Runway Intersection Lights (RIL): The RIL system is composed of flush mounted, in-pavement, unidirectional fixtures in a double longitudinal row aligned either side of the runway centerline lighting in the same manner as THLs. Their appearance to a pilot is similar to that of THLs. Fixtures are focused toward the arrival end of the runway, and they extend for 3,000 feet in front of an aircraft that is approaching an intersecting runway. They end at the Land and Hold Short Operation (LASHO) light bar or the hold short line for the intersecting runway.

1. Operating Characteristics – Departing Aircraft:
RILs will illuminate for an aircraft departing or in position to depart when there is high speed traffic operating on the intersecting runway (see FIG 2–1–9). Note that there must be an aircraft or vehicle in a position to observe the RILs for them to illuminate. Once that traffic passes through the intersection, the RILs extinguish.

2. Operating Characteristics – Arriving Aircraft:
RILs will illuminate for an aircraft that has landed and is rolling out when there is high speed traffic on the intersecting runway that is 5 seconds of meeting at the intersection. Once that traffic passes through the intersection, the RILs extinguish.

3. What a pilot would observe: A pilot departing or arriving will observe RILs illuminate in reaction to the high speed traffic operation on the intersecting runway. The lights will extinguish when that traffic has passed through the runway intersection.

4. Whenever a pilot observes the red light of the RIL array, the pilot will stop before the LAHOS stop bar or the hold line for the intersecting runway. If a departing aircraft is already at high speed in the takeoff roll when the RILs illuminate, it may be impractical to stop for safety reasons. The crew should safely operate according to their best judgment while understanding the illuminated lights indicate that continuing the takeoff is unsafe. Contact ATC at the earliest possible opportunity.

e. The Final Approach Runway Occupancy Signal (FAROS) is activated by flashing of the Precision Approach Path Indicator (PAPI) (see FIG 2–1–9). When activated, the light fixtures of the PAPI flash or pulse to indicate to the pilot on an approach that the runway is occupied and that it may be unsafe to land.

1. Operating Characteristics:
If an aircraft or surface vehicle occupies a FAROS equipped runway, the PAPI(s) on that runway will flash or pulse. The glide path indication will not be affected, and the allotment of red and white PAPI lights observed by the pilot on approach will not change. Some FAROS systems will flash or pulse the PAPI when traffic enters the runway whether or not there is an aircraft on approach. Others will flash the PAPI only if there is an aircraft on approach and within 1.5 nautical miles of the landing threshold.

2. What a pilot would observe: A pilot on approach to the runway will observe the PAPI flash or pulse if there is traffic on the runway and will notice the PAPI ceases to flash or pulse when the traffic moves outside the hold short lines for the runway.

3. Whenever a pilot observes a flashing or pulsing PAPI, the pilot will verify the FAROS activation. At 500 feet above ground level (AGL), the contact height, the pilot must look for and acquire the traffic on the runway. At 300 feet AGL, the pilot must contact ATC for resolution if the clearance is in conflict with the FAROS indication. If the PAPI continues to flash or pulse, the pilot must execute an immediate “go around” and contact ATC at the earliest possible opportunity.

f. Pilot Actions:

1. When operating at airports with RWSL, pilots will operate with the transponder “On” when departing the gate or parking area until it is shutdown upon arrival at the gate or parking area. This ensures interaction with the FAA surveillance systems which provide information to the RWSL system.

2. Pilots must always inform the ATCT when they have either stopped, are verifying a landing clearance, or are executing a missed approach due to RWSL or FAROS indication that are in conflict with ATC instructions. Pilots must request clarification of the taxi, takeoff, or landing clearance.

3. Never cross over illuminated red lights. Under normal circumstances, RWSL will confirm the pilot’s taxi or takeoff clearance. If RWSL indicates that it is unsafe to takeoff from, land on, cross, or enter a runway, immediately notify ATC of the conflict and confirm your clearance. Never land if PAPI continues to flash or pulse. Execute a go around and notify ATC.
4. Do not proceed when lights have extinguished without an ATC clearance. RWSL verifies an ATC clearance; it does not substitute for an ATC clearance.

g. ATC Control of RWSL System:

1. Controllers can set in-pavement lights to one of five (5) brightness levels to assure maximum conspicuity under all visibility and lighting conditions. REL, THL, and RIL subsystems may be independently set.

2. The system can be shutdown should RWSL operations impact the efficient movement of air traffic or contribute, in the opinion of the ATC Supervisor, to unsafe operations. REL, THL, RIL, and FAROS subsystems may be shutdown separately. Shutdown of the FAROS subsystem will not extinguish PAPI lights or impact its glide path function. Whenever the system or a component is shutdown, a NOTAM must be issued, and the Automatic Terminal Information System (ATIS) must be updated.

2–1–7. Control of Lighting Systems

a. Operation of approach light systems and runway lighting is controlled by the control tower (ATCT). At some locations the FSS may control the lights where there is no control tower in operation.

b. Pilots may request that lights be turned on or off. Runway edge lights, in-pavement lights and approach lights also have intensity controls which may be varied to meet the pilots request. Sequenced flashing lights (SFL) may be turned on and off. Some sequenced flashing light systems also have intensity control.

2–1–8. Pilot Control of Airport Lighting

Radio control of lighting is available at selected airports to provide airborne control of lights by keying the aircraft’s microphone. Control of lighting systems is often available at locations without specified hours for lighting and where there is no control tower or FSS or when the tower or FSS is closed (locations with a part-time tower or FSS) or specified hours. All lighting systems which are radio controlled at an airport, whether on a single runway or multiple runways, operate on the same radio frequency. (See TBL 2–1–1 and TBL 2–1–2.)
FIG 2–1–11
Takeoff Hold Lights

FIG 2–1–12
Taxiway Lead–On Light Configuration
**Runways With Approach Lights**

<table>
<thead>
<tr>
<th>Lighting System</th>
<th>No. of Int. Steps</th>
<th>Status During Nonuse Period</th>
<th>Intensity Step Selected Per No. of Mike Clicks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 Clicks</td>
</tr>
<tr>
<td>Approach Lights (Med. Int.)</td>
<td>2</td>
<td>Off</td>
<td>Low</td>
</tr>
<tr>
<td>Approach Lights (Med. Int.)</td>
<td>3</td>
<td>Off</td>
<td>Low</td>
</tr>
<tr>
<td>MIRL</td>
<td>3</td>
<td>Off or Low</td>
<td>♦</td>
</tr>
<tr>
<td>HIRL</td>
<td>5</td>
<td>Off or Low</td>
<td>♦</td>
</tr>
<tr>
<td>VASI</td>
<td>2</td>
<td>Off</td>
<td>*</td>
</tr>
</tbody>
</table>

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

**Runways Without Approach Lights**

<table>
<thead>
<tr>
<th>Lighting System</th>
<th>No. of Int. Steps</th>
<th>Status During Nonuse Period</th>
<th>Intensity Step Selected Per No. of Mike Clicks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>3 Clicks</td>
</tr>
<tr>
<td>MIRL</td>
<td>3</td>
<td>Off or Low</td>
<td>Low</td>
</tr>
<tr>
<td>HIRL</td>
<td>5</td>
<td>Off or Low</td>
<td>Step 1 or 2</td>
</tr>
<tr>
<td>LIRL</td>
<td>1</td>
<td>Off</td>
<td>On</td>
</tr>
<tr>
<td>VASI*</td>
<td>2</td>
<td>Off</td>
<td>♦</td>
</tr>
<tr>
<td>REIL*</td>
<td>1</td>
<td>Off</td>
<td>Off</td>
</tr>
<tr>
<td>REIL*</td>
<td>3</td>
<td>Off</td>
<td>Low</td>
</tr>
</tbody>
</table>

**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.
d. For all public use airports with FAA standard systems the Airport/Facility Directory 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 Airport/Facility Directory 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 Airport/Facility Directory 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:
  1. 24 to 30 per minute for beacons marking airports, landmarks, and points on Federal airways.
  2. 30 to 45 per minute for beacons marking heliports.

- **b.** The colors and color combinations of beacons are:
  1. White and Green—Lighted land airport.
  3. White and Yellow—Lighted water airport.
  4. *Yellow alone—Lighted water airport.
  5. Green, Yellow, and White—Lighted heliport.

**NOTE**—
*Green alone or yellow alone is used only in connection with a white-and-green or white-and-yellow beacon display, respectively.

e. Military airport beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes.

d. In Class B, Class C, Class D and Class E surface areas, operation of the airport beacon during the hours of daylight often indicates that the ground visibility is less than 3 miles and/or the ceiling is less than 1,000 feet. ATC clearance in accordance with 14 CFR Part 91 is required for landing, takeoff and flight in the traffic pattern. Pilots should not rely solely on the operation of the airport beacon to indicate if weather conditions are IFR or VFR. At some locations with operating control towers, ATC personnel turn the beacon on or off when controls are in the tower. At many airports the airport beacon is turned on by a photoelectric cell or time clocks and ATC personnel cannot control them. There is no regulatory requirement for daylight operation and it is the pilot’s responsibility to comply with proper preflight planning as required by 14 CFR Section 91.103.

### 2–1–10. Taxiway Lights

- **a.** Taxiway Edge Lights. Taxiway edge lights are used to outline the edges of taxiways during periods of darkness or restricted visibility conditions. These fixtures emit blue light.

**NOTE**—
At most major airports these lights have variable intensity settings and may be adjusted at pilot request or when deemed necessary by the controller.

- **b.** Taxiway Centerline Lights. Taxiway centerline lights are used to facilitate ground traffic under low visibility conditions. They are located along the taxiway centerline in a straight line on straight
portions, on the centerline of curved portions, and along designated taxiing paths in portions of runways, ramp, and apron areas. Taxiway centerline lights are steady burning and emit green light.

c. Clearance Bar Lights. Clearance bar lights are installed at holding positions on taxiways in order to increase the conspicuity of the holding position in low visibility conditions. They may also be installed to indicate the location of an intersecting taxiway during periods of darkness. Clearance bars consist of three in-pavement steady-burning yellow lights.

d. Runway Guard Lights. Runway guard lights are installed at taxiway/runway intersections. They are primarily used to enhance the conspicuity of taxiway/runway intersections during low visibility conditions, but may be used in all weather conditions. Runway guard lights consist of either a pair of elevated flashing yellow lights installed on either side of the taxiway, or a row of in-pavement yellow lights installed across the entire taxiway, at the runway holding position marking.

NOTE–Some airports may have a row of three or five in-pavement yellow lights installed at taxiway/runway intersections. They should not be confused with clearance bar lights described in paragraph 2–1–10c, Clearance Bar Lights.

e. Stop Bar Lights. Stop bar lights, when installed, are used to confirm the ATC clearance to enter or cross the active runway in low visibility conditions (below 1,200 ft Runway Visual Range). A stop bar consists of a row of red, unidirectional, steady–burning in-pavement lights installed across the entire taxiway at the runway holding position, and elevated steady–burning red lights on each side. A controlled stop bar is operated in conjunction with the taxiway centerline lead-on lights which extend from the stop bar toward the runway. Following the ATC clearance to proceed, the stop bar is turned off and the lead-on lights are turned on. The stop bar and lead-on lights are automatically reset by a sensor or backup timer.

CAUTION–
Pilots should never cross a red illuminated stop bar, even if an ATC clearance has been given to proceed onto or across the runway.

NOTE–
If after crossing a stop bar, the taxiway centerline lead-on lights inadvertently extinguish, pilots should hold their position and contact ATC for further instructions.
FIG 2–3–15
Taxiways Located in Runway Approach 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
2–3–15. Security Identifications Display Area (Airport Ramp Area)

a. Security Identification Display Areas (SIDA) are limited access areas that require a badge issued in accordance with procedures in CFR 49 Part 1542. Movement through or into these areas is prohibited without proper identification being displayed. If you are unsure of the location of a SIDA, contact the airport authority for additional information. Airports that have a SIDA must have the following information available:

1. A description and map detailing boundaries and pertinent features;

2. Measures used to perform the access control functions required under CFR 49 Part 1542.201(b)(1);

3. Procedures to control movement within the secured area, including identification media required under CFR 49 Part 1542.201(b)(3); and

4. A description of the notification signs required under CFR 49 Part 1542.201(b)(6).

b. Pilots or passengers without proper identification that are observed entering a SIDA (ramp area) may be reported to TSA or airport security. Pilots are advised to brief passengers accordingly.
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 Airport/Facility Directory. 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 Airport/Facility Directory.

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. VFR aircraft will be separated from VFR/IFR aircraft by one of the following:

(a) 500 feet vertical separation.

(b) Visual separation.

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

7. Participating pilots operating VFR in a TRSA:

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

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

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

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

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

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

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

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

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

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

### 4–1–19. Tower En Route Control (TEC)

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

b. Pilots requesting TEC are subject to the same delay factor at the destination airport as other aircraft in the ATC system. In addition, departure and en route delays may occur depending upon individual facility workload. When a major metropolitan airport is incurring significant delays, pilots in the TEC program may want to consider an alternative airport experiencing no delay.

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

d. All approach controls in the system may not operate up to the maximum TEC altitude of 10,000 feet. IFR flight may be planned to any satellite airport in proximity to the major primary airport via the same routing.
4–1–20. Transponder Operation

a. General

1. Pilots should be aware that proper application of transponder operating procedures will provide both VFR and IFR aircraft with a higher degree of safety in the environment where high-speed closure rates are possible. Transponders substantially increase the capability of radar to see an aircraft and the Mode C feature enables the controller to quickly determine where potential traffic conflicts may exist. Even VFR pilots who are not in contact with ATC will be afforded greater protection from IFR aircraft and VFR aircraft which are receiving traffic advisories. Nevertheless, pilots should never relax their visual scanning vigilance for other aircraft.

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

3. Civil and military transponders should be adjusted to the “on” or normal operating position as late as practicable prior to takeoff and to “off” or “standby” as soon as practicable after completing landing roll, unless the change to “standby” has been accomplished previously at the request of ATC. IN ALL CASES, WHILE IN CONTROLLED AIRSPACE EACH PILOT OPERATING AN AIRCRAFT EQUIPPED WITH AN OPERABLE ATC TRANSPONDER MAINTAINED IN ACCORDANCE WITH 14 CFR SECTION 91.413 SHALL OPERATE THE TRANSPONDER, INCLUDING MODE C IF INSTALLED, ON THE APPROPRIATE CODE OR AS ASSIGNED BY ATC. IN CLASS G AIRSPACE, THE TRANSPONDER SHOULD BE OPERATING WHILE AIRBORNE UNLESS OTHERWISE REQUESTED BY ATC.

4. A pilot on an IFR flight who elects to cancel the IFR flight plan prior to reaching destination, should adjust the transponder according to VFR operations.

5. If entering a U.S. OFFSHORE AIRSPACE AREA from outside the U.S., the pilot should advise on first radio contact with a U.S. radar ATC facility that such equipment is available by adding “transponder” to the aircraft identification.

6. It should be noted by all users of ATC transponders that the coverage they can expect is limited to “line of sight.” Low altitude or aircraft antenna shielding by the aircraft itself may result in reduced range. Range can be improved by climbing to a higher altitude. It may be possible to minimize antenna shielding by locating the antenna where dead spots are only noticed during abnormal flight attitudes.

7. If operating at an airport with Airport Surface Detection Equipment – Model X (ASDE–X), transponders should be transmitting (on position) continuously with altitude reporting while moving on the airport surface.

8. Aircraft equipped with ADS–B (1090 ES or UAT) must operate the equipment in the transmit mode (on position) at all times while on any airport surface.

NOTE – Pilots of aircraft equipped with ADS–B should refer to AIM, Automatic Dependant Surveillance – Broadcast Services, Paragraph 4–5–7 for a complete description of operating limitations and procedures.

b. Transponder Code Designation

1. For ATC to utilize one or a combination of the 4096 discrete codes FOUR DIGIT CODE DESIGNATION will be used, e.g., code 2100 will be expressed as TWO ONE ZERO ZERO. Due to the operational characteristics of the rapidly expanding automated ATC system, THE LAST TWO DIGITS OF THE SELECTED TRANSPONDER CODE SHOULD ALWAYS READ “00” UNLESS SPECIFICALLY REQUESTED BY ATC TO BE OTHERWISE.

c. Automatic Altitude Reporting (Mode C)

1. Some transponders are equipped with a Mode C automatic altitude reporting capability. This system converts aircraft altitude in 100 foot increments to coded digital information which is transmitted together with Mode C framing pulses to the interrogating radar facility. The manner in which transponder panels are designed differs, therefore, a pilot should be thoroughly familiar with the operation of the transponder so that ATC may realize its full capabilities.

2. Adjust transponder to reply on the Mode A/3 code specified by ATC and, if equipped, to reply on Mode C with altitude reporting capability activated.
3. Military pilots operating VFR or IFR within restricted/warning areas should adjust their transponders to Code 4000 unless another code has been assigned by ATC.

f. Mode C Transponder Requirements

1. Specific details concerning requirements to carry and operate Mode C transponders, as well as exceptions and ATC authorized deviations from the requirements are found in 14 CFR Section 91.215 and 14 CFR Section 99.12.

2. In general, the CFRs require aircraft to be equipped with Mode C transponders when operating:
   (a) At or above 10,000 feet MSL over the 48 contiguous states or the District of Columbia, excluding that airspace below 2,500 feet AGL;
   (b) Within 30 miles of a Class B airspace primary airport, below 10,000 feet MSL. Balloons, gliders, and aircraft not equipped with an engine driven electrical system are excepted from the above requirements when operating below the floor of Class A airspace and/or outside of a Class B airspace and below the ceiling of the Class B airspace (or 10,000 feet MSL, whichever is lower);
   (c) Within and above all Class C airspace, up to 10,000 feet MSL;
   (d) Within 10 miles of certain designated airports, excluding that airspace which is both outside the Class D surface area and below 1,200 feet AGL. Balloons, gliders and aircraft not equipped with an engine driven electrical system are excepted from this requirement.

3. 14 CFR Section 99.12 requires all aircraft flying into, within, or across the contiguous U.S. ADIZ be equipped with a Mode C or Mode S transponder. Balloons, gliders and aircraft not equipped with an engine driven electrical system are excepted from this requirement.

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

5. In-flight requests for “immediate” deviation from the transponder requirement may be approved unless deactivation is directed by ATC or unless the installed aircraft equipment has not been tested and calibrated as required by 14 CFR Section 91.217. If deactivation is required by ATC, turn off the altitude reporting feature of your transponder. An instruction by ATC to “STOP ALTITUDE SQUAWK, ALTITUDE DIFFERS (number of feet) FEET,” may be an indication that your transponder is transmitting incorrect altitude information or that you have an incorrect altimeter setting. While an incorrect altimeter setting has no effect on the Mode C altitude information transmitted by your transponder (transponders are preset at 29.92), it would cause you to fly at an actual altitude different from your assigned altitude. When a controller indicates that an altitude readout is invalid, the pilot should initiate a check to verify that the aircraft altimeter is set correctly.

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

d. Transponder IDENT Feature

1. The transponder shall be operated only as specified by ATC. Activate the “IDENT” feature only upon request of the ATC controller.

e. Code Changes

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

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

3. When making routine code changes, pilots should avoid inadvertent selection of Codes 7500, 7600 or 7700 thereby causing momentary false alarms at automated ground facilities.
Services Available to Pilots

by controllers only when the flight will continue IFR
or when weather conditions prevent VFR descent and
continued VFR flight in airspace not affected by the
CFRs. All other requests for deviation should be
made by contacting the nearest Flight Service or
Air Traffic facility in person or by telephone. The
nearest ARTCC will normally be the controlling
agency and is responsible for coordinating requests
involving deviations in other ARTCC areas.

g. Transponder Operation Under Visual Flight
Rules (VFR)

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

2. Adjust transponder to reply on Mode C, with
altitude reporting capability activated if the aircraft
is so equipped, unless deactivation is directed by ATC
or unless the installed equipment has not been tested
and calibrated as required by 14 CFR Section 91.217.
If deactivation is required and your transponder is so
designed, turn off the altitude reporting switch and
continue to transmit Mode C framing pulses. If this
capability does not exist, turn off Mode C.

h. Radar Beacon Phraseology

Air traffic controllers, both civil and military, will use
the following phraseology when referring to
operation of the Air Traffic Control Radar Beacon
System (ATCRBS). Instructions by ATC refer only to
Mode A/3 or Mode C operation and do not affect the
operation of the transponder on other Modes.

1. SQUAWK (number). Operate radar beacon
transponder on designated code in Mode A/3.

2. IDENT. Engage the “IDENT” feature (military
I/P) of the transponder.

3. SQUAWK (number) and IDENT. Operate
transponder on specified code in Mode A/3 and
engage the “IDENT” (military I/P) feature.

4. SQUAWK STANDBY. Switch transponder
to standby position.

5. SQUAWK LOW/NORMAL. Operate
transponder on low or normal sensitivity as specified.
Transponder is operated in “NORMAL” position
unless ATC specifies “LOW” (“ON” is used instead
of “NORMAL” as a master control label on some
types of transponders.)

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

7. STOP ALTITUDE SQUAWK. Turn off
altitude reporting switch and continue transmitting
Mode C framing pulses. If your equipment does not
have this capability, turn off Mode C.

8. STOP SQUAWK (mode in use). Switch off
specified mode. (Used for military aircraft when the
controller is unaware of military service requirements
for the aircraft to continue operation on another
Mode.)

9. STOP SQUAWK. Switch off transponder.

10. SQUAWK MAYDAY. Operate transponder
in the emergency position (Mode A Code 7700 for
civil transponder. Mode 3 Code 7700 and emergency
feature for military transponder.)

11. SQUAWK VFR. Operate radar beacon
transponder on Code 1200 in the Mode A/3, or other
appropriate VFR code.
4–1–21. Hazardous Area Reporting Service

a. Selected FSSs provide flight monitoring where regularly traveled VFR routes cross large bodies of water, swamps, and mountains. This service is provided for the purpose of expeditiously alerting Search and Rescue facilities when required. (See FIG 4–1–3.)

1. When requesting the service either in person, by telephone or by radio, pilots should be prepared to give the following information: type of aircraft, altitude, indicated airspeed, present position, route of flight, heading.

2. Radio contacts are desired at least every 10 minutes. If contact is lost for more than 15 minutes, Search and Rescue will be alerted. Pilots are responsible for canceling their request for service when they are outside the service area boundary. Pilots experiencing two-way radio failure are expected to land as soon as practicable and cancel their request for the service. FIG 4–1–3 depicts the areas and the FSS facilities involved in this program.

b. Long Island Sound Reporting Service.

New York and Bridgeport FSS Radio Sectors provide Long Island Sound Reporting service on request for aircraft traversing Long Island Sound.

1. When requesting the service, pilots should ask for SOUND REPORTING SERVICE and should be prepared to provide the following appropriate information:

(a) Type and color of aircraft;
(b) The specific route and altitude across the sound including the shore crossing point;
(c) The overwater crossing time;
(d) Number of persons on board; and
(e) True air speed.
4–3–4. Visual Indicators at Airports Without an Operating Control Tower

a. At those airports without an operating control tower, a segmented circle visual indicator system, if installed, is designed to provide traffic pattern information.

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

b. The segmented circle system consists of the following components:

1. The segmented circle. Located in a position affording maximum visibility to pilots in the air and on the ground and providing a centralized location for other elements of the system.

2. The wind direction indicator. A wind cone, wind sock, or wind tee installed near the operational runway to indicate wind direction. The large end of the wind cone/wind sock points into the wind as does the large end (cross bar) of the wind tee. In lieu of a tetrahedron and where a wind sock or wind cone is collocated with a wind tee, the wind tee may be manually aligned with the runway in use to indicate landing direction. These signaling devices may be located in the center of the segmented circle and may be lighted for night use. Pilots are cautioned against using a tetrahedron to indicate wind direction.

3. The landing direction indicator. A tetrahedron is installed when conditions at the airport warrant its use. It may be used to indicate the direction of landings and takeoffs. A tetrahedron may be located at the center of a segmented circle and may be lighted for night operations. The small end of the tetrahedron points in the direction of landing. Pilots are cautioned against using a tetrahedron for any purpose other than as an indicator of landing direction. Further, pilots should use extreme caution when making runway selection by use of a tetrahedron in very light or calm wind conditions as the tetrahedron may not be aligned with the designated calm-wind runway. At airports with control towers, the tetrahedron should only be referenced when the control tower is not in operation. Tower instructions supersede tetrahedron indications.

4. Landing strip indicators. Installed in pairs as shown in the segmented circle diagram and used to show the alignment of landing strips.

5. Traffic pattern indicators. Arranged in pairs in conjunction with landing strip indicators and used to indicate the direction of turns when there is a variation from the normal left traffic pattern. (If there is no segmented circle installed at the airport, traffic pattern indicators may be installed on or near the end of the runway.)

c. Preparatory to landing at an airport without a control tower, or when the control tower is not in operation, pilots should concern themselves with the indicator for the approach end of the runway to be used. When approaching for landing, all turns must be made to the left unless a traffic pattern indicator indicates that turns should be made to the right. If the pilot will mentally enlarge the indicator for the runway to be used, the base and final approach legs of the traffic pattern to be flown immediately become apparent. Similar treatment of the indicator at the departure end of the runway will clearly indicate the direction of turn after takeoff.

d. When two or more aircraft are approaching an airport for the purpose of landing, the pilot of the aircraft at the lower altitude has the right-of-way over the pilot of the aircraft at the higher altitude. However, the pilot operating at the lower altitude should not take advantage of another aircraft, which is on final approach to land, by cutting in front of, or overtaking that aircraft.
4–3–5. Unexpected Maneuvers in the Airport Traffic Pattern

There have been several incidents in the vicinity of controlled airports that were caused primarily by aircraft executing unexpected maneuvers. ATC service is based upon observed or known traffic and airport conditions. Controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight as necessary to achieve proper spacing. These adjustments can only be based on observed traffic, accurate pilot reports, and anticipated aircraft maneuvers. Pilots are expected to cooperate so as to preclude disrupting traffic flows or creating conflicting patterns. The pilot-in-command of an aircraft is directly responsible for and is the final authority as to the operation of the aircraft. On occasion it may be necessary for pilots to maneuver their aircraft to maintain spacing with the traffic they have been sequenced to follow. The controller can anticipate minor maneuvering such as shallow “S” turns. The controller cannot, however, anticipate a major maneuver such as a 360 degree turn. If a pilot makes a 360 degree turn after obtaining a landing sequence, the result is usually a gap in the landing interval and, more importantly, it causes a chain reaction which may result in a conflict with following traffic and an interruption of the sequence established by the tower or approach controller. Should a pilot decide to make maneuvering turns to maintain spacing behind a preceding aircraft, the pilot should always advise the controller if at all possible. Except when requested by the controller or in emergency situations, a 360 degree turn should never be executed in the traffic pattern or when receiving radar service without first advising the controller.

4–3–6. Use of Runways/Declared Distances

a. Runways are identified by numbers which indicate the nearest 10–degree increment of the azimuth of the runway centerline. For example, where the magnetic azimuth is 183 degrees, the runway designation would be 18; for a magnetic azimuth of 87 degrees, the runway designation would be 9. For a magnetic azimuth ending in the number 5, such as 185, the runway designation could be either 18 or 19. Wind direction issued by the tower is also magnetic and wind velocity is in knots.

b. Airport proprietors are responsible for taking the lead in local aviation noise control. Accordingly, they may propose specific noise abatement plans to the FAA. If approved, these plans are applied in the form of Formal or Informal Runway Use Programs for noise abatement purposes.

REFERENCE—
Pilot/Controller Glossary Term— “Runway Use Program”

1. At airports where no runway use program is established, ATC clearances may specify:
   (a) The runway most nearly aligned with the wind when it is 5 knots or more;
   (b) The “calm wind” runway when wind is less than 5 knots; or
   (c) Another runway if operationally advantageous.

NOTE—
It is not necessary for a controller to specifically inquire if the pilot will use a specific runway or to offer a choice of runways. If a pilot prefers to use a different runway from that specified, or the one most nearly aligned with the wind, the pilot is expected to inform ATC accordingly.

2. At airports where a runway use program is established, ATC will assign runways deemed to have the least noise impact. If in the interest of safety a runway different from that specified is preferred, the pilot is expected to advise ATC accordingly. ATC will honor such requests and advise pilots when the requested runway is noise sensitive. When use of a runway other than the one assigned is requested, pilot cooperation is encouraged to preclude disruption of traffic flows or the creation of conflicting patterns.

c. Declared Distances.

1. Declared distances for a runway represent the maximum distances available and suitable for meeting takeoff and landing distance performance requirements. These distances are determined in accordance with FAA runway design standards by adding to the physical length of paved runway any clearway or stopway and subtracting from that sum any lengths necessary to obtain the standard runway safety areas, runway object free areas, or runway protection zones. As a result of these additions and subtractions, the declared distances for a runway may be more or less than the physical length of the runway as depicted on aeronautical charts and related publications, or available in electronic navigation databases provided by either the U.S. Government or commercial companies.

2. All 14 CFR Part 139 airports report declared distances for each runway. Other airports may also
report declared distances for a runway if necessary to meet runway design standards or to indicate the presence of a clearway or stopway. Where reported, declared distances for each runway end are published in the Airport/Facility Directory (A/FD). 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 is shown on U.S. Government charts to indicate that runway declared distance information is available (See appropriate A/FD, Alaska, or Pacific Supplement).

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

**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 A/FD’s entry for that runway end.

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 A/FD’s entry for that runway end.

(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 4–3–5). 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 4–3–5). The following examples clarify the intent of this paragraph.

**REFERENCE—**
AIM, Runway Markings, Paragraph 2–3–3
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.
Declared Distances with Full–Standard Runway Safety Areas, Runway Object Free Areas, and Runway Protection Zones

Note: - All declared distances in this illustration are based on operations from left to right

<table>
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<th>Runway</th>
<th>Length (feet)</th>
<th>TORA</th>
<th>ASDA</th>
<th>TODA</th>
<th>LDA</th>
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<td>8700</td>
<td>7700</td>
</tr>
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</table>
**FIG 4–3–5**

Effects of a Geographical Constraint on a Runway’s Declared Distances

**Runway 27 operations:** Runway 27 threshold displaced to provide the required RSA at the approach end of the runway. As a result, the LDA is reduced 200 ft.

**Runway 9 operations:** The ASDA is reduced by 600 ft to achieve the required RSA at the roll-out end of the runway. The LDA is reduced by 900 ft because, 1) the 300 ft displaced threshold located at the approach end of the runway (due to an approach obstacle), and 2) as result of the 600 ft of runway needed to achieve the required RSA at the roll-out end of the runway.

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<tr>
<th>Runway</th>
<th>Length (feet)</th>
<th>TORA</th>
<th>TODA</th>
<th>ASDA</th>
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<td>8000</td>
<td>7800</td>
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</tbody>
</table>

**NOTE**—A runway's RSA begins a set distance prior to the threshold and will extend a set distance beyond the end of the runway depending on the runway's design criteria. If these required lengths cannot be achieved, the ASDA and/or LDA will be reduced as necessary to obtain the required lengths to the extent practicable.
4–3–7. Low Level Wind Shear/Microburst Detection Systems

Low Level Wind Shear Alert System (LLWAS), Terminal Doppler Weather Radar (TDWR), Weather System Processor (WSP), and Integrated Terminal Weather System (ITWS) display information on hazardous wind shear and microburst activity in the vicinity of an airport to air traffic controllers who relay this information to pilots.

a. LLWAS provides wind shear alert and gust front information but does not provide microburst alerts. The LLWAS is designed to detect low level wind shear conditions around the periphery of an airport. It does not detect wind shear beyond that limitation. Controllers will provide this information to pilots by giving the pilot the airport wind followed by the boundary wind.

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, Microbursts, Paragraph 7–1–26

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 Airport/Facility Directory 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 or airport management. The quality of braking action is described by the terms “good,” “fair,” “poor,” and “nil,” or a combination of these terms. 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. For NOTAM purposes, braking action reports are classified according to the most critical term (“fair,” “poor,” or “nil”) used and issued as a NOTAM(D).

c. When tower controllers have received runway braking action reports which include the terms 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 latest 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 volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

4–3–9. Runway Friction Reports and Advisories

a. Friction is defined as the ratio of the tangential force needed to maintain uniform relative motion between two contacting surfaces (aircraft tires to the
pavement surface) to the perpendicular force holding them in contact (distributed aircraft weight to the aircraft tire area). Simply stated, friction quantifies slipperiness of pavement surfaces.

b. The greek letter MU (pronounced “myew”), is used to designate a friction value representing runway surface conditions.

c. MU (friction) values range from 0 to 100 where zero is the lowest friction value and 100 is the maximum friction value obtainable. For frozen contaminants on runway surfaces, a MU value of 40 or less is the level when the aircraft braking performance starts to deteriorate and directional control begins to be less responsive. The lower the MU value, the less effective braking performance becomes and the more difficult directional control becomes.

d. At airports with friction measuring devices, airport management should conduct friction measurements on runways covered with compacted snow and/or ice.

1. Numerical readings may be obtained by using any FAA approved friction measuring device. As these devices do not provide equal numerical readings on contaminated surfaces, it is necessary to designate the type of friction measuring device used.

2. When the MU value for any one-third zone of an active runway is 40 or less, a report should be given to ATC by airport management for dissemination to pilots. The report will identify the runway, the time of measurement, the type of friction measuring device used, MU values for each zone, and the contaminant conditions, e.g., wet snow, dry snow, slush, deicing chemicals, etc. Measurements for each one-third zone will be given in the direction of takeoff and landing on the runway. A report should also be given when MU values rise above 40 in all zones of a runway previously reporting a MU below 40.

3. Airport management should initiate a NOTAM(D) when the friction measuring device is out of service.

e. When MU reports are provided by airport management, the ATC facility providing approach control or local airport advisory will provide the report to any pilot upon request.

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

g. No correlation has been established between MU values and the descriptive terms “good,” “fair,” “poor,” and “nil” used in braking action reports.

### 4–3–10. Intersection Takeoffs

a. In order to enhance airport capacities, reduce taxiing distances, minimize departure delays, and provide for more efficient movement of air traffic, controllers may initiate intersection takeoffs as well as approve them when the pilot requests. If for ANY reason a pilot prefers to use a different intersection or the full length of the runway or desires to obtain the distance between the intersection and the runway end, THE PILOT IS EXPECTED TO INFORM ATC ACCORDINGLY.

b. Pilots are expected to assess the suitability of an intersection for use at takeoff during their preflight planning. They must consider the resultant length reduction to the published runway length and to the published declared distances from the intersection intended to be used for takeoff. The minimum runway required for takeoff must fall within the reduced runway length and the reduced declared distances before the intersection can be accepted for takeoff.

REFERENCE– AIM, Use of Runways/Declared Distances, Paragraph 4–3–6

c. Controllers will issue the measured distance from the intersection to the runway end rounded “down” to the nearest 50 feet to any pilot who requests and to all military aircraft, unless use of the intersection is covered in appropriate directives. Controllers, however, will not be able to inform pilots of the distance from the intersection to the end of any of the published declared distances.


d. An aircraft is expected to taxi to (but not onto) the end of the assigned runway unless prior approval for an intersection departure is received from ground control.

e. Pilots should state their position on the airport when calling the tower for takeoff from a runway intersection.

EXAMPLE– Cleveland Tower, Apache Three Seven Two Two Papa, at the intersection of taxiway Oscar and runway two three right, ready for departure.
f. Controllers are required to separate small aircraft (12,500 pounds or less, maximum certificated takeoff weight) departing (same or opposite direction) from an intersection behind a large nonheavy aircraft on the same runway, by ensuring that at least a 3-minute interval exists between the time the preceding large aircraft has taken off and the succeeding small aircraft begins takeoff roll. To inform the pilot of the required 3-minute hold, the controller will state, “Hold for wake turbulence.” If after considering wake turbulence hazards, the pilot feels that a lesser time interval is appropriate, the pilot may request a waiver to the 3-minute interval. To initiate such a request, simply say “Request waiver to 3-minute interval,” or a similar statement. Controllers may then issue a takeoff clearance if other traffic permits, since the pilot has accepted the responsibility for wake turbulence separation.

g. The 3-minute interval is not required when the intersection is 500 feet or less from the departure point of the preceding aircraft and both aircraft are taking off in the same direction. Controllers may permit the small aircraft to alter course after takeoff to avoid the flight path of the preceding departure.

h. The 3-minute interval is mandatory behind a heavy aircraft in all cases.

4–3–11. Pilot Responsibilities When Conducting Land and Hold Short Operations (LAHSO)

a. LAHSO is an acronym for “Land and Hold Short Operations.” These operations include landing and holding short of an intersecting runway, an intersecting taxiway, or some other designated point on a runway other than an intersecting runway or taxiway. (See FIG 4–3–6, FIG 4–3–7, FIG 4–3–8.)

b. Pilot Responsibilities and Basic Procedures.

1. LAHSO is an air traffic control procedure that requires pilot participation to balance the needs for increased airport capacity and system efficiency, consistent with safety. This procedure can be done safely provided pilots and controllers are knowledgeable and understand their responsibilities. The following paragraphs outline specific pilot/operator responsibilities when conducting LAHSO.

2. At controlled airports, air traffic may clear a pilot to land and hold short. Pilots may accept such a clearance provided that the pilot—in—command determines that the aircraft can safely land and stop within the Available Landing Distance (ALD). ALD data are published in the special notices section of the Airport/Facility Directory (A/FD) 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.
EXAMPLE—
FIG 4–3–8 — 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.

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 acknowledgment of all LAHSO clearances. In order to reduce frequency congestion, pilots are encouraged to read back the LAHSO clearance.
without prompting. Don’t make the controller have to ask for a read back!

c. LAHSO Situational Awareness

1. Situational awareness is **vital** to the success of LAHSO. Situational awareness starts with having current airport information in the cockpit, readily accessible to the pilot. (An airport diagram assists pilots in identifying their location on the airport, thus reducing requests for “progressive taxi instructions” from controllers.)

2. Situational awareness includes effective pilot–controller radio communication. ATC expects pilots to specifically acknowledge and read back all LAHSO clearances as follows:

   **EXAMPLE**–
   
   **ATC:** “(Aircraft ID) cleared to land runway six right, hold short of taxiway bravo for crossing traffic (type aircraft).”
   **Aircraft:** “(Aircraft ID), wilco, cleared to land runway six right to hold short of taxiway bravo.”
   **ATC:** “(Aircraft ID) cross runway six right at taxiway bravo, landing aircraft will hold short.”
   **Aircraft:** “(Aircraft ID), wilco, cross runway six right at bravo, landing traffic (type aircraft) to hold.”

3. For those airplanes flown with two crewmembers, effective **intra–cockpit** communication between cockpit crewmembers is also critical. There have been several instances where the pilot working the radios accepted a LAHSO clearance but then simply forgot to tell the pilot flying the aircraft.

4. Situational awareness also includes a thorough understanding of the airport markings, signage, and lighting associated with LAHSO. These visual aids consist of a three–part system of **yellow hold–short markings, red and white signage** and, in certain cases, **in–pavement lighting**. Visual aids assist the pilot in determining where to hold short. FIG 4–3–6, FIG 4–3–7, FIG 4–3–8 depict how these markings, signage, and lighting combinations will appear once installed. Pilots are cautioned that not all airports conducting LAHSO have installed any or all of the above markings, signage, or lighting.

5. Pilots should only receive a LAHSO clearance when there is a minimum ceiling of 1,000 feet and 3 statute miles visibility. The intent of having “basic” VFR weather conditions is to allow pilots to maintain visual contact with other aircraft and ground vehicle operations. Pilots should consider the effects of prevailing inflight visibility (such as landing into the sun) and how it may affect overall situational awareness. Additionally, surface vehicles and aircraft being taxied by maintenance personnel may also be participating in LAHSO, especially in those operations that involve crossing an active runway.

### 4–3–12. Low Approach

a. A low approach (sometimes referred to as a low pass) is the go-around maneuver following an approach. Instead of landing or making a touch-and-go, a pilot may wish to go around (low approach) in order to expedite a particular operation (a series of practice instrument approaches is an example of such an operation). Unless otherwise authorized by ATC, the low approach should be made straight ahead, with no turns or climb made until the pilot has made a thorough visual check for other aircraft in the area.

b. When operating within a Class B, Class C, and Class D surface area, a pilot intending to make a low approach should contact the tower for approval. This request should be made prior to starting the final approach.

c. When operating to an airport, not within a Class B, Class C, and Class D surface area, a pilot intending to make a low approach should, prior to leaving the final approach fix inbound (nonprecision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach), so advise the FSS, UNICOM, or make a broadcast as appropriate.

**REFERENCE**–

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

### 4–3–13. Traffic Control Light Signals

a. The following procedures are used by ATCTs in the control of aircraft, ground vehicles, equipment, and personnel not equipped with radio. These same procedures will be used to control aircraft, ground vehicles, equipment, and personnel equipped with radio if radio contact cannot be established. ATC personnel use a directive traffic control signal which emits an intense narrow light beam of a selected color (either red, white, or green) when controlling traffic by light signals.
b. Although the traffic signal light offers the advantage that some control may be exercised over nonradio equipped aircraft, pilots should be cognizant of the disadvantages which are:

1. Pilots may not be looking at the control tower at the time a signal is directed toward their aircraft.

2. The directions transmitted by a light signal are very limited since only approval or disapproval of a pilot’s anticipated actions may be transmitted. No supplement or explanatory information may be transmitted except by the use of the “General Warning Signal” which advises the pilot to be on the alert.

c. Between sunset and sunrise, a pilot wishing to attract the attention of the control tower should turn on a landing light and taxi the aircraft into a position, clear of the active runway, so that light is visible to the tower. The landing light should remain on until appropriate signals are received from the tower.

d. Air Traffic Control Tower Light Gun Signals. (See TBL 4–3–1.)

e. 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.

<table>
<thead>
<tr>
<th>Color and Type of Signal</th>
<th>Movement of Vehicles, Equipment and Personnel</th>
<th>Aircraft on the Ground</th>
<th>Aircraft in Flight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steady green</td>
<td>Cleared to cross, proceed or go</td>
<td>Cleared for takeoff</td>
<td>Cleared to land</td>
</tr>
<tr>
<td>Flashing green</td>
<td>Not applicable</td>
<td>Cleared for taxi</td>
<td>Return for landing (to be followed by steady green at the proper time)</td>
</tr>
<tr>
<td>Steady red</td>
<td>STOP</td>
<td>STOP</td>
<td>Give way to other aircraft and continue circling</td>
</tr>
<tr>
<td>Flashing red</td>
<td>Clear the taxiway/runway</td>
<td>Taxi clear of the runway in use</td>
<td>Airport unsafe, do not land</td>
</tr>
<tr>
<td>Flashing white</td>
<td>Return to starting point on airport</td>
<td>Return to starting point on airport</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Alternating red and green</td>
<td>Exercise extreme caution</td>
<td>Exercise extreme caution</td>
<td>Exercise extreme caution</td>
</tr>
</tbody>
</table>

4–3–14. Communications

a. Pilots of departing aircraft should communicate with the control tower on the appropriate ground control/clearance delivery frequency prior to starting engines to receive engine start time, taxi and/or clearance information. Unless otherwise advised by the tower, remain on that frequency during taxiing and runup, then change to local control frequency when ready to request takeoff clearance.

NOTE—
Pilots are encouraged to monitor the local tower frequency as soon as practical consistent with other ATC requirements.

REFERENCE—
AIM, Automatic Terminal Information Service (ATIS), Paragraph 4–1–13

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.

c. The majority of ground control frequencies are in the 121.6–121.9 MHz bandwidth. Ground control frequencies are provided to eliminate frequency congestion on the tower (local control) frequency and are limited to communications between the tower and aircraft on the ground and between the tower and utility vehicles on the airport. Provide a clear VHF channel for arriving and departing aircraft. They are used for issuance of taxi 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 4–3–20, 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, helipad and heliport (See Pilot/Controller Glossary). These areas may be improved or unimproved and may be separate from or located on an airport/heliport. ATC will issue takeoff clearances from _movement_ areas other than active runways, or in diverse directions from active runways, with additional instructions as necessary. Whenever possible, takeoff clearance will be issued in lieu of extended hover/air taxi operations. Phraseology will be “CLEARED FOR TAKEOFF FROM (taxiway, helipad, runway number, etc.), MAKE RIGHT/LEFT TURN FOR (direction, heading, NAVAID radial) DEPARTURE/DEPARTURE ROUTE (number, name, etc.).” Unless requested by the pilot, downwind takeoffs will not be issued if the tailwind exceeds 5 knots.

2. Pilots should be alert to wind information as well as to wind indications in the vicinity of the helicopter. ATC should be advised of the intended method of departing. A pilot request to takeoff in a given direction indicates that the pilot is willing to accept the wind condition and controllers will honor the request if traffic permits. Departure points could be a significant distance from the control tower and it may be difficult or impossible for the controller to determine the helicopter’s relative position to the wind.
3. If takeoff is requested from nonmovement areas, the phraseology “PROCEED AS REQUESTED” will be used. Additional instructions will be issued as necessary. The pilot is responsible for operating in a safe manner and should exercise due caution. When other known traffic is not a factor and takeoff is requested from an area not visible from the tower, an area not authorized for helicopter use, an unlighted area at night, or an area not on the airport, the phraseology “DEPARTURE FROM (location) WILL BE AT YOUR OWN RISK (with reason, and additional instructions as necessary).”

4. Similar phraseology is used for helicopter landing operations. Every effort will be made to permit helicopters to proceed direct and land as near as possible to their final destination on the airport. Traffic density, the need for detailed taxiing instructions, frequency congestion, or other factors may affect the extent to which service can be expedited. As with ground movement operations, a high degree of pilot/controller cooperation and communication is necessary to achieve safe and efficient operations.

4–3–18. Taxiing

a. General. Approval must be obtained prior to moving an aircraft or vehicle onto the movement area during the hours an Airport Traffic Control Tower is in operation.

1. Always state your position on the airport when calling the tower for taxi instructions.

2. The movement area is normally described in local bulletins issued by the airport manager or control tower. These bulletins may be found in FSSs, fixed base operators offices, air carrier offices, and operations offices.

3. The control tower also issues bulletins describing areas where they cannot provide ATC service due to nonvisibility or other reasons.

4. A clearance must be obtained prior to taxiing on a runway, taking off, or landing during the hours an Airport Traffic Control Tower is in operation.

5. A clearance must be obtained prior to crossing any runway. ATC will issue an explicit clearance for all runway crossings.

6. When assigned a takeoff runway, ATC will first specify the runway, issue taxi instructions, and state any hold short instructions or runway crossing clearances if the taxi route will cross a runway. This does not authorize the aircraft to “enter” or “cross” the assigned departure runway at any point. In order to preclude misunderstandings in radio communications, ATC will not use the word “cleared” in conjunction with authorization for aircraft to taxi.

7. When issuing taxi instructions to any point other than an assigned takeoff runway, ATC will specify the point to taxi to, issue taxi instructions, and state any hold short instructions or runway crossing clearances if the taxi route will cross a runway.

NOTE--
ATC is required to obtain a readback from the pilot of all runway hold short instructions.

8. If a pilot is expected to hold short of a runway approach (“APPCH”) area or ILS holding position (see FIG 2–3–15, Taxiways Located in Runway Approach Area), ATC will issue instructions.

9. When taxi instructions are received from the controller, pilots should always read back:

(a) The runway assignment.

(b) Any clearance to enter a specific runway.

(c) Any instruction to hold short of a specific runway or line up and wait. Controllers are required to request a readback of runway hold short assignment when it is not received from the pilot/vehicle.

b. ATC clearances or instructions pertaining to taxiing are predicated on known traffic and known physical airport conditions. Therefore, it is important that pilots clearly understand the clearance or instruction. Although an ATC clearance is issued for taxiing purposes, when operating in accordance with the CFRs, it is the responsibility of the pilot to avoid collision with other aircraft. Since “the pilot-in-command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft” the pilot should obtain clarification of any clearance or instruction which is not understood.

REFERENCE--
AIM, General, Paragraph 7–3–1

1. Good operating practice dictates that pilots acknowledge all runway crossing, hold short, or takeoff clearances unless there is some misunderstanding, at which time the pilot should query the controller until the clearance is understood.
Air traffic controllers are required to obtain from the pilot a readback of all runway hold short instructions.

2. Pilots operating a single pilot aircraft should monitor only assigned ATC communications after being cleared onto the active runway for departure. Single pilot aircraft should not monitor other than ATC communications until flight from Class B, Class C, or Class D surface area is completed. This same procedure should be practiced from after receipt of the clearance for landing until the landing and taxi activities are complete. Proper effective scanning for other aircraft, surface vehicles, or other objects should be continuously exercised in all cases.

3. If the pilot is unfamiliar with the airport or for any reason confusion exists as to the correct taxi routing, a request may be made for progressive taxi instructions which include step-by-step routing directions. Progressive instructions may also be issued if the controller deems it necessary due to traffic or field conditions (for example, construction or closed taxiways).

c. At those airports where the U.S. Government operates the control tower and ATC has authorized noncompliance with the requirement for two-way radio communications while operating within the Class B, Class C, or Class D surface area, or at those airports where the U.S. Government does not operate the control tower and radio communications cannot be established, pilots shall obtain a clearance by visual light signal prior to taxiing on a runway and prior to takeoff and landing.

d. The following phraseologies and procedures are used in radiotelephone communications with aeronautical ground stations.

1. Request for taxi instructions prior to departure. State your aircraft identification, location, type of operation planned (VFR or IFR), and the point of first intended landing.

   EXAMPLE–
   Aircraft: “Washington ground, Beechcraft One Three One Five Niner at hangar eight, ready to taxi, I-F-R to Chicago.”

   Tower: “Beechcraft one three one five niner, Washington ground, runway two seven, taxi via taxiways Charlie and Delta, hold short of runway three three left.”

   Aircraft: “Beechcraft One Three One Five Niner, hold short of runway three three left.”

   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.”

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, Surface Movement Guidance and Control System, commonly known as SMGCS (pronounced “SMIGS”) requires 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 600 feet RVR and operations less than 600 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. 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 shall 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. A clearance from ATC to taxi to the ramp authorizes the aircraft to cross all runways and taxiway intersections. Pilots not familiar with the taxi route should request specific taxi instructions from ATC.

4–3–21. 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. Separation will not be provided unless the missed approach has been approved by ATC.

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.

4–3–22. 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. 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.

4–3–23. 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. At the discretion of the pilot—in-command turn on all external illumination, including landing lights, when taxiing on, across, or holding in position on any runway. This increases the conspicuity 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. When cleared for takeoff pilots should turn on any remaining exterior lights.
4–3–24. **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.

4–3–25. **Hand Signals**

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**FIG 4–3–9**
**Signalman Directs Towing**

**FIG 4–3–10**
**Signalman’s Position**

**FIG 4–3–11**
**All Clear (O.K.)**
FIG 4–3–12
Start Engine

POINT TO ENGINE TO BE STARTED

FIG 4–3–13
Pull Chocks

FIG 4–3–14
Proceed Straight Ahead

FIG 4–3–15
Left Turn
FIG 4–3–16
Right Turn

FIG 4–3–18
Flagman Directs Pilot

FIG 4–3–17
Slow Down

FIG 4–3–19
Insert Chocks
**FIG 4–3–20**
Cut Engines

**FIG 4–3–21**
Night Operation

Use same hand movements as day operation

**FIG 4–3–22**
Stop

a. Many airports throughout the National Airspace System are equipped with either ASOS, AWSS, 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/AWSS/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 Airport/Facility Directory. 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/AWSS/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/AWSS/AWOS. All aircraft arriving or departing an ASOS/AWSS/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 effect 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, Weather Observing Programs, Paragraph 7–1–12
4–4–17. Traffic Information Service (TIS)

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

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

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

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

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

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

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

3. Center Radar Automated Radar Terminal Systems (ARTS) Processing (CENRAP) was developed to provide an alternative to a nonradar environment at terminal facilities should an ASR fail or malfunction. CENRAP sends aircraft radar beacon target information to the ASR terminal facility equipped with ARTS. Procedures used for the separation of aircraft may increase under certain conditions when a facility is utilizing CENRAP because radar target information updates at a slower rate than the normal ASR radar. Radar services for VFR aircraft are also limited during CENRAP operations because of the additional workload required to provide services to IFR aircraft.

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

4–5–4. Precision Approach Radar (PAR)

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

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

4–5–5. Airport Surface Detection Equipment – Model X (ASDE–X)

a. The Airport Surface Detection Equipment – Model X (ASDE–X) is a multi-sensor surface surveillance system the FAA is acquiring for airports in the United States. This system will provide high resolution, short-range, clutter free surveillance information about aircraft and vehicles, both moving and fixed, located on or near the surface of the airport’s runways and taxiways under all weather and visibility conditions. The system consists of:

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

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

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

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

b. The combination of data collected from the multiple sensors ensures that the most accurate information about aircraft location is received in the tower, thereby increasing surface safety and efficiency.
c. The following facilities have been projected to receive ASDE–X:

<table>
<thead>
<tr>
<th>Facility</th>
<th>Airport Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>STL</td>
<td>Lambert–St. Louis International</td>
</tr>
<tr>
<td>CLT</td>
<td>Charlotte Douglas International</td>
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<tr>
<td>SDF</td>
<td>Louisville International Standiford</td>
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<tr>
<td>DFW</td>
<td>Dallas/Ft. Worth International</td>
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<tr>
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<td>PVD</td>
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<tr>
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</tr>
<tr>
<td>RDU</td>
<td>Raleigh–Durham International</td>
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<tr>
<td>HOU</td>
<td>William P. Hobby (Houston, TX)</td>
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<tr>
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<tr>
<td>SMF</td>
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<td>FLL</td>
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<tr>
<td>HNL</td>
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<td>Indianapolis International</td>
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<td>SJU</td>
<td>San Juan International</td>
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### 4–5–6. Traffic Information Service (TIS)

#### a. Introduction

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

#### b. Requirements

1. In order to use TIS, the client and any intruder aircraft must be equipped with the appropriate cockpit equipment and fly within the radar coverage of a Mode S radar capable of providing TIS. Typically, this will be within 55 NM of the sites depicted in FIG 4–5–5, Terminal Mode S Radar Sites. ATC communication is not a requirement to receive TIS, although it may be required by the particular airspace or flight operations in which TIS is being used.
indicated in FIG 4–5–4. TIS users must be alert to altitude encoder malfunctions, as TIS has no mechanism to determine if client altitude reporting is correct. A failure of this nature will cause erroneous and possibly unpredictable TIS operation. If this malfunction is suspected, confirmation of altitude reporting with ATC is suggested.

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

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

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

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

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

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

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

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

2) When a rapidly closing intruder is on a course that crosses the client at a shallow angle (either overtaking or head on) and either aircraft abruptly changes course within ¼ NM, TIS will display the intruder on the opposite side of the client than it actually is. These are relatively rare occurrences and will be corrected in a few radar scans once the course has stabilized.

(g) Heading/Course Reference. Not all TIS aircraft installations will have onboard heading reference information. In these installations, aircraft course reference to the TIS display is provided by the
Mode S radar. The radar only determines ground track information and has no indication of the client aircraft heading. In these installations, all intruder bearing information is referenced to ground track and does not account for wind correction. Additionally, since ground-based radar will require several scans to determine aircraft course following a course change, a lag in TIS display orientation (intruder aircraft bearing) will occur. As in (f) above, intruder distance and altitude are still usable.

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

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

e. Reports of TIS Malfunctions

1. Users of TIS can render valuable assistance in the early correction of malfunctions by reporting their observations of undesirable performance. Reporters should identify the time of observation, location, type and identity of aircraft, and describe the condition observed; the type of transponder processor, and software in use can also be useful information. Since TIS performance is monitored by maintenance personnel rather than ATC, it is suggested that malfunctions be reported in the following ways:

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

(b) By FAA Form 8740–5, Safety Improvement Report, a postage-paid card designed for this purpose. These cards may be obtained at FAA FSSs, General Aviation District Offices, Flight Standards District Offices, and General Aviation Fixed Based Operations.

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

a. Introduction

1. Automatic Dependent Surveillance–Broadcast (ADS–B) is a surveillance technology being deployed throughout the NAS (see FIG 4–5–7). The ADS–B system is composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft by using the GNSS and transmit its position along with additional information about the aircraft to ground stations for use by ATC and other ADS–B services. This information is transmitted at a rate of approximately once per second.

2. In the United States, ADS–B equipped aircraft exchange information is on one of two frequencies: 978 or 1090 MHz. The 1090 MHz frequency is associated with Mode A, C, and S transponder operations. 1090 MHz transponders with integrated ADS–B functionality extend the transponder message sets with additional ADS–B information. This additional information is known as an “extended squitter” message and referred to as 1090ES. ADS–B equipment operating on 978 MHz is known as the Universal Access Transceiver (UAT).
3. ADS B avionics can have the ability to both transmit and receive information. The transmission of ADS–B information from an aircraft is known as ADS–B Out. The receipt of ADS–B information by an aircraft is known as ADS–B In. On January 1, 2020, all aircraft operating within the airspace defined in 14 CFR part 91, § 91.225 will be required to transmit the information defined in § 91.227 using ADS–B Out avionics.

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

b. ADS–B Certification and Performance Requirements

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

c. ADS–B Capabilities

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

2. ADS–B avionics typically allow pilots to enter the aircraft’s call sign and Air Traffic Control (ATC)–assigned transponder code, which will be transmitted to other aircraft and ground receivers. Pilots are cautioned to use care when selecting and
entering the aircraft’s identification and transponder codes. Some installations may require separate entries of this information into both the ADS–B system and the transponder. Therefore, it is extremely important to ensure that the transponder and ADS–B codes being transmitted are identical to avoid false conflict alerts within the ATC system.

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

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

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

1. Preflight:

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

2. Inflight:

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

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

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

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

**PHRASEOLOGY** – YOUR ADS–B TRANSMITTER APPEARS TO BE INOPERATIVE/MALFUNCTIONING. STOP ADS–B TRANSMISSIONS.

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

**PHRASEOLOGY** – (Name of facility) GROUND BASED TRANSCIEVER INOPERATIVE/MALFUNCTIONING. (And if appropriate) RADAR CONTACT LOST.

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

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

**PHRASEOLOGY** – STOP ADS–B TRANSMISSIONS.

(d) Other malfunctions and considerations:

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

e. ADS–B Limitations

1. The ADS–B cockpit display of traffic is NOT intended to be used as a collision avoidance system and does not relieve the pilot’s responsibility to “see and avoid” other aircraft. (See paragraph 5–5–8, See and Avoid). ADS–B shall not be used for avoidance maneuvers during IMC or other times when there is no visual contact with the intruder aircraft. ADS–B is intended only to assist in visual acquisition of other aircraft. No avoidance maneuvers are provided nor authorized, as a direct result of an ADS–B target being displayed in the cockpit.
2. Use of ADS–B radar services is limited to the service volume of the GBT.

NOTE—
The coverage volume of GBTs are limited to line–of–sight.

f. Reports of ADS–B Malfunctions

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

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

2. By FAA Form 8740–5, Safety Improvement Report, a postage–paid card is designed for this purpose. These cards may be obtained from FAA FSSs, Flight Standards District Offices, and general aviation fixed–based operators.


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

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

a. TIS–B Requirements.

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

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

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

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

b. TIS–B Capabilities.

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

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

c. TIS–B Limitations.

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

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

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

(a) A pilot may receive an intermittent TIS–B target of themselves, typically when maneuvering (e.g., climbing turns) due to the radar not tracking the aircraft as quickly as ADS–B.
(b) The ADS−B to radar association process within the ground system may at times have difficulty correlating an ADS−B report with corresponding radar returns from the same aircraft. When this happens the pilot may see duplicate traffic symbols (i.e., “TIS−B shadows”) on the cockpit display.

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

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

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

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

d. Reports of TIS−B Malfunctions

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

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

2. By FAA Form 8740−5, Safety Improvement Report, a postage−paid card is designed for this purpose. These cards may be obtained from FAA FSSs, Flight Standards District Offices, and general aviation fixed−based operators.

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

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

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

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

REFERENCE– Advisory Circular AC–00–45, “Aviation Weather Services.”

2. Convective Significant Meteorological Conditions (SIGMET) – Text report/graphical – Convective SIGMETS (also known internationally as SIGMET for Convection) are issued for the contiguous U.S. Each bulletin includes one or more Convective SIGMETS for a specific region of the CONUS. Convective SIGMETS issued for thunderstorms and related phenomena do not include references to all weather associated with thunderstorms such as turbulence, icing, low-level wind shear and IFR conditions.

REFERENCE– Advisory Circular AC–00–45, “Aviation Weather Services.”

3. Aviation Routine Weather Reports (METAR) – Text reports – Surface meteorological data. The body of the report includes airport identifier, time of observation, wind, visibility, runway visual range, present weather phenomena, sky conditions, temperature, dew point, and alimeter setting. Remarks may be appended to the end.

REFERENCE– Advisory Circular AC–00–45, “Aviation Weather Services.”

4. Special Aviation Reports (SPECI) – Text reports – Non– routine, unscheduled report when any of SPECI criteria have been met.Contains all data elements found in METAR plus additional information which elaborates on data.


5. Next Generation Radar (NEXRAD) (CONUS and Regional) – Derived from Next Generation Weather Radar (WSR–88D). Radar mosaic consists of multiple single site radar images combined to produce a graphical image on a regional or national scale. Regional and national radar mosaics can be found at the National Weather Service (NWS) Doppler Radar Images web site: http://radar.weather.gov/ridge/.

REFERENCE– Advisory Circular AC–00–45, “Aviation Weather Services.”

6. Notice to Airmen (NOTAM) Distant and Flight Data Center (D/FDC) – Text/graphical reports – includes Temporary Flight Restrictions (TFRs) – TFR text and graphic reports, prescribes procedures used to obtain, format, and disseminate information on unanticipated or temporary changes to components of or hazards in the NAS until the associated aeronautical charts and related publications have been amended.

REFERENCE– FAA Order JO 7930.2, Notices to Airmen (NOTAM).

7. Pilot Weather Reports (PIREP) – Text report – Pilots report observations to assist other pilots with flight planning and preparation, help NWS verify forecast products, and create more accurate products for aviation community.

REFERENCE– Advisory Circular AC–00–45, “Aviation Weather Services.”

8. Significant Meteorological Information (SIGMET) – Text/graphical report – Potentially hazardous en route phenomena such as thunderstorms and hail, turbulence, icing, sand and dust storms, tropical cyclones, and volcanic ash in an area affecting 3,000 square miles or an area deemed to have a significant effect on safety of aircraft operations.

REFERENCE– Advisory Circular AC–00–45, “Aviation Weather Services.”

9. Special Use Airspace (SUA) Status – Text/graphical report – Establishes/designates airspace in the interest of National Defense, security and/or welfare. Charted SUA identifies to other airspace users where these activities occur. SUA is airspace of defined dimensions wherein activities must be confined because of their nature, or wherein limitations may be imposed upon aircraft operations that are not a part of those activities.


10. Terminal Aerodrome Forecast (TAF) and their amendments (AMEND) – Text report – Routine forecast that gives a concise statement of expected meteorological conditions for a specified time period within five statute miles (SM) of the center of the airport’s runway complex (terminal). TAFs are amended whenever they become, in the forecaster’s judgment, unrepresentative of existing or expected conditions, particularly regarding those elements and events significant to aircraft and airports. An amended forecast is identified by TAF AMD (in place of TAF) on the first line of the forecast text.

REFERENCE– Advisory Circular AC–00–45, “Aviation Weather Services.”
11. Temperature Aloft – Text report – Computer prepared forecasts, based on North American Mesoscale (NAM) forecast model run, of temperature at specified times, altitudes, and locations.

REFERENCE – Advisory Circular AC–00–45, “Aviation Weather Services.”


REFERENCE – Advisory Circular AC–00–45, “Aviation Weather Services.”

### TBL 4–5–2

**FIS–B Basic Product Update and Transmission Intervals**

<table>
<thead>
<tr>
<th>Product</th>
<th>FIS–B Service Update Interval</th>
<th>FIS–B Service Transmission Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIRMET</td>
<td>As available</td>
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</tr>
<tr>
<td>Convective SIGMET</td>
<td>As available</td>
<td>5 minutes</td>
</tr>
<tr>
<td>METAR/SPECI</td>
<td>Hourly/as available</td>
<td>5 minutes</td>
</tr>
<tr>
<td>NEXRAD Reflectivity (CONUS)</td>
<td>5 minutes</td>
<td>15 minutes</td>
</tr>
<tr>
<td>NEXRAD Reflectivity (Regional)</td>
<td>5 minutes</td>
<td>2.5 minutes</td>
</tr>
<tr>
<td>NOTAM–D/FDC</td>
<td>As available</td>
<td>10 minutes</td>
</tr>
<tr>
<td>PIREP</td>
<td>As available</td>
<td>10 minutes</td>
</tr>
<tr>
<td>SIGMET</td>
<td>As available</td>
<td>5 minutes</td>
</tr>
<tr>
<td>SUA Status</td>
<td>As available</td>
<td>10 minutes</td>
</tr>
<tr>
<td>TAF/AMEND</td>
<td>8 hours/as available</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Temperature Aloft</td>
<td>6 hours/as available</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Winds Aloft</td>
<td>6 hours</td>
<td>10 minutes</td>
</tr>
</tbody>
</table>

1 The Update Interval is the rate at which the product data is available from the source.
2 The Transmission Interval is the amount of time within which a new or updated product transmission must be completed and the rate or repetition interval at which the product is rebroadcast.

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

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

ADS–R is a datalink translation function of the ADS–B ground system required to accommodate the two separate operating frequencies (978 MHz and 1090 ES). The ADS–B system receives the ADS–B messages transmitted on one frequency and ADS–R translates and reformats the information for rebroadcast and use on the other frequency. This allows ADS–B In equipped aircraft to see nearby ADS–B Out traffic regardless of the operating link of the other aircraft. Aircraft operating on the same ADS–B frequency exchange information directly and do not require the ADS–R translation function.
Preflight Data Center (FDC) NOTAMs, Pointer NOTAMs, and Military NOTAMs.

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

All NOTAM Ds must have one of the following keywords as the first part of the text after the location identifier:

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>RWY</td>
<td>Runway</td>
</tr>
<tr>
<td>TWY</td>
<td>Taxiway</td>
</tr>
<tr>
<td>RAMP</td>
<td>Ramp</td>
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<tr>
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<td>Apron</td>
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<tr>
<td>AD</td>
<td>Aerodrome</td>
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<tr>
<td>OBST</td>
<td>Obstruction</td>
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<tr>
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<td>Navigation</td>
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<tr>
<td>COM</td>
<td>Communications</td>
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<tr>
<td>SVC</td>
<td>Services</td>
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</table>

Example

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Definition</th>
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</thead>
<tbody>
<tr>
<td>RWY</td>
<td>ABC XX/XXX ABC RWY 3/21 CLSD</td>
</tr>
<tr>
<td>TWY</td>
<td>ABC XX/XXX ABC TWY F LGTS OTS</td>
</tr>
<tr>
<td>RAMP</td>
<td>ABC XX/XXX ABC RAMP TERMINAL EAST SIDE CONSTRUCTION</td>
</tr>
<tr>
<td>APRON</td>
<td>ABC XX/XXX ABC APRON SW TWY C NEAR HANGARS CLSD</td>
</tr>
<tr>
<td>AD</td>
<td>ABC XX/XXX ABC AD ABN OTS</td>
</tr>
<tr>
<td>OBST</td>
<td>ABC XX/XXX ABC OBST TOWER 283 (246 AGL) 2.2 S LGTS OTS (ASR 1065881) TIL 1003282300</td>
</tr>
<tr>
<td>NAV</td>
<td>ABC XX/XXX ABC NAV VOR OTS</td>
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<tr>
<td>COM</td>
<td>ABC XX/XXX ABC COM ATIS OTS</td>
</tr>
<tr>
<td>SVC</td>
<td>XX/XXX ABC SVC JET FUEL UNAVBL TIL 1003291600</td>
</tr>
</tbody>
</table>

2. FDC NOTAMs

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

(b) FDC NOTAMs are transmitted via Service A only once and are kept on file at the FSS until published or canceled. FSSs are responsible for maintaining a file of current, unpublished FDC NOTAMs concerning conditions within 400 miles of their facilities. FDC information concerning conditions that are more than 400 miles from the FSS, or that is already published, is given to a pilot only on request.

* Unverified Aeronautical Information can be movement area or other information received that meets NOTAM criteria and has not been confirmed by the Airport Manager (AMGR) or their designee. If Flight Service is unable to contact airport management, Flight Service shall forward (U) NOTAM information to the United States NOTAM System (USNS). Subsequent to USNS distribution of a (U) NOTAM, Flight Service will inform airport management of the action taken as soon as practical. Any such NOTAM will be prefaced with “(U)” as the keyword and followed by the appropriate keyword contraction, following the location identifier.

** Other Aeronautical Information is that which is received from any authorized source that may be beneficial to aircraft operations and does not meet defined NOTAM criteria. Any such NOTAM will be prefaced with “(O)” as the keyword following the location identifier.
NOTE–
1. DUATS vendors will provide FDC NOTAMs only upon site-specific requests using a location identifier.

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

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

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

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

c. An integral part of the NOTAM System is the Notices to Airmen Publication (NTAP) published every four weeks. Data is included in this publication to reduce congestion on the telecommunications circuits and, therefore, is not available via Service A. Once published, the information is not provided during pilot weather briefings unless specifically requested by the pilot. This publication contains two sections.

1. The first section consists of notices that meet the criteria for NOTAM (D) and are expected to remain in effect for an extended period and FDC NOTAMs that are current at the time of publication. Occasionally, unique information is included in this section when it will contribute to flight safety.

2. The second section contains special notices that are either too long or concern a wide or unspecified geographic area and are not suitable for inclusion in the first section. The content of these notices vary widely and there are no specific criteria for their inclusion, other than their enhancement of flight safety.

3. The number of the last FDC NOTAM included in the publication is noted on the first page to aid the user in updating the listing with any FDC NOTAMs which may have been issued between the cut-off date and the date the publication is received. All information contained will be carried until the information expires, is canceled, or in the case of permanent conditions, is published in other publications, such as the A/FD.

4. All new notices entered, excluding FDC NOTAMs, will be published only if the information is expected to remain in effect for at least 7 days after the effective date of the publication.

d. NOTAM information is not available from a Supplemental Weather Service Locations (SWSL).

TBL.5–1–1
NOTAM CONTRACTIONS

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<th>A</th>
<th>Contractions</th>
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<td>AADC</td>
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<td>Amendment</td>
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5–1–4. Flight Plan – VFR Flights

a. Except for operations in or penetrating a Coastal or Domestic ADIZ or DEWIZ a flight plan is not required for VFR flight.

REFERENCE–
AIM, National Security, Paragraph 5–6–1

b. It is strongly recommended that a flight plan (for a VFR flight) be filed with an FAA FSS. This will ensure that you receive VFR Search and Rescue Protection.

REFERENCE–
AIM, Search and Rescue, Paragraph 6–2–7 gives the proper method of filing a VFR flight plan.

c. To obtain maximum benefits from the flight plan program, flight plans should be filed directly with the nearest FSS. For your convenience, FSSs provide aeronautical and meteorological briefings while accepting flight plans. Radio may be used to file if no other means are available.

NOTE–
Some states operate aeronautical communications facilities which will accept and forward flight plans to the FSS for further handling.

d. When a “stopover” flight is anticipated, it is recommended that a separate flight plan be filed for each “leg” when the stop is expected to be more than 1 hour duration.

e. Pilots are encouraged to give their departure times directly to the FSS serving the departure airport or as otherwise indicated by the FSS when the flight plan is filed. This will ensure more efficient flight plan service and permit the FSS to advise you of significant changes in aeronautical facilities or meteorological conditions. When a VFR flight plan is filed, it will be held by the FSS until 1 hour after the proposed departure time unless:

1. The actual departure time is received.

2. A revised proposed departure time is received.

3. At a time of filing, the FSS is informed that the proposed departure time will be met, but actual time cannot be given because of inadequate communications (assumed departures).

f. On pilot’s request, at a location having an active tower, the aircraft identification will be forwarded by the tower to the FSS for reporting the actual departure time. This procedure should be avoided at busy airports.

g. Although position reports are not required for VFR flight plans, periodic reports to FAA 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.

EXAMPLE–
1. Bonanza 314K, over Kingfisher at (time), VFR flight plan, Tulsa to Amarillo.

2. Cherokee 5133J, over Oklahoma City at (time), Shreveport to Denver, no flight plan.

h. Pilots not operating on an IFR flight plan and when in level cruising flight, are cautioned to conform with VFR cruising altitudes appropriate to the direction of flight.

i. When filing VFR flight plans, indicate aircraft equipment capabilities by appending the appropriate suffix to aircraft type in the same manner as that prescribed for IFR flight.

REFERENCE–
AIM, Flight Plan – Domestic IFR Flights, Paragraph 5–1–8

j. Under some circumstances, ATC computer tapes can be useful in constructing the radar history of a downed or crashed aircraft. In each case, knowledge of the aircraft’s transponder equipment is necessary in determining whether or not such computer tapes might prove effective.
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 Airport/Facility Directory.

5–2–2. Pre-departure Clearance Procedures

a. Many airports in the National Airspace System are equipped with the Tower Data Link System (TDLS) that includes the Pre-departure Clearance (PDC) function. The PDC function automates the Clearance Delivery operations in the ATCT for participating users. The PDC function displays 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. 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 nondata link equipped aircraft, via a printer located at the departure gate. PDC reduces frequency congestion, controller workload and is intended to mitigate delivery/readback errors. Also, information from participating users indicates a reduction in pilot workload.

b. PDC is available only to participating aircraft that have subscribed to the service through an approved service provider.

c. Due to technical reasons, the following limitations currently exist in the PDC program:

1. Aircraft filing multiple flight plans are limited to one PDC clearance per departure airport within a 24–hour period. Additional clearances will be delivered verbally.
2. 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.

d. No acknowledgment of receipt or readback is required for a PDC.

e. In all situations, the pilot is encouraged to contact clearance delivery if a question or concern exists regarding an automated clearance.

5–2–3. 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.

5–2–4. 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.

**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—**

d. Situational awareness during line up and wait operations is enhanced by monitoring ATC instructions/clearances issued to other aircraft. Pilots should listen carefully if another aircraft is on frequency that has a similar call sign and pay close attention to communications between ATC and other aircraft. If you are uncertain of an ATC instruction or clearance, query ATC immediately. Care should be taken to not inadvertently execute a clearance/instruction for another aircraft.

e. Pilots should be especially vigilant when conducting line up and wait operations at night or during reduced visibility conditions. They should scan the full length of the runway and look for aircraft on final approach or landing roll out when taxiing onto a runway. ATC should be contacted anytime there is a concern about a potential conflict.

f. When two or more runways are active, aircraft may be instructed to “LINE UP AND WAIT” on two or more runways. When multiple runway operations are being conducted, it is important to listen closely for your call sign and runway. Be alert for similar sounding call signs and acknowledge all instructions with your call sign. When you are holding in position and are not sure if the takeoff clearance was for you, ask ATC before you begin takeoff roll. ATC prefers that you confirm a takeoff clearance rather than mistake another aircraft’s clearance for your own.

g. When ATC issues intersection “line up and wait” and takeoff clearances, the intersection designator will be used. If ATC omits the intersection designator, call ATC for clarification.

**EXAMPLE—**
Aircraft: “Cherokee 234AR, Runway 24L at November 4, line up and wait.”

h. If landing traffic is a factor during line up and wait operations, ATC will inform the aircraft in position of the closest traffic that has requested a full—stop, touch—and—go, stop—and—go, or an unrestricted low approach to the same runway. Pilots should take care to note the position of landing traffic. ATC will also advise the landing traffic when an aircraft is authorized to “line up and wait” on the same runway.

**EXAMPLE—**
Tower: “Cessna 234AR, Runway 24L, line up and wait. Traffic a Boeing 737, six mile final.”
Tower: “Delta 1011, continue, traffic a Cessna 210 holding in position Runway 24L.”

**NOTE—**
ATC will normally withhold landing clearance to arrival aircraft when another aircraft is in position and holding on the runway.

i. Never land on a runway that is occupied by another aircraft, even if a landing clearance was issued. Do not hesitate to ask the controller about the traffic on the runway and be prepared to execute a go—around.

**NOTE—**
Always clarify any misunderstanding or confusion concerning ATC instructions or clearances. ATC should be advised immediately if there is any uncertainty about the ability to comply with any of their instructions.

5–2–5. Abbreviated IFR Departure Clearance (Cleared. . .as Filed) Procedures

a. ATC facilities will issue an abbreviated IFR departure clearance based on the ROUTE of flight filed in the IFR flight plan, provided the filed route can be approved with little or no revision. These abbreviated clearance procedures are based on the following conditions:
1. The aircraft is on the ground or it has departed visual flight rules (VFR) and the pilot is requesting IFR clearance while airborne.

2. That a pilot will not accept an abbreviated clearance if the route or destination of a flight plan filed with ATC has been changed by the pilot or the company or the operations officer before departure.

3. That it is the responsibility of the company or operations office to inform the pilot when they make a change to the filed flight plan.

4. That it is the responsibility of the pilot to inform ATC in the initial call-up (for clearance) when the filed flight plan has been either:

   (a) Amended, or

   (b) Canceled and replaced with a new filed flight plan.

**NOTE**

The facility issuing a clearance may not have received the revised route or the revised flight plan by the time a pilot requests clearance.

b. Controllers will issue a detailed clearance when they know that the original filed flight plan has been changed or when the pilot requests a full route clearance.

c. The clearance as issued will include the destination airport filed in the flight plan.

d. ATC procedures now require the controller to state the DP name, the current number and the DP transition name after the phrase “Cleared to (destination) airport” prior to the phrase, “then as filed,” for all departure clearances when the DP or DP transition is to be flown. The procedures apply whether or not the DP is filed in the flight plan.

e. STARs, when filed in a flight plan, are considered a part of the filed route of flight and will not normally be stated in an initial departure clearance. If the ARTCC’s jurisdictional airspace includes the departure airport and the fix where a STAR or STAR transition begins, the STAR name, the current number and the STAR transition name may be stated in the initial clearance.

f. “Cleared to (destination) airport as filed” does NOT include the en route altitude filed in a flight plan.

An en route altitude will be stated in the clearance or the pilot will be advised to expect an assigned or filed altitude within a given time frame or at a certain point after departure. This may be done verbally in the departure instructions or stated in the DP.

g. In both radar and nonradar environments, the controller will state “Cleared to (destination) airport as filed” or:

1. If a DP or DP transition is to be flown, specify the DP name, the current DP number, the DP transition name, the assigned altitude/flight level, and any additional instructions (departure control frequency, beacon code assignment, etc.) necessary to clear a departing aircraft via the DP or DP transition and the route filed.

**EXAMPLE**

National Seven Twenty cleared to Miami Airport Intercontinental one departure, Lake Charles transition then as filed, maintain Flight Level two seven zero.

2. When there is no DP or when the pilot cannot accept a DP, the controller will specify the assigned altitude or flight level, and any additional instructions necessary to clear a departing aircraft via an appropriate departure routing and the route filed.

**NOTE**

A detailed departure route description or a radar vector may be used to achieve the desired departure routing.

3. If it is necessary to make a minor revision to the filed route, the controller will specify the assigned DP or DP transition (or departure routing), the revision to the filed route, the assigned altitude or flight level and any additional instructions necessary to clear a departing aircraft.

**EXAMPLE**

Jet Star One Four Two Four cleared to Atlanta Airport, South Boston two departure then as filed except change route to read South Boston Victor 20 Greensboro, maintain one seven thousand.

4. Additionally, in a nonradar environment, the controller will specify one or more fixes, as necessary, to identify the initial route of flight.

**EXAMPLE**

Cessna Three One Six Zero Foxtrot cleared to Charlotte Airport as filed via Brooke, maintain seven thousand.
h. To ensure success of the program, pilots should:

1. Avoid making changes to a filed flight plan just prior to departure.

2. State the following information in the initial call-up to the facility when no change has been made to the filed flight plan: Aircraft call sign, location, type operation (IFR) and the name of the airport (or fix) to which you expect clearance.

**EXAMPLE—**
“Washington clearance delivery (or ground control if appropriate) American Seventy Six at gate one, IFR Los Angeles.”

3. If the flight plan has been changed, state the change and request a full route clearance.

**EXAMPLE—**
“Washington clearance delivery, American Seventy Six at gate one, IFR San Francisco. My flight plan route has been amended (or destination changed). Request full route clearance.”

4. Request verification or clarification from ATC if ANY portion of the clearance is not clearly understood.

5. When requesting clearance for the IFR portion of a VFR/IFR flight, request such clearance prior to the fix where IFR operation is proposed to commence in sufficient time to avoid delay. Use the following phraseology:

**EXAMPLE—**
“Los Angeles center, Apache Six One Papa, VFR estimating Paso Robles VOR at three two, one thousand five hundred, request IFR to Bakersfield.”


a. ATC may assign departure restrictions, clearance void times, hold for release, and release times, when necessary, to separate departures from other traffic or to restrict or regulate the departure flow.

1. **Clearance Void Times.** A pilot may receive a clearance, when operating from an airport without a control tower, which contains a provision for the clearance to be void if not airborne by a specific time. A pilot who does not depart prior to the clearance void time must advise ATC as soon as possible of their intentions. ATC will normally advise the pilot of the time allotted to notify ATC that the aircraft did not depart prior to the clearance void time. This time cannot exceed 30 minutes. Failure of an aircraft to contact ATC within 30 minutes after the clearance void time will result in the aircraft being considered overdue and search and rescue procedures initiated.

**NOTE—**
1. Other IFR traffic for the airport where the clearance is issued is suspended until the aircraft has contacted ATC or until 30 minutes after the clearance void time or 30 minutes after the clearance release time if no clearance void time is issued.

2. Pilots who depart at or after their clearance void time are not afforded IFR separation and may be in violation of 14 CFR Section 91.173 which requires that pilots receive an appropriate ATC clearance before operating IFR in controlled airspace.

**EXAMPLE—**
Clearance void if not off by (clearance void time) and, if required, if not off by (clearance void time) advise (facility) not later than (time) of intentions.

2. **Hold for Release.** ATC may issue “hold for release” instructions in a clearance to delay an aircraft’s departure for traffic management reasons (i.e., weather, traffic volume, etc.). When ATC states in the clearance, “hold for release,” the pilot may not depart utilizing that IFR clearance until a release time or additional instructions are issued by ATC. In addition, ATC will include departure delay information in conjunction with “hold for release” instructions. The ATC instruction, “hold for release,” applies to the IFR clearance and does not prevent the pilot from departing under VFR. However, prior to takeoff the pilot should cancel the IFR flight plan and operate the transponder on the appropriate VFR code. An IFR clearance may not be available after departure.

**EXAMPLE—**
(Aircraft identification) cleared to (destination) airport as filed, maintain (altitude), and, if required (additional instructions or information), hold for release, expect (time in hours and/or minutes) departure delay.

3. **Release Times.** A “release time” is a departure restriction issued to a pilot by ATC, specifying the earliest time an aircraft may depart. ATC will use “release times” in conjunction with traffic management procedures and/or to separate a departing aircraft from other traffic.

**EXAMPLE—**
(Aircraft identification) released for departure at (time in hours and/or minutes).
5–3–4. Airways and Route Systems

a. Three fixed route systems are established for air navigation purposes. They are the Federal airway system (consisting of VOR and L/MF routes), the jet route system, and the RNAV route system. To the extent possible, these route systems are aligned in an overlying manner to facilitate transition between each.

1. The VOR and L/MF (nondirectional radio beacons) Airway System consists of airways designated from 1,200 feet above the surface (or in some instances higher) up to but not including 18,000 feet MSL. These airways are depicted on IFR Enroute Low Altitude Charts.

   NOTE—
   The altitude limits of a victor airway should not be exceeded except to effect transition within or between route structures.

   (a) Except in Alaska, the VOR airways are: predicated solely on VOR or VORTAC navigation aids; depicted in black on aeronautical charts; and identified by a “V” (Victor) followed by the airway number (for example, V12).

   NOTE—
   Segments of VOR airways in Alaska are based on L/MF navigation aids and charted in brown instead of black on en route charts.

   (1) A segment of an airway which is common to two or more routes carries the numbers of all the airways which coincide for that segment. When such is the case, pilots filing a flight plan need to indicate only that airway number for the route filed.

   NOTE—
   A pilot who intends to make an airway flight, using VOR facilities, will simply specify the appropriate “victor” airway(s) in the flight plan. For example, if a flight is to be made from Chicago to New Orleans at 8,000 feet, using omniranges only, the route may be indicated as “departing from Chicago—Midway, cruising 8,000 feet via Victor 9 to Moisant International.” If flight is to be conducted in part by means of L/MF navigation aids and in part on omniranges, specifications of the appropriate airways in the flight plan will indicate which types of facilities will be used along the described routes, and, for IFR flight, permit ATC to issue a traffic clearance accordingly. A route may also be described by specifying the station over which the flight will pass, but in this case since many VORs and L/MF aids have the same name, the pilot must be careful to indicate which aid will be used at a particular location. This will be indicated in the route of flight portion of the flight plan by specifying the type of facility to be used after the location name in the following manner: Newark L/MF; Allentown VOR.

   (2) With respect to position reporting, reporting points are designated for VOR Airway Systems. Flights using Victor Airways will report over these points unless advised otherwise by ATC.

   (b) The L/MF airways (colored airways) are predicated solely on L/MF navigation aids and are depicted in brown on aeronautical charts and are identified by color name and number (e.g., Amber One). Green and Red airways are plotted east and west. Amber and Blue airways are plotted north and south.

   NOTE—
   Except for G13 in North Carolina, the colored airway system exists only in the state of Alaska. All other such airways formerly so designated in the conterminous U.S. have been rescinded.

   (c) The use of TSO–C145a or TSO–C146a GPS/WAAS navigation systems is allowed in Alaska as the only means of navigation on published air traffic routes including those Victor and colored airway segments designated with a second minimum en route altitude (MEA) depicted in blue and followed by the letter G at those lower altitudes. The altitudes so depicted are below the minimum reception altitude (MRA) of the land-based navigation facility defining the route segment, and guarantee standard en route obstacle clearance and two-way communications. Air carrier operators requiring operations specifications are authorized to conduct operations on those routes in accordance with FAA operations specifications.

2. The jet route system consists of jet routes established from 18,000 feet MSL to FL 450 inclusive.

   (a) These routes are depicted on Enroute High Altitude Charts. Jet routes are depicted in black on aeronautical charts and are identified by a “J” (Jet) followed by the airway number (e.g., J12). Jet routes, as VOR airways, are predicated solely on VOR or VORTAC navigation facilities (except in Alaska).

   NOTE—
   Segments of jet routes in Alaska are based on L/MF navigation aids and are charted in brown color instead of black on route charts.

   (b) With respect to position reporting, reporting points are designated for jet route systems.
Flights using jet routes will report over these points unless otherwise advised by ATC.


(a) Published RNAV routes, including Q–Routes and T–Routes, can be flight planned for use by aircraft with RNAV capability, subject to any limitations or requirements noted on en route charts, in applicable Advisory Circulars, or by NOTAM. RNAV routes are depicted in blue on aeronautical charts and are identified by the letter “Q” or “T” followed by the airway number (e.g., Q–13, T–205). Published RNAV routes are RNAV–2 except when specifically charted as RNAV–1. These routes require system performance currently met by GPS or DME/DME/IRU RNAV systems that satisfy the criteria discussed in AC 90–100A, U.S. Terminal and En Route Area Navigation (RNAV) Operations.

NOTE—AC 90–100A does not apply to over water RNAV routes (reference 14 CFR 91.511, including the Q–routes in the Gulf of Mexico and the Atlantic routes) or Alaska VOR/DME RNAV routes (“JxxxR”). The AC does not apply to off–route RNAV operations, Alaska GPS routes or Caribbean routes.

(1) Q–routes are available for use by RNAV equipped aircraft between 18,000 feet MSL and FL 450 inclusive. Q–routes are depicted on Enroute High Altitude Charts.

(2) T–routes are available for use by RNAV equipped aircraft from 1,200 feet above the surface (or in some instances higher) up to but not including 18,000 feet MSL. T–routes are depicted on Enroute Low Altitude Charts.

(b) Unpublished RNAV routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree–distance fixes, or offsets from established routes/airways at a specified distance and direction. Radar monitoring by ATC is required on all unpublished RNAV routes.

(c) Magnetic Reference Bearing (MRB) is the published bearing between two waypoints on an RNAV/GPS/GNSS route. The MRB is calculated by applying magnetic variation at the waypoint to the calculated true course between two waypoints. The MRB enhances situational awareness by indicating a reference bearing (no–wind heading) that a pilot should see on the compass/HSI/RMI etc., when turning prior to/over a waypoint en route to another waypoint. Pilots should use this bearing as a reference only, because their RNAV/GPS/GNSS navigation system will fly the true course between the waypoints.

b. Operation above FL 450 may be conducted on a point-to-point basis. Navigational guidance is provided on an area basis utilizing those facilities depicted on the enroute high altitude charts.

c. Radar Vectors. Controllers may vector aircraft within controlled airspace for separation purposes, noise abatement considerations, when an operational advantage will be realized by the pilot or the controller, or when requested by the pilot. Vectors outside of controlled airspace will be provided only on pilot request. Pilots will be advised as to what the vector is to achieve when the vector is controller initiated and will take the aircraft off a previously assigned nonradar route. To the extent possible, aircraft operating on RNAV routes will be allowed to remain on their own navigation.

d. When flying in Canadian airspace, pilots are cautioned to review Canadian Air Regulations.

1. Special attention should be given to the parts which differ from U.S. CFRs.

(a) The Canadian Airways Class B airspace restriction is an example. Class B airspace is all controlled low level airspace above 12,500 feet MSL or the MEA, whichever is higher, within which only IFR and controlled VFR flights are permitted. (Low level airspace means an airspace designated and defined as such in the Designated Airspace Handbook.)

(b) Regardless of the weather conditions or the height of the terrain, no person shall operate an aircraft under VFR conditions within Class B airspace except in accordance with a clearance for VFR flight issued by ATC.

(e) The requirement for entry into Class B airspace is a student pilot permit (under the guidance or control of a flight instructor).

(d) VFR flight requires visual contact with the ground or water at all times.

2. Segments of VOR airways and high level routes in Canada are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.
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 NA V AID(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 NA V AID 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 Z 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). VOR/DME RNAV approaches will continue to be identified as VOR/DME RNAV RWY (Number) (e.g., VOR/DME RNAV RWY 21). VOR/DME RNAV procedures which can be flown by GPS will be annotated with “or GPS” (e.g., VOR/DME RNAV or GPS RWY 31).

4. Approach minimums are based on the local altimeter setting for that airport, unless annotated otherwise; e.g., Oklahoma City/Will Rogers World approaches are based on having a Will Rogers World altimeter setting. When a different altimeter source is required, or more than one source is authorized, it will be annotated on the approach chart; e.g., use Sidney altimeter setting, if not received, use Scottsbluff altimeter setting. Approach minimums may be raised when a nonlocal altimeter source is authorized. When more than one altimeter source is authorized, and the minima are different, they will be shown by separate lines in the approach minima box or a note; e.g., use Manhattan altimeter setting; when not available use Salina altimeter setting and increase all MDAs 40 feet. When the altimeter must be obtained from a source other than air traffic a note will indicate the source; e.g., Obtain local altimeter setting on CTAF.
When the altimeter setting(s) on which the approach is based is not available, the approach is not authorized. Baro–VNAV must be flown using the local altimeter setting only. Where no local altimeter is available, the LNAV/VNAV line will still be published for use by WAAS receivers with a note that Baro–VNAV is not authorized. When a local and at least one other altimeter setting source is authorized and the local altimeter is not available Baro–VNAV is not authorized; however, the LNAV/VNAV minima can still be used by WAAS receivers using the alternate altimeter setting source.

**NOTE—**
Barometric Vertical Navigation (baro–VNAV). An RNAV system function which uses barometric altitude information from the aircraft’s altimeter to compute and present a vertical guidance path to the pilot. The specified vertical path is computed as a geometric path, typically computed between two waypoints or an angle based computation from a single waypoint. Further guidance may be found in Advisory Circular 90–105.

5. A pilot adhering to the altitudes, flight paths, and weather minimums depicted on the IAP chart or vectors and altitudes issued by the radar controller, is assured of terrain and obstruction clearance and runway or airport alignment during approach for landing.

6. IAPs are designed to provide an IFR descent from the en route environment to a point where a safe landing can be made. They are prescribed and approved by appropriate civil or military authority to ensure a safe descent during instrument flight conditions at a specific airport. It is important that pilots understand these procedures and their use prior to attempting to fly instrument approaches.

7. TERPS criteria are provided for the following types of instrument approach procedures:

   **(a)** Precision Approach (PA). An instrument approach based on a navigation system that provides course and glidepath deviation information meeting the precision standards of ICAO Annex 10. For example, PAR, ILS, and GLS are precision approaches.

   **(b)** Approach with Vertical Guidance (APV). An instrument approach based on a navigation system that is not required to meet the precision approach standards of ICAO Annex 10 but provides course and glidepath deviation information. For example, Baro–VNAV, LDA with glidepath, LNAV/VNAV and LPV are APV approaches.

   (c) Nonprecision Approach (NPA). An instrument approach based on a navigation system which provides course deviation information, but no glidepath deviation information. For example, VOR, NDB and LNAV. As noted in subparagraph i, Vertical Descent Angle (VDA) on Nonprecision Approaches, some approach procedures may provide a Vertical Descent Angle as an aid in flying a stabilized approach, without requiring its use in order to fly the procedure. This does not make the approach an APV procedure, since it must still be flown to an MDA and has not been evaluated with a glidepath.

   b. The method used to depict prescribed altitudes on instrument approach charts differs according to techniques employed by different chart publishers. Prescribed altitudes may be depicted in four different configurations: minimum, maximum, mandatory, and recommended. The U.S. Government distributes charts produced by National Geospatial–Intelligence Agency (NGA) and FAA. Altitudes are depicted on these charts in the profile view with underscore, overscore, both or none to identify them as minimum, maximum, mandatory or recommended.

   1. Minimum altitude will be depicted with the altitude value underscored. Aircraft are required to maintain altitude at or above the depicted value, e.g., 3000.

   2. Maximum altitude will be depicted with the altitude value overscored. Aircraft are required to maintain altitude at or below the depicted value, e.g., 4000.

   3. Mandatory altitude will be depicted with the altitude value both underscored and overscored. Aircraft are required to maintain altitude at the depicted value, e.g., 5000.

   4. Recommended altitude will be depicted with no overscore or underscore. These altitudes are depicted for descent planning, e.g., 6000.

**NOTE—**
1. Pilots are cautioned to adhere to altitudes as prescribed because, in certain instances, they may be used as the basis for vertical separation of aircraft by ATC. When a depicted altitude is specified in the ATC clearance, that altitude becomes mandatory as defined above.

2. The ILS glide slope is intended to be intercepted at the published glide slope intercept altitude. This point marks the PFAF and is depicted by the "lightning bolt" symbol.
on U.S. Government charts. Intercepting the glide slope at this altitude marks the beginning of the final approach segment and ensures required obstacle clearance during descent from the glide slope intercept altitude to the lowest published decision altitude for the approach. Interception and tracking of the glide slope prior to the published glide slope interception altitude does not necessarily ensure that minimum, maximum, and/or mandatory altitudes published for any preceding fixes will be complied with during the descent. If the pilot chooses to track the glide slope prior to the glide slope interception altitude, they remain responsible for complying with published altitudes for any preceding stepdown fixes encountered during the subsequent descent.

c. Minimum Safe/Sector Altitudes (MSA) are published for emergency use on IAP charts. For conventional navigation systems, the MSA is normally based on the primary omnidirectional facility on which the IAP is predicated. The MSA depiction on the approach chart contains the facility identifier of the NAVAID used to determine the MSA altitudes. For RNAV approaches, the MSA is based on the runway waypoint (RWY WP) for straight-in approaches, or the airport waypoint (APT WP) for circling approaches. For GPS approaches, the MSA center will be the missed approach waypoint (MAWP). MSAs are expressed in feet above mean sea level and normally have a 25 NM radius; however, this radius may be expanded to 30 NM if necessary to encompass the airport landing surfaces. Ideally, a single sector altitude is established and depicted on the plan view of approach charts; however, when necessary to obtain relief from obstructions, the area may be further sectored and as many as four MSAs established. When established, sectors may be no less than 90° in spread. MSAs provide 1,000 feet clearance over all obstructions but do not necessarily assure acceptable navigation signal coverage.

d. Terminal Arrival Area (TAA)

1. The objective of the TAA is to provide a seamless transition from the en route structure to the terminal environment for arriving aircraft equipped with Flight Management System (FMS) and/or Global Positioning System (GPS) navigational equipment. The underlying instrument approach procedure is an area navigation (RNAV) procedure described in this section. The TAA provides the pilot and air traffic controller with a very efficient method for routing traffic into the terminal environment with little required air traffic control interface, and with minimum altitudes depicted that provide standard obstacle clearance compatible with the instrument procedure associated with it. The TAA will not be found on all RNAV procedures, particularly in areas of heavy concentration of air traffic. When the TAA is published, it replaces the MSA for that approach procedure. See FIG 5–4–9 for a depiction of a RNAV approach chart with a TAA.

2. The RNAV procedure underlying the TAA will be the “T” design (also called the “Basic T”), or a modification of the “T.” The “T” design incorporates from one to three IAFs; an intermediate fix (IF) that serves as a dual purpose IF (IAF); a final approach fix (FAF), and a missed approach point (MAP) usually located at the runway threshold. The three IAFs are normally aligned in a straight line perpendicular to the intermediate course, which is an extension of the final course leading to the runway, forming a “T.” The initial segment is normally from 3–6 NM in length; the intermediate 5–7 NM, and the final segment 5 NM. Specific segment length may be varied to accommodate specific aircraft categories for which the procedure is designed. However, the published segment lengths will reflect the highest category of aircraft normally expected to use the procedure.

(a) A standard racetrack holding pattern may be provided at the center IAF, and if present may be necessary for course reversal and for altitude adjustment for entry into the procedure. In the latter case, the pattern provides an extended distance for the descent required by the procedure. Depiction of this pattern in U.S. Government publications will utilize the “hold-in-lieu-of-PT” holding pattern symbol.

(b) The published procedure will be annotated to indicate when the course reversal is not necessary when flying within a particular TAA area; e.g., “NoPT.” Otherwise, the pilot is expected to execute the course reversal under the provisions of 14 CFR Section 91.175. The pilot may elect to use the course reversal pattern when it is not required by the procedure, but must inform air traffic control and receive clearance to do so. (See FIG 5–4–1, FIG 5–4–2, FIG 5–4–9, and paragraph 5–4–9, Procedure Turn and Hold–in-lieu of Procedure Turn).
3. The “T” design may be modified by the procedure designers where required by terrain or air traffic control considerations. For instance, the “T” design may appear more like a regularly or irregularly shaped “Y”, or may even have one or both outboard IAFs eliminated resulting in an upside down “L” or an “I” configuration. (See FIG 5–4–3 and FIG 5–4–10). Further, the leg lengths associated with the outboard IAFs may differ. (See FIG 5–4–5 and FIG 5–4–6).

4. Another modification of the “T” design may be found at airports with parallel runway configurations. Each parallel runway may be served by its own “T” IAF, IF (IAF), and FAF combination, resulting in parallel final approach courses. (See FIG 5–4–4). Common IAFs may serve both runways; however, only the intermediate and final approach segments for the landing runway will be shown on the approach chart. (See FIG 5–4–5 and FIG 5–4–6).
such time as traffic conditions permit. However, a pilot involved in an emergency situation will be given priority. If the pilot is not familiar with the specific approach procedure, ATC should be advised and they will provide detailed information on the execution of the procedure.

**REFERENCE**

AIM, Advance Information on Instrument Approach, Paragraph 5−4−4

d. At times ATC may not specify a particular approach procedure in the clearance, but will state “CLEARED APPROACH.” Such clearance indicates that the pilot may execute any one of the authorized IAPs for that airport. This clearance does not constitute approval for the pilot to execute a contact approach or a visual approach.

e. Except when being radar vectored to the final approach course, when cleared for a specifically prescribed IAP; i.e., “cleared ILS runway one niner approach” or when “cleared approach” i.e., execution of any procedure prescribed for the airport, pilots shall execute the entire procedure commencing at an IAF or an associated feeder route as described on the IAP chart unless an appropriate new or revised ATC clearance is received, or the IFR flight plan is canceled.

f. Pilots planning flights to locations which are private airfields or which have instrument approach procedures based on private navigation aids should obtain approval from the owner. In addition, the pilot must be authorized by the FAA to fly special instrument approach procedures associated with private navigation aids (see paragraph 5−4−8). Owners of navigation aids that are not for public use may elect to turn off the signal for whatever reason they may have; e.g., maintenance, energy conservation, etc. Air traffic controllers are not required to question pilots to determine if they have permission to land at a private airfield or to use procedures based on privately owned navigation aids, and they may not know the status of the navigation aid. Controllers presume a pilot has obtained approval from the owner and the FAA for use of special instrument approach procedures and is aware of any details of the procedure if an IFR flight plan was filed to that airport.

g. Pilots should not rely on radar to identify a fix unless the fix is indicated as “RADAR” on the IAP. Pilots may request radar identification of an OM, but the controller may not be able to provide the service due either to workload or not having the fix on the video map.

h. If a missed approach is required, advise ATC and include the reason (unless initiated by ATC). Comply with the missed approach instructions for the instrument approach procedure being executed, unless otherwise directed by ATC.

**REFERENCE**

AIM, Missed Approach, Paragraph 5−4−21
AIM, Missed Approach, Paragraph 5−5−5

i. ATC may clear aircraft that have filed an Advanced RNAV equipment suffix to the intermediate fix when clearing aircraft for an instrument approach procedure. ATC will take the following actions when clearing Advanced RNAV aircraft to the intermediate fix:

1. Provide radar monitoring to the intermediate fix.

2. Advise the pilot to expect clearance direct to the intermediate fix at least 5 miles from the fix.

**NOTE**

This is to allow the pilot to program the RNAV equipment to allow the aircraft to fly to the intermediate fix when cleared by ATC.

3. Assign an altitude to maintain until the intermediate fix.

4. Insure the aircraft is on a course that will intercept the intermediate segment at an angle not greater than 90 degrees and is at an altitude that will permit normal descent from the intermediate fix to the final approach fix.

5−4−8. Special Instrument Approach Procedures

Instrument Approach Procedure (IAP) charts reflect the criteria associated with the U.S. Standard for Terminal Instrument [Approach] Procedures (TERPs), which prescribes standardized methods for use in developing IAPs. Standard IAPs are published in the Federal Register (FR) in accordance with Title 14 of the Code of Federal Regulations, Part 97, and are available for use by appropriately qualified pilots operating properly equipped and airworthy aircraft in accordance with operating rules and procedures acceptable to the FAA. Special IAPs are also developed using TERPS but are not given public notice in the FR. The FAA authorizes only certain individual pilots and/or pilots in individual organizations to use special IAPs, and may require
additional crew training and/or aircraft equipment or performance, and may also require the use of landing aids, communications, or weather services not available for public use. Additionally, IAPs that service private use airports or heliports are generally special IAPs.

5–4–9. Procedure Turn and Hold—in–lieu of Procedure Turn

a. A procedure turn is the maneuver prescribed when it is necessary to reverse direction to establish the aircraft inbound on an intermediate or final approach course. The procedure turn or hold—in–lieu—of—PT is a required maneuver when it is depicted on the approach chart, unless cleared by ATC for a straight—in approach. Additionally, the procedure turn or hold—in–lieu—of—PT is not permitted when the symbol “No PT” is depicted on the initial segment being used, when a RADAR VECTOR to the final approach course is provided, or when conducting a timed approach from a holding fix. The altitude prescribed for the procedure turn is a minimum altitude until the aircraft is established on the inbound course. The maneuver must be completed within the distance specified in the profile view. For a hold—in–lieu—of—PT, the holding pattern direction must be flown as depicted and the specified leg length/timing must not be exceeded.

NOTE—
The pilot may elect to use the procedure turn or hold—in–lieu—of—PT when it is not required by the procedure, but must first receive an amended clearance from ATC. If the pilot is uncertain whether the ATC clearance intends for a procedure turn to be conducted or to allow for a straight—in approach, the pilot must immediately request clarification from ATC (14 CFR Section 91.123).

1. On U.S. Government charts, a barbed arrow indicates the maneuvering side of the outbound course on which the procedure turn is made. Headings are provided for course reversal using the 45 degree type procedure turn. However, the point at which the turn may be commenced and the type and rate of turn is left to the discretion of the pilot (limited by the charted remain within xx NM distance). Some of the options are the 45 degree procedure turn, the racetrack pattern, the teardrop procedure turn, or the 80 degree ↔ 260 degree course reversal. Racetrack entries should be conducted on the maneuvering side where the majority of protected airspace resides. If an entry places the pilot on the non—maneuvering side of the PT, correction to intercept the outbound course ensures remaining within protected airspace. Some procedure turns are specified by procedural track. These turns must be flown exactly as depicted.

2. Descent to the procedure turn (PT) completion altitude from the PT fix altitude (when one has been published or assigned by ATC) must not begin until crossing over the PT fix or abeam and proceeding outbound. Some procedures contain a note in the chart profile view that says “Maintain (altitude) or above until established outbound for procedure turn” (See FIG 5–4–14). Newer procedures will simply depict an “at or above” altitude at the PT fix without a chart note (See FIG 5–4–15). Both are there to ensure required obstacle clearance is provided in the procedure turn entry zone (See FIG 5–4–16). Absence of a chart note or specified minimum altitude adjacent to the PT fix is an indication that descent to the procedure turn altitude can commence immediately upon crossing over the PT fix, regardless of the direction of flight. This is because the minimum altitudes in the PT entry zone and the PT maneuvering zone are the same.
c. Straight-in Minimums are shown on the IAP when the final approach course is within 30 degrees of the runway alignment (15 degrees for GPS IAPs) and a normal descent can be made from the IFR altitude shown on the IAP to the runway surface. When either the normal rate of descent or the runway alignment factor of 30 degrees (15 degrees for GPS IAPs) is exceeded, a straight-in minimum is not published and a circling minimum applies. The fact that a straight-in minimum is not published does not preclude pilots from landing straight-in if they have the active runway in sight and have sufficient time to make a normal approach for landing. Under such conditions and when ATC has cleared them for landing on that runway, pilots are not expected to circle even though only circling minimums are published. If they desire to circle, they should advise ATC.

d. Side-Step Maneuver Minimums. Landing minimums for a side-step maneuver to the adjacent runway will normally be higher than the minimums to the primary runway.

e. Published Approach Minimums. Approach minimums are published for different aircraft categories and consist of a minimum altitude (DA, DH, MDA) and required visibility. These minimums are determined by applying the appropriate TERPS criteria. When a fix is incorporated in a nonprecision final segment, two sets of minimums may be published: one for the pilot that is able to identify the fix, and a second for the pilot that cannot. Two sets of minimums may also be published when a second altimeter source is used in the procedure. When a nonprecision procedure incorporates both a stepdown fix in the final segment and a second
altimeter source, two sets of minimums are published to account for the stepdown fix and a note addresses minimums for the second altimeter source.

f. Circling Minimums. In some busy terminal areas, ATC may not allow circling and circling minimums will not be published. Published circling minimums provide obstacle clearance when pilots remain within the appropriate area of protection. Pilots should remain at or above the circling altitude until the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers. Circling may require maneuvers at low altitude, at low airspeed, and in marginal weather conditions. Pilots must use sound judgment, have an in-depth knowledge of their capabilities, and fully understand the aircraft performance to determine the exact circling maneuver since weather, unique airport design, and the aircraft position, altitude, and airspeed must all be considered. The following basic rules apply:

1. Maneuver the shortest path to the base or downwind leg, as appropriate, considering existing weather conditions. There is no restriction from passing over the airport or other runways.

2. It should be recognized that circling maneuvers may be made while VFR or other flying is in progress at the airport. Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.

3. At airports without a control tower, it may be desirable to fly over the airport to observe wind and turn indicators and other traffic which may be on the runway or flying in the vicinity of the airport.

REFERENCE--
AC 90−66A, Recommended Standards Traffic patterns for Aeronautical Operations at Airports without Operating Control Towers.

4. The missed approach point (MAP) varies depending upon the approach flown. For vertically guided approaches, the MAP is at the decision altitude/decision height. Non−vertically guided and circling procedures share the same MAP and the pilot determines this MAP by timing from the final approach fix, by a fix, a NAVAID, or a waypoint. Circling from a GLS, an ILS without a localizer line of minima or an RNAV (GPS) approach without an LNAV line of minima is prohibited.

g. Instrument Approach at a Military Field. When instrument approaches are conducted by civil aircraft at military airports, they shall be conducted in accordance with the procedures and minimums approved by the military agency having jurisdiction over the airport.

5−4−21. Missed Approach

a. When a landing cannot be accomplished, advise ATC and, upon reaching the missed approach point defined on the approach procedure chart, the pilot must comply with the missed approach instructions for the procedure being used or with an alternate missed approach procedure specified by ATC.

b. Obstacle protection for missed approach is predicated on the missed approach being initiated at the decision altitude/height (DA/H) or at the missed approach point and not lower than minimum descent altitude (MDA). A climb gradient of at least 200 feet per nautical mile is required, (except for Copter approaches, where a climb of at least 400 feet per nautical mile is required), unless a higher climb gradient is published in the notes section of the approach procedure chart. When higher than standard climb gradients are specified, the end point of the non−standard climb will be specified at either an altitude or a fix. Pilots must preplan to ensure that the aircraft can meet the climb gradient (expressed in feet per nautical mile) required by the procedure in the event of a missed approach, and be aware that flying at a higher than anticipated ground speed increases the climb rate requirement (feet per minute). Tables for the conversion of climb gradients (feet per nautical mile) to climb rate (feet per minute), based on ground speed, are included on page D1 of the U.S. Terminal Procedures booklets. Reasonable buffers are provided for normal maneuvers. However, no consideration is given to an abnormally early turn. Therefore, when an early missed approach is executed, pilots should, unless otherwise cleared by ATC, fly the IAP as specified on the approach plate to the missed approach point at or above the MDA or DH before executing a turning maneuver.

c. If visual reference is lost while circling-to-land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by ATC). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn
toward the landing runway and continue the turn until established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft position at the time visual reference is lost. Adherence to the procedure will help assure that an aircraft will remain laterally within the circling and missed approach obstruction clearance areas. Refer to paragraph h concerning vertical obstruction clearance when starting a missed approach at other than the MAP. (See FIG 5–4–28.)

d. At locations where ATC radar service is provided, the pilot should conform to radar vectors when provided by ATC in lieu of the published missed approach procedure. (See FIG 5–4–29.)

e. Some locations may have a preplanned alternate missed approach procedure for use in the event the primary NAVAID used for the missed approach procedure is unavailable. To avoid confusion, the alternate missed approach instructions are not published on the chart. However, the alternate missed approach holding pattern will be depicted on the instrument approach chart for pilot situational awareness and to assist ATC by not having to issue detailed holding instructions. The alternate missed approach may be based on NAVAIDs not used in the approach procedure or the primary missed approach. When the alternate missed approach procedure is implemented by NOTAM, it becomes a mandatory part of the procedure. The NOTAM will specify both the textual instructions and any additional equipment requirements necessary to complete the procedure. Air traffic may also issue instructions for the alternate missed approach when necessary, such as when the primary missed approach NAVAID fails during the approach. Pilots may reject an ATC clearance for an alternate missed approach that requires equipment not necessary for the published approach procedure when the alternate missed approach is issued after beginning the approach. However, when the alternate missed approach is issued prior to beginning the approach, the pilot must either accept the entire procedure (including the alternate missed approach), request a different approach procedure, or coordinate with ATC for alternative action to be taken, i.e., proceed to an alternate airport, etc.

f. When approach has been missed, request clearance for specific action; i.e., to alternative airport, another approach, etc.

g. Pilots must ensure that they have climbed to a safe altitude prior to proceeding off the published missed approach, especially in nonradar environments. Abandoning the missed approach prior to reaching the published altitude may not provide adequate terrain clearance. Additional climb may be required after reaching the holding pattern before proceeding back to the IAF or to an alternate.
A clearance for an instrument approach procedure includes a clearance to fly the published missed approach procedure, unless otherwise instructed by ATC. The published missed approach procedure provides obstacle clearance only when the missed approach is conducted on the missed approach segment from or above the missed approach point, and assumes a climb rate of 200 feet/NM or higher, as published. If the aircraft initiates a missed approach at a point other than the missed approach point (see paragraph 5−4−5b), from below MDA or DA (H), or on a circling approach, obstacle clearance is not necessarily provided by following the published missed approach procedure, nor is separation assured from other air traffic in the vicinity.

In the event a balked (rejected) landing occurs at a position other than the published missed approach point, the pilot should contact ATC as soon as possible to obtain an amended clearance. If unable to contact ATC for any reason, the pilot should attempt to re-intercept a published segment of the missed approach and comply with route and altitude instructions. If unable to contact ATC, and in the pilot’s judgment it is no longer appropriate to fly the published missed approach procedure, then consider either maintaining visual conditions if practicable and reattempt a landing, or a circle–climb over the airport. Should a missed approach become necessary when operating to an airport that is not served by an operating control tower, continuous contact with an air traffic facility may not be possible. In this case, the pilot should execute the appropriate go-around/missed approach procedure without delay and contact ATC when able to do so.

Prior to initiating an instrument approach procedure, the pilot should assess the actions to be taken in the event of a balked (rejected) landing beyond the missed approach point or below the MDA or DA (H) considering the anticipated weather conditions and available aircraft performance. 14 CFR 91.175(e) authorizes the pilot to fly an appropriate missed approach procedure that ensures obstruction clearance, but it does not necessarily consider separation from other air traffic. The pilot must consider other factors such as the aircraft’s geographical location with respect to the prescribed missed approach point, direction of flight, and/or minimum turning altitudes in the prescribed missed approach procedure. The pilot must also consider aircraft performance, visual
climb restrictions, charted obstacles, published obstacle departure procedure, takeoff visual climb requirements as expressed by nonstandard takeoff minima, other traffic expected to be in the vicinity, or other factors not specifically expressed by the approach procedures.


An EFVS is an installed airborne system which uses an electronic means to provide a display of the forward external scene topography (the applicable natural or manmade features of a place or region especially in a way to show their relative positions and elevation) through the use of imaging sensors, such as forward looking infrared, millimeter wave radiometry, millimeter wave radar, and/or low light level image intensifying. The EFVS imagery is displayed along with the additional flight information and aircraft flight symbology required by 14 CFR 91.175 (m) on a head–up display (HUD), or an equivalent display, in the same scale and alignment as the external view and includes the display element, sensors, computers and power supplies, indications, and controls. The display is typically presented to the pilot by means of an approved HUD.

a. Basic Strategy Using EFVS. When flying an instrument approach procedure (IAP), if the runway environment cannot be visually acquired at decision altitude (DA) or minimum descent altitude (MDA) using natural vision, then a pilot may use an EFVS to continue descending down to 100 feet above the Touchdown Zone Elevation (TDZE), provided all of the visibility requirements of 14 CFR part 91.175 (l) are met. The primary reference for maneuvering the aircraft is based on what the pilot sees through the EFVS. At 100 feet above the TDZE, a pilot can continue to descend only when the visual reference requirements for descent below 100 feet can be seen using natural vision (without the aid of the EFVS). In other words, a pilot may not continue to rely on the EFVS sensor image to identify the required visual references below 100 feet above the TDZE. Supporting information is provided by the flight path vector (FPV), flight path angle (FPA) reference cue, on–board navigation system, and other imagery and flight symbology displayed on the EFVS. The FPV and FPA reference cue, along with the EFVS imagery of the Touchdown Zone (TDZ), provide the primary vertical path reference for the pilot when vertical guidance from a precision approach or approach with vertical guidance is not available.

1. Straight–In Instrument Approach Procedures. An EFVS may be used to descend below DA or MDA from any straight–in IAP, other than Category II or Category III approaches, provided all of the requirements of 14 CFR part 91.175 (l) are met. This includes straight–in precision approaches, approaches with vertical guidance (for example, LPV or LNAV/VNAV), and non–precision approaches (for example, VOR, NDB, LOC, RNAV, GPS, LDA, SDF, etc.).

2. Circling Approach Procedure. An IAP with a circle–to–land maneuver or circle–to–land minimums does not meet criteria for straight–in landing minimums. While the regulations do not prohibit EFVS from being used during any phase of flight, they do prohibit it from being used for operational credit on anything but a straight–in IAP with straight–in landing minima. EFVS shall only be used during a circle–to–land maneuver provided the visual references required throughout the circling maneuver are distinctly visible using natural vision. An EFVS cannot be used to satisfy the requirement that an identifiable part of the airport be distinctly visible to the pilot during a circling maneuver at or above MDA or while descending below MDA from a circling maneuver.

3. Enhanced Flight Visibility. Flight visibility is determined by using natural vision, and enhanced flight visibility (EFV) is determined by using an EFVS. 14 CFR part 91.175 (l) requires that the EFV observed by using an EFVS cannot be less than the visibility prescribed in the IAP to be used in order to continue to descend below the DA or MDA.

b. EFVS Operations At or Below DA or MDA Down to 100 Feet Above the TDZE. The visual segment of an IAP begins at DA or MDA and continues to the runway. There are two means of operating in the visual segment—one is by using natural vision and the other is by using an EFVS. If the pilot determines that the EFV observed by using the EFVS is not less than the minimum visibility prescribed in the IAP being flown, and the pilot acquires the required visual references prescribed in 14 CFR part 91.175 (l)(3) using the EFVS, then the pilot can continue the approach to 100 feet above the TDZE. To continue the approach, the pilot uses the EFVS image to visually acquire the runway environment (the approach
light system (ALS), if installed, or both the runway threshold and the TDZ), confirm lateral alignment, maneuver to the extended runway centerline earlier than would otherwise be possible, and continue a normal descent from the DA or MDA to 100 feet above the TDZE.

1. Required Visual References. In order to descend below DA or MDA, the following visual references (specified in 14 CFR part 91.175 (l)(3)) for the runway of intended landing must be distinctly visible and identifiable to the pilot using the EFVS:

   (a) The ALS (if installed), or

   (b) The following visual references in both (b)(1) and (b)(2) below:

      (1) The runway threshold, identified by at least one of the following: the beginning of the runway landing surface, the threshold lights, or the runway end identifier lights (REIL).

      (2) The TDZ, identified by at least one of the following: the runway TDZ landing surface, the TDZ lights, the TDZ markings, or the runway lights.

2. Comparison of Visual Reference Requirements for EFVS and Natural Vision. The EFVS visual reference requirements of 14 CFR part 91.175 (l)(3) comprise a more stringent standard than the visual reference requirements prescribed under 14 CFR part 91.175 (c)(3) when using natural vision. The more stringent standard is needed because an EFVS might not display the color of the lights used to identify specific portions of the runway or might not be able to consistently display the runway markings. The main differences for EFVS operations are that the visual glide slope indicator (VGSI) lights cannot be used as a visual reference, and specific visual references from both the threshold and TDZ must be distinctly visible and identifiable. However, when using natural vision, only one of the specified visual references must be visible and identifiable.

3. Visual References and Offset Approaches. Pilots must be especially knowledgeable of the approach conditions and approach course alignment when considering whether to rely on EFVS during a non-precision approach with an offset final approach course. Depending upon the combination of crosswind correction and the lateral field of view provided by a particular EFVS, the required visual references may or may not be within the pilot’s view looking through the EFVS display. Pilots conducting any non-precision approach must verify lateral alignment with the runway centerline when determining when to descend from MDA.

4. When to Go Around. Any pilot operating an aircraft with an EFVS installed should be aware that the requirements of 14 CFR part 91.175 (c) for using natural vision and the requirements of 14 CFR part 91.175 (l) for using an EFVS are different. A pilot would, therefore, first have to determine whether an approach will be commenced using natural vision or using an EFVS. While these two sets of requirements provide a parallel decisionmaking process, the requirements for when a missed approach must be executed differ. Using EFVS, a missed approach must be initiated at or below DA or MDA down to 100 feet above TDZE whenever the pilot determines that:

   (a) The EFV is less than the visibility minima prescribed for the IAP being used;

   (b) The required visual references for the runway of intended landing are no longer distinctly visible and identifiable to the pilot using the EFVS imagery;

   (c) The aircraft is not continuously in a position from which a descent to a landing can be made on the intended runway, at a normal rate of descent, using normal maneuvers; or

   (d) For operations under 14 CFR parts 121 and 135, the descent rate of the aircraft would not allow touchdown to occur within the TDZ of the runway of intended landing.

5. Missed Approach Considerations. It should be noted that a missed approach after passing the DA, or beyond the missed approach point (MAP), involves additional risk until established on the published missed approach segment. Initiating a go-around after passing the published MAP may result in loss of obstacle clearance. As with any approach, pilot planning should include contingencies between the published MAP and touchdown with reference to obstacle clearance, aircraft performance, and alternate escape plans.

   c. EFVS Operations At and Below 100 Feet Above the TDZE. At and below 100 feet above the TDZE, the regulations do not require the EFVS to be turned off or the display to be stowed in order to continue to a landing. A pilot may continue the approach
 Arrival Procedures

5–4–23. Visual Approach

a. A visual approach is conducted on an IFR flight plan and authorizes a pilot to proceed visually and clear of clouds to the airport. The pilot must have either the airport or the preceding identified aircraft in sight. This approach must be authorized and controlled by the appropriate air traffic control facility. Reported weather at the airport must have a ceiling at or above 1,000 feet and visibility 3 miles or greater. ATC may authorize this type approach when it will be operationally beneficial. Visual approaches are an IFR procedure conducted under IFR in visual meteorological conditions. Cloud clearance requirements of 14 CFR Section 91.155 are not applicable, unless required by operation specifications.

b. Operating to an Airport Without Weather Reporting Service. ATC will advise the pilot when weather is not available at the destination airport. ATC may initiate a visual approach provided there is a reasonable assurance that weather at the airport is a
ceiling at or above 1,000 feet and visibility 3 miles or greater (e.g., area weather reports, PIREPs, etc.).

c. Operating to an Airport With an Operating Control Tower. Aircraft may be authorized to conduct a visual approach to one runway while other aircraft are conducting IFR or VFR approaches to another parallel, intersecting, or converging runway. When operating to airports with parallel runways separated by less than 2,500 feet, the succeeding aircraft must report sighting the preceding aircraft unless standard separation is being provided by ATC. When operating to parallel runways separated by at least 2,500 feet but less than 4,300 feet, controllers will clear/vector aircraft to the final at an angle not greater than 30 degrees unless radar, vertical, or visual separation is provided during the turn-on. The purpose of the 30 degree intercept angle is to reduce the potential for overshoots of the final and to preclude side-by-side operations with one or both aircraft in a belly-up configuration during the turn-on. The operations may be conducted simultaneously. When the parallel runways are separated by 4,300 feet or more, or intersecting/converging runways are in use, ATC may authorize a visual approach after advising all aircraft involved that other aircraft are conducting operations to the other runway. This may be accomplished through use of the ATIS.

d. Separation Responsibilities. If the pilot has the airport in sight but cannot see the aircraft to be followed, ATC may clear the aircraft for a visual approach; however, ATC retains both separation and wake vortex separation responsibility. When visually following a preceding aircraft, acceptance of the visual approach clearance constitutes acceptance of pilot responsibility for maintaining a safe approach interval and adequate wake turbulence separation.

e. A visual approach is not an IAP and therefore has no missed approach segment. If a go around is necessary for any reason, aircraft operating at controlled airports will be issued an appropriate advisory/clearance/instruction by the tower. At uncontrolled airports, aircraft are expected to remain clear of clouds and complete a landing as soon as possible. If a landing cannot be accomplished, the aircraft is expected to remain clear of clouds and contact ATC as soon as possible for further clearance. Separation from other IFR aircraft will be maintained under these circumstances.

f. Visual approaches reduce pilot/controller workload and expedite traffic by shortening flight paths to the airport. It is the pilot’s responsibility to advise ATC as soon as possible if a visual approach is not desired.

g. Authorization to conduct a visual approach is an IFR authorization and does not alter IFR flight plan cancellation responsibility.

REFERENCE – AIM, Canceling IFR Flight Plan, Paragraph 5–1–15

h. Radar service is automatically terminated, without advising the pilot, when the aircraft is instructed to change to advisory frequency.


a. CVFPs are charted visual approaches established for environmental/noise considerations, and/or when necessary for the safety and efficiency of air traffic operations. The approach charts depict prominent landmarks, courses, and recommended altitudes to specific runways. CVFPs are designed to be used primarily for turbojet aircraft.

b. These procedures will be used only at airports with an operating control tower.

c. Most approach charts will depict some NAVAID information which is for supplemental navigational guidance only.

d. Unless indicating a Class B airspace floor, all depicted altitudes are for noise abatement purposes and are recommended only. Pilots are not prohibited from flying other than recommended altitudes if operational requirements dictate.

e. When landmarks used for navigation are not visible at night, the approach will be annotated “PROCEDURE NOT AUTHORIZED AT NIGHT.”

f. CVFPs usually begin within 20 flying miles from the airport.

g. Published weather minimums for CVFPs are based on minimum vectoring altitudes rather than the recommended altitudes depicted on charts.

h. CVFPs are not instrument approaches and do not have missed approach segments.

i. ATC will not issue clearances for CVFPs when the weather is less than the published minimum.
j. ATC will clear aircraft for a CVFP after the pilot reports sighting a charted landmark or a preceding aircraft. If instructed to follow a preceding aircraft, pilots are responsible for maintaining a safe approach interval and wake turbulence separation.

k. Pilots should advise ATC if at any point they are unable to continue an approach or lose sight of a preceding aircraft. Missed approaches will be handled as a go-around.

5–4–25. Contact Approach

a. Pilots operating in accordance with an IFR flight plan, provided they are clear of clouds and have at least 1 mile flight visibility and can reasonably expect to continue to the destination airport in those conditions, may request ATC authorization for a contact approach.

b. Controllers may authorize a contact approach provided:

1. The contact approach is specifically requested by the pilot. ATC cannot initiate this approach.

   EXAMPLE—
   Request contact approach.

2. The reported ground visibility at the destination airport is at least 1 statute mile.

3. The contact approach will be made to an airport having a standard or special instrument approach procedure.

4. Approved separation is applied between aircraft so cleared and between these aircraft and other IFR or special VFR aircraft.

   EXAMPLE—
   Cleared contact approach (and, if required) at or below (altitude) (routing) if not possible (alternative procedures) and advise.

c. A contact approach is an approach procedure that may be used by a pilot (with prior authorization from ATC) in lieu of conducting a standard or special IAP to an airport. It is not intended for use by a pilot on an IFR flight clearance to operate to an airport not having a published and functioning IAP. Nor is it intended for an aircraft to conduct an instrument approach to one airport and then, when “in the clear,” discontinue that approach and proceed to another airport. In the execution of a contact approach, the pilot assumes the responsibility for obstruction clearance. If radar service is being received, it will automatically terminate when the pilot is instructed to change to advisory frequency.

5–4–26. Landing Priority

A clearance for a specific type of approach (ILS, MLS, ADF, VOR or Straight-in Approach) to an aircraft operating on an IFR flight plan does not mean that landing priority will be given over other traffic. ATCTs handle all aircraft, regardless of the type of flight plan, on a “first-come, first-served” basis. Therefore, because of local traffic or runway in use, it may be necessary for the controller in the interest of safety, to provide a different landing sequence. In any case, a landing sequence will be issued to each aircraft as soon as possible to enable the pilot to properly adjust the aircraft’s flight path.

5–4–27. Overhead Approach Maneuver

a. Pilots operating in accordance with an IFR flight plan in Visual Meteorological Conditions (VMC) may request ATC authorization for an overhead maneuver. An overhead maneuver is not an instrument approach procedure. Overhead maneuver patterns are developed at airports where aircraft have an operational need to conduct the maneuver. An aircraft conducting an overhead maneuver is considered to be VFR and the IFR flight plan is cancelled when the aircraft reaches the initial point on the initial approach portion of the maneuver. (See FIG 5–4–30.) The existence of a standard overhead maneuver pattern does not eliminate the possible requirement for an aircraft to conform to conventional rectangular patterns if an overhead maneuver cannot be approved. Aircraft operating to an airport without a functioning control tower must initiate cancellation of an IFR flight plan prior to executing the overhead maneuver. Cancellation of the IFR flight plan must be accomplished after crossing the landing threshold on the initial portion of the maneuver or after landing. Controllers may authorize an overhead maneuver and issue the following to arriving aircraft:

1. Pattern altitude and direction of traffic. This information may be omitted if either is standard.

   PHRASEOLOGY—
   PATTERN ALTITUDE (altitude). RIGHT TURNS.
2. Request for a report on initial approach.

**PHRASEOLOGY--**

**REPORT INITIAL.**

3. “Break” information and a request for the pilot to report. The “Break Point” will be specified if nonstandard. Pilots may be requested to report “break” if required for traffic or other reasons.

**PHRASEOLOGY--**

**BREAK AT (specified point).**

**REPORT BREAK.**
Instructed to do so by ATC.

Advises ATC that a missed approach will be made. Include the reason for the missed approach unless the missed approach is initiated by ATC.

Complies with the missed approach instructions for the IAP being executed from the MAP, unless other missed approach instructions are specified by ATC.

If executing a missed approach prior to reaching the MAP, fly the lateral navigation path of the instrument procedure to the MAP. Climb to the altitude specified in the missed approach procedure, except when a maximum altitude is specified between the final approach fix (FAF) and the MAP. In that case, comply with the maximum altitude restriction. Note, this may require a continued descent on the final approach.

Following a missed approach, requests clearance for specific action; i.e., another approach, hold for improved conditions, proceed to an alternate airport, etc.

b. Controller.

Issues an approved alternate missed approach procedure if it is desired that the pilot execute a procedure other than as depicted on the instrument approach chart.

May vector a radar identified aircraft executing a missed approach when operationally advantageous to the pilot or the controller.

In response to the pilot’s stated intentions, issues a clearance to an alternate airport, to a holding fix, or for reentry into the approach sequence, as traffic conditions permit.

5–5–6. Radar Vectors

a. Pilot.

Promptly complies with headings and altitudes assigned to you by the controller.

Questions any assigned heading or altitude believed to be incorrect.

If operating VFR and compliance with any radar vector or altitude would cause a violation of any CFR, advises ATC and obtains a revised clearance or instructions.

b. Controller.

Vectors aircraft in Class A, Class B, Class C, Class D, and Class E airspace:

(a) For separation.

(b) For noise abatement.

(c) To obtain an operational advantage for the pilot or controller.

Vectors aircraft in Class A, Class B, Class C, Class D, Class E, and Class G airspace when requested by the pilot.

Vectors IFR aircraft at or above minimum vectoring altitudes.

May vector VFR aircraft, not at an ATC assigned altitude, at any altitude. In these cases, terrain separation is the pilot’s responsibility.

5–5–7. Safety Alert

a. Pilot.

Initiates appropriate action if a safety alert is received from ATC.

Be aware that this service is not always available and that many factors affect the ability of the controller to be aware of a situation in which unsafe proximity to terrain, obstructions, or another aircraft may be developing.

b. Controller.

Issues a safety alert if aware an aircraft under their control is at an altitude which, in the controller’s judgment, places the aircraft in unsafe proximity to terrain, obstructions, or another aircraft. Types of safety alerts are:

(a) Terrain or Obstruction Alert. Immediately issued to an aircraft under their control if aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain or obstructions.

(b) Aircraft Conflict Alert. Immediately issued to an aircraft under their control if aware of an aircraft not under their control at an altitude believed to place the aircraft in unsafe proximity to each other. With the alert, they offer the pilot an alternative, if feasible.

Discontinue further alerts if informed by the pilot action is being taken to correct the situation or that the other aircraft is in sight.
5–5–8. See and Avoid

a. Pilot. When meteorological conditions permit, regardless of type of flight plan or whether or not under control of a radar facility, the pilot is responsible to see and avoid other traffic, terrain, or obstacles.

b. Controller.

1. Provides radar traffic information to radar identified aircraft operating outside positive control airspace on a workload permitting basis.

2. Issues safety alerts to aircraft under their control if aware the aircraft is at an altitude believed to place the aircraft in unsafe proximity to terrain, obstructions, or other aircraft.

5–5–9. Speed Adjustments

a. Pilot.

1. Advises ATC any time cruising airspeed varies plus or minus 5 percent or 10 knots, whichever is greater, from that given in the flight plan.

2. Complies with speed adjustments from ATC unless:

   (a) The minimum or maximum safe airspeed for any particular operation is greater or less than the requested airspeed. In such cases, advises ATC.

   NOTE—
   It is the pilot's responsibility and prerogative to refuse speed adjustments considered excessive or contrary to the aircraft's operating specifications.

   (b) Operating at or above 10,000 feet MSL on an ATC assigned SPEED ADJUSTMENT of more than 250 knots IAS and subsequent clearance is received for descent below 10,000 feet MSL. In such cases, pilots are expected to comply with 14 CFR Section 91.117(a).

3. When complying with speed adjustment assignments, maintains an indicated airspeed within plus or minus 10 knots or 0.02 Mach number of the specified speed.

b. Controller.

1. Assigns speed adjustments to aircraft when necessary but not as a substitute for good vectoring technique.

2. Adheres to the restrictions published in the FAAO JO 7110.65, Air Traffic Control, as to when speed adjustment procedures may be applied.

3. Avoids speed adjustments requiring alternate decreases and increases.

4. Assigns speed adjustments to a specified IAS (KNOTS)/Mach number or to increase or decrease speed using increments of 10 knots or multiples thereof.

5. Advises pilots to resume normal speed when speed adjustments are no longer required.

6. Gives due consideration to aircraft capabilities to reduce speed while descending.

7. Does not assign speed adjustments to aircraft at or above FL 390 without pilot consent.

5–5–10. Traffic Advisories (Traffic Information)

a. Pilot.

1. Acknowledges receipt of traffic advisories.

2. Informs controller if traffic in sight.

3. Advises ATC if a vector to avoid traffic is desired.

4. Does not expect to receive radar traffic advisories on all traffic. Some aircraft may not appear on the radar display. Be aware that the controller may be occupied with higher priority duties and unable to issue traffic information for a variety of reasons.

5. Advises controller if service is not desired.

b. Controller.

1. Issues radar traffic to the maximum extent consistent with higher priority duties except in Class A airspace.

2. Provides vectors to assist aircraft to avoid observed traffic when requested by the pilot.

3. Issues traffic information to aircraft in the Class B, Class C, and Class D surface areas for sequencing purposes.

4. Controllers are required to issue to each aircraft operating on intersecting or nonintersecting converging runways where projected flight paths will cross.
(a) The products should be either FAA/NWS “accepted” aviation weather reports or products, or based on FAA/NWS accepted aviation weather reports or products. If products are used which do not meet this criteria, they should be so identified. The operator must determine the applicability of such products to their particular flight operations.

(b) In the case of a weather product which is the result of the application of a process which alters the form, function or content of the base FAA/NWS accepted weather product(s), that process, and any limitations to the application of the resultant product, should be described in the vendor’s user guidance material.

2. An example would be a NEXRAD radar composite/mosaic map, which has been modified by changing the scaling resolution. The methodology of assigning reflectivity values to the resultant image components should be described in the vendor’s guidance material to ensure that the user can accurately interpret the displayed data.

7–1–12. Weather Observing Programs

a. Manual Observations. With only a few exceptions, these reports are from airport locations staffed by FAA or NWS 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 7–1–30, Key to Aviation Routine Weather Report (METAR) and Aerodrome Forecasts (TAF).


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 paragraph 7–2–2 Procedures, for the altimeter setting procedures.

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 A/FD. 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–1 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 NAVAID. 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 A/FD, and where applicable, on published Instrument Approach Procedures. Selected individual systems may be incorporated into nationwide data collection and dissemination networks in the future.

c. AWOS Broadcasts. Computer-generated voice is used in AWOS to automate the broadcast of the minute-by-minute weather observations. In addition, some systems are configured to permit the addition of an operator-generated voice message; e.g., weather remarks following the automated parameters. The phraseology used generally follows that used for other weather broadcasts. Following are explanations and examples of the exceptions.

1. Location and Time. The location/name and the phrase “AUTOMATED WEATHER OBSERVATION,” followed by the time are announced.

(a) If the airport’s specific location is included in the airport’s name, the airport’s name is announced.

EXAMPLE–
“Bremerton National Airport automated weather observation, one four five six zulu;”
“Ravenswood Jackson County Airport automated weather observation, one four five six zulu.”

(b) If the airport’s specific location is not included in the airport’s name, the location is announced followed by the airport’s name.

EXAMPLE–
“Sault Ste. Marie, Chippewa County International Airport automated weather observation;”
“Sandusky, Cowley Field automated weather observation.”

(c) The word “TEST” is added following “OBSERVATION” when the system is not in commissioned status.

EXAMPLE–
“Bremerton National Airport automated weather observation test, one four five six zulu.”

(d) The phrase “TEMPORARILY INOPERATIVE” is added when the system is inoperative.

EXAMPLE–
“Bremerton National Airport automated weather observing system temporarily inoperative.”

2. Visibility.

(a) The lowest reportable visibility value in AWOS is “less than 1/4.” It is announced as “VISIBILITY LESS THAN ONE QUARTER.”

(b) A sensor for determining visibility is not included in some AWOS. In these systems, visibility is not announced. “VISIBILITY MISSING” is announced only if the system is configured with a visibility sensor and visibility information is not available.

3. Weather. In the future, some AWOSs are to be configured to determine the occurrence of precipitation. However, the type and intensity may not always be determined. In these systems, the word “PRECIPITATION” will be announced if precipitation is occurring, but the type and intensity are not determined.

4. Ceiling and Sky Cover.

(a) Ceiling is announced as either “CEILING” or “INDEFINITE CEILING.” With the exception of indefinite ceilings, all automated ceiling heights are measured.
7−1−29

EXAMPLE−
“Bremerton National Airport automated weather observation, one four five six zulu. Ceiling two thousand overcast;”

“Bremerton National Airport automated weather observation, one four five six zulu. Indefinite ceiling two hundred, sky obscured.”

(b) The word “Clear” is not used in AWOS due to limitations in the height ranges of the sensors. No clouds detected is announced as “NO CLOUDS BELOW XXX” or, in newer systems as “CLEAR BELOW XXX” (where XXX is the range limit of the sensor).

EXAMPLE−
“No clouds below one two thousand.”
“Clear below one two thousand.”

(c) A sensor for determining ceiling and sky cover is not included in some AWOS. In these systems, ceiling and sky cover are not announced. “SKY CONDITION MISSING” is announced only if the system is configured with a ceilometer and the ceiling and sky cover information is not available.

5. Remarks. If remarks are included in the observation, the word “REMARKS” is announced following the altimeter setting.

(a) Automated “Remarks.”

(1) Density Altitude.
(2) Variable Visibility.
(3) Variable Wind Direction.

(b) Manual Input Remarks. Manual input remarks are prefaced with the phrase “OBSERVER WEATHER.” As a general rule the manual remarks are limited to:

(1) Type and intensity of precipitation.
(2) Thunderstorms and direction; and
(3) Obstructions to vision when the visibility is 3 miles or less.

EXAMPLE−
“Remarks density altitude, two thousand five hundred ... visibility variable between one and two ... wind direction variable between two four zero and three one zero ... observer ceiling estimated two thousand broken ... observer temperature two, dew point minus five.”

(d) “REMARKS” are announced in the following order of priority:

(1) Automated “REMARKS.”

[a] Density Altitude.
[b] Variable Visibility.
[c] Variable Wind Direction.

(2) Manual Input “REMARKS.”

[a] Sky Condition.
[b] Visibility.
[c] Weather and Obstructions to Vision.
[d] Temperature.
[e] Dew Point.
[f] Wind; and
[g] Altimeter Setting.

EXAMPLE−
“Remarks density altitude, two thousand five hundred ... visibility variable between one and two ... wind direction variable between two four zero and three one zero ... observer ceiling estimated two thousand broken ... observer temperature two, dew point minus five.”

d. Automated Surface Observing System (ASOS)/Automated Weather Sensor System (AWSS). The ASOS/AWSS is the primary surface weather observing system of the U.S. (See Key to Decode an ASOS/AWSS (METAR) Observation, FIG 7−1−9 and FIG 7−1−10.) 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. AWSS is a follow−on program that provides identical data as ASOS. ASOS/AWSS is designed to support aviation operations and weather forecast activities. The ASOS/AWSS 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/AWSS transmissions on a discrete VHF radio frequency are engineered to be receivable to a maximum of 25 NM from the ASOS/AWSS site and a maximum altitude of 10,000 feet AGL. At many locations, ASOS/AWSS 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/AWSS at each airport location consists of four main components:
      (1) Individual weather sensors.
      (2) Data collection and processing units.
      (3) Peripherals and displays.
   (b) The ASOS/AWSS 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/AWSS 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.

3. The ASOS/AWSS 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 broadcast over FAA radios is in reference to magnetic north.

4. An ASOS/AWOS/AWSS 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 back-ups an ASOS/AWOS/AWSS 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” shall appear in remarks. (A precipitation discriminator can determine the difference between liquid and frozen/freezing precipitation).

**NOTE—**
To decode an ASOS/AWSS report, refer to FIG 7–1–9 and FIG 7–1–10.

**REFERENCE—**
A complete explanation of METAR terminology is located in AIM, Paragraph 7–1–30 Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR).
e. TBL 7–1–2 contains a comparison of weather observing programs and the elements reported.

f. Service Standards. During 1995, a government/industry team worked to comprehensively reassess the requirements for surface observations at the nation’s airports. That work resulted in agreement on a set of service standards, and the FAA and NWS ASOS sites to which the standards would apply. The term “Service Standards” refers to the level of detail in weather observation. The service standards consist of four different levels of service (A, B, C, and D) as described below. Specific observational elements included in each service level are listed in TBL 7–1–3.

1. Service Level D defines the minimum acceptable level of service. It is a completely automated service in which the ASOS/AWSS observation will constitute the entire observation, i.e., no additional weather information is added by a human observer. This service is referred to as a stand alone D site.

2. Service Level C is a service in which the human observer, usually an air traffic controller, augments or adds information to the automated observation. Service Level C also includes backup of ASOS/AWSS elements in the event of an ASOS/AWSS malfunction or an unrepresentative ASOS/AWSS report. In backup, the human observer inserts the correct or missing value for the automated ASOS/AWSS elements. This service is provided by air traffic controllers under the Limited Aviation Weather Reporting Station (LAWRS) process, FSS and NWS observers, and, at selected sites, Non–Federal Observation Program observers.

Two categories of airports require detail beyond Service Level C in order to enhance air traffic control efficiency and increase system capacity. Services at these airports are typically provided by contract weather observers, NWS observers, and, at some locations, FSS observers.

3. Service Level B is a service in which weather observations consist of all elements provided under Service Level C, plus augmentation of additional data beyond the capability of the ASOS/AWSS. This category of airports includes smaller hubs or special airports in other ways that have worse than average bad weather operations for thunderstorms and/or freezing/frozen precipitation, and/or that are remote airports.

4. Service Level A, the highest and most demanding category, includes all the data reported in Service Standard B, plus additional requirements as specified. Service Level A covers major aviation hubs and/or high volume traffic airports with average or worse weather.

<table>
<thead>
<tr>
<th>Element Reported</th>
<th>Wind</th>
<th>Visibility</th>
<th>Temperature Dew Point</th>
<th>Altimeter</th>
<th>Density Altimeter</th>
<th>Cloud/Ceiling</th>
<th>Precipitation Identification</th>
<th>Thunderstorm/Lightning</th>
<th>Precipitation Occurrence</th>
<th>Rainfall Accumulation</th>
<th>Runway Surface Condition</th>
<th>Freezing Rain Occurrence</th>
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</tr>
</tbody>
</table>

REFERENCE—FAA Order 7900.5B, Surface Weather Observing, for element reporting.
### SERVICE LEVEL A

<table>
<thead>
<tr>
<th>Service Level A consists of all the elements of Service Levels B, C and D plus the elements listed to the right, if observed.</th>
<th>10 minute longline RVR at precedented sites or additional visibility increments of 1/8, 1/16 and 0</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sector visibility</td>
</tr>
<tr>
<td></td>
<td>Variable sky condition</td>
</tr>
<tr>
<td></td>
<td>Cloud layers above 12,000 feet and cloud types</td>
</tr>
<tr>
<td></td>
<td>Widespread dust, sand and other obscurations</td>
</tr>
<tr>
<td></td>
<td>Volcanic eruptions</td>
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</table>

### SERVICE LEVEL B

<table>
<thead>
<tr>
<th>Service Level B consists of all the elements of Service Levels C and D plus the elements listed to the right, if observed.</th>
<th>Longline RVR at precedented sites (may be instantaneous readout)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Freezing drizzle versus freezing rain</td>
</tr>
<tr>
<td></td>
<td>Ice pellets</td>
</tr>
<tr>
<td></td>
<td>Snow depth &amp; snow increasing rapidly remarks</td>
</tr>
<tr>
<td></td>
<td>Thunderstorm and lightning location remarks</td>
</tr>
<tr>
<td></td>
<td>Observed significant weather not at the station remarks</td>
</tr>
</tbody>
</table>

### SERVICE LEVEL C

<table>
<thead>
<tr>
<th>Service Level C consists of all the elements of Service Level D plus augmentation and backup by a human observer or an air traffic control specialist on location nearby. Backup consists of inserting the correct value if the system malfunctions or is unrepresentative. Augmentation consists of adding the elements listed to the right, if observed. During hours that the observing facility is closed, the site reverts to Service Level D.</th>
<th>Thunderstorms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tornadoes</td>
</tr>
<tr>
<td></td>
<td>Hail</td>
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<td></td>
<td>Virga</td>
</tr>
<tr>
<td></td>
<td>Volcanic ash</td>
</tr>
<tr>
<td></td>
<td>Tower visibility</td>
</tr>
<tr>
<td></td>
<td>Operationally significant remarks as deemed appropriate by the observer</td>
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</table>

### SERVICE LEVEL D

<table>
<thead>
<tr>
<th>This level of service consists of an ASOS or AWSS continually measuring the atmosphere at a point near the runway. The ASOS or AWSS senses and measures the weather parameters listed to the right.</th>
<th>Wind</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Visibility</td>
</tr>
<tr>
<td></td>
<td>Precipitation/Obstruction to vision</td>
</tr>
<tr>
<td></td>
<td>Cloud height</td>
</tr>
<tr>
<td></td>
<td>Sky cover</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
</tr>
<tr>
<td></td>
<td>Dew point</td>
</tr>
<tr>
<td></td>
<td>Altimeter</td>
</tr>
</tbody>
</table>

### 7–1–13. Weather Radar Services

**a.** The National Weather Service operates a network of radar sites for detecting coverage, intensity, and movement of precipitation. The network is supplemented by FAA and DOD radar sites in the western sections of the country. Local warning radar sites augment the network by operating on an as needed basis to support warning and forecast programs.

**b.** Scheduled radar observations are taken hourly and transmitted in alpha-numeric format on weather telecommunications circuits for flight planning purposes. Under certain conditions, special radar reports are issued in addition to the hourly transmittals. Data contained in the reports are also collected by the National Center for Environmental Prediction and used to prepare national radar summary charts for dissemination on facsimile circuits.

**c.** A clear radar display (no echoes) does not mean that there is no significant weather within the coverage of the radar site. Clouds and fog are not detected by the radar. However, when echoes are present, turbulence can be implied by the intensity of the precipitation, and icing is implied by the presence of the precipitation at temperatures at or below zero degrees Celsius. Used in conjunction with other weather products, radar provides invaluable information for weather avoidance and flight planning.
FIG 9–1–9
U.S. Terminal Publication Volumes

Types of Charts Available
FIG 9–1–10
Airport/Facility Directory Geographic Areas

FIG 9–1–11
Sectional and VFR Terminal Area Charts for Alaska
Helicopter Approach Procedures to VFR Heliports

a. Helicopter approaches may be developed for heliports that do not meet the design standards for an IFR heliport. The majority of IFR approaches to VFR heliports are developed in support of helicopter emergency medical services (HEMS) operators. These approaches can be developed from conventional NA VADs or a RNA V system (including GPS). They are developed either as a Special Approach (pilot training is required for special procedures due to their unique characteristics) or a public approach (no special training required). These instrument procedures are developed as either an approach designed to a specific landing site, or an approach designed to a point–in–space.

1. Approach to a specific landing site. The approach is aligned to a missed approach point from which a landing can be accomplished with a maximum course change of 30 degrees. The visual segment from the MAP to the landing site is evaluated for obstacle hazards. These procedures are annotated: “PROCEED VISUALLY FROM (NAMED MAP) OR CONDUCT THE SPECIFIED MISSED APPROACH.”

(a) This phrase requires the pilot to either acquire and maintain visual contact with the landing site at or prior to the MAP, or execute a missed approach. The visibility minimum is based on the distance from the MAP to the landing site, among other factors.

(b) The pilot is required to maintain the published minimum visibility throughout the visual segment.

(c) Similar to an approach to a runway, the missed approach segment protection is not provided between the MAP and the landing site, and obstacle or terrain avoidance from the MAP to the landing site is the responsibility of the pilot.

(d) Upon reaching the MAP defined on the approach procedure, or as soon as practicable after reaching the MAP, the pilot advises ATC whether proceeding visually and canceling IFR or complying with the missed approach instructions. See paragraph 5–1–15, Canceling IFR Flight Plan.

(e) At least one of the following visual references must be visible or identifiable before the pilot may proceed visually:

(1) FATO or FATO lights.
(2) TLOF or TLOF lights.
(3) Heliport Instrument Lighting System (HILS).
(4) Heliport Approach Lighting System (HALS) or lead-in lights.
(5) Visual Glideslope Indicator (VGSI).
(6) Windsock or windsock light(s). See note below.
(7) Heliport beacon. See note below.
(8) Other facilities or systems approved by the Flight Technologies and Procedures Division (AFS–400).

NOTE–Windsock lights and heliport beacons should be located within 500 ft of the TLOF.

2. Approach to a Point–in–Space (PinS). At locations where the MAP is located more than 2 SM from the landing site, or the path from the MAP to the landing site is populated with obstructions which require avoidance actions or requires turns greater than 30 degrees, a PinS procedure may be developed. These approaches are annotated “PROCEED VFR FROM (NAMED MAP) OR CONDUCT THE SPECIFIED MISSED APPROACH.”

(a) These procedures require the pilot, at or prior to the MAP, to determine if the published minimum visibility, or the weather minimums required by the operating rule, or operations specifications (whichever is higher) is available to safely transition from IFR to VFR flight. If not, the pilot must execute a missed approach. For Part 135 operations, pilots may not begin the instrument approach unless the latest weather report indicates that the weather conditions are at or above the authorized IFR minimums or the VFR weather minimums (as required by the class of airspace, operating rule and/or Operations Specifications) whichever is higher.

(b) Visual contact with the landing site is not required; however, the pilot must maintain the appropriate VFR weather minimums throughout the visual segment. The visibility is limited to no lower
than that published in the procedure, until canceling IFR.

(c) IFR obstruction clearance areas are not applied to the VFR segment between the MAP and the landing site. Obstacle or terrain avoidance from the MAP to the landing site is the responsibility of the pilot.

(d) Upon reaching the MAP defined on the approach procedure, or as soon as practicable after reaching the MAP, the pilot advises ATC whether proceeding VFR and canceling IFR, or complying with the missed approach instructions. See paragraph 5−1−15, Canceling IFR Flight Plan.

(e) If the visual segment penetrates Class B, C, or D airspace, pilots are responsible for obtaining a Special VFR clearance, when required.

10−1−4. The Gulf of Mexico Grid System

a. On October 8, 1998, the Southwest Regional Office of the FAA, with assistance from the Helicopter Safety Advisory Conference (HSAC), implemented the world’s first Instrument Flight Rules (IFR) Grid System in the Gulf of Mexico. This navigational route structure is completely independent of ground−based navigation aids (NAVAIDs) and was designed to facilitate helicopter IFR operations to offshore destinations. The Grid System is defined by over 300 offshore waypoints located 20 minutes apart (latitude and longitude). Flight plan routes are routinely defined by just 4 segments: departure point (lat/long), first en route grid waypoint, last en route grid waypoint prior to approach procedure, and destination point (lat/long). There are over 4,000 possible offshore landing sites. Upon reaching the waypoint prior to the destination, the pilot may execute an Offshore Standard Approach Procedure (OSAP), a Helicopter En Route Descent Areas (HEDA) approach, or an Airborne Radar Approach (ARA). For more information on these helicopter instrument procedures, refer to FAA AC 90−80B, Approval of Offshore Standard Approach Procedures, Airborne Radar Approaches, and Helicopter En Route Descent Areas, on the FAA web site http://www.faa.gov under Advisory Circulars. The return flight plan is just the reverse with the requested stand-alone GPS approach contained in the remarks section.

1. The large number (over 300) of waypoints in the grid system makes it difficult to assign phonetically pronounceable names to the waypoints that would be meaningful to pilots and controllers. A unique naming system was adopted that enables pilots and controllers to derive the fix position from the name. The five−letter names are derived as follows:

(a) The waypoints are divided into sets of 3 columns each. A three−letter identifier, identifying a geographical area or a NAVAID to the north, represents each set.

(b) Each column in a set is named after its position, i.e., left (L), center (C), and right (R).

(c) The rows of the grid are named alphabetically from north to south, starting with A for the northern most row.

EXAMPLE−
LCHRC would be pronounced “Lake Charles Romeo Charlie.” The waypoint is in the right−hand column of the Lake Charles VOR set, in row C (third south from the northern most row).

2. In December 2009, significant improvements to the Gulf of Mexico grid system were realized with the introduction of ATC separation services using ADS−B. In cooperation with the oil and gas services industry, HSAC and Helicopter Association International (HAI), the FAA installed an infrastructure of ADS−B ground stations, weather stations (AWOS) and VHF remote communication outlets (RCO) throughout a large area of the Gulf of Mexico. This infrastructure allows the FAA’s Houston ARTCC to provide “domestic−like” air traffic control service in the offshore area beyond 12nm from the coastline to hundreds of miles offshore to aircraft equipped with ADS−B. Properly equipped aircraft can now be authorized to receive more direct routing, domestic en route separation minima and real time flight following. Operators who do not have authorization to receive ATC separation services using ADS−B, will continue to use the low altitude grid system and receive procedural separation from Houston ARTCC. Non−ADS−B equipped aircraft also benefit from improved VHF communication and expanded weather information coverage.

3. Three 3 requirements must be met for operators to file IFR flight plans utilizing the grid:
(a) The helicopter must be equipped for IFR operations and equipped with IFR approved GPS navigational units.

(b) The operator must obtain prior written approval from the appropriate Flight Standards District Office through a Letter of Authorization or Operations Specification, as appropriate.

(c) The operator must be a signatory to the Houston ARTCC Letter of Agreement.

4. Operators who wish to benefit from ADS-B based ATC separation services must meet the following additional requirements:

(a) The Operator’s installed ADS-B Out equipment must meet the performance requirements of one of the following FAA Technical Standard Orders (TSO), or later revisions: TSO–C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance–Broadcast (ADS–B) Equipment, or TSO–C166b, Extended Squitter Automatic Dependent Surveillance–Broadcast (ADS–B) and Traffic Information.

(b) Flight crews must comply with the procedures prescribed in the Houston ARTCC Letter of Agreement dated December 17, 2009, or later.

**NOTE—**
The unique ADS–B architecture in the Gulf of Mexico depends upon reception of an aircraft’s Mode C in addition to the other message elements described in 14 CFR 91.227. Flight crews must be made aware that loss of Mode C also means that ATC will not receive the aircraft’s ADS–B signal.

5. FAA/NACO publishes the grid system waypoints on the IFR Gulf of Mexico Vertical Flight Reference Chart. A commercial equivalent is also available. The chart is updated annually and is available from a FAA chart agent or FAA directly, web site address: [http://www.naco.faa.gov](http://www.naco.faa.gov).
Appendix 4. Abbreviations/Acronyms

As used in this manual, the following abbreviations/acronyms have the meanings indicated.

<table>
<thead>
<tr>
<th>Abbreviation/Acronym</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAWU . . . . . . . . .</td>
<td>Alaskan Aviation Weather Unit</td>
</tr>
<tr>
<td>AAS . . . . . . . . . .</td>
<td>Airport Advisory Service</td>
</tr>
<tr>
<td>AC . . . . . . . . . .</td>
<td>Advisory Circular</td>
</tr>
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<td>ACAR . . . . . . . . .</td>
<td>Aircraft Communications Addressing and Reporting System</td>
</tr>
<tr>
<td>ADCUS . . . . . . . .</td>
<td>Advise Customs</td>
</tr>
<tr>
<td>ADDS . . . . . . . .</td>
<td>Aviation Digital Data Service</td>
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<td>ADF . . . . . . . . .</td>
<td>Automatic Direction Finder</td>
</tr>
<tr>
<td>ADIZ . . . . . . . .</td>
<td>Air Defense Identification Zone</td>
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<td>Automatic Dependent Surveillance−Broadcast</td>
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<td>Air Force Base</td>
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<td>Airport/Facility Directory</td>
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<td>Automatic Flight Information Service</td>
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<td>AFM . . . . . . . .</td>
<td>Aircraft Flight Manual</td>
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<td>Automated Flight Service Station</td>
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<td>Above Ground Level</td>
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<td>Attitude Heading Reference System</td>
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<td>Aeronautical Information Manual</td>
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<td>Airmen’s Meteorological Information</td>
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<td>Areas Noted for Attention</td>
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<td>Aircraft Rescue and Fire Fighting Incident Commander</td>
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<td>ARINC . . . . . .</td>
<td>Aeronautical Radio Incorporated</td>
</tr>
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<td>Airport Reservations Office</td>
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</tr>
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<td>Along−Track Distance</td>
</tr>
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<td>Automatic Terminal Information Service</td>
</tr>
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</tr>
<tr>
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</tr>
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</tr>
<tr>
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</tr>
<tr>
<td>AWTT . . .</td>
<td>Aviation Weather Transfer Technology</td>
</tr>
<tr>
<td>AWW . . .</td>
<td>Severe Weather Forecast Alert</td>
</tr>
<tr>
<td>BAASS . .</td>
<td>Bigelow Aerospace Advanced Space Studies</td>
</tr>
<tr>
<td>BBS . . .</td>
<td>Bulletin Board System</td>
</tr>
<tr>
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<td>Back Course</td>
</tr>
<tr>
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<td>Becoming group</td>
</tr>
<tr>
<td>C/A . . .</td>
<td>Coarse Acquisition</td>
</tr>
<tr>
<td>CARTS . . .</td>
<td>Common Automated Radar Terminal System (ARTS) (to include ARTS IIE and ARTS IIIE)</td>
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<td>CFR . . .</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>COA . . .</td>
<td>Certificate of Waiver or Authorization</td>
</tr>
<tr>
<td>CPDLC . .</td>
<td>Controller Pilot Data Link Communications</td>
</tr>
<tr>
<td>CTAF . . .</td>
<td>Common Traffic Advisory Frequency</td>
</tr>
<tr>
<td>CVFP . .</td>
<td>Charted Visual Flight Procedure</td>
</tr>
<tr>
<td>CVRS . . .</td>
<td>Computerized Voice Reservation System</td>
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<td>Ronald Reagan Washington National Airport</td>
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<tr>
<td>DCP . . .</td>
<td>Data Collection Package</td>
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<td>Distance Measuring Equipment</td>
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<tr>
<td>Abbreviation/Acronym</td>
<td>Meaning</td>
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<td>----------------------</td>
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<td>DOD</td>
<td>Department of Defense</td>
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<td>DP</td>
<td>Instrument Departure Procedure</td>
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<td>DPU</td>
<td>Data Processor Unit</td>
</tr>
<tr>
<td>DRT</td>
<td>Diversion Recovery Tool</td>
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<td>DRVSM</td>
<td>Domestic Reduced Vertical Separation Minimum</td>
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<td>DUATS</td>
<td>Direct User Access Terminal System</td>
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<td>DVA</td>
<td>Diverse Vector Area</td>
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<td>DVFR</td>
<td>Defense Visual Flight Rules</td>
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<td>DVRSN</td>
<td>Diversion</td>
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<td>EDCT</td>
<td>Expect Departure Clearance Time</td>
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<td>EPAS</td>
<td>En Route Flight Advisory Service</td>
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<td>EFV</td>
<td>Enhanced Flight Visibility</td>
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<td>EFVS</td>
<td>Enhanced Flight Vision System</td>
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<tr>
<td>ELT</td>
<td>Emergency Locator Transmitter</td>
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<tr>
<td>EMAS</td>
<td>Engineered Materials Arresting System</td>
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<td>EPE</td>
<td>Estimate of Position Error</td>
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<td>ESV</td>
<td>Expanded Service Volume</td>
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<tr>
<td>ETA</td>
<td>Estimated Time of Arrival</td>
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<td>ETD</td>
<td>Estimated Time of Departure</td>
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<tr>
<td>ETE</td>
<td>Estimated Time En Route</td>
</tr>
<tr>
<td>EWINS</td>
<td>Enhanced Weather Information System</td>
</tr>
<tr>
<td>EWR</td>
<td>Newark International Airport</td>
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<tr>
<td>FA</td>
<td>Area Forecast</td>
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<td>FAA</td>
<td>Federal Aviation Administration</td>
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<tr>
<td>FAF</td>
<td>Final Approach Fix</td>
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<tr>
<td>FAROS</td>
<td>Final Approach Runway Occupancy Signal</td>
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<td>FAWP</td>
<td>Final Approach Waypoint</td>
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<tr>
<td>FB</td>
<td>Fly–by</td>
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<td>FCC</td>
<td>Federal Communications Commission</td>
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<td>FD</td>
<td>Flight Director System</td>
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<tr>
<td>FDC</td>
<td>Flight Data Center</td>
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<tr>
<td>FDE</td>
<td>Fault Detection and Exclusion</td>
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<tr>
<td>FIR</td>
<td>Flight Information Region</td>
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<td>FIS</td>
<td>Flight Information Service</td>
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<td>FISDL</td>
<td>Flight Information Services Data Link</td>
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<td>FLIP</td>
<td>Flight Information Publication</td>
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<tr>
<td>FMS</td>
<td>Flight Management System</td>
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<td>FMSP</td>
<td>Flight Management System Procedure</td>
</tr>
<tr>
<td>FO</td>
<td>Fly–over</td>
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<tr>
<td>FPA</td>
<td>Flight Path Angle</td>
</tr>
<tr>
<td>FPV</td>
<td>Flight Path Vector</td>
</tr>
<tr>
<td>FPNM</td>
<td>Feet Per Nautical Mile</td>
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<tr>
<td>FSDOB</td>
<td>Flight Standards District Office</td>
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<tr>
<td>FSS</td>
<td>Flight Service Station</td>
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Appendix 4–2

Abbreviations/Acronyms
<table>
<thead>
<tr>
<th>Abbreviation/Acronym</th>
<th>Meaning</th>
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<tbody>
<tr>
<td>LIRL</td>
<td>Low Intensity Runway Lights</td>
</tr>
<tr>
<td>LLWAS</td>
<td>Low Level Wind Shear Alert System</td>
</tr>
<tr>
<td>LLWAS NE</td>
<td>Low Level Wind Shear Alert System Network Expansion</td>
</tr>
<tr>
<td>LLWAS–RS</td>
<td>Low Level Wind Shear Alert System Relocation/Sustainment</td>
</tr>
<tr>
<td>LNAV</td>
<td>Lateral Navigation</td>
</tr>
<tr>
<td>LOC</td>
<td>Localizer</td>
</tr>
<tr>
<td>LOP</td>
<td>Line–of–position</td>
</tr>
<tr>
<td>LORAN</td>
<td>Long Range Navigation System</td>
</tr>
<tr>
<td>LP</td>
<td>Localizer Performance</td>
</tr>
<tr>
<td>LPV</td>
<td>Localizer Performance with Vertical Guidance</td>
</tr>
<tr>
<td>LUAW</td>
<td>Line Up and Wait</td>
</tr>
<tr>
<td>LZ</td>
<td>Landing Zone</td>
</tr>
<tr>
<td>MAHWP</td>
<td>Missed Approach Holding Waypoint</td>
</tr>
<tr>
<td>MAP</td>
<td>Missed Approach Point</td>
</tr>
<tr>
<td>MAWP</td>
<td>Missed Approach Waypoint</td>
</tr>
<tr>
<td>MDA</td>
<td>Minimum Descent Altitude</td>
</tr>
<tr>
<td>MEA</td>
<td>Minimum En Route Altitude</td>
</tr>
<tr>
<td>MEARTS</td>
<td>Micro En Route Automated Radar Tracking System</td>
</tr>
<tr>
<td>METAR</td>
<td>Aviation Routine Weather Report</td>
</tr>
<tr>
<td>MHz</td>
<td>Megahertz</td>
</tr>
<tr>
<td>MIRL</td>
<td>Medium Intensity Runway Lights</td>
</tr>
<tr>
<td>MLS</td>
<td>Microwave Landing System</td>
</tr>
<tr>
<td>MM</td>
<td>Middle Marker</td>
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<tr>
<td>MOA</td>
<td>Military Operations Area</td>
</tr>
<tr>
<td>MOCA</td>
<td>Minimum Obstruction Clearance Altitude</td>
</tr>
<tr>
<td>MRA</td>
<td>Minimum Reception Altitude</td>
</tr>
<tr>
<td>MRB</td>
<td>Magnetic Reference Bearing</td>
</tr>
<tr>
<td>MSA</td>
<td>Minimum Safe Altitude</td>
</tr>
<tr>
<td>MSAW</td>
<td>Minimum Safe Altitude Warning</td>
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<tr>
<td>MSL</td>
<td>Mean Sea Level</td>
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<tr>
<td>MITI</td>
<td>Moving Target Indicator</td>
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<tr>
<td>MTOS</td>
<td>Mountain Obscuration</td>
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<tr>
<td>MTR</td>
<td>Military Training Route</td>
</tr>
<tr>
<td>MVA</td>
<td>Minimum Veting Altitude</td>
</tr>
<tr>
<td>MWA</td>
<td>Mountain Wave Activity</td>
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<tr>
<td>MWO</td>
<td>Meteorological Watch Office</td>
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<tr>
<td>NACO</td>
<td>National Aeronautical Charting Office</td>
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<td>NAS</td>
<td>National Airspace System</td>
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<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
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<tr>
<td>NAVAID</td>
<td>Navigational Aid</td>
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<tr>
<td>NAVcen</td>
<td>Coast Guard Navigation Center</td>
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<tr>
<td>NCWF</td>
<td>National Convective Weather Forecast</td>
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<tr>
<td>NDB</td>
<td>Nondirectional Radio Beacon</td>
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<table>
<thead>
<tr>
<th>Abbreviation/Acronym</th>
<th>Meaning</th>
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<tr>
<td>NEXRAD</td>
<td>Next Generation Weather Radar</td>
</tr>
<tr>
<td>NFDC</td>
<td>National Flight Data Center</td>
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<tr>
<td>NGA</td>
<td>National Geospatial–Intelligence Agency</td>
</tr>
<tr>
<td>NM</td>
<td>Nautical Mile</td>
</tr>
<tr>
<td>NMAC</td>
<td>Near Midair Collision</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>NOPAC</td>
<td>North Pacific</td>
</tr>
<tr>
<td>NoPT</td>
<td>No Procedure Turn Required</td>
</tr>
<tr>
<td>NOTAM</td>
<td>Notice to Airmen</td>
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<tr>
<td>NPA</td>
<td>Nonprecision Approach</td>
</tr>
<tr>
<td>NRS</td>
<td>Navigation Reference System</td>
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<tr>
<td>NSA</td>
<td>National Security Area</td>
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<tr>
<td>NSW</td>
<td>No Significant Weather</td>
</tr>
<tr>
<td>NTAP</td>
<td>Notices to Airmen Publication</td>
</tr>
<tr>
<td>NTSB</td>
<td>National Transportation Safety Board</td>
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<tr>
<td>NTZ</td>
<td>No Transgression Zone</td>
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<tr>
<td>NWS</td>
<td>National Weather Service</td>
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<tr>
<td>OAT</td>
<td>Outside Air Temperature</td>
</tr>
<tr>
<td>OBS</td>
<td>Omni–bearing Selector</td>
</tr>
<tr>
<td>ODP</td>
<td>Obstacle Departure Procedure</td>
</tr>
<tr>
<td>OIS</td>
<td>Operational Information System</td>
</tr>
<tr>
<td>OIS</td>
<td>Obstacle Identification Surface</td>
</tr>
<tr>
<td>OM</td>
<td>Outer Marker</td>
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<tr>
<td>ORD</td>
<td>Chicago O’Hare International Airport</td>
</tr>
<tr>
<td>PA</td>
<td>Precision Approach</td>
</tr>
<tr>
<td>PAPI</td>
<td>Precision Approach Path Indicator</td>
</tr>
<tr>
<td>PAR</td>
<td>Precision Approach Radar</td>
</tr>
<tr>
<td>PAR</td>
<td>Preferred Arrival Route</td>
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<tr>
<td>PC</td>
<td>Personal Computer</td>
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<tr>
<td>P/CG</td>
<td>Pilot/Controller Glossary</td>
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<td>PDC</td>
<td>Pre–departure Clearance</td>
</tr>
<tr>
<td>PFD</td>
<td>Personal Flotation Device</td>
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<tr>
<td>PinS</td>
<td>Point–in–Space</td>
</tr>
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<td>PIREP</td>
<td>Pilot Weather Report</td>
</tr>
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<td>POB</td>
<td>Persons on Board</td>
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<td>POFZ</td>
<td>Precision Obstacle Free Zone</td>
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<tr>
<td>POI</td>
<td>Principal Operations Inspector</td>
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<td>PPS</td>
<td>Precise Positioning Service</td>
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<td>PRM</td>
<td>Precision Runway Monitor</td>
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<td>PT</td>
<td>Procedure Turn</td>
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<td>QICP</td>
<td>Qualified Internet Communications Provider</td>
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<td>RA</td>
<td>Resolution Advisory</td>
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<td>RAA</td>
<td>Remote Advisory Airport</td>
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<td>RAIM</td>
<td>Receiver Autonomous Integrity Monitoring</td>
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<td>RAIS</td>
<td>Remote Airport Information Service</td>
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<tr>
<td>Abbreviation/ Acronym</td>
<td>Meaning</td>
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<td>----------------------</td>
<td>----------------------------------------------</td>
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<tr>
<td>RBDT</td>
<td>Ribbon Display Terminals</td>
</tr>
<tr>
<td>RCAG</td>
<td>Remote Center Air/Ground</td>
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<td>RCC</td>
<td>Rescue Coordination Center</td>
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<td>RCLS</td>
<td>Runway Centerline Lighting System</td>
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<td>RCO</td>
<td>Remote Communications Outlet</td>
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<td>RD</td>
<td>Rotor Diameter</td>
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<td>REIL</td>
<td>Runway End Identifier Lights</td>
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<td>REL</td>
<td>Runway Entrance Lights</td>
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<td>RFM</td>
<td>Rotorcraft Flight Manual</td>
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<td>RIL</td>
<td>Runway Intersection Lights</td>
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<td>RILM</td>
<td>Runway Light Intensity Monitor</td>
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<td>Radio Magnetic Indicator</td>
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<td>RIMAX</td>
<td>Required Navigation Performance</td>
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<td>ROC</td>
<td>Required Obstacle Clearance</td>
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<tr>
<td>RPAT</td>
<td>RNP Parallel Approach Runway Transitions</td>
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<td>RVR</td>
<td>Runway Visual Range</td>
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<td>RVS</td>
<td>Reduced Vertical Separation Minimum</td>
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<td>RWSL</td>
<td>Runway Status Light</td>
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<td>SAAAR</td>
<td>Special Aircraft and Aircrew Authorization Required</td>
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<td>SAM</td>
<td>System Area Monitor</td>
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<td>SAR</td>
<td>Search and Rescue</td>
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<td>SAS</td>
<td>Stability Augmentation System</td>
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<td>SBAS</td>
<td>Satellite–based Augmentation System</td>
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<td>SCAT−I</td>
<td>Special Category I Differential GPS</td>
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<td>DGPS</td>
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<td>SDF</td>
<td>Simplified Directional Facility</td>
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<td>SFL</td>
<td>Sequenced Flashing Lights</td>
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<td>Special Flight Rules</td>
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<td>Standard Instrument Approach Procedure</td>
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<td>SID</td>
<td>Standard Instrument Departure</td>
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<td>SIGMET</td>
<td>Significant Meteorological Information</td>
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<td>SM</td>
<td>Statute Mile</td>
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<td>SMGCS</td>
<td>Surface Movement Guidance Control System</td>
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<td>SNR</td>
<td>Signal–to–noise Ratio</td>
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<td>SOIA</td>
<td>Simultaneous Offset Instrument Approaches</td>
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<td>SOP</td>
<td>Standard Operating Procedure</td>
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<td>Storm Prediction Center</td>
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<td>Standard Positioning Service</td>
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<td>STAR</td>
<td>Standard Terminal Arrival</td>
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<td>STARS</td>
<td>Standard Terminal Automation Replacement System</td>
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<td>STMP</td>
<td>Special Traffic Management Program</td>
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<td>Supplemental Weather Service Locations</td>
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<tr>
<td>Abbreviation/Acronym</td>
<td>Meaning</td>
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<tr>
<td>VMINI . . . . . .</td>
<td>Instrument flight minimum speed, utilized in complying with minimum limit speed requirements for instrument flight</td>
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<tr>
<td>VNAV . . . . . .</td>
<td>Vertical Navigation</td>
</tr>
<tr>
<td>VNE . . . . . .</td>
<td>Never exceed speed</td>
</tr>
<tr>
<td>VNEI . . . . . .</td>
<td>Instrument flight never exceed speed, utilized instead of VNE for compliance with maximum limit speed requirements for instrument flight</td>
</tr>
<tr>
<td>VOR . . . . . .</td>
<td>Very High Frequency Omni–directional Range</td>
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<td>VORTAC . . . . .</td>
<td>VHF Omni–directional Range/Tactical Air Navigation</td>
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<td>VOT . . . . . .</td>
<td>VOR Test Facility</td>
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<tr>
<td>VR . . . . . .</td>
<td>VFR Military Training Route</td>
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<td>VREF . . . . . .</td>
<td>The reference landing approach speed, usually about 1.3 times Vso plus 50 percent of the wind gust speed in excess of the mean wind speed.</td>
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<td>VSO . . . . . .</td>
<td>The stalling speed or the minimum steady flight speed in the landing configuration at maximum weight.</td>
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<tr>
<td>VTF . . . . . .</td>
<td>Vector to Final</td>
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<tr>
<td>VV . . . . . .</td>
<td>Vertical Visibility</td>
</tr>
<tr>
<td>VVI . . . . . .</td>
<td>Vertical Velocity Indicator</td>
</tr>
<tr>
<td>Vy . . . . . .</td>
<td>Speed for best rate of climb</td>
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<tr>
<td>VYI . . . . . .</td>
<td>Instrument climb speed, utilized instead of Vy for compliance with the climb requirements for instrument flight</td>
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<td>WA . . . . . .</td>
<td>AIRMET</td>
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<td>WAAS . . . . .</td>
<td>Wide Area Augmentation System</td>
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<td>World Aeronautical Chart</td>
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<td>WFO . . . . . .</td>
<td>Weather Forecast Office</td>
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<td>WGS–84 . . . .</td>
<td>World Geodetic System of 1984</td>
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<td>WMO . . . . . .</td>
<td>World Meteorological Organization</td>
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<td>WMS . . . . . .</td>
<td>Wide–Area Master Station</td>
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<td>WMSC . . . . .</td>
<td>Weather Message Switching Center</td>
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<td>WMSCR . . . . .</td>
<td>Weather Message Switching Center Replacement</td>
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<td>WP . . . . . .</td>
<td>Waypoint</td>
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<td>WRS . . . . . .</td>
<td>Wide–Area Ground Reference Station</td>
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<tr>
<td>WS . . . . . .</td>
<td>SIGMET</td>
</tr>
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<td>WSO . . . . . .</td>
<td>Weather Service Office</td>
</tr>
<tr>
<td>WSP . . . . . .</td>
<td>Weather System Processor</td>
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<tr>
<td>WST . . . . . .</td>
<td>Convective Significant Meteorological Information</td>
</tr>
<tr>
<td>WW . . . . . .</td>
<td>Severe Weather Watch Bulletin</td>
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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. This Glossary will be revised, as necessary, to maintain a common understanding of the system.

EXPLANATION OF CHANGES

a. Terms Added:
   - CONFIDENCE MANEUVER
   - LANDING DISTANCE AVAILABLE (LDA)
   - LINE UP AND WAIT (LUAW)
   - PROMINENT OBSTACLE
   - TAKEOFF DISTANCE AVAILABLE (TODA)
   - TAKEOFF RUN AVAILABLE (TORA)
   - TARMAC DELAY
   - TARMAC DELAY AIRCRAFT
   - TARMAC DELAY REQUEST
   - THREE-HOUR TARMAC RULE

b. Terms Modified:
   - AIRCRAFT CLASSES
   - AREA NAVIGATION (RNAV)
   - CT MESSAGE
   - NORDO
   - NOTICES TO AIRMEN
   - TARGET RESOLUTION

c. Terms Deleted:
   - AREA NAVIGATION (RNAV) [ICAO]
   - POSITION AND HOLD

d. Editorial/format changes were made where necessary. Revision bars were not used due to the insignificant nature of the changes.
AIR TRAFFIC— Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

(See ICAO term AIR TRAFFIC.)

AIR TRAFFIC [ICAO]— All aircraft in flight or operating on the maneuvering area of an aerodrome.

AIR TRAFFIC CLEARANCE— An authorization by air traffic control for the purpose of preventing collision between known aircraft, for an aircraft to proceed under specified traffic conditions within controlled airspace. The pilot-in-command of an aircraft may not deviate from the provisions of a visual flight rules (VFR) or instrument flight rules (IFR) air traffic clearance except in an emergency or unless an amended clearance has been obtained. Additionally, the pilot may request a different clearance from that which has been issued by air traffic control (ATC) if information available to the pilot makes another course of action more practicable or if aircraft equipment limitations or company procedures forbid compliance with the clearance issued. Pilots may also request clarification or amendment, as appropriate, any time a clearance is not fully understood, or considered unacceptable because of safety of flight. Controllers should, in such instances and to the extent of operational practicality and safety, honor the pilot’s request. 14 CFR Part 91.3(a) states: “The pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft.”

THE PILOT IS RESPONSIBLE TO REQUEST AN AMENDED CLEARANCE if ATC issues a clearance that would cause a pilot to deviate from a rule or regulation, or in the pilot’s opinion, would place the aircraft in jeopardy.

(See ATC INSTRUCTIONS.)

(See ICAO term AIR TRAFFIC CONTROL CLEARANCE.)

AIR TRAFFIC CONTROL— A service operated by appropriate authority to promote the safe, orderly and expeditious flow of air traffic.

(See ICAO term AIR TRAFFIC CONTROL SERVICE.)

AIR TRAFFIC CONTROL CLEARANCE [ICAO]— Authorization for an aircraft to proceed under conditions specified by an air traffic control unit.

Note 1: For convenience, the term air traffic control clearance is frequently abbreviated to clearance when used in appropriate contexts.

Note 2: The abbreviated term clearance may be prefixed by the words taxi, takeoff, departure, en route, approach or landing to indicate the particular portion of flight to which the air traffic control clearance relates.

AIR TRAFFIC CONTROL SERVICE—

(See AIR TRAFFIC CONTROL.)

AIR TRAFFIC CONTROL SERVICE [ICAO]— A service provided for the purpose of:

a. Preventing collisions:
   1. Between aircraft; and
   2. On the maneuvering area between aircraft and obstructions.

b. Expediting and maintaining an orderly flow of air traffic.

AIR TRAFFIC CONTROL SPECIALIST— A person authorized to provide air traffic control service.

(See AIR TRAFFIC CONTROL.)

(See FLIGHT SERVICE STATION.)

(See ICAO term CONTROLLER.)

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER (ATCSCC) – An Air Traffic Tactical Operations facility responsible for monitoring and managing the flow of air traffic throughout the NAS, producing a safe, 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.)


(Refer to 14 CFR Part 93.)

(Refer to AIRPORT/FACILITY DIRECTORY.)
c. U.S. Notice to Airmen (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 AIRMEN.)

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.

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 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.

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 Heavy, Large, and Small as follows:

a. 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.
b. Large – Aircraft of more than 41,000 pounds, maximum certificated takeoff weight, up to but not including 300,000 pounds.
c. Small – Aircraft of 41,000 pounds or less maximum certificated takeoff weight. (Refer to AIM.)

AIRCRAFT CONFLICT – Predicted conflict, within URET, 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 USER REQUEST EVALUATION TOOL.)

AIRCRAFT LIST (ACL) – A view available with URET 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 USER REQUEST EVALUATION TOOL.)
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 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.

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 30NM arc centered on the IF bounded by a straight line extending through the IF perpendicular to the intermediate course.

2. LEFT BASE AREA– A 30NM arc centered on the right corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

3. RIGHT BASE AREA– A 30NM arc centered on the left corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

ARINC– An acronym for Aeronautical Radio, Inc., a corporation largely owned by a group of airlines. ARINC is licensed by the FCC as an aeronautical station and contracted by the FAA to provide communications support for air traffic control and meteorological services in portions of international airspace.

ARMY AVIATION FLIGHT INFORMATION BULLETIN– A bulletin that provides air operation data covering Army, National Guard, and Army Reserve aviation activities.

ARO– (See AIRPORT RESERVATION OFFICE.)

ARRESTING SYSTEM– A safety device consisting of two major components, namely, engaging or catching devices and energy absorption devices for the purpose of arresting both tailhook and/or nontailhook–equipped aircraft. It is used to prevent aircraft from overrunning runways when the aircraft cannot be stopped after landing or during aborted takeoff. Arresting systems have various names; e.g., arresting gear, hook device, wire barrier cable. (See ABORT.) (Refer to AIM.)
ARRIVAL AIRCRAFT INTERVAL—An internally generated program in hundredths of minutes based upon the AAR. AAI is the desired optimum interval between successive arrival aircraft over the vertex.

ARRIVAL CENTER—The ARTCC having jurisdiction for the impacted airport.

ARRIVAL DELAY—A parameter which specifies a period of time in which no aircraft will be metered for arrival at the specified airport.

ARRIVAL SECTOR—An operational control sector containing one or more meter fixes.

ARRIVAL SECTOR ADVISORY LIST—An ordered list of data on arrivals displayed at the PVD/MDM of the sector which controls the meter fix.

ARRIVAL SEQUENCING PROGRAM—The automated program designed to assist in sequencing aircraft destined for the same airport.

ARRIVAL TIME—The time an aircraft touches down on arrival.

ARSR—
(See AIR ROUTE SURVEILLANCE RADAR.)

ARTCC—
(See AIR ROUTE TRAFFIC CONTROL CENTER.)

ARTS—
(See AUTOMATED RADAR TERMINAL SYSTEMS.)

ASDA—
(See ACCELERATE-STOP DISTANCE AVAILABLE.)

ASDA [ICAO]—
(See ICAO Term ACCELERATE-STOP DISTANCE AVAILABLE.)

ASDE—
(See AIRPORT SURFACE DETECTION EQUIPMENT.)

ASF—
(See AIRPORT STREAM FILTER.)

ASLAR—
(See AIRCRAFT SURGE LAUNCH AND RECOVERY.)

ASP—
(See ARRIVAL SEQUENCING PROGRAM.)

ASR—
(See AIRPORT SURVEILLANCE RADAR.)

ASR APPROACH—
(See SURVEILLANCE APPROACH.)

ASSOCIATED—A radar target displaying a data block with flight identification and altitude information.
(See UNASSOCIATED.)

ATC—
(See AIR TRAFFIC CONTROL.)

ATC ADVISES—Used to prefix a message of noncontrol information when it is relayed to an aircraft by other than an air traffic controller.
(See ADVISORY.)

ATC ASSIGNED AIRSPACE—Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic.
(See SPECIAL USE AIRSPACE.)

ATC CLEARANCE—
(See AIR TRAFFIC CLEARANCE.)

ATC CLEARS—Used to prefix an ATC clearance when it is relayed to an aircraft by other than an air traffic controller.

ATC INSTRUCTIONS—Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions; e.g., “Turn left heading two five zero,” “Go around,” “Clear the runway.”
(Refer to 14 CFR Part 91.)

ATC PREFERRED ROUTE NOTIFICATION—URET notification to the appropriate controller of the need to determine if an ATC preferred route needs to be applied, based on destination airport.
(See ROUTE ACTION NOTIFICATION.)
(See USER REQUEST EVALUATION TOOL.)

ATC PREFERRED ROUTES—Preferred routes that are not automatically applied by Host.

ATC REQUESTS—Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

ATC SECURITY SERVICES—Communications and security tracking provided by an ATC facility in support of the DHS, the DOD, or other Federal security elements in the interest of national security. Such security services are only applicable within...
designated areas. ATC security services do not include ATC basic radar services or flight following.

**ATC SECURITY SERVICES POSITION** – The position responsible for providing ATC security services as defined. This position does not provide ATC, IFR separation, or VFR flight following services, but is responsible for providing security services in an area comprising airspace assigned to one or more ATC operating sectors. This position may be combined with control positions.

**ATC SECURITY TRACKING** – The continuous tracking of aircraft movement by an ATC facility in support of the DHS, the DOD, or other security elements for national security using radar (i.e., radar tracking) or other means (e.g., manual tracking) without providing basic radar services (including traffic advisories) or other ATC services not defined in this section.

**ATCAA**–
(See ATC ASSIGNED AIRSPACE.)

**ATCRBS**–
(See RADAR.)

**ATCS CC**–
(See AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER.)

**ATCT**–
(See TOWER.)

**ATD**–
(See ALONG-TRACK DISTANCE.)

**ATIS**–
(See AUTOMATIC TERMINAL INFORMATION SERVICE.)

**ATIS [ICAO]**–
(See ICAO Term AUTOMATIC TERMINAL INFORMATION SERVICE.)

**ATS ROUTE [ICAO]**– A specified route designed for channelling 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.

**AUTOLAND APPROACH**– An autoland approach is a precision instrument approach to touchdown and, in some cases, through the landing rollout. An autoland approach is performed by the aircraft autopilot which is receiving position information and/or steering commands from onboard navigation equipment.

Note: Autoland and coupled approaches are flown in VFR and IFR. It is common for carriers to require their crews to fly coupled approaches and autoland approaches (if certified) when the weather conditions are less than approximately 4,000 RVR.

(See COUPLED APPROACH.)

**AUTOMATED INFORMATION TRANSFER**– A precoordinated process, specifically defined in facility directives, during which a transfer of altitude control and/or radar identification is accomplished without verbal coordination between controllers using information communicated in a full data block.

**AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM**– A facility which can deliver, in a matter of minutes, a surface picture (SURPIC) of vessels in the area of a potential or actual search and rescue incident, including their predicted positions and their characteristics.

(See FAAO JO 7110.65, Para 10–6–4, INFLIGHT CONTINGENCIES.)

**AUTOMATED PROBLEM DETECTION (APD)**– An Automation Processing capability that compares trajectories in order to predict conflicts.

**AUTOMATED PROBLEM DETECTION BOUNDARY (APB)**– The adapted distance beyond a facilities boundary defining the airspace within which URET performs conflict detection.

(See USER REQUEST EVALUATION TOOL.)

**AUTOMATED PROBLEM DETECTION INHIBITED AREA (APDIA)**– Airspace surrounding a terminal area within which APD is inhibited for all flights within that airspace.

**AUTOMATED RADAR TERMINAL SYSTEMS (ARTS)**– A generic term for several tracking systems included in the Terminal Automation Systems (TAS). ARTS plus a suffix roman numeral denotes a major modification to that system.

  a. ARTS IIIA. The Radar Tracking and Beacon Tracking Level (RT&BTL) of the modular, programmable automated radar terminal system. ARTS IIIA detects, tracks, and predicts primary as well as secondary radar-derived aircraft targets. This more sophisticated computer-driven system upgrades the existing ARTS III system by providing improved tracking, continuous data recording, and fail-soft capabilities.
b. Common ARTS. Includes ARTS IIE, ARTS IIIE; and ARTS IIIE with ACD (see DTAS) which combines functionalities of the previous ARTS systems.

c. Programmable Indicator Data Processor (PIDP). The PIDP is a modification to the AN/TPX−42 interrogator system currently installed in fixed RAPCONs. The PIDP detects, tracks, and predicts secondary radar aircraft targets. These are displayed by means of computer−generated symbols and alphanumeric characters depicting flight identification, aircraft altitude, ground speed, and flight plan data. Although primary radar targets are not tracked, they are displayed coincident with the secondary radar targets as well as with the other symbols and alphanumerics. The system has the capability of interfacing with ARTCCs.

AUTOMATED WEATHER SYSTEM− Any of the automated weather sensor platforms that collect weather data at airports and disseminate the weather information via radio and/or landline. The systems currently consist of the Automated Surface Observing System (ASOS), Automated Weather Sensor System (AWSS) and Automated Weather Observation System (AWOS).

AUTOMATED UNICOM− Provides completely automated weather, radio check capability and airport advisory information on an Automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the UNICOM frequency. Availability will be published in the Airport/Facility Directory and approach charts.

AUTOMATIC ALTITUDE REPORT−
(See ALTITUDE READOUT.)

AUTOMATIC ALTITUDE REPORTING− That function of a transponder which responds to Mode C interrogations by transmitting the aircraft’s altitude in 100-foot increments.

AUTOMATIC CARRIER LANDING SYSTEM− U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

AUTOMATIC DEPENDENT SURVEILLANCE (ADS) [ICAO]− A surveillance technique in which aircraft automatically provide, via a data link, data derived from on−board navigation and position fixing systems, including aircraft identification, four dimensional position and additional data as appropriate.

AUTOMATIC DEPENDENT SURVEILLANCE−BROADCAST (ADS−B)− A surveillance system in which an aircraft or vehicle to be detected is fitted with cooperative equipment in the form of a data link transmitter. The aircraft or vehicle periodically broadcasts its GPS−derived position and other information such as velocity over the data link, which is received by a ground−based transmitter/receiver (transceiver) for processing and display at an air traffic control facility.

(See GLOBAL POSITIONING SYSTEM.)
(See GROUND−BASED TRANSCEIVER.)

AUTOMATIC DEPENDENT SURVEILLANCE−CONTRACT (ADS−C)− A data link position reporting system, controlled by a ground station, that establishes contracts with an aircraft’s avionics that occur automatically whenever specific events occur, or specific time intervals are reached.

AUTOMATIC DIRECTION FINDER− An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum.

(See BEARING.)
(See NONDIRECTIONAL BEACON.)

AUTOMATIC FLIGHT INFORMATION SERVICE (AFIS) − ALASKA FSSs ONLY− The continuous broadcast of recorded non−control information at airports in Alaska where a FSS provides local airport advisory service. The AFIS broadcast automates the repetitive transmission of essential but routine information such as weather, wind, altimeter, favored runway, breaking action, airport NOTAMs, and other applicable information. The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS/ AWSS/AWOS frequency.)

AUTOMATIC TERMINAL INFORMATION SERVICE− The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to
relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g., “Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa.”

(See ICAO term AUTOMATIC TERMINAL INFORMATION SERVICE.)

(Refer to AIM.)

AUTOMATIC TERMINAL INFORMATION SERVICE [ICAO]– The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

AUTOROTATION– A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

a. Autorotative Landing/Touchdown Autorotation. Used by a pilot to indicate that the landing will be made without applying power to the rotor.

b. Low Level Autorotation. Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.

c. 180 degrees Autorotation. Initiated from a downwind heading and is commenced well inside the normal traffic pattern. “Go around” may not be possible during the latter part of this maneuver.

AVAILABLE LANDING DISTANCE (ALD)– The portion of a runway available for landing and roll-out for aircraft cleared for LAHSO. This distance is measured from the landing threshold to the hold-short point.

AVIATION WEATHER SERVICE– A service provided by the National Weather Service (NWS) and FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS.

(See EN ROUTE FLIGHT ADVISORY SERVICE.)

(See TRANSCRIBED WEATHER BROADCAST.)

(See WEATHER ADVISORY.)

(Refer to AIM.)

AWW–

(See SEVERE WEATHER FORECAST ALERTS.)

AZIMUTH (MLS)– A magnetic bearing extending from an MLS navigation facility.

Note: Azimuth bearings are described as magnetic and are referred to as “azimuth” in radio telephone communications.
back onto an arrival or departure procedure to comply with all altitude and/or speed restrictions depicted on the procedure. This term may be used in lieu of repeating each remaining restriction that appears on the procedure.

COMPOSITE FLIGHT PLAN— A flight plan which specifies VFR operation for one portion of flight and IFR for another portion. It is used primarily in military operations.

(Refer to AIM.)

COMPOSITE ROUTE SYSTEM— An organized oceanic route structure, incorporating reduced lateral spacing between routes, in which composite separation is authorized.

COMPOSITE SEPARATION— A method of separating aircraft in a composite route system where, by management of route and altitude assignments, a combination of half the lateral minimum specified for the area concerned and half the vertical minimum is applied.

COMPULSORY REPORTING POINTS— Reporting points which must be reported to ATC. They are designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes. These points are geographical locations which are defined by navigation aids/fixed. Pilots should discontinue position reporting over compulsory reporting points when informed by ATC that their aircraft is in “radar contact.”

CONFIDENCE MANEUVER— A confidence maneuver consists of one or more turns, a climb or descent, or other maneuver to determine if the pilot in command (PIC) is able to receive and comply with ATC instructions.

CONFLICT ALERT— A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations between tracked targets (known IFR or VFR aircraft) that require his/her immediate attention/action.

(See MODE C INTRUDER ALERT.)

CONFLICT RESOLUTION— The resolution of potential 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.

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.


CONTINENTAL UNITED STATES– The 49 States located on the continent of North America and the District of Columbia.

CONTINUE– When used as a control instruction should be followed by another word or words clarifying what is expected of the pilot. Example: “continue taxi,” “continue descent,” “continue inbound,” etc.

CONTROL AREA [ICAO]– A controlled airspace extending upwards from a specified limit above the earth.

CONTROL SECTOR– An airspace area of defined horizontal and vertical dimensions for which a controller or group of controllers has air traffic control responsibility, normally within an air route traffic control center or an approach control facility. Sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot-communications during operations within a sector are normally maintained on discrete frequencies assigned to the sector.

(See DISCRETE FREQUENCY.)

CONTROL SLASH– A radar beacon slash representing the actual position of the associated aircraft. Normally, the control slash is the one closest to the interrogating radar beacon site. When ARTCC radar is operating in narrowband (digitized) mode, the control slash is converted to a target symbol.

CONTROLLED AIRSPACE– An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

a. Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace.

b. Controlled airspace is also that airspace within which all aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements in 14 CFR Part 91 (for specific operating requirements, please refer to 14 CFR Part 91). For IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan and receive an appropriate ATC clearance. Each Class B, Class C, and Class D airspace area designated for an airport contains at least one primary airport around which the airspace is designated (for specific designations and descriptions of the airspace classes, please refer to 14 CFR Part 71).

c. Controlled airspace in the United States is designated as follows:

1. CLASS A– Generally, that airspace from 18,000 feet MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under IFR.

2. CLASS B– Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation’s busiest airports in terms of airport operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspaces areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is “clear of clouds.”

3. CLASS C– Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5 nautical mile (NM) radius, a circle with a 10NM radius that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation and an outer area that is not charted. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace.

(See OUTER AREA.)
4. CLASS D— Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.

5. CLASS E— Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or en route environment, en route domestic, and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska, up to, but not including 18,000 feet MSL, and the airspace above FL 600.

CONTROLLED AIRSPACE [ICAO]— An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

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 very high frequency (VHF) air/ground communications system that conveys textual air traffic control messages between controllers and pilots.

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.

CONVEXTIVE SIGNIFICANT METEOROLOGICAL INFORMATION—
(See CONVECTIVE SIGMET.)

COORDINATES— The intersection of lines of reference, usually expressed in degrees/minutes/seconds of latitude and longitude, used to determine position or location.

COORDINATION FIX— The fix in relation to which facilities will handoff, transfer control of an aircraft, or coordinate flight progress data. For terminal facilities, it may also serve as a clearance for arriving aircraft.

COPTER—
(See HELICOPTER.)

CORRECTION— An error has been made in the transmission and the correct version follows.

COUPLED APPROACH— A coupled approach is an instrument approach performed by the aircraft autopilot which is receiving position information and/or steering commands from onboard navigation equipment. In general, coupled nonprecision approaches must be discontinued and flown manually at altitudes lower than 50 feet below the minimum descent altitude, and coupled precision approaches must be flown manually below 50 feet AGL.

Note: Coupled and autoland approaches are flown in VFR and IFR. It is common for carriers to require...
their crews to fly coupled approaches and autoland approaches (if certified) when the weather conditions are less than approximately 4,000 RVR.
(See AUTOLAND APPROACH.)

COURSE–

a. The intended direction of flight in the horizontal plane measured in degrees from north.

b. The ILS localizer signal pattern usually specified as the front course or the back course.

c. The intended track along a straight, curved, or segmented MLS path.
(See BEARING.)
(See INSTRUMENT LANDING SYSTEM.)
(See MICROWAVE LANDING SYSTEM.)
(See RADIAL.)

CPDLC–
(See CONTROLLER PILOT DATA LINK COMMUNICATIONS.)

CPL [ICAO]–
(See ICAO term CURRENT FLIGHT PLAN.)

CRITICAL ENGINE– The engine which, upon failure, would most adversely affect the performance or handling qualities of an aircraft.

CROSS (FIX) AT (ALTITUDE)– Used by ATC when a specific altitude restriction at a specified fix is required.

CROSS (FIX) AT OR ABOVE (ALTITUDE)– Used by ATC when an altitude restriction at a specified fix is required. It does not prohibit the aircraft from crossing the fix at a higher altitude than specified; however, the higher altitude may not be one that will violate a succeeding altitude restriction or altitude assignment.
(See ALTITUDE RESTRICTION.)
(Refer to AIM.)

CROSS (FIX) AT OR BELOW (ALTITUDE)– Used by ATC when a maximum crossing altitude at a specific fix is required. It does not prohibit the aircraft from crossing the fix at a lower altitude; 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.

CT MESSAGE– An EDCT time generated by the ATCSCC to regulate traffic at arrival airports. Normally, a CT message is automatically transferred from the traffic management system computer to the NAS en route computer and appears as an EDCT. In the event of a communication failure between the traffic management system computer and the NAS, the CT message can be manually entered by the TMC at the en route facility.

CTA–
   (See CONTROLLED TIME OF ARRIVAL.)
   (See ICAO term CONTROL AREA.)

CTAF–
   (See COMMON TRAFFIC ADVISORY FREQUENCY.)

CTAS–
   (See CENTER TRACON AUTOMATION SYSTEM.)

CTRD–
   (See CERTIFIED TOWER RADAR DISPLAY.)

CURRENT FLIGHT PLAN [ICAO]– The flight plan, including changes, if any, brought about by subsequent clearances.

CURRENT PLAN– The ATC clearance the aircraft has received and is expected to fly.

CVFP APPROACH–
   (See CHARTED VISUAL FLIGHT PROCEDURE APPROACH.)

CWA–
   (See CENTER WEATHER ADVISORY and WEATHER ADVISORY.)
L

**LAAS**– (See LOW ALTITUDE ALERT SYSTEM.)

**LAHSO**– An acronym for “Land and Hold Short Operation.” These operations include landing and holding short of an intersecting runway, a taxiway, a predetermined point, or an approach/departure flightpath.

**LAHSO-DRY**– Land and hold short operations on runways that are dry.

**LAHSO-WET**– Land and hold short operations on runways that are wet (but not contaminated).

**LAND AND HOLD SHORT OPERATIONS**– Operations which include simultaneous takeoffs and landings and/or simultaneous landings when a landing aircraft is able and is instructed by the controller to hold-short of the intersecting runway/taxiway or designated hold-short point. Pilots are expected to promptly inform the controller if the hold short clearance cannot be accepted.

(See PARALLEL RUNWAYS.)
(Refer to AIM.)

**LANDING AREA**– Any locality either on land, water, or structures, including airports/heliports and intermediate landing fields, which is used, or intended to be used, for the landing and takeoff of aircraft whether or not facilities are provided for the shelter, servicing, or for receiving or discharging passengers or cargo.

(See ICAO term LANDING AREA.)

**LANDING AREA [ICAO]**– That part of a movement area intended for the landing or take-off of aircraft.

**LANDING DIRECTION INDICATOR**– A device which visually indicates the direction in which landings and takeoffs should be made.

(See TETRAHEDRON.)
(Refer to AIM.)

**LANDING DISTANCE AVAILABLE**– The runway length declared available and suitable for a landing operation.

(See ICAO term LANDING DISTANCE AVAILABLE.)

**LANDING DISTANCE AVAILABLE [ICAO]**– The length of runway which is declared available and suitable for the ground run of an aeroplane landing.

**LANDING MINIMUMS**– The minimum visibility prescribed for landing a civil aircraft while using an instrument approach procedure. The minimum applies with other limitations set forth in 14 CFR Part 91 with respect to the Minimum Descent Altitude (MDA) or Decision Height (DH) prescribed in the instrument approach procedures as follows:

a. Straight-in landing minimums. A statement of MDA and visibility, or DH and visibility, required for a straight-in landing on a specified runway, or


Note: Descent below the established MDA or DH is not authorized during an approach unless the aircraft is in a position from which a normal approach to the runway of intended landing can be made and adequate visual reference to required visual cues is maintained.

(See CIRCLE-TO-LAND MANEUVER.)
(See DECISION HEIGHT.)
(See INSTRUMENT APPROACH PROCEDURE.)
(See MINIMUM DESCENT ALTITUDE.)
(See STRAIGHT-IN LANDING.)
(See VISIBILITY.)
(Refer to 14 CFR Part 91.)

**LANDING ROLL**– The distance from the point of touchdown to the point where the aircraft can be brought to a stop or exit the runway.

**LANDING SEQUENCE**– The order in which aircraft are positioned for landing.

(See APPROACH SEQUENCE.)

**LAST ASSIGNED ALTITUDE**– The last altitude/flight level assigned by ATC and acknowledged by the pilot.

(See MAINTAIN.)
(Refer to 14 CFR Part 91.)

**LATERAL NAVIGATION** (LNAV)– A function of area navigation (RNAV) equipment which calculates, displays, and provides lateral guidance to a profile or path.
LATERAL SEPARATION – The lateral spacing of aircraft at the same altitude by requiring operation on different routes or in different geographical locations. (See SEPARATION.)

LDA –
(See LOCALIZER TYPE DIRECTIONAL AID.)
(See LANDING DISTANCE AVAILABLE.)
(See ICAO Term LANDING DISTANCE AVAILABLE.)

LF –
(See LOW FREQUENCY.)

LIGHTED AIRPORT – An airport where runway and obstruction lighting is available.
(See AIRPORT LIGHTING.)
(Refer to AIM.)

LIGHT GUN – A handheld directional light signaling device which emits a brilliant narrow beam of white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used to approve or disapprove anticipated pilot actions where radio communication is not available. The light gun is used for controlling traffic operating in the vicinity of the airport and on the airport movement area.
(Refer to AIM.)

LINE UP AND WAIT (LUAW) – Used by ATC to inform a pilot to taxi onto the departure runway to line up and wait. It is not authorization for takeoff. It is used when takeoff clearance cannot immediately be issued because of traffic or other reasons.
(See CLEARED FOR TAKEOFF.)

LOCAL AIRPORT ADVISORY (LAA) – A service provided by facilities, which are located on the landing airport, have a discrete ground-to-air communication frequency or the tower frequency when the tower is closed, automated weather reporting with voice broadcasting, and a continuous ASOS/AWSS/AWOS data display, other continuous direct reading instruments, or manual observations available to the specialist.
(See AIRPORT ADVISORY AREA.)

LOCAL TRAFFIC – Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport.
(See TRAFFIC PATTERN.)

LOCALIZER – The component of an ILS which provides course guidance to the runway.
(See INSTRUMENT LANDING SYSTEM.)
(See ICAO term LOCALIZER COURSE.)
(Refer to AIM.)

LOCALIZER COURSE [ICAO] – The locus of points, in any given horizontal plane, at which the DDM (difference in depth of modulation) is zero.

LOCALIZER OFFSET – An angular offset of the localizer from the runway extended centerline in a direction away from the no transgression zone (NTZ) that increases the normal operating zone (NOZ) width. An offset requires a 50 foot increase in DH and is not authorized for CAT II and CAT III approaches.
(Refer to AIM.)

LOCALIZER TYPE DIRECTIONAL AID – A NAVAID used for nonprecision instrument approaches with utility and accuracy comparable to a localizer but which is not a part of a complete ILS and is not aligned with the runway.
(Refer to AIM.)

LOCALIZER USABLE DISTANCE – The maximum distance from the localizer transmitter at a specified altitude, as verified by flight inspection, at which reliable course information is continuously received.
(Refer to AIM.)

LOCATOR [ICAO] – An LM/MF NDB used as an aid to final approach.
Note: A locator usually has an average radius of rated coverage of between 18.5 and 46.3 km (10 and 25 NM).

LONG RANGE NAVIGATION –
(See LORAN.)

LONGITUDINAL SEPARATION – The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time or miles.
(See SEPARATION.)
(Refer to AIM.)

LORAN – An electronic navigational system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran A operates in the 1750-1950 kHz frequency band. Loran C and D operate in the 100-110 kHz frequency band.
(Refer to AIM.)

LOST COMMUNICATIONS – Loss of the ability to communicate by radio. Aircraft are sometimes
referred to as NORDO (No Radio). Standard pilot procedures are specified in 14 CFR Part 91. Radar controllers issue procedures for pilots to follow in the event of lost communications during a radar approach when weather reports indicate that an aircraft will likely encounter IFR weather conditions during the approach.
(Refer to 14 CFR Part 91.)
(Refer AIM.)

LOW ALTITUDE AIRWAY STRUCTURE— The network of airways serving aircraft operations up to but not including 18,000 feet MSL.
(See AIRWAY.)
(Refer to AIM.)

LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY—
(See SAFETY ALERT.)

LOW ALTITUDE ALERT SYSTEM— An automated function of the TPX-42 that alerts the controller when a Mode C transponder equipped aircraft on an IFR flight plan is below a predetermined minimum safe altitude. If requested by the pilot, Low Altitude Alert System monitoring is also available to VFR Mode C transponder equipped aircraft.

LOW APPROACH— An approach over an airport or runway following an instrument approach or a VFR approach including the go-around maneuver where the pilot intentionally does not make contact with the runway.
(Refer to AIM.)

LOW FREQUENCY— The frequency band between 30 and 300 kHz.
(Refer to AIM.)

LPV— A type of approach with vertical guidance (APV) based on WAAS, published on RNAV (GPS) approach charts. This procedure takes advantage of the precise lateral guidance available from WAAS. The minima is published as a decision altitude (DA).

LUAW—
(See LINE UP AND WAIT.)
approach is not provided by ground-based precision or surveillance radar. Radar vectors to the final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, and ILS/MLS approaches.

(See FINAL APPROACH COURSE.)
(See FINAL APPROACH-IFR.)
(See INSTRUMENT APPROACH PROCEDURE.)
(See RADAR APPROACH.)

b. Nonradar Approach Control. An ATC facility providing approach control service without the use of radar.
(See APPROACH CONTROL FACILITY.)
(See APPROACH CONTROL SERVICE.)

c. Nonradar Arrival. An aircraft arriving at an airport without radar service or at an airport served by a radar facility and radar contact has not been established or has been terminated due to a lack of radar service to the airport.
(See RADAR ARRIVAL.)
(See RADAR SERVICE.)

d. Nonradar Route. A flight path or route over which the pilot is performing his/her own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route.
(See RADAR ROUTE.)

(See ICAO term NONRADAR SEPARATION.)

NONRADAR SEPARATION [ICAO]– The separation used when aircraft position information is derived from sources other than radar.

NON–RESTRICTIVE ROUTING (NRR)– Portions of a proposed route of flight where a user can flight plan the most advantageous flight path with no requirement to make reference to ground–based NAVAIDs.

NOPAC–
(See NORTH PACIFIC.)

NORDO (No Radio)– Aircraft that cannot or do not communicate by radio when radio communication is required are referred to as “NORDO.”
(See LOST COMMUNICATIONS.)

NORMAL OPERATING ZONE (NOZ)– The NOZ is the operating zone within which aircraft flight remains during normal independent simultaneous parallel ILS approaches.

NORTH AMERICAN ROUTE– A numerically coded route preplanned over existing airway and route systems to and from specific coastal fixes serving the North Atlantic. North American Routes consist of the following:

a. Common Route/Portion. That segment of a North American Route between the inland navigation facility and the coastal fix.

b. Noncommon Route/Portion. That segment of a North American Route between the inland navigation facility and a designated North American terminal.

c. Inland Navigation Facility. A navigation aid on a North American Route at which the common route and/or the noncommon route begins or ends.

d. Coastal Fix. A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

NORTH AMERICAN ROUTE PROGRAM (NRP)– The NRP is a set of rules and procedures which are designed to increase the flexibility of user flight planning within published guidelines.

NORTH MARK– A beacon data block sent by the host computer to be displayed by the ARTS on a 360 degree bearing at a locally selected radar azimuth and distance. The North Mark is used to ensure correct range/azimuth orientation during periods of CENRAP.

NORTH PACIFIC– An organized route system between the Alaskan west coast and Japan.

NOTAM–
(See NOTICE TO AIRMEN.)

NOTAM [ICAO]– A notice containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.


b. II Distribution– Distribution by means other than telecommunications.

NOTICE TO AIRMEN– A notice containing information (not known sufficiently in advance to publicize by other means) concerning the
establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

a. NOTAM(D)– A NOTAM given (in addition to local dissemination) distant dissemination beyond the area of responsibility of the Flight Service Station. These NOTAMs will be stored and available until canceled.

b. FDC NOTAM– A NOTAM regulatory in nature, transmitted by USNOF and given system wide dissemination.

(See ICAO term NOTAM.)

NOTICES TO AIRMEN PUBLICATION– A publication issued every 28 days, designed primarily for the pilot, which contains current NOTAM information considered essential to the safety of flight as well as supplemental data to other aeronautical publications. The contraction NTAP is used in NOTAM text.

(See NOTICE TO AIRMEN.)

NRR–

(See NON–RESTRICTIVE ROUTING.)

NRS–

(See NAVIGATION REFERENCE SYSTEM.)

NTAP–

(See NOTICES TO AIRMEN PUBLICATION.)

NUMEROUS TARGETS VICINITY (LOCATION)– A traffic advisory issued by ATC to advise pilots that targets on the radar scope are too numerous to issue individually.

(See TRAFFIC ADVISORIES.)
P

P TIME—
(See PROPOSED DEPARTURE TIME.)

P-ACP—
(See PREARRANGED COORDINATION PROCEDURES.)

PAN-PAN—The international radio-telephony urgency signal. When repeated three times, indicates uncertainty or alert followed by the nature of the urgency.
(See MAYDAY.)
(Refer to AIM.)

PAR—
(See PRECISION APPROACH RADAR.)
PAR [ICAO]—
(See ICAO Term PRECISION APPROACH RADAR.)

PARALLEL ILS APPROACHES—Approaches to parallel runways by IFR aircraft which, when established inbound toward the airport on the adjacent final approach courses, are radar-separated by at least 2 miles.
(See FINAL APPROACH COURSE.)
(See SIMULTANEOUS ILS APPROACHES.)

PARALLEL MLS APPROACHES—
(See PARALLEL ILS APPROACHES.)

PARALLEL OFFSET ROUTE—A parallel track to the left or right of the designated or established airway/route. Normally associated with Area Navigation (RNAV) operations.
(See AREA NAVIGATION.)

PARALLEL RUNWAYS—Two or more runways at the same airport whose centerlines are parallel. In addition to runway number, parallel runways are designated as L (left) and R (right) or, if three parallel runways exist, L (left), C (center), and R (right).

PBCT—
(See PROPOSED BOUNDARY CROSSING TIME.)

PBN—
(See ICAO Term PERFORMANCE–BASED NAVIGATION.)

PDC—
(See PRE–DEPARTURE CLEARANCE.)

PERFORMANCE–BASED NAVIGATION (PBN) [ICAO]—Area navigation based on performance requirements for aircraft operating along an ATS route, on an instrument approach procedure or in a designated airspace.

Note: Performance requirements are expressed in navigation specifications (RNAV specification, RNP specification) in terms of accuracy, integrity, continuity, availability, and functionality needed for the proposed operation in the context of a particular airspace concept.

PERMANENT ECHO—Radar signals reflected from fixed objects on the earth’s surface; e.g., buildings, towers, terrain. Permanent echoes are distinguished from “ground clutter” by being definable locations rather than large areas. Under certain conditions they may be used to check radar alignment.

PHOTO RECONNAISSANCE—Military activity that requires locating individual photo targets and navigating to the targets at a preplanned angle and altitude. The activity normally requires a lateral route width of 16 NM and altitude range of 1,500 feet to 10,000 feet AGL.

PILOT BRIEFING—A service provided by the FSS to assist pilots in flight planning. Briefing items may include weather information, NOTAMS, military activities, flow control information, and other items as requested.
(Refer to AIM.)

PILOT IN COMMAND—The pilot responsible for the operation and safety of an aircraft during flight time.
(Refer to 14 CFR Part 91.)

PILOT WEATHER REPORT—A report of meteorological phenomena encountered by aircraft in flight.
(Refer to AIM.)

PILOT’S DISCRETION—When used in conjunction with altitude assignments, means that ATC has offered the pilot the option of starting climb or descent whenever he/she wishes and conducting the climb or descent at any rate he/she wishes. He/she may temporarily level off at any intermediate
altitude. However, once he/she has vacated an altitude, he/she may not return to that altitude.

PIREP—
(See PILOT WEATHER REPORT.)

PITCH POINT—A fix/waypoint that serves as a transition point from a departure procedure or the low altitude ground-based navigation structure into the high altitude waypoint system.

PLANS DISPLAY—A display available in URET that provides detailed flight plan and predicted conflict information in textual format for requested Current Plans and all Trial Plans.
(See USER REQUEST EVALUATION TOOL.)

POFZ—
(See PRECISION OBSTACLE FREE ZONE.)

POINT OUT—
(See RADAR POINT OUT.)

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.

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 standard 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 standard 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 (< 30 dBZ)
b. MODERATE (30 to 40 dBZ)
c. HEAVY (> 40 to 50 dBZ)
d. EXTREME (> 50 dBZ)
(Refer to AC 00–45, Aviation Weather Services.)

PRECISION APPROACH—
(See PRECISION APPROACH PROCEDURE.)

PRECISION APPROACH PROCEDURE—A standard instrument approach procedure in which an electronic glideslope/glidepath is provided; e.g., ILS, MLS, and PAR.
(See INSTRUMENT LANDING SYSTEM.)
(See MICROWAVE LANDING SYSTEM.)
(See PRECISION APPROACH RADAR.)
Pilot/Controller Glossary

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.

Note: The abbreviation “PAR” is also used to denote preferential arrival routes in ARTCC computers.

(See GLIDEPATH.)
(See PAR.)
(See PREFERENTIAL ROUTES.)
(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.

Note: Precision approach radars are designed to enable pilots of aircraft to be given guidance by radio communication during the final stages of the approach to land.

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)— Provides air traffic controllers with high precision secondary surveillance data for aircraft on final approach to parallel runways that have extended centerlines separated by less than 4,300 feet. High resolution color monitoring displays (FMA) are required to present surveillance track data to controllers along with detailed maps depicting approaches and no transgression zone.

PREDICTIVE WIND SHEAR ALERT SYSTEM (PWS)— A self-contained system used onboard 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.

PREFERENTIAL ROUTES— Preferential routes (PDRs, PARs, and PDARs) are adapted in ARTCC computers to accomplish inter/intrafacility controller coordination and to assure that flight data is posted at the proper control positions. Locations having a need for these specific inbound and outbound routes normally publish such routes in local facility bulletins, and their use by pilots minimizes flight plan route amendments. When the workload or traffic situation permits, controllers normally provide radar vectors or assign requested routes to minimize circuitous routing. Preferential routes are usually confined to one ARTCC’s area and are referred to by the following names or acronyms:

a. Preferential Departure Route (PDR). A specific departure route from an airport or terminal area to an en route point where there is no further need for flow control. It may be included in an Instrument Departure Procedure (DP) or a Preferred IFR Route.

b. Preferential Arrival Route (PAR). A specific arrival route from an appropriate en route point to an airport or terminal area. It may be included in a Standard Terminal Arrival (STAR) or a Preferred IFR Route. The abbreviation “PAR” is used primarily within the ARTCC and should not be confused with the abbreviation for Precision Approach Radar.

c. Preferential Departure and Arrival Route (PDAR). A route between two terminals which are within or immediately adjacent to one ARTCC’s area. PDARs are not synonymous with Preferred IFR Routes but may be listed as such as they do accomplish essentially the same purpose.

(See PREFERRED IFR ROUTES.)

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 Airport/Facility Directory. If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Airport/Facility Directory, 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 are correlated with DPs and STARs and may be defined by airways, jet routes, direct routes between NAVAIDs, Waypoints, NAVAID radials/DME, or any combinations thereof.

(See CENTER’S AREA.)
(See INSTRUMENT DEPARTURE PROCEDURE.)
(See PREFERENTIAL ROUTES.)
(See STANDARD TERMINAL ARRIVAL.)
(Refer to AIRPORT/FACILITY DIRECTORY.)
(Refer to NOTICES TO AIRMEN PUBLICATION.)

PRE-FLIGHT PILOT BRIEFING– (See PILOT BRIEFING.)

PREVAILING VISIBILITY– (See VISIBILITY.)

PRIMARY RADAR TARGET– An analog or digital target, exclusive of a secondary radar target, presented on a radar display.

PRM–
(See ILS PRM APPROACH and PRECISION RUNWAY MONITOR.)

PROCEDURE TURN– The maneuver prescribed when it is necessary to reverse direction to establish an aircraft on the intermediate approach segment or final approach course. The outbound course, direction of turn, distance within which the turn must be completed, and minimum altitude are specified in the procedure. However, unless otherwise restricted, the point at which the turn may be commenced and the type and rate of turn are left to the discretion of the pilot.
(See ICAO term PROCEDURE TURN.)

PROCEDURE TURN [ICAO]– A maneuver in which a turn is made away from a designated track followed by a turn in the opposite direction to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

Note 1: Procedure turns are designated “left” or “right” according to the direction of the initial turn.

Note 2: Procedure turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual approach procedure.

PROCEDURE TURN INBOUND– That point of a procedure turn maneuver where course reversal has been completed and an aircraft is established inbound on the intermediate approach segment or final approach course. A report of “procedure turn inbound” is normally used by ATC as a position report for separation purposes.

(See FINAL APPROACH COURSE.)
(See PROCEDURE TURN.)
(See SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE.)

PROFILE DESCENT– An uninterrupted descent (except where level flight is required for speed adjustment; e.g., 250 knots at 10,000 feet MSL) from cruising altitude/level to interception of a glideslope or to a minimum altitude specified for the initial or intermediate approach segment of a nonprecision instrument approach. The profile descent normally terminates at the approach gate or where the glideslope or other appropriate minimum altitude is intercepted.

PROGRESS REPORT– (See POSITION REPORT.)

PROGRESSIVE TAXI– Precise taxi instructions given to a pilot unfamiliar with the airport or issued in stages as the aircraft proceeds along the taxi route.

PROHIBITED AREA–
(See SPECIAL USE AIRSPACE.)
(See ICAO term PROHIBITED AREA.)

PROHIBITED AREA [ICAO]– An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

PROMINENT OBSTACLE– An obstacle that meets one or more of the following conditions:

a. An obstacle which stands out beyond the adjacent surface of surrounding terrain and immediately projects a noticeable hazard to aircraft in flight.

b. An obstacle, not characterized as low and close in, whose height is no less than 300 feet above the departure end of takeoff runway (DER) elevation, is within 10NM from the DER, and that penetrates that airport/heliport’s diverse departure obstacle clearance surface (OCS).
c. An obstacle beyond 10NM from an airport/heliport that requires an obstacle departure procedure (ODP) to ensure obstacle avoidance.  
(See OBSTACLE.)  
(See OBSTRUCTION.)

PROPOSED BOUNDARY CROSSING TIME—Each center has a PBCT parameter for each internal airport. Proposed internal flight plans are transmitted to the adjacent center if the flight time along the proposed route from the departure airport to the center boundary is less than or equal to the value of PBCT or if airport adaptation specifies transmission regardless of PBCT.

PROPOSED DEPARTURE TIME—The time that the aircraft expects to become airborne.

PROTECTED AIRSPACE—The airspace on either side of an oceanic route/track that is equal to one-half the lateral separation minimum except where reduction of protected airspace has been authorized.

PT—
(See PROCEDURE TURN.)

PTP—
(See POINT-TO-POINT.)

PTS—
(See POLAR TRACK STRUCTURE.)

PUBLISHED INSTRUMENT APPROACH PROCEDURE VISUAL SEGMENT—A segment on an IAP chart annotated as “Fly Visual to Airport” or “Fly Visual.” A dashed arrow will indicate the visual flight path on the profile and plan view with an associated note on the approximate heading and distance. The visual segment should be flown as a dead reckoning course while maintaining visual conditions.

PUBLISHED ROUTE—A route for which an IFR altitude has been established and published; e.g., Federal Airways, Jet Routes, Area Navigation Routes, Specified Direct Routes.

PWS—
(See PREDICTIVE WIND SHEAR ALERT SYSTEM.)
**REPORT**—Used to instruct pilots to advise ATC of specified information; e.g., “Report passing Hamilton VOR.”

**REPORTING POINT**—A geographical location in relation to which the position of an aircraft is reported.

(See COMPULSORY REPORTING POINTS.)
(See ICAO term REPORTING POINT.)
(Refer to AIM.)

**REPORTING POINT [ICAO]**—A specified geographical location in relation to which the position of an aircraft can be reported.

**REQUEST FULL ROUTE CLEARANCE**—Used by pilots to request that the entire route of flight be read verbatim in an ATC clearance. Such request should be made to preclude receiving an ATC clearance based on the original filed flight plan when a filed IFR flight plan has been revised by the pilot, company, or operations prior to departure.

**REQUIRED NAVIGATION PERFORMANCE (RNP)**—A statement of the navigational performance necessary for operation within a defined airspace. The following terms are commonly associated with RNP:

a. **Required Navigation Performance Level or Type (RNP-X).** A value, in nautical miles (NM), from the intended horizontal position within which an aircraft would be at least 95-percent of the total flying time.

b. **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.

c. **Actual Navigation Performance (ANP).** A measure of the current estimated navigational performance. Also referred to as Estimated Position Error (EPE).

d. **Estimated Position Error (EPE).** A measure of the current estimated navigational performance. Also referred to as Actual Navigation Performance (ANP).

e. **Lateral Navigation (LNAV).** A function of area navigation (RNAV) equipment which calculates, displays, and provides lateral guidance to a profile or path.

f. **Vertical Navigation (VNAV).** A function of area navigation (RNAV) equipment which calculates, displays, and provides vertical guidance to a profile or path.

**RESCUE COORDINATION CENTER**—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 systems (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 that previously issued speed control restrictions are deleted. An instruction to “resume normal speed” does not delete speed restrictions that are applicable to published procedures of upcoming segments of flight, unless specifically stated by ATC. This does not relieve the pilot of those speed restrictions which 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.)

RMI—
(See RADIO MAGNETIC INDICATOR.)

RNAV—
(See AREA NAVIGATION (RNAV).)

RNAV APPROACH—An instrument approach procedure which relies on aircraft area navigation equipment for navigational guidance.

(See AREA NAVIGATION (RNAV).)
(See INSTRUMENT APPROACH PROCEDURE.)

ROAD RECONNAISSANCE—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.)

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—URET notification that a PAR/PDR/PDAR has been applied to the flight plan.

(See ATC PREFERRED ROUTE NOTIFICATION.)
(See USER REQUEST EVALUATION TOOL.)

ROUTE SEGMENT—As used in Air Traffic Control, a part of a route that can be defined by two navigational fixes, two NAVAIDs, or a fix and a NAVAID.

(See FIX.)
(See ROUTE.)
(See ICAO term ROUTE SEGMENT.)

ROUTE SEGMENT [ICAO]—A portion of a route to be flown, as defined by two consecutive significant points specified in a flight plan.

RSA—
(See RUNWAY SAFETY AREA.)

RTR—
(See REMOTE TRANSMITTER/RECEIVER.)

RUNWAY—A defined rectangular area on a land airport prepared for the landing and takeoff run of aircraft along its length. Runways are normally numbered in relation to their magnetic direction rounded off to the nearest 10 degrees; e.g., Runway 1, Runway 25.

(See PARALLEL RUNWAYS.)
(See ICAO term RUNWAY.)

RUNWAY [ICAO]—A defined rectangular area on a land aerodrome prepared for the landing and take-off of aircraft.

RUNWAY CENTERLINE LIGHTING—
(See AIRPORT LIGHTING.)

RUNWAY CONDITION READING—Numerical decelerometer readings relayed by air traffic controllers at USAF and certain civil bases for use by the pilot in determining runway braking action. These readings are routinely relayed only to USAF and Air National Guard Aircraft.

(See BRAKING ACTION.)

RUNWAY END IDENTIFIER LIGHTS—
(See AIRPORT LIGHTING.)

RUNWAY GRADIENT—The average slope, measured in percent, between two ends or points on a runway. Runway gradient is depicted on Government aerodrome sketches when total runway gradient exceeds 0.3%.

RUNWAY HEADING—The magnetic direction that corresponds with the runway centerline extended, not the painted runway number. When cleared to “fly or maintain runway heading,” pilots are expected to fly or maintain the heading that corresponds with the extended centerline of the departure runway. Drift correction shall not be applied; e.g., Runway 4, actual magnetic heading of the runway centerline 044, fly 044.
RUNWAY IN USE/ACTIVE RUNWAY/DUTY

RUNWAY—Any runway or runways currently being used for takeoff or landing. When multiple runways are used, they are all considered active runways. In the metering sense, a selectable adapted item which specifies the landing runway configuration or direction of traffic flow. The adapted optimum flight plan from each transition fix to the vertex is determined by the runway configuration for arrival metering processing purposes.

RUNWAY LIGHTS—
(See AIRPORT LIGHTING.)

RUNWAY MARKINGS—
(See AIRPORT MARKING AIDS.)

RUNWAY OVERRUN—In military aviation exclusively, a stabilized or paved area beyond the end of a runway, of the same width as the runway plus shoulders, centered on the extended runway centerline.

RUNWAY PROFILE DESCENT—An instrument flight rules (IFR) air traffic control arrival procedure to a runway published for pilot use in graphic and/or textual form and may be associated with a STAR. Runway Profile Descents provide routing and may depict crossing altitudes, speed restrictions, and headings to be flown from the en route structure to the point where the pilot will receive clearance for and execute an instrument approach procedure. A Runway Profile Descent may apply to more than one runway if so stated on the chart.
(Refer to AIM.)

RUNWAY SAFETY AREA—A defined surface surrounding the runway prepared, or suitable, for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The dimensions of the RSA vary and can be determined by using the criteria contained within AC 150/5300-13, Airport Design, Chapter 3. Figure 3–1 in AC 150/5300-13 depicts the RSA. The design standards dictate that the RSA shall be:

a. Cleared, graded, and have no potentially hazardous ruts, humps, depressions, or other surface variations;

b. Drained by grading or storm sewers to prevent water accumulation;

c. Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and,

d. Free of objects, except for objects that need to be located in the runway safety area because of their function. These objects shall be constructed on low impact resistant supports (frangible mounted structures) to the lowest practical height with the frangible point no higher than 3 inches above grade.
(Refer to AC 150/5300-13, Airport Design, Chapter 3.)

RUNWAY TRANSITION—

a. Conventional STARs/SIDs. The portion of a STAR/SID that serves a particular runway or runways at an airport.

b. RNAV STARs/SIDs. Defines a path(s) from the common route to the final point(s) on a STAR. For a SID, the common route that serves a particular runway or runways at an airport.

RUNWAY USE PROGRAM—A noise abatement runway selection plan designed to enhance noise abatement efforts with regard to airport communities for arriving and departing aircraft. These plans are developed into runway use programs and apply to all turbojet aircraft 12,500 pounds or heavier; turbojet aircraft less than 12,500 pounds are included only if the airport proprietor determines that the aircraft creates a noise problem. Runway use programs are coordinated with FAA offices, and safety criteria used in these programs are developed by the Office of Flight Operations. Runway use programs are administered by the Air Traffic Service as “Formal” or “Informal” programs.

a. Formal Runway Use Program—An approved noise abatement program which is defined and acknowledged in a Letter of Understanding between Flight Operations, Air Traffic Service, the airport proprietor, and the users. Once established, participation in the program is mandatory for aircraft operators and pilots as provided for in 14 CFR Section 91.129.

b. Informal Runway Use Program—An approved noise abatement program which does not require a Letter of Understanding, and participation in the program is voluntary for aircraft operators/pilots.
RUNWAY VISIBILITY VALUE—
(See VISIBILITY.)

RUNWAY VISUAL RANGE—
(See VISIBILITY.)
TACAN–  
(See TACTICAL AIR NAVIGATION.)

TACAN-ONLY AIRCRAFT– An aircraft, normally military, possessing TACAN with DME but no VOR navigational system capability. Clearances must specify TACAN or VORTAC fixes and approaches.

TACTICAL AIR NAVIGATION– An ultra-high frequency electronic rho-theta air navigation aid which provides suitably equipped aircraft a continuous indication of bearing and distance to the TACAN station.
(See VORTAC.)
(Refer to AIM.)

TAILWIND– Any wind more than 90 degrees to the longitudinal axis of the runway. The magnetic direction of the runway shall be used as the basis for determining the longitudinal axis.

TAKEOFF AREA–  
(See LANDING AREA.)

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.
(See ICAO term TAKEOFF DISTANCE AVAILABLE.)

TAKEOFF DISTANCE AVAILABLE [ICAO]– The length of the takeoff run available plus the length of the clearway, if provided.

TAKEOFF RUN AVAILABLE (TORA) – The runway length declared available and suitable for the ground run of an airplane taking off.
(See ICAO term TAKEOFF RUN AVAILABLE.)

TAKEOFF RUN AVAILABLE [ICAO]– The length of runway declared available and suitable for the ground run of an aeroplane take-off.

TARGET– The indication shown on an analog display resulting from a primary radar return or a radar beacon reply.
(See ASSOCIATED.)
(See DIGITAL TARGET.)
(See DIGITIZED RADAR TARGET.)
(See PRIMARY RADAR TARGET.)
(See RADAR.)
(See SECONDARY RADAR TARGET.)
(See TARGET SYMBOL.)
(See ICAO term TARGET.)
(See UNASSOCIATED.)

TARGET [ICAO]– In radar:
  a. Generally, any discrete object which reflects or retransmits energy back to the radar equipment.
  b. Specifically, an object of radar search or surveillance.

TARGET RESOLUTION– A process to ensure that correlated radar targets do not touch. Target resolution must be applied as follows:
  a. Between the edges of two primary targets or the edges of the ASR-9/11 primary target symbol.
  b. Between the end of the beacon control slash and the edge of a primary target.
  c. Between the ends of two beacon control slashes.

Note 1: Mandatory traffic advisories and safety alerts must be issued when this procedure is used.
Note 2: This procedure must not be used when utilizing mosaic radar systems or multi-sensor mode.

TARGET SYMBOL– A computer-generated indication shown on a radar display resulting from a primary radar return or a radar beacon reply.

TARMAC DELAY– The holding of an aircraft on the ground either before departure or after landing with no opportunity for its passengers to deplane.

TARMAC DELAY AIRCRAFT– An aircraft whose pilot-in-command has requested to taxi to the ramp, gate, or alternate deplaning area to comply with the Three-hour Tarmac Rule.

TARMAC DELAY REQUEST– A request by the pilot-in-command to taxi to the ramp, gate, or alternate deplaning location to comply with the Three-hour Tarmac Rule.
TAS—
   (See TERMINAL AUTOMATION SYSTEMS.)
TAWS—
   (See TERRAIN AWARENESS WARNING SYSTEM.)
TAXI— The movement of an airplane under its own power on the surface of an airport (14 CFR Section 135.100 [Note]). Also, it describes the surface movement of helicopters equipped with wheels.
   (See AIR TAXI.)
   (See HOVER TAXI.)
   (Refer to 14 CFR Section 135.100.)
   (Refer to AIM.)
TAXI PATTERNS— Patterns established to illustrate the desired flow of ground traffic for the different runways or airport areas available for use.
TCAS—
   (See TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM.)
TCH—
   (See THRESHOLD CROSSING HEIGHT.)
TCLT—
   (See TENTATIVE CALCULATED LANDING TIME.)
TDLS—
   (See TERMINAL DATA LINK SYSTEM.)
TDZE—
   (See TOUCHDOWN ZONE ELEVATION.)
TELEPHONE INFORMATION BRIEFING SERVICE— A continuous telephone recording of meteorological and/or aeronautical information.
   (Refer to AIM.)
TENTATIVE CALCULATED LANDING TIME— A projected time calculated for adapted vertex for each arrival aircraft based upon runway configuration, airport acceptance rate, airport arrival delay period, and other metered arrival aircraft. This time is either the VTA of the aircraft or the TCLT/ACLT of the previous aircraft plus the AAI, whichever is later. This time will be updated in response to an aircraft’s progress and its current relationship to other arrivals.
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 ARTS IIE, ARTS IIIA, ARTS IIIE, 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 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 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 Airport/Facility Directory.
   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 AIRPORT/FACILITY DIRECTORY.)

TERMINAL-VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE STATION– 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.)

THAT IS CORRECT– The understanding you have is right.

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 MLS glidepath.
(See GLIDESLOPE.)
(See THRESHOLD.)

THRESHOLD LIGHTS–
(See AIRPORT LIGHTING.)

TIBS–
(See TELEPHONE INFORMATION BRIEFING SERVICE.)

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.

TIS–B–
(See TRAFFIC INFORMATION SERVICE–BROADCAST.)

TMA–
(See TRAFFIC MANAGEMENT ADVISOR.)

TMPA–
(See TRAFFIC MANAGEMENT PROGRAM ALERT.)

TMU–
(See TRAFFIC MANAGEMENT UNIT.)
TODA--
(See TAKEOFF DISTANCE AVAILABLE.)
(See ICAO term TAKEOFF DISTANCE AVAILABLE.)

TOI--
(See TRACK OF INTEREST.)

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.

TOTAL ESTIMATED ELAPSED TIME [ICAO]-- For IFR flights, the estimated time required from take-off 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 take-off 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.)

TPX-42-- A numeric beacon decoder equipment/system. It is designed to be added to terminal radar
systems for beacon decoding. It provides rapid target identification, reinforcement of the primary radar target, and altitude information from Mode C.  
(See AUTOMATED RADAR TERMINAL SYSTEMS.)  
(See TRANSponder.)

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/AWSS 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– 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 ground–based air traffic surveillance sensors, typically from radar targets. TIS–B service will be available throughout the NAS where there are both adequate surveillance coverage (radar) and adequate broadcast coverage from ADS–B ground stations. Loss of TIS–B will occur when an aircraft enters an area not covered by the GBT network. If this occurs in an area with adequate surveillance coverage (radar), nearby aircraft that remain within the adequate broadcast coverage (ADS–B) area will view the first aircraft. TIS–B may continue when an aircraft enters an area with inadequate surveillance coverage (radar); nearby aircraft that remain within the adequate broadcast coverage (ADS–B) area will not view the first aircraft.

**TRAFFIC IN SIGHT**– Used by pilots to inform a controller that previously issued traffic is in sight.
(See NEGATIVE CONTACT.)
(See TRAFFIC ADVISORIES.)

**TRAFFIC MANAGEMENT ADVISOR (TMA)**– A computerized tool which assists Traffic Management Coordinators to efficiently schedule arrival traffic to a metered airport, by calculating meter fix times and delays then sending that information to the sector controllers.

**TRAFFIC MANAGEMENT PROGRAM ALERT**– A term used in a Notice to Airmen (NOTAM) issued in conjunction with a special traffic management program to alert pilots to the existence of the program and to refer them to either the Notices to Airmen publication or a special traffic management program advisory message for program details. The contraction TMPA is used in NOTAM text.

**TRAFFIC MANAGEMENT UNIT**– The entity in ARTCCs and designated terminals directly involved in the active management of facility traffic. Usually under the direct supervision of an assistant manager for traffic management.

**TRAFFIC NO FACTOR**– Indicates that the traffic described in a previously issued traffic advisory is no factor.

**TRAFFIC NO LONGER OBSERVED**– Indicates that the traffic described in a previously issued traffic advisory is no longer depicted on radar, but may still be a factor.

**TRAFFIC PATTERN**– The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are upwind leg, crosswind leg, downwind leg, base leg, and final approach.

a. **Upwind Leg**– A flight path parallel to the landing runway in the direction of landing.

b. **Crosswind Leg**– A flight path at right angles to the landing runway off its upwind end.

c. **Downwind Leg**– A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.

d. **Base Leg**– A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.

e. **Final Approach**. A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

(See STRAIGHT-IN APPROACH VFR.)
(See TAXI PATTERNS.)
(See ICAO term AERODROME TRAFFIC CIRCUIT.)
(Refer to 14 CFR Part 91.)
(Refer to AIM.)

**TRAFFIC SITUATION DISPLAY (TSD)**– TSD is a computer system that receives radar track data from all 20 CONUS ARTCCs, organizes this data into a mosaic display, and presents it on a computer screen. The display allows the traffic management coordinator multiple methods of selection and highlighting of individual aircraft or groups of aircraft. The user has the option of superimposing these aircraft positions over any number of background displays. These background options include ARTCC boundaries, any stratum of en route sector boundaries, fixes, airways, military and other special use airspace, airports, and geopolitical boundaries. By using the TSD, a
coordinator can monitor any number of traffic situations or the entire systemwide traffic flows.

TRAJECTORY— A URET representation of the path an aircraft is predicted to fly based upon a Current Plan or Trial Plan. (See USER REQUEST EVALUATION TOOL.)

TRAJECTORY MODELING— The automated process of calculating a trajectory.

TRANSCRIBED WEATHER BROADCAST— A continuous recording of meteorological and aeronautical information that is broadcast on L/MF and VOR facilities for pilots. (Provided only in Alaska.) (Refer to AIM.)

TRANSFER OF CONTROL— That action whereby the responsibility for the separation of an aircraft is transferred from one controller to another. (See ICAO term TRANSFER OF CONTROL.)

TRANSFER OF CONTROL [ICAO]— Transfer of responsibility for providing air traffic control service.

TRANSFERRING CONTROLLER— A controller/facility transferring control of an aircraft to another controller/facility. (See ICAO term TRANSFERRING UNIT/CONTROLLER.)

TRANSFERRING FACILITY— (See TRANSFERRING CONTROLLER.)

TRANSFERRING UNIT/CONTROLLER [ICAO]— Air traffic control unit/air traffic controller in the process of transferring the responsibility for providing air traffic control service to an aircraft to the next air traffic control unit/air traffic controller along the route of flight.

Note: See definition of accepting unit/controller.

TRANSITION—

a. The general term that describes the change from one phase of flight or flight condition to another; e.g., transition from en route flight to the approach or transition from instrument flight to visual flight.

b. A published procedure (DP Transition) used to connect the basic DP to one of several en route airways/jet routes, or a published procedure (STAR Transition) used to connect one of several en route airways/jet routes to the basic STAR. (Refer to DP/STAR Charts.)

TRANSITION POINT— A point at an adapted number of miles from the vertex at which an arrival aircraft would normally commence descent from its en route altitude. This is the first fix adapted on the arrival speed segments.

TRANSITION WAYPOINT— The waypoint that defines the beginning of a runway or en route transition on an RNAV SID or STAR.

TRANSITIONAL AIRSPACE— That portion of controlled airspace wherein aircraft change from one phase of flight or flight condition to another.

TRANSMISSOMETER— An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR) and runway visibility value (RVV). (See VISIBILITY.)

TRANSMITTING IN THE BLIND— A transmission from one station to other stations in circumstances where two-way communication cannot be established, but where it is believed that the called stations may be able to receive the transmission.

TRANSPONDER— The airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS) which automatically receives radio signals from interrogators on the ground, and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond. (See INTERROGATOR.) (See ICAO term TRANSPONDER.) (Refer to AIM.)

TRANSPONDER [ICAO]— A receiver/transmitter which will generate a reply signal upon proper interrogation; the interrogation and reply being on different frequencies.

TRANSPONDER CODES— (See CODES.)

TRANSPONDER OBSERVED— Phraseology used to inform a VFR pilot the aircraft’s assigned beacon code and position have been observed. Specifically, this term conveys to a VFR pilot the transponder reply has been observed and its position correlated for transit through the designated area.

TRIAL PLAN— A proposed amendment which utilizes automation to analyze and display potential
conflicts along the predicted trajectory of the selected aircraft.

TRSA—
(See TERMINAL RADAR SERVICE AREA.)

TSD—
(See TRAFFIC SITUATION DISPLAY.)

TURBOJET AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which in turn operates the air compressor.

TURBOPROP AIRCRAFT— An aircraft having a jet engine in which the energy of the jet operates a turbine which drives the propeller.

TURN ANTICIPATION— (maneuver anticipation).

TVOR—
(See TERMINAL-VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION.)

TWEB—
(See TRANSCRIBED WEATHER BROADCAST.)

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