



U.S. Department  
of Transportation

**Federal Aviation  
Administration**

# *AERONAUTICAL INFORMATION MANUAL*

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*Change 1  
January 30, 2020*

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**DO NOT DESTROY  
BASIC DATED  
AUGUST 15, 2019**



# Aeronautical Information Manual

## Explanation of Changes

**Effective: January 30, 2020**

**a. 1–1–9. Instrument Landing System (ILS)  
1–1–10. Simplified Directional Facility (SDF)**

The majority of Middle Markers (MM) have been decommissioned and are not operationally required. Outer Markers (OM), or a suitable substitute, are required to identify the final approach fix for non-precision approaches. This change identifies suitable substitution methods for an OM. In addition, this change notes the service volume of a localizer can be utilized beyond 18 NM with the approval of the Flight Inspection branch. FIG 1–1–7 has been amended to add comments that refer to the MM.

**b. 1–1–12. NAVAIDS with Voice  
4–2–14. Communications for VFR Flights  
7–1–10. Inflight Weather Broadcasts  
Appendix 3. Abbreviations/Acronyms**

This change deletes Hazardous Inflight Weather Advisory Service (HIWAS), as this continuous broadcast service is no longer provided by Flight Service. However, Flight Service is still responsible to advise pilots of hazardous weather that will impact operation.

**c. 2–1–6. Runway Status Light (RWSL) System  
3–1–2. General Dimensions of Airspace Segments**

**3–2–2. Class A. Airspace  
3–2–3. Class B Airspace  
3–2–4. Class C Airspace  
3–2–6. Class E Airspace  
4–1–15. Radar Traffic Information Service  
4–5–1. Radar  
4–5–5. Airport Surface Detection Equipment (ASDE–X) Airport Surface Surveillance Capability (ASSC)  
4–5–7. Automatic Dependent Surveillance–Broadcast (ADS–B) Services  
5–1–4. Flight Plan – VFR Flights  
5–1–8. Flight Plan (FAA Form 7233–1) –**

**Domestic IFR Flights**

**5–2–7. Departure Restrictions, Clearance Void Times, Hold for Release, and Release Times**

**5–2–8. Departure Control**

**5–6–6. Civil Aircraft Operations Within U.S. Territorial Airspace**

**5–6–7. Civil Aircraft Operations Transiting U.S. Territorial Airspace**

**5–6–8. Foreign State Aircraft Operations**

**10–2–1. Offshore Helicopter Operations**

This change updates references and procedures to include ADS–B, providing guidance for ADS–B operations in the National Airspace System.

**d. 3–2–3. Class B Airspace**

This change reflects the statutory authority of 14 CFR 61.325 allowing light-sport aircraft to operate within Class B airspace by sport pilot certificate holders.

**e. 4–1–20. Transponder Operation**

This change clarifies that most existing operating procedures and phraseology for aircraft transponders also apply to ADS–B Out. This change also removes several obsolete terms, references, phraseology examples, and other minor editorial changes.

**f. 4–4–12. Speed Adjustments**

This change clarifies what pilots should expect when vectored off or deviating off a procedure that includes published speeds, and corrects a typographical error. It also includes guidance on what pilots should expect when reaching the end of a STAR. The change clarifies the range of speeds that pilots are expected to maintain for published or verbally-assigned speeds.

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

This change corrects grammar and uses examples that more accurately reflect the intent.

**h. 4-6-1. Applicability and RVSM Mandate (Date/Time and Area)**

**4-6-3. Aircraft and Operator approval Policy/Procedures, RVSM Monitoring, and Databases for Aircraft and Operator Approval**

**4-6-4. Flight Planning Into RVSM Airspace**

**4-6-5. Pilot RVSM Operating Practices and Procedures**

**4-6-10. Procedures for Accommodation of Non-RVSM Aircraft**

This update supports changes to 14 CFR Part 91, Appendix G and Advisory Circular 91-85, Authorization of Aircraft and Operators for Flight in RVSM Airspace.

**i. 5-1-3. Notice to Airman (NOTAM) System**

This change provides NAS users of updates to the U.S. NOTAM System and governance, reflecting a more accurate view of NOTAM information. It also removes references to sections that are no longer published in the Notices to Airmen Publication.

**j. 5-1-11. Flights Outside the U.S. Territorial Airspace**

This change incorporates the present day Canadian AIM policy regarding Round-Robin flights into the AIM. NAVCANADA and Transport Canada regulations no longer allow Round-Robin flight plans to be filed with a stop in Canadian territory.

**k. 5-2-8. Departure Control**

This change clarifies what pilots should expect prior to takeoff when a departure procedure was included in the departure clearance, but an initial heading to fly is assigned.

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

This change gives pilots, operators, performance engineers, etc., further information on the value, accuracy, and limitations of the low, close-in obstacles published in the Terminal Procedures Publication (TPP). Some operators/performance engineers interpreted the existing verbiage to mean that the information in the TPP was the only source of obstacle data deemed appropriate for departure

performance planning. The intent of this additional note is to direct attention to sources other than the TPP, without being specific (at least in the AIM/AIP) as to what those other sources might be.

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

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

**5-5-6. Radar Vectors**

This change clarifies what pilots should expect when vectored or deviating off a procedure that includes published speeds.

**n. 5-3-1. ARTCC Communications**

To keep pace with technological advances, the Controller Pilot Data Link Communications (CPDLC) message sets will continually evolve. As needed, new messages will be added and existing messages will be rewritten or removed. This change adds one new message, removes two messages, and modifies two messages of the CPDLC message set.

**o. 5-4-5. Instrument approach Procedure (IAP) Charts**

This change removes any references to VOR/DME RNAV.

**p. 5-4-7. Instrument Approach Procedures**

This change provides pilots with additional options when it is necessary to conduct an instrument approach at an airspeed higher than the maximum airspeed of its certificated aircraft approach category. It explains the flexibility provided in 14 CFR and emphasizes the primary safety issue of staying within protected areas.

**q. 5-4-16. Simultaneous Close Parallel PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA)**

This change removes the term PRM from the monitor controller references in the paragraph.

**r. 5-4-22. Use of Enhanced Flight Vision Systems (EFVS) on Instrument Approaches**

This change adds additional verbiage and updated figures to clarify the information regarding EFVS operations.

**s. 5-4-23. Visual Approach****5-4-24. Charted Visual Flight Procedure (CVFP)**

This change encourages pilots to use other available navigational aids to assist in positive lateral and vertical alignment with the runway.

**t. 7-1-11. Flight Information Services (FIS)**

This change announces that, with the exception of TFRs, NOTAMs older than 30 days will not be provided via FIS-B.

**u. 7-1-21. PIREPs Related to Airframe Icing**

This change harmonizes Icing definitions with Advisory Circular 91-74B, as recommended by NTSB Recommendation A-10-034.

**v. 7-1-24. Wind Shear PIREPs**

This change adds content on Wind Shear Escape Pilot Reports. This change advises the pilot to inform ATC when they are conducting a wind shear escape, only after aircraft safety and control is assured. Additionally, this change informs the pilot that once a wind shear escape maneuver is initiated, ATC is not responsible for providing approved separation until the pilot advises that the escape maneuver is complete, and approved separation has been re-established.

**w. Entire publication.**

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



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**Page Control Chart**  
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## Comments/Corrections

The office of primary responsibility (OPR) for this manual is:

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Proposed changes must be submitted electronically, using the following format, to the Policy Directorate Correspondence Mailbox at [9-AJV-8-HQ-Correspondence@faa.gov](mailto:9-AJV-8-HQ-Correspondence@faa.gov).

## Notice to Editor

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**TBL 1-1-1  
VOR/DME/TACAN Standard Service Volumes**

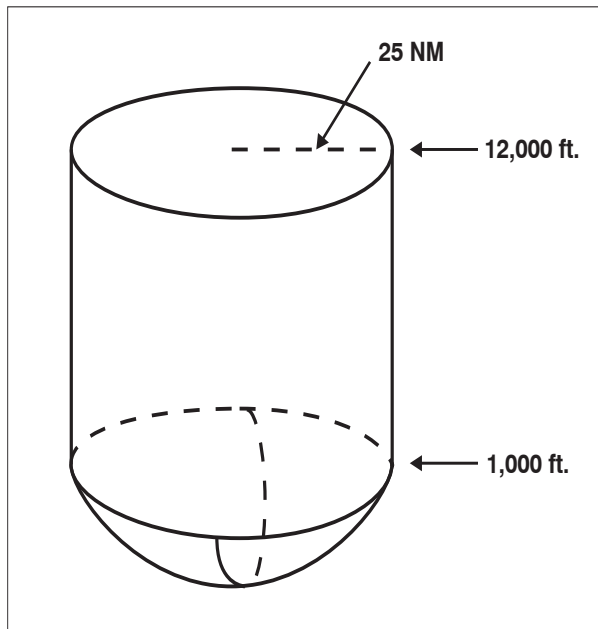
SSV Class Designator	Altitude and Range Boundaries
T (Terminal) . . . . .	From 1,000 feet above ground level (AGL) up to and including 12,000 feet AGL at radial distances out to 25 NM.
L (Low Altitude) . . . .	From 1,000 feet AGL up to and including 18,000 feet AGL at radial distances out to 40 NM.
H (High Altitude) . . . .	From 1,000 feet AGL up to and including 14,500 feet AGL at radial distances out to 40 NM. From 14,500 feet AGL up to and including 60,000 feet at radial distances out to 100 NM. From 18,000 feet AGL up to and including 45,000 feet AGL at radial distances out to 130 NM.

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

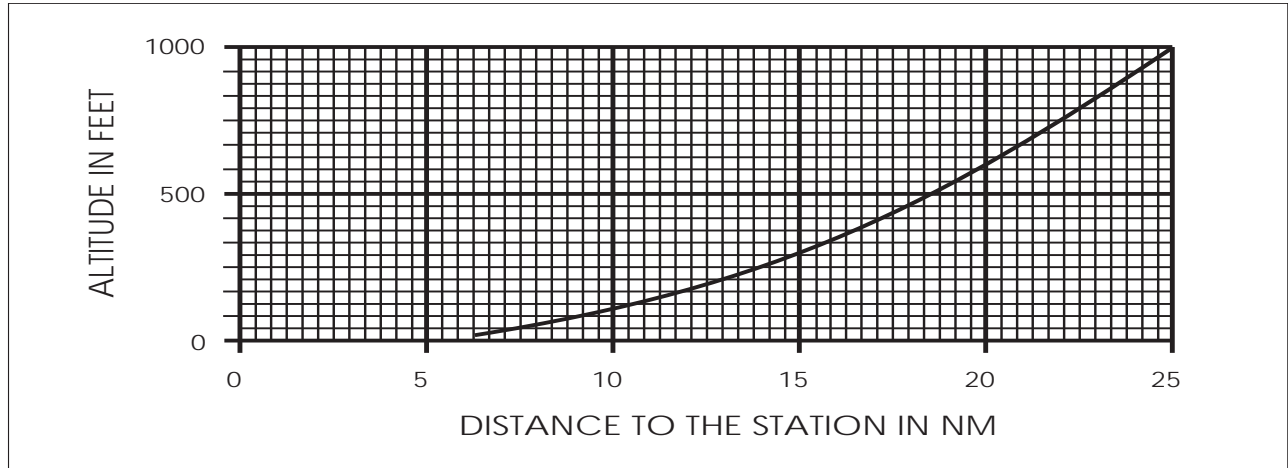
Class	Distance (Radius)
Compass Locator	15 NM
MH	25 NM
H	50 NM*
HH	75 NM

*\*Service ranges of individual facilities may be less than 50 nautical miles (NM). Restrictions to service volumes are first published as a Notice to Airmen and then with the alphabetical listing of the NAVAID in the Chart Supplement U.S.*

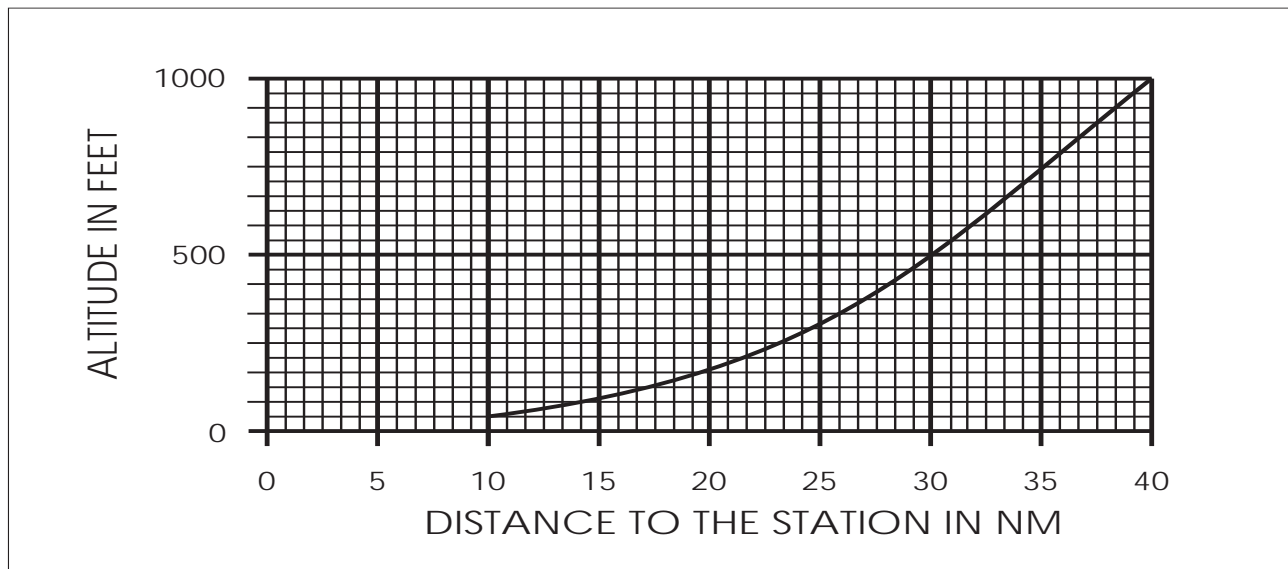
**FIG 1-1-3  
Standard Terminal Service Volume**  
(See FIG 1-1-4 for altitudes below 1,000 feet).



**FIG 1-1-4**  
**Service Volume Lower Edge Terminal**



**FIG 1-1-5**  
**Service Volume Lower Edge**  
**Standard High and Low**



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

### a. General

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

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

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

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

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

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

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

(a) Compass locator; or

(b) Precision Approach Radar (PAR); or

(c) Airport Surveillance Radar (ASR); or

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

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

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

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

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

### b. Localizer

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

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

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

#### CAUTION-

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

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

#### EXAMPLE-

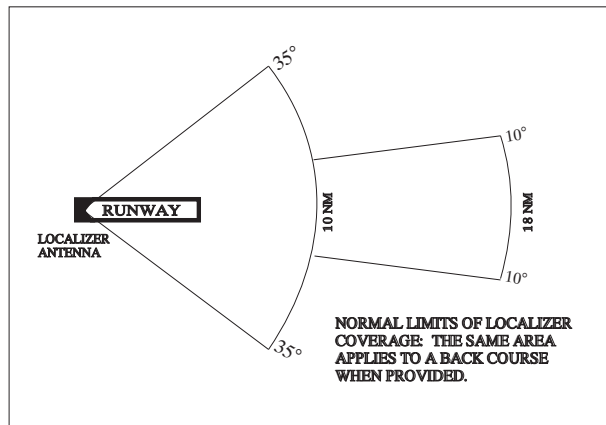
*I-DIA*

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

(a) To 10 degrees either side of the course along a radius of 18 NM from the antenna; and

(b) From 10 to 35 degrees either side of the course along a radius of 10 NM. (See FIG 1-1-6.)

FIG 1-1-6  
Limits of Localizer Coverage



6. Unreliable signals may be received outside these areas.

7. The areas described in paragraph 1-1-9 b.5 and depicted in FIG 1-1-6 represent a Standard Service Volume (SSV) localizer. All charted procedures with localizer coverage beyond the 18 NM SSV have been through the approval process for Expanded Service Volume (ESV), and have been validated by flight inspection.

### c. Localizer Type Directional Aid (LDA)

1. The LDA is of comparable use and accuracy to a localizer but is not part of a complete ILS. The LDA course usually provides a more precise approach course than the similar Simplified Directional Facility (SDF) installation, which may have a course width of 6 or 12 degrees.

2. The LDA is not aligned with the runway. Straight-in minimums may be published where alignment does not exceed 30 degrees between the course and runway. Circling minimums only are published where this alignment exceeds 30 degrees.

3. A very limited number of LDA approaches also incorporate a glideslope. These are annotated in the plan view of the instrument approach chart with a note, "LDA/Glideslope." These procedures fall under a newly defined category of approaches called Approach with Vertical Guidance (APV) described in paragraph 5-4-5, Instrument Approach Procedure Charts, subparagraph a7(b), Approach with Vertical Guidance (APV). LDA minima for with and without glideslope is provided and annotated on the minima lines of the approach chart as S-LDA/GS and

S-LDA. Because the final approach course is not aligned with the runway centerline, additional maneuvering will be required compared to an ILS approach.

### d. Glide Slope/Glide Path

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

#### CAUTION-

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

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

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

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

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



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

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

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

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

**e. Distance Measuring Equipment (DME)**

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

- (a) In lieu of the OM;
- (b) As a back course (BC) final approach fix (FAF); and
- (c) To establish other fixes on the localizer course.

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

- (a) To provide ARC initial approach segments;
- (b) As a FAF for BC approaches; and

(c) As a substitute for the OM.

**f. Marker Beacon**

1. ILS marker beacons have a rated power output of 3 watts or less and an antenna array designed to produce an elliptical pattern with dimensions, at 1,000 feet above the antenna, of approximately 2,400 feet in width and 4,200 feet in length. Airborne marker beacon receivers with a selective sensitivity feature should always be operated in the "low" sensitivity position for proper reception of ILS marker beacons.

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

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

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

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

*TBL 1-1-3*  
**Marker Passage Indications**

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

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

**g. Compass Locator**

1. Compass locator transmitters are often situated at the MM and OM sites. The transmitters have a power of less than 25 watts, a range of at least 15 miles and operate between 190 and 535 kHz. At some locations, higher powered radio beacons, up to 400 watts, are used as OM compass locators. These generally carry Transcribed Weather Broadcast (TWEB) information.

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

**h. ILS Frequency (See TBL 1-1-4.)**

*TBL 1-1-4*

**Frequency Pairs Allocated for ILS**

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

Localizer MHz	Glide Slope
111.15	331.55
111.30	332.30
111.35	332.15
111.50	332.9
111.55	332.75
111.70	333.5
111.75	333.35
111.90	331.1
111.95	330.95

**i. ILS Minimums**

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

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

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

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

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

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

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

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

**NOTE-**

*Special authorization and equipment required for Categories II and III.*

**j. Inoperative ILS Components**

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

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

**REFERENCE-**

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

**k. ILS Course Distortion**

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

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

(a) **Weather Conditions.** Official weather observation is a ceiling of less than 800 feet and/or visibility 2 miles.

(1) **Localizer Critical Area.** Except for aircraft that land, exit a runway, depart, or execute a missed approach, vehicles and aircraft are not authorized in or over the critical area when an arriving aircraft is inside the outer marker (OM) or the fix used in lieu of the OM. Additionally, whenever the official weather observation is a ceiling of less than 200 feet or RVR less than 2,000 feet, do not authorize vehicles or aircraft operations in or over the area when an arriving aircraft is inside the MM, or in the absence of a MM, ½ mile final.

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

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

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

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

**EXAMPLE-**

Denver Tower, United 1153, Request Autoland/Coupled Approach (runway)

ATC replies with:

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

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

4. Pilots are cautioned that vehicular traffic not subject to ATC may cause momentary deviation to ILS course or glide slope signals. Also, critical areas are not protected at uncontrolled airports or at airports with an operating control tower when weather or visibility conditions are above those requiring protective measures. Aircraft conducting coupled or autoland operations should be especially alert in monitoring automatic flight control systems. (See FIG 1-1-7.)

**NOTE-**

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

**1-1-10. Simplified Directional Facility (SDF)**

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

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

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

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

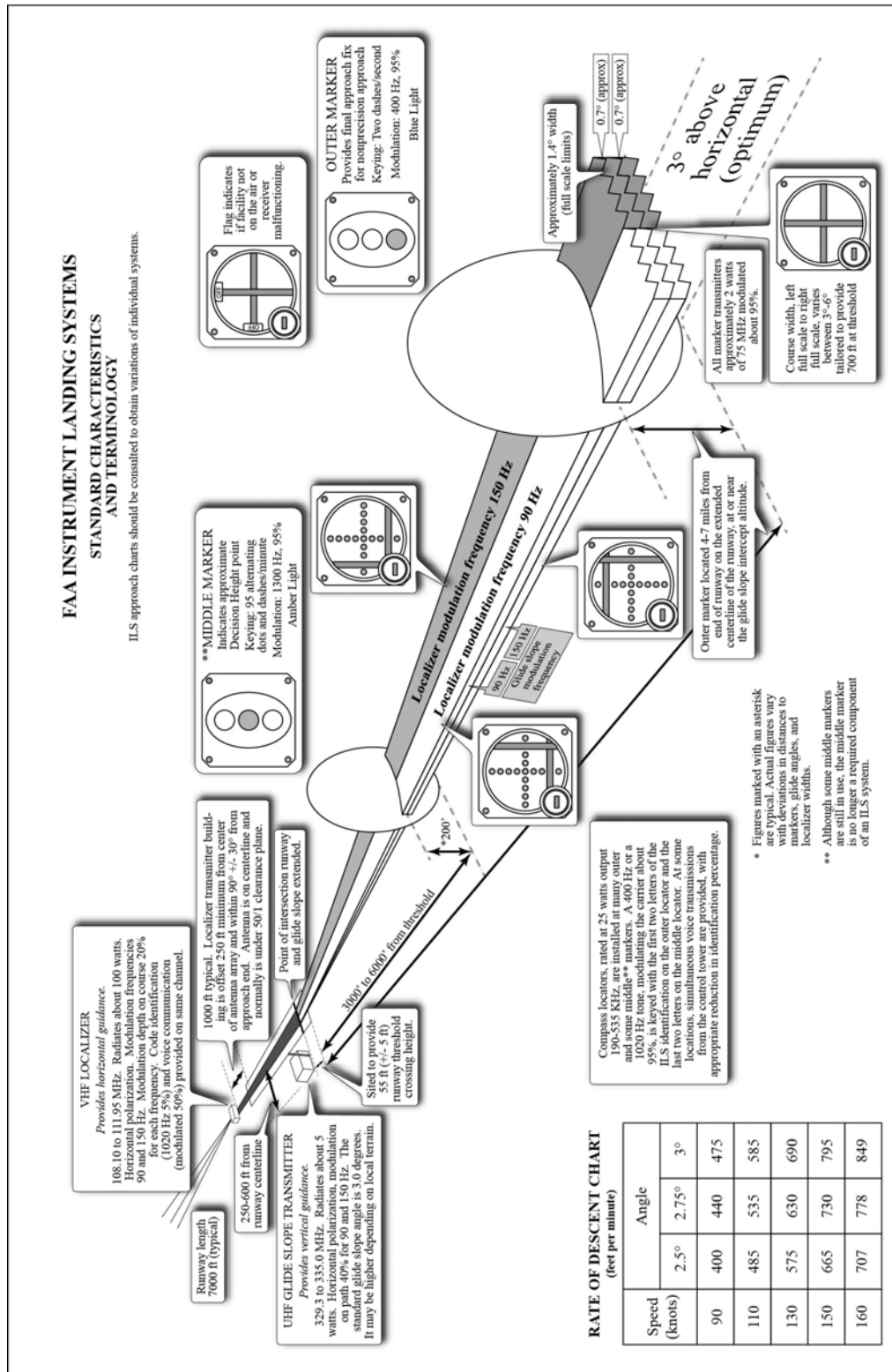
**e.** The SDF antenna may be offset from the runway centerline. Because of this, the angle of convergence between the final approach course and the runway bearing should be determined by reference to the instrument approach procedure chart. This angle is generally not more than 3 degrees. However, it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

the runway centerline.

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

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

FIG 1-1-7  
**FAA Instrument Landing Systems**



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

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

**NOTE-**

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

**NOTE-**

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

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

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

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

### 1-1-13. User Reports Requested on NAVAID or Global Navigation Satellite System (GNSS) Performance or Interference

a. Users of the National Airspace System (NAS) can render valuable assistance in the early correction of NAVAID malfunctions or GNSS problems and are encouraged to report their observations of undesirable avionics performance. Although NAVAIDs are monitored by electronic detectors, adverse effects of electronic interference, new obstructions, or changes in terrain near the NAVAID can exist without detection by the ground monitors. Some of the characteristics of malfunction or deteriorating performance which should be reported are: erratic course or bearing indications; intermittent, or full, flag alarm; garbled, missing or obviously improper

coded identification; poor quality communications reception; or, in the case of frequency interference, an audible hum or tone accompanying radio communications or NAVAID identification. GNSS problems are often characterized by navigation degradation or service loss indications. For instance, pilots conducting operations in areas where there is GNSS interference may be unable to use GPS for navigation, and ADS-B may be unavailable for surveillance. Radio frequency interference may affect both navigation for the pilot and surveillance by the air traffic controller. Depending on the equipment and integration, either an advisory light or message may alert the pilot. Air traffic controllers monitoring ADS-B reports may stop receiving ADS-B position messages and associated aircraft tracks.

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

b. Pilots reporting potential interference should identify the NAVAID (for example, VOR) malfunction or GNSS problem, location of the aircraft (that is, latitude, longitude or bearing/distance from a reference NAVAID), magnetic heading, altitude, date and time of the observation, type of aircraft (make/model/call sign), and description of the condition observed, and the type of receivers in use (that is, make/model/software revision). Reports should be made in any of the following ways:

1. Immediately, by voice radio communication to the controlling ATC facility or FSS.

2. By telephone to the nearest ATC facility controlling the airspace where the disruption was experienced.

3. Additionally, GNSS problems should be reported by Internet via the GPS Anomaly Reporting

Form at [http://www.faa.gov/air\\_traffic/nas/gps\\_reports/](http://www.faa.gov/air_traffic/nas/gps_reports/).

c. In aircraft equipped with more than one avionics receiver, there are many combinations of potential interference between units that could cause erroneous navigation indications, or complete or partial blanking out of the display.

**NOTE—**

*GPS interference or outages associated with known testing NOTAMs should not be reported to ATC.*

### 1-1-14. LORAN

**NOTE—**

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

### 1-1-15. Inertial Reference Unit (IRU), Inertial Navigation System (INS), and Attitude Heading Reference System (AHRS)

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

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

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

d. Aircraft equipped with slaved compass systems may be susceptible to heading errors caused by exposure to magnetic field disturbances (flux fields) found in materials that are commonly located on the

surface or buried under taxiways and ramps. These materials generate a magnetic flux field that can be sensed by the aircraft’s compass system flux detector or “gate”, which can cause the aircraft’s system to align with the material’s magnetic field rather than the earth’s natural magnetic field. The system’s erroneous heading may not self-correct. Prior to take off pilots should be aware that a heading misalignment may have occurred during taxi. Pilots are encouraged to follow the manufacturer’s or other appropriate procedures to correct possible heading misalignment before take off is commenced.

### 1-1-16. 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.

### 1-1-17. Global Positioning System (GPS)

#### a. System Overview

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

#### 2. System Availability and Reliability.

(a) The status of GPS satellites is broadcast as part of the data message transmitted by the GPS

satellites. GPS status information is also available by means of the U.S. Coast Guard navigation information service: (703) 313-5907, Internet: <http://www.navcen.uscg.gov/>. Additionally, satellite status is available through the Notice to Airmen (NOTAM) system.

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

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

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

vertical errors that will make the integrity monitoring function invalid.

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

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

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

### **1. VFR Operations**

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

(b) GPS receivers used for VFR navigation vary from fully integrated IFR/VFR installation used to support VFR operations to hand-held devices. Pilots must understand the limitations of the receivers prior to using in flight to avoid misusing navigation information. (See TBL 1-1-6.) Most receivers are not intuitive. The pilot must learn the various



keystrokes, knob functions, and displays that are used in the operation of the receiver. Some manufacturers provide computer-based tutorials or simulations of their receivers that pilots can use to become familiar with operating the equipment.

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

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

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

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

installing a panel- or yoke-mounted holder, is governed by 14 CFR Part 43. Consult with your mechanic to ensure compliance with the regulation and safe installation.

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

#### (e) **VFR Waypoints**

(1) VFR waypoints provide VFR pilots with a supplementary tool to assist with position awareness while navigating visually in aircraft equipped with area navigation receivers. VFR waypoints should be used as a tool to supplement current navigation procedures. The uses of VFR waypoints include providing navigational aids for pilots unfamiliar with an area, waypoint definition of existing reporting points, enhanced navigation in and around Class B and Class C airspace, 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 identified by small magenta flag symbols. VFR waypoints collocated with visual check points will be pronounceable based on the name of the visual check point and may be used for ATC communications. Each VFR waypoint name will appear in parentheses adjacent to the geographic location on the chart. Latitude/longitude data for all

established VFR waypoints may be found in the appropriate regional Chart Supplement U.S.

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

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

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

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

## 2. IFR Use of GPS

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

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

(2) Aircraft using un-augmented GPS (TSO-C129() or TSO-C196()) for navigation under IFR must be equipped with an alternate approved and

operational means of navigation suitable for navigating the proposed route of flight. (Examples of alternate navigation equipment include VOR or DME/DME/IRU capability). Active monitoring of alternative navigation equipment is not required when RAIM is available for integrity monitoring. Active monitoring of an alternate means of navigation is required when the GPS RAIM capability is lost.

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

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

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

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

(b) **Database Requirements.** The onboard navigation data must be current and appropriate for the region of intended operation and should include the navigation aids, waypoints, and relevant coded terminal airspace procedures for the departure, arrival, and alternate airfields.

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

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

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

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

**[a] Preflight:**

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

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

**[b] Inflight:**

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

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

**NOTE—**

*There is no specific requirement to check each waypoint latitude and longitude, type of waypoint and/or altitude constraint, only the general relationship of waypoints in*

*the procedure, or the logic of an individual waypoint's location.*

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

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

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

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

**NOTE—**

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

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

[d] To satisfy the requirement for two independent navigation systems, if the primary navigation system is GPS-based, the second system

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

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

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

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

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

[a] In Alaska, aircraft may operate on GNSS Q-routes with GPS (TSO-C129 () or

TSO-C196 ()) equipment while the aircraft remains in Air Traffic Control (ATC) radar surveillance or with GPS/WAAS (TSO-C145 () or TSO-C146 ()) which does not require ATC radar surveillance.

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

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

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

#### REFERENCE-

*AIM, Paragraph 5-3-4, Airways and Route Systems*

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

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

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

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

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

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

### 4. Departures and Instrument Departure Procedures (DPs)

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

### 5. GPS Instrument Approach Procedures

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

#### **NOTE-**

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

(b) Stand-alone approach procedures specifically designed for GPS systems have replaced many of the original overlay approaches. All approaches that contain “GPS” in the title (e.g.,

“VOR or GPS RWY 24,” “GPS RWY 24,” or “RNAV (GPS) RWY 24”) can be flown using GPS. GPS-equipped aircraft do not need underlying ground-based NAVAIDs or associated aircraft avionics to fly the approach. Monitoring the underlying approach with ground-based NAVAIDs is suggested when able. Existing overlay approaches may be requested using the GPS title; for example, the VOR or GPS RWY 24 may be requested as “GPS RWY 24.” Some GPS procedures have a Terminal Arrival Area (TAA) with an underlining RNAV approach.

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

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

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

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

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

#### **(e) Procedures for Accomplishing GPS Approaches**

(1) An RNAV (GPS) procedure may be associated with a Terminal Arrival Area (TAA). The basic design of the RNAV procedure is the “T” design or a modification of the “T” (See Paragraph 5-4-5d, Terminal Arrival Area (TAA), for complete information).

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

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

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

(5) When within 2 NM of the Final Approach Waypoint (FAWP) with the approach mode armed, the approach mode will switch to active, which results in RAIM and CDI changing to approach sensitivity. Beginning 2 NM prior to the FAWP, the full scale CDI sensitivity will smoothly change from  $\pm 1$  NM to  $\pm 0.3$  NM at the FAWP. As sensitivity changes from  $\pm 1$  NM to  $\pm 0.3$  NM approaching the FAWP, with the CDI not centered, the corresponding increase in CDI displacement may give the impression that the aircraft is moving further away from the intended course even though it is on an acceptable intercept heading. Referencing the

digital track displacement information (cross track error), if it is available in the approach mode, may help the pilot remain position oriented in this situation. Being established on the final approach course prior to the beginning of the sensitivity change at 2 NM will help prevent problems in interpreting the CDI display during ramp down. Therefore, requesting or accepting vectors which will cause the aircraft to intercept the final approach course within 2 NM of the FAWP is not recommended.

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

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

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

sensitivity will not automatically change to  $\pm 0.3$  NM. Manually setting CDI sensitivity does not automatically change the RAIM sensitivity on some receivers. Some existing non-precision approach procedures cannot be coded for use with GPS and will not be available as overlays.

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

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

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

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

(13) Unnamed stepdown fixes in the final approach segment may or may not be coded in the waypoint sequence of the aircraft's navigation database and must be identified using ATD.

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

#### (f) Missed Approach

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

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

#### (g) GPS NOTAMs/Aeronautical Information

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

(2) The terms UNRELIABLE and MAY NOT BE AVAILABLE are used in conjunction with GPS NOTAMs. Both UNRELIABLE and MAY NOT BE AVAILABLE are advisories to pilots indicating the expected level of service may not be available. UNRELIABLE does not mean there is a problem with GPS signal integrity. If GPS service is available, pilots may continue operations. If the LNAV or LNAV/VNAV service is available, pilots may use the

displayed level of service to fly the approach. GPS operation may be NOTAMed UNRELIABLE or MAY NOT BE AVAILABLE due to testing or anomalies. (Pilots are encouraged to report GPS anomalies, including degraded operation and/or loss of service, as soon as possible, reference paragraph 1–1–13.) When GPS testing NOTAMS are published and testing is actually occurring, Air Traffic Control will advise pilots requesting or cleared for a GPS or RNAV (GPS) approach that GPS may not be available and request intentions. If pilots have reported GPS anomalies, Air Traffic Control will request the pilot's intentions and/or clear the pilot for an alternate approach, if available and operational.

**EXAMPLE–**

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

(3) Civilian pilots may obtain GPS RAIM availability information for non–precision approach procedures by using a manufacturer-supplied RAIM prediction tool, or using the Service Availability Prediction Tool (SAPT) on the FAA en route and terminal RAIM prediction website. Pilots can also request GPS RAIM aeronautical information from a flight service station during preflight briefings. GPS RAIM aeronautical information can be obtained for a period of 3 hours (for example, if you are scheduled to arrive at 1215 hours, then the GPS RAIM information is available from 1100 to 1400 hours) or a 24–hour timeframe at a particular airport. FAA briefers will provide RAIM information for a period of 1 hour before to 1 hour after the ETA hour, unless a specific timeframe is requested by the pilot. If flying a published GPS departure, a RAIM prediction should also be requested for the departure airport.

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

(5) Receiver manufacturers and/or database suppliers may supply “NOTAM” type information concerning database errors. Pilots

should check these sources, when available, to ensure that they have the most current information concerning their electronic database.

**(h) Receiver Autonomous Integrity Monitoring (RAIM)**

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

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

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

(4) If the receiver does not sequence into the approach mode or a RAIM failure/status annunciation occurs prior to the FAWP, the pilot must not initiate the approach or descend, but instead proceed to the missed approach waypoint (MAWP) via the FAWP, perform a missed approach, and contact ATC as soon as practical. The GPS receiver may continue to operate after a RAIM flag/status annunciation appears, but the navigation information



should be considered advisory only. Refer to the receiver operating manual for specific indications and instructions associated with loss of RAIM prior to the FAF.

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

#### (i) Waypoints

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

(2) A Computer Navigation Fix (CNF) is also a point defined by a latitude/longitude coordinate and is required to support Performance-Based Navigation (PBN) operations. The GPS receiver uses CNFs in conjunction with waypoints to navigate from point to point. However, CNFs are not recognized by ATC. ATC does not maintain CNFs in their database and they do not use CNFs for any air traffic control purpose. CNFs may or may not be charted on FAA aeronautical navigation products, are listed in the chart legends, and are for advisory purposes only. Pilots are not to use CNFs for point to point navigation (proceed direct), filing a flight plan, or in aircraft/ATC communications. CNFs that do appear on aeronautical charts allow pilots increased situational awareness by identifying points in the

aircraft database route of flight with points on the aeronautical chart. CNFs are random five-letter identifiers, not pronounceable like waypoints and placed in parenthesis. Eventually, all CNFs will begin with the letters "CF" followed by three consonants (for example, CFWBG). This five-letter identifier will be found next to an "x" on enroute charts and possibly on an approach chart. On instrument approach procedures (charts) in the terminal procedures publication, CNFs may represent unnamed DME fixes, beginning and ending points of DME arcs, and sensor (ground-based signal i.e., VOR, NDB, ILS) final approach fixes on GPS overlay approaches. These CNFs provide the GPS with points on the procedure that allow the overlay approach to mirror the ground-based sensor approach. These points should only be used by the GPS system for navigation and should not be used by pilots for any other purpose on the approach. The CNF concept has not been adopted or recognized by the International Civil Aviation Organization (ICAO).

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

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

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

#### (j) Position Orientation.

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

#### (k) Impact of Magnetic Variation on PBN Systems

(1) Differences may exist between PBN systems and the charted magnetic courses on ground-based NAVAID instrument flight procedures (IFP), enroute charts, approach charts, and Standard Instrument Departure/Standard Terminal Arrival (SID/STAR) charts. These differences are due to the magnetic variance used to calculate the magnetic

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

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

**(I) GPS Familiarization**

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

- (1) Using the receiver autonomous integrity monitoring (RAIM) prediction function;
- (2) Inserting a DP into the flight plan, including setting terminal CDI sensitivity, if required, and the conditions under which terminal RAIM is available for departure;
- (3) Programming the destination airport;
- (4) Programming and flying the approaches (especially procedure turns and arcs);

- (5) Changing to another approach after selecting an approach;
- (6) Programming and flying “direct” missed approaches;
- (7) Programming and flying “routed” missed approaches;
- (8) Entering, flying, and exiting holding patterns, particularly on approaches with a second waypoint in the holding pattern;
- (9) Programming and flying a “route” from a holding pattern;
- (10) Programming and flying an approach with radar vectors to the intermediate segment;
- (11) Indication of the actions required for RAIM failure both before and after the FAWP; and
- (12) Programming a radial and distance from a VOR (often used in departure instructions).

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

<b>TSO-C129</b>						
<b>Equipment Class</b>	<b>RAIM</b>	<b>Int. Nav. Sys. to Prov. RAIM Equiv.</b>	<b>Oceanic</b>	<b>En Route</b>	<b>Terminal</b>	<b>Non-precision Approach Capable</b>
<b>Class A – GPS sensor and navigation capability.</b>						
A1	yes		yes	yes	yes	yes
A2	yes		yes	yes	yes	no
<b>Class B – GPS sensor data to an integrated navigation system (i.e., FMS, multi-sensor navigation system, etc.).</b>						
B1	yes		yes	yes	yes	yes
B2	yes		yes	yes	yes	no
B3		yes	yes	yes	yes	yes
B4		yes	yes	yes	yes	no
<b>Class C – 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.</b>						
C1	yes		yes	yes	yes	yes
C2	yes		yes	yes	yes	no
C3		yes	yes	yes	yes	yes
C4		yes	yes	yes	yes	no

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

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

**NOTE-**

- <sup>1</sup>To determine equipment approvals and limitations, refer to the AFM, AFM supplements, or pilot guides.
- <sup>2</sup>Requires verification of data for correctness if database is expired.
- <sup>3</sup>Requires current database or verification that the procedure has not been amended since the expiration of the database.
- <sup>4</sup>VFR and hand-held GPS systems are not authorized for IFR navigation, instrument approaches, or as a primary instrument flight reference. During IFR operations they may be considered only an aid to situational awareness.
- <sup>5</sup>Hand-held receivers require no approval. However, any aircraft modification to support the hand-held receiver; i.e., installation of an external antenna or a permanent mounting bracket, does require approval.

**1-1-18. Wide Area Augmentation System (WAAS)**

**a. General**

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

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

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

4. In addition to providing the correction signal, the WAAS GEO provides an additional pseudorange measurement to the aircraft receiver, improving the availability of GPS by providing, in effect, an additional GPS satellite in view. The integrity of GPS is improved through real-time monitoring, and the accuracy is improved by providing differential corrections to reduce errors. The performance

improvement is sufficient to enable approach procedures with GPS/WAAS glide paths (vertical guidance).

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

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

#### **b. Instrument Approach Capabilities**

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

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

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

#### **NOTE-**

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

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

#### **c. General Requirements**

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

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

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

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

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

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

**EXAMPLE-**

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

or

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

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

(b) WAAS area-wide NOTAMs are originated when WAAS assets are out of service and impact the service area. Area-wide WAAS NOT AVAILABLE (AVBL) NOTAMs indicate loss or malfunction of the WAAS system. In flight, Air

Traffic Control will advise pilots requesting a GPS or RNAV (GPS) approach of WAAS NOT AVBL NOTAMs if not contained in the ATIS broadcast.

**EXAMPLE-**

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

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

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

**NOTE-**

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

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

**EXAMPLE-**

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

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

**EXAMPLE-**

*Here is an example of a GPS testing NOTAM: !GPS 06/001 ZAB NAV GPS (INCLUDING WAAS, GBAS,*

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

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

**NOTE-**

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

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

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

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

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

**NOTE-**

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

**d. Flying Procedures with WAAS**

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

40 meters for LPV. It also provides vertical integrity monitoring, which bounds the vertical error to 50 meters for LNAV/VNAV and LPVs with minima of 250' or above, and bounds the vertical error to 35 meters for LPVs with minima below 250'.

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

**NOTE-**

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

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

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

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

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

6. There are two ways to select the final approach segment of an instrument approach. Most



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

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

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

### a. General

1. The GLS provides precision navigation guidance for exact alignment and descent of aircraft on approach to a runway. GBAS equipment provides localized differential augmentation to the Global Positioning System (GPS).

#### **NOTE-**

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

2. GLS displays three-dimension vertical and horizontal navigation guidance to the pilot much like

ILS. GLS navigation is based on GPS signals augmented by position correction, integrity parameters, and approach path definition information transmitted over VHF from the local GBAS ground station. One GBAS station can support multiple GLS precision approaches to nearby runways within the GBAS's maximum use distance.

3. GLS provides guidance similar to ILS approaches for the final approach segment, though the approach service volume has different dimensions (see FIG 1-1-8). The GLS approach is constructed using the RNP approach (RNP APCH) navigation specification, and may include vertically-guided turn(s) after the IAF or on the missed approach procedure. Portions of the approach prior to an IAF and after the final approach segment may also require Area Navigation (RNAV) typically using the Required Navigation Performance 1 (RNP 1) navigation specification. See paragraph 1-2-1 for more information on navigation specifications.

4. GLS consists of a GBAS Ground Facility (GGF), at least four ground reference stations, a corrections processor, a VHF Data Broadcast (VDB) uplink antenna, an aircraft GBAS receiver, and a charted instrument approach procedure.

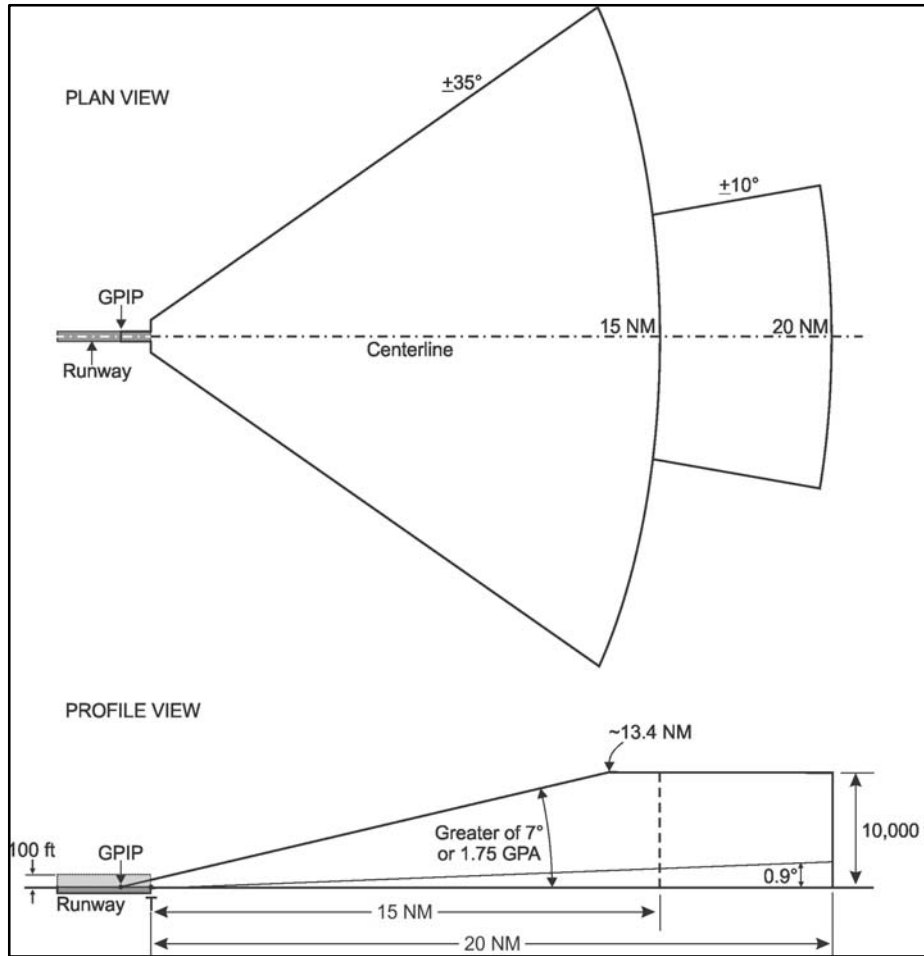
### b. Procedure

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

2. Following procedure selection, confirmation that the correct GLS procedure is loaded can be accomplished by cross checking the charted Reference Path Indicator (RPI) or approach ID with the cockpit displayed RPI or audio identification of the RPI with Morse Code (for some systems). Distance to the runway threshold will be displayed to the pilot once the aircraft is inside the approach service volume.

3. The pilot will fly the GLS approach using many of the same techniques as ILS including using a heading or lateral steering mode to intercept the GLS final approach course and then switching to the appropriate approach navigation mode once the aircraft is within the approach service volume and prior to the glide path intercept point. See also the Instrument Procedures Handbook for more information on GLS.

**FIG 1-1-8  
GLS Standard Approach Service Volume**



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

**a. General**

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

**b. Special Instrument Approach Procedure**

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

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

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

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

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

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

special instrument approach procedure to allow aircrews to verify the TLS guidance.

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

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

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

**3.** Ground equipment consists of GPS receivers and a VHF digital radio transmitter. The SCAT-I DGPS detects the position of GPS satellites relative to GPS receiver equipment and broadcasts differential corrections over the VHF digital radio.

**4.** Category I Ground Based Augmentation System (GBAS) will displace SCAT-I DGPS as the public use service.

**REFERENCE-**

*AIM, Paragraph 5-4-7j, Instrument Approach Procedures*



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 light 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. RIL 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 the conflicting traffic passes through the intersection, the RILs extinguish.

**2. RIL 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  $\pm 5$  seconds of meeting at the intersection. Once the conflicting 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 LAHSO 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 communicated 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.

**NOTE–**

*FAROS is an independent automatic alerting system that does not rely on ATC control or input.*

**1. FAROS Operating Characteristics:**

If an aircraft or surface vehicle occupies a FAROS equipped runway, the PAPI(s) on that runway will flash. 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. The FAROS system will flash the PAPI when traffic enters the runway and 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 if there is traffic on the runway and will notice the PAPI ceases to flash when the traffic moves outside the hold short lines for the runway.

**3. When a pilot observes a flashing PAPI 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 FAROS indication is in conflict with the clearance. If the PAPI continues to flash, 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/ADS-B “On” when departing the gate or parking area until it is shut down upon arrival at the gate or parking area.** This ensures interaction with the FAA surveillance systems such as ASDE-X/Airport Surface Surveillance Capability (ASSC) 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 go-around 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 previously issued by ATC. If RWSL indicates that it is unsafe to takeoff from, land on, cross, or enter a runway, immediately notify ATC of the conflict and re-confirm the clearance.

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.

5. Never land if PAPI continues to flash. Execute a go around and notify ATC.

**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. System lights can be disabled should RWSL operations impact the efficient movement of air traffic or contribute, in the opinion of the assigned ATC Manager, to unsafe operations. REL, THL, RIL, and FAROS light fixtures may be disabled separately. Disabling of the FAROS subsystem does not extinguish PAPI lights or impact its glide path function. Whenever the system or a component is disabled, a NOTAM must be issued, and the

Automatic Terminal Information System (ATIS) must be updated.

**2-1-7. Stand-Alone Final Approach Runway Occupancy Signal (FAROS)**

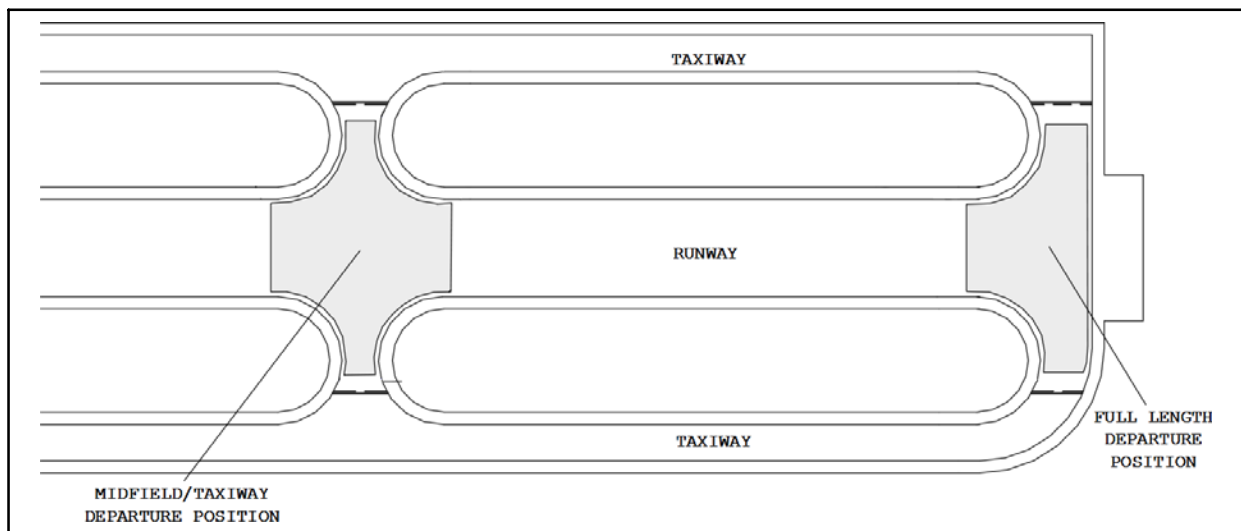
**a. Introduction:**

The stand-alone FAROS system is a fully automated system that provides runway occupancy status to pilots on final approach to indicate whether it may be unsafe to land. When an aircraft or vehicle is detected on the runway, the Precision Approach Path Indicator (PAPI) light fixtures flash as a signal to indicate that the runway is occupied and that it may be unsafe to land. The stand-alone FAROS system is activated by localized or comprehensive sensors detecting aircraft or ground vehicles occupying activation zones.

The stand-alone FAROS system monitors specific areas of the runway, called activation zones, to determine the presence of aircraft or ground vehicles in the zone (see FIG 2-1-10). These activation zones are defined as areas on the runway that are frequently occupied by ground traffic during normal airport operations and could present a hazard to landing aircraft. Activation zones may include the full-length departure position, the midfield departure position, a frequently crossed intersection, or the entire runway.

Pilots can refer to the airport specific FAROS pilot information sheet for activation zone configuration.

**FIG 2-1-10  
FAROS Activation Zones**



Clearance to land on a runway must be issued by Air Traffic Control (ATC). ATC personnel have limited

control over the system and may not be able to view the FAROS signal.

# Chapter 3. **Airspace**

## Section 1. **General**

### 3-1-1. **General**

a. There are two categories of airspace or airspace areas:

1. Regulatory (Class A, B, C, D and E airspace areas, restricted and prohibited areas); and
2. Nonregulatory (military operations areas [MOA], warning areas, alert areas, controlled firing areas [CFA], and national security areas [NSA]).

**NOTE-**

*Additional information on special use airspace (prohibited areas, restricted areas [permanent or temporary], warning areas, MOAs [permanent or temporary], alert areas, CFAs, and NSAs) may be found in Chapter 3, Airspace, Section 4, Special Use Airspace, paragraphs 3-4-1 through 3-4-8.*

b. Within these two categories, there are four types:

1. Controlled,
2. Uncontrolled,
3. Special use, and
4. Other airspace.

c. The categories and types of airspace are dictated by:

1. The complexity or density of aircraft movements,
2. The nature of the operations conducted within the airspace,
3. The level of safety required, and
4. The national and public interest.

d. It is important that pilots be familiar with the operational requirements for each of the various types or classes of airspace. Subsequent sections will cover each class in sufficient detail to facilitate understanding.

### 3-1-2. **General Dimensions of Airspace Segments**

Refer to Title 14 of the U.S. Code of Federal Regulations (CFR) for specific dimensions, exceptions, geographical areas covered, exclusions, specific transponder/ADS-B or other equipment requirements, and flight operations.

### 3-1-3. **Hierarchy of Overlapping Airspace Designations**

a. When overlapping airspace designations apply to the same airspace, the operating rules associated with the more restrictive airspace designation apply.

b. For the purpose of clarification:

1. Class A airspace is more restrictive than Class B, Class C, Class D, Class E, or Class G airspace;
2. Class B airspace is more restrictive than Class C, Class D, Class E, or Class G airspace;
3. Class C airspace is more restrictive than Class D, Class E, or Class G airspace;
4. Class D airspace is more restrictive than Class E or Class G airspace; and
5. Class E is more restrictive than Class G airspace.

### 3-1-4. **Basic VFR Weather Minimums**

a. No person may operate an aircraft under basic VFR when the flight visibility is less, or at a distance from clouds that is less, than that prescribed for the corresponding altitude and class of airspace. (See TBL 3-1-1.)

**NOTE-**

*Student pilots must comply with 14 CFR Section 61.89(a) (6) and (7).*

b. Except as provided in 14 CFR Section 91.157, Special VFR Weather Minimums, no person may operate an aircraft beneath the ceiling under VFR within the lateral boundaries of controlled airspace designated to the surface for an airport when the ceiling is less than 1,000 feet. (See 14 CFR Section 91.155(c).)

*TBL 3-1-1*  
**Basic VFR Weather Minimums**

Airspace	Flight Visibility	Distance from Clouds
Class A .....	Not Applicable	Not Applicable
Class B .....	3 statute miles	Clear of Clouds
Class C .....	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
Class D .....	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
Class E Less than 10,000 feet MSL .....	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
At or above 10,000 feet MSL .....	5 statute miles	1,000 feet below 1,000 feet above 1 statute mile horizontal
Class G 1,200 feet or less above the surface (regardless of MSL altitude).  For aircraft other than helicopters: Day, except as provided in §91.155(b) .....	1 statute mile	Clear of clouds
Night, except as provided in §91.155(b) .....	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
For helicopters: Day .....	½ statute mile	Clear of clouds
Night, except as provided in §91.155(b) .....	1 statute mile	Clear of clouds
More than 1,200 feet above the surface but less than 10,000 feet MSL. Day .....	1 statute mile	500 feet below 1,000 feet above 2,000 feet horizontal
Night .....	3 statute miles	500 feet below 1,000 feet above 2,000 feet horizontal
More than 1,200 feet above the surface and at or above 10,000 feet MSL. ....	5 statute miles	1,000 feet below 1,000 feet above 1 statute mile horizontal

**3-1-5. VFR Cruising Altitudes and Flight Levels**

(See TBL 3-1-2.)



## Section 2. Controlled Airspace

### 3-2-1. General

**a. Controlled Airspace.** A generic term that covers the different classification of airspace (Class A, Class B, Class C, Class D, and Class E airspace) and defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification. (See FIG 3-2-1.)

**b. IFR Requirements.** IFR operations in any class of controlled airspace requires that a pilot must file an IFR flight plan and receive an appropriate ATC clearance.

**c. IFR Separation.** Standard IFR separation is provided to all aircraft operating under IFR in controlled airspace.

**d. VFR Requirements.** It is the responsibility of the pilot to ensure that ATC clearance or radio communication requirements are met prior to entry

into Class B, Class C, or Class D airspace. The pilot retains this responsibility when receiving ATC radar advisories. (See 14 CFR Part 91.)

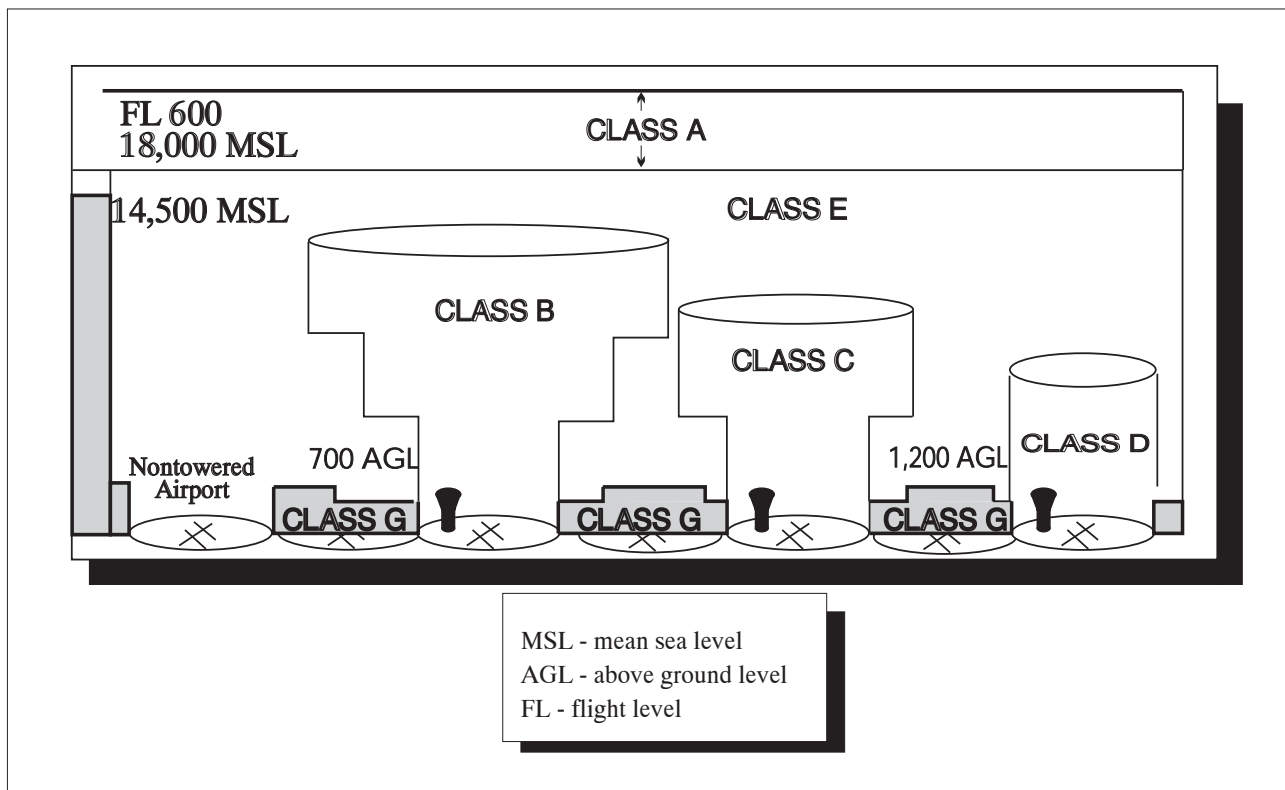
**e. Traffic Advisories.** Traffic advisories will be provided to all aircraft as the controller’s work situation permits.

**f. Safety Alerts.** Safety Alerts are mandatory services and are provided to ALL aircraft. There are two types of Safety Alerts:

**1. Terrain/Obstruction Alert.** A Terrain/Obstruction Alert is issued when, in the controller’s judgment, an aircraft’s altitude places it in unsafe proximity to terrain and/or obstructions; and

**2. Aircraft Conflict/Mode C Intruder Alert.** An Aircraft Conflict/Mode C Intruder Alert is issued if the controller observes another aircraft which places it in an unsafe proximity. When feasible, the controller will offer the pilot an alternative course of action.

FIG 3-2-1  
Airspace Classes



**g. Ultralight Vehicles.** No person may operate an ultralight vehicle within Class A, Class B, Class C, or Class D airspace or within the lateral boundaries of the surface area of Class E airspace designated for an airport unless that person has prior authorization from the ATC facility having jurisdiction over that airspace. (See 14 CFR Part 103.)

**h. Unmanned Free Balloons.** Unless otherwise authorized by ATC, no person may operate an unmanned free balloon below 2,000 feet above the surface within the lateral boundaries of Class B, Class C, Class D, or Class E airspace designated for an airport. (See 14 CFR Part 101.)

**i. Parachute Jumps.** No person may make a parachute jump, and no pilot-in-command may allow a parachute jump to be made from that aircraft, in or into Class A, Class B, Class C, or Class D airspace without, or in violation of, the terms of an ATC authorization issued by the ATC facility having jurisdiction over the airspace. (See 14 CFR Part 105.)

### 3-2-2. Class A Airspace

**a. Definition.** Generally, that airspace from 18,000 feet MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles off the coast of the 48 contiguous States and Alaska; and designated international airspace beyond 12 nautical miles off the coast of the 48 contiguous States and Alaska within areas of domestic radio navigational signal or ATC radar coverage, and within which domestic procedures are applied.

**b. Operating Rules and Pilot/Equipment Requirements.** Unless otherwise authorized, all persons must operate their aircraft under IFR. (See 14 CFR Section 71.33, Sections 91.167 through 91.193, Sections 91.215 through 91.217, and Sections 91.225 through 91.227.)

**c. Charts.** Class A airspace is not specifically charted.

### 3-2-3. Class B Airspace

**a. Definition.** Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of IFR operations or passenger enplanements. The configuration of each Class B airspace area is individually tailored and

consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."

**b. Operating Rules and Pilot/Equipment Requirements.** Regardless of weather conditions, an ATC clearance is required prior to operating within Class B airspace. Pilots should not request a clearance to operate within Class B airspace unless the requirements of 14 CFR Sections 91.131, 91.215, and 91.225 are met. Included among these requirements are:

**1.** Unless otherwise authorized by ATC, aircraft must be equipped with an operable two-way radio capable of communicating with ATC on appropriate frequencies for that Class B airspace.

**2.** No person may take off or land a civil aircraft at the following primary airports within Class B airspace unless the pilot-in-command holds at least a private pilot certificate:

- (a) Andrews Air Force Base, MD
- (b) Atlanta Hartsfield Airport, GA
- (c) Boston Logan Airport, MA
- (d) Chicago O'Hare Intl. Airport, IL
- (e) Dallas/Fort Worth Intl. Airport, TX
- (f) Los Angeles Intl. Airport, CA
- (g) Miami Intl. Airport, FL
- (h) Newark Intl. Airport, NJ
- (i) New York Kennedy Airport, NY
- (j) New York La Guardia Airport, NY
- (k) Ronald Reagan Washington National Airport, DC
- (l) San Francisco Intl. Airport, CA

**3.** No person may take off or land a civil aircraft at an airport within Class B airspace or operate a civil aircraft within Class B airspace unless:

(a) The pilot-in-command holds at least a private pilot certificate; or

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

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

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

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

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

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

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

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

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

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

**NOTE-**

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

**REFERENCE-**

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

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

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

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

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

**d. Flight Procedures.**

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

**2. VFR Flights.**

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

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

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

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

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

**REFERENCE—**

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

**NOTE—**

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

**2.** Separation of VFR aircraft will be suspended during CENRAP operations. Traffic advisories and sequencing to the primary airport will be provided on a workload permitting basis. The pilot will be advised when center radar presentation (CENRAP) is in use.

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

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

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

- (a) 1 1/2 miles lateral separation, or
- (b) 500 feet vertical separation, or
- (c) Visual separation.

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

with respect to terrain and obstruction clearance, vortex exposure, and weather minimums.

**4.** ATC may assign altitudes to VFR aircraft that do not conform to 14 CFR Section 91.159. **“RESUME APPROPRIATE VFR ALTITUDES”** will be broadcast when the altitude assignment is no longer needed for separation or when leaving Class B airspace. Pilots must return to an altitude that conforms to 14 CFR Section 91.159.

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

### 3-2-4. Class C Airspace

**a. Definition.** Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C airspace area is individually tailored, the airspace usually consists of a 5 NM radius core surface area that extends from the surface up to 4,000 feet above the airport elevation, and a 10 NM radius shelf area that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation.

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

#### **c. Operating Rules and Pilot/Equipment Requirements:**

**1. Pilot Certification.** No specific certification required.

**2. Equipment.**

- (a) Two-way radio; and

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

**NOTE-**

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

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

**NOTE-**

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

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

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

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

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

**EXAMPLE-**

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

2. “Aircraft calling Dulles approach control, standby.”

**4. Departures from:**

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

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

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

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

1. Sequenced to the primary airport.

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

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

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

1. Visual separation.

2. 500 feet vertical separation.

3. Target resolution.

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

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

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

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

**NOTE-**

1. Separation and sequencing of VFR aircraft will be suspended in the event of a radar outage as this service is dependent on radar. The pilot will be advised that the service is not available and issued wind, runway information and the time or place to contact the tower.
2. Separation of VFR aircraft will be suspended during CENRAP operations. Traffic advisories and sequencing to the primary airport will be provided on a workload permitting basis. The pilot will be advised when CENRAP is in use.
3. Pilot participation is voluntary within the outer area and can be discontinued, within the outer area, at the pilot's request. Class C services will be provided in the outer area unless the pilot requests termination of the service.
4. Some facilities provide Class C services only during published hours. At other times, terminal IFR radar service will be provided. It is important to note that the communications and transponder/ADS-B requirements are dependent on the class of airspace established outside of the published hours.

**f. Secondary Airports**

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

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

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

4. This program is not to be interpreted as relieving pilots of their responsibilities to see and avoid other traffic operating in basic VFR weather conditions, to adjust their operations and flight path as necessary to preclude serious wake encounters, to maintain appropriate terrain and obstruction clearance or to remain in weather conditions equal to or

better than the minimums required by 14 CFR Section 91.155. Approach control should be advised and a revised clearance or instruction obtained when compliance with an assigned route, heading and/or altitude is likely to compromise pilot responsibility with respect to terrain and obstruction clearance, vortex exposure, and weather minimums.

**g. Class C Airspace Areas by State**

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

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

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

State/City	Airport
Orlando	Sanford International
Palm Beach	International
Pensacola	NAS
Pensacola	Regional
Sarasota	Bradenton International
Tallahassee	Regional
Whiting	NAS
<b>GEORGIA</b>	
Savannah	Hilton Head International
<b>HAWAII</b>	
Kahului	Kahului
<b>IDAHO</b>	
Boise	Air Terminal
<b>ILLINOIS</b>	
Champaign	Urbana U of Illinois–Willard
Chicago	Midway International
Moline	Quad City International
Peoria	Greater Peoria Regional
Springfield	Abraham Lincoln Capital
<b>INDIANA</b>	
Evansville	Regional
Fort Wayne	International
Indianapolis	International
South Bend	Regional
<b>IOWA</b>	
Cedar Rapids	The Eastern Iowa
Des Moines	International
<b>KANSAS</b>	
Wichita	Mid–Continent
<b>KENTUCKY</b>	
Lexington	Blue Grass
Louisville	International–Standiford Field
<b>LOUISIANA</b>	
Baton Rouge	Metropolitan, Ryan Field
Lafayette	Regional
Shreveport	Barksdale AFB
Shreveport	Regional
<b>MAINE</b>	
Bangor	International
Portland	International Jetport
<b>MICHIGAN</b>	
Flint	Bishop International
Grand Rapids	Gerald R. Ford International
Lansing	Capital City
<b>MISSISSIPPI</b>	
Columbus	AFB
Jackson	Jackson–Evers International
<b>MISSOURI</b>	
Springfield	Springfield–Branson National
<b>MONTANA</b>	
Billings	Logan International
<b>NEBRASKA</b>	
Lincoln	Lincoln
Omaha	Eppley Airfield

State/City	Airport
Offutt	AFB
<b>NEVADA</b>	
Reno	Reno/Tahoe International
<b>NEW HAMPSHIRE</b>	
Manchester	Manchester
<b>NEW JERSEY</b>	
Atlantic City	International
<b>NEW MEXICO</b>	
Albuquerque	International Sunport
<b>NEW YORK</b>	
Albany	International
Buffalo	Niagara International
Islip	Long Island MacArthur
Rochester	Greater Rochester International
Syracuse	Hancock International
<b>NORTH CAROLINA</b>	
Asheville	Regional
Fayetteville	Regional/Grannis Field
Greensboro	Piedmont Triad International
Pope	AFB
Raleigh	Raleigh–Durham International
<b>OHIO</b>	
Akron	Akron–Canton Regional
Columbus	Port Columbus International
Dayton	James M. Cox International
Toledo	Express
<b>OKLAHOMA</b>	
Oklahoma City	Will Rogers World
Tinker	AFB
Tulsa	International
<b>OREGON</b>	
Portland	International
<b>PENNSYLVANIA</b>	
Allentown	Lehigh Valley International
<b>PUERTO RICO</b>	
San Juan	Luis Munoz Marin International
<b>RHODE ISLAND</b>	
Providence	Theodore Francis Green State
<b>SOUTH CAROLINA</b>	
Charleston	AFB/International
Columbia	Metropolitan
Greer	Greenville–Spartanburg International
Myrtle Beach	Myrtle Beach International
Shaw	AFB
<b>TENNESSEE</b>	
Chattanooga	Lovell Field
Knoxville	McGhee Tyson
Nashville	International
<b>TEXAS</b>	
Abilene	Regional
Amarillo	Rick Husband International
Austin	Austin–Bergstrom International
Corpus Christi	International

State/City	Airport
Dyess .....	AFB
El Paso .....	International
Harlingen .....	Valley International
Laughlin .....	AFB
Lubbock .....	Preston Smith International
Midland .....	International
San Antonio .....	International
<b>VERMONT</b>	
Burlington .....	International
<b>VIRGIN ISLANDS</b>	
St. Thomas .....	Charlotte Amalie Cyril E. King
<b>VIRGINIA</b>	
Richmond .....	International
Norfolk .....	International
Roanoke .....	Regional/Woodrum Field
<b>WASHINGTON</b>	
Point Roberts .....	Vancouver International
Spokane .....	Fairchild AFB
Spokane .....	International
Whidbey Island .....	NAS, Ault Field
<b>WEST VIRGINIA</b>	
Charleston .....	Yeager
<b>WISCONSIN</b>	
Green Bay .....	Austin Straubel International
Madison .....	Dane County Regional–Traux Field
Milwaukee .....	General Mitchell International

**3–2–5. Class D Airspace**

**a. Definition.** Generally, Class D airspace extends upward from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures.

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

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

**NOTE–**

**1.** The airport listing in the Chart Supplement U.S. will

state the part–time surface area status (for example, “other times CLASS E” or “other times CLASS G”).

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

**b. Operating Rules and Pilot/Equipment Requirements:**

**1. Pilot Certification.** No specific certification required.

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

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

**NOTE–**

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

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

**EXAMPLE–**

**1.** “[Aircraft callsign] remain outside the Class Delta airspace and standby.”

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

**2.** “Aircraft calling Manassas tower standby.”

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



#### 4. Departures from:

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

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

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

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

d. Surface area arrival extensions:

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

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

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

### 3-2-6. Class E Airspace

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

b. **Operating Rules and Pilot/Equipment Requirements:**

1. **Pilot Certification.** No specific certification required.

2. **Equipment.** Unless otherwise authorized by ATC:

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

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

**NOTE-**

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**NOTE—**

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

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

(a) Class E transition areas extend upward from either 700 feet AGL (shown as magenta vignette on sectional charts) or 1,200 feet AGL (blue vignette)

and are designated for airports with an approved instrument procedure.

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

**NOTE—**

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

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

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

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

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

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

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

**NOTE—**

*See AIM Paragraph 5-3-4, Airways and Route Systems, for more details and charting information.*

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

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

numbers” in communications with the FSS. Use of this phrase means that the pilot has received wind, runway, and altimeter information ONLY and the Alaska FSS does not have to repeat this information. It does not indicate receipt of the AFIS broadcast and should never be used for this purpose.

#### **4-1-15. Radar Traffic Information Service**

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

##### **a. Purpose of the Service**

1. The issuance of traffic information as observed on a radar display is based on the principle of assisting and advising a pilot that a particular radar target’s position and track indicates it may intersect or pass in such proximity to that pilot’s intended flight path that it warrants attention. This is to alert the pilot to the traffic, to be on the lookout for it, and thereby be in a better position to take appropriate action should the need arise.

2. Pilots are reminded that the surveillance radar used by ATC does not provide altitude information unless the aircraft is equipped with Mode C and the radar facility is capable of displaying altitude information.

##### **b. Provisions of the Service**

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

tion may be provided to flights not operating on IFR flight plans when requested by pilots of such flights.

##### **NOTE-**

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

2. When receiving VFR radar advisory service, pilots should monitor the assigned frequency at all times. This is to preclude controllers’ concern for radio failure or emergency assistance to aircraft under the controller’s jurisdiction. VFR radar advisory service does not include vectors away from conflicting traffic unless requested by the pilot. When advisory service is no longer desired, advise the controller before changing frequencies and then change your transponder code to 1200, if applicable. Pilots should also inform the controller when changing VFR cruising altitude. Except in programs where radar service is automatically terminated, the controller will advise the aircraft when radar is terminated.

##### **NOTE-**

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

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

##### **1. Radar identified**

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

(b) When rapidly maneuvering civil test or military aircraft prevent accurate issuance of traffic

as in (a) above, specify the direction from an aircraft's position in terms of the eight cardinal compass points (N, NE, E, SE, S, SW, W, NW). This method must be terminated at the pilot's request.

(c) Distance from the aircraft in nautical miles;

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

(e) Type of aircraft and altitude if known.

**EXAMPLE-**

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

**2. Not radar identified**

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

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

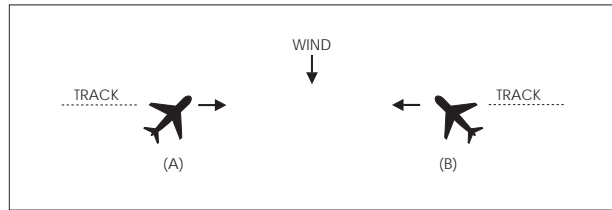
(c) Type of aircraft and altitude if known.

**EXAMPLE-**

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

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

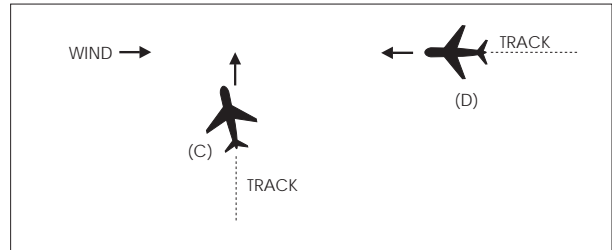
**FIG 4-1-1  
Induced Error in Position of Traffic**



**EXAMPLE-**

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

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



**EXAMPLE-**

In FIG 4-1-2 traffic information would be issued to the pilot of aircraft "C" as 2 o'clock. The actual position of the traffic as seen by the pilot of aircraft "C" would be 3 o'clock. Traffic information issued to aircraft "D" would be at an 11 o'clock position. Since it is not necessary for the pilot of aircraft "D" to apply wind correction (crab) to remain on track, the actual position of the traffic issued would be correct. Since the radar controller can only observe aircraft track (course) on the radar display, traffic advisories are issued accordingly, and pilots should give due consideration to this fact when looking for reported traffic.

**4-1-16. Safety Alert**

A safety alert will be issued to pilots of aircraft being controlled by ATC if the controller is aware the aircraft is at an altitude which, in the controller's judgment, places the aircraft in unsafe proximity to terrain, obstructions or other aircraft. The provision of this service is contingent upon the capability of the controller to have an awareness of a situation involving unsafe proximity to terrain, obstructions and uncontrolled aircraft. The issuance of a safety alert cannot be mandated, but it can be expected on a

remarks section of the flight plan when requesting tower en route control.

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

#### 4-1-20. Transponder and ADS-B Out Operation

##### a. General

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

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

3. **Transponder and ADS-B operations on the ground.** Civil and military aircraft should operate with the transponder in the altitude reporting mode (consult the aircraft's flight manual to determine the specific transponder position to enable altitude reporting) and ADS-B Out transmissions enabled at all airports, any time the aircraft is positioned on any portion of the airport movement area. This includes all defined taxiways and runways. Pilots must pay particular attention to ATIS and airport diagram notations, General Notes (included on airport charts),

and comply with directions pertaining to transponder and ADS-B usage. Generally, these directions are:

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

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

#### 4. Transponder and ADS-B Operations While Airborne.

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

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

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

##### **NOTE-**

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

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

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

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

**NOTE-**

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

**b. Transponder/ADS-B Code Designation**

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

**NOTE-**

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

**REFERENCE-**

*FAA Order JO 7110.66, National Beacon Code Allocation Plan.*

**c. Automatic Altitude Reporting**

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

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

an altitude readout is invalid, the pilot should verify that the aircraft altimeter is set correctly.

**NOTE-**

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

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

**d. IDENT Feature**

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

**e. Code Changes**

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

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

3. Military pilots operating VFR or IFR within restricted/warning areas should adjust their transponders to Code 4000 unless another code has been assigned by ATC.

**f. Mode C Transponder and ADS-B Out Requirements**

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

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

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

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

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

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

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

**NOTE—**

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

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

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

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

3. 14 CFR Section 99.13 requires all aircraft flying into, within, or across the contiguous U.S. ADIZ be equipped with a Mode C or Mode S transponder. Balloons, gliders and aircraft not equipped with an engine-driven electrical system are excepted from this requirement.

**REFERENCE—**

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

4. Pilots must ensure that their aircraft transponder/ADS-B is operating on an appropriate

ATC-assigned VFR/IFR code with altitude reporting enabled when operating in such airspace. If in doubt about the operational status of either feature of your transponder while airborne, contact the nearest ATC facility or FSS and they will advise you what facility you should contact for determining the status of your equipment.

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

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

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

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

**NOTE—**

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

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

3. *Gliders not in contact with ATC should squawk 1202 in lieu of 1200.*

**REFERENCE—**

*FAA Order JO 7110.66, National Beacon Code Allocation Plan.*

2. When required to operate their transponder/ADS-B, pilots must always operate that equipment

with altitude reporting enabled, unless otherwise instructed by ATC or unless the installed equipment has not been tested and calibrated as required by 14 CFR Section 91.217. If deactivation is required, turn off altitude reporting.

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

**NOTE-**

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

**h. Cooperative Surveillance Phraseology**

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

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

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

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

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

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

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

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

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

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

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

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

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

**a. Slot Controlled Airports.**

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

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

**NOTE-**

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

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

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



### **b. Special Traffic Management Programs (STMP).**

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

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

#### **NOTE—**

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

1. *Touch-tone interface: 1-800-875-9755.*
2. *Web interface: [www.fly.faa.gov](http://www.fly.faa.gov).*
3. *Trouble number: 540-422-4246.*

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

#### **d. Making Reservations.**

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

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

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

b. The grant of a Certificate of Waiver or Authorization from 14 CFR constitutes relief from specific regulations, to the degree and for the period of time specified in the certificate, and does not waive any state law or local ordinance. Should the proposed operations conflict with any state law or local ordinance, or require permission of local authorities or property owners, it is the applicant's responsibility to resolve the matter. The holder of a waiver is responsible for compliance with the terms of the waiver and its provisions.

c. A waiver may be canceled at any time by the Administrator, the person authorized to grant the waiver, or the representative designated to monitor a specific operation. In such case either written notice of cancellation, or written confirmation of a verbal cancellation will be provided to the holder.

### **4-1-23. Weather System Processor**

The Weather System Processor (WSP) was developed for use in the National Airspace System to provide weather processor enhancements to selected Airport Surveillance Radar (ASR)-9 facilities. The WSP provides Air Traffic with warnings of hazardous wind shear and microbursts. The WSP also provides users with terminal area 6-level weather, storm cell locations and movement, as well as the location and predicted future position and intensity of wind shifts that may affect airport operations.



b. To convert from Standard Time to Coordinated Universal Time:

TBL 4-2-3

Standard Time to Coordinated Universal Time

Eastern Standard Time . . . . .	Add 5 hours
Central Standard Time . . . . .	Add 6 hours
Mountain Standard Time . . . . .	Add 7 hours
Pacific Standard Time . . . . .	Add 8 hours
Alaska Standard Time . . . . .	Add 9 hours
Hawaii Standard Time . . . . .	Add 10 hours

NOTE-

For daylight time, subtract 1 hour.

c. A reference may be made to local daylight or standard time utilizing the 24-hour clock system. The hour is indicated by the first two figures and the minutes by the last two figures.

EXAMPLE-

0000 . . . . . zero zero zero zero  
0920 . . . . . zero niner two zero

d. Time may be stated in minutes only (two figures) in radiotelephone communications when no misunderstanding is likely to occur.

e. Current time in use at a station is stated in the nearest quarter minute in order that pilots may use this information for time checks. Fractions of a quarter minute less than 8 seconds are stated as the preceding quarter minute; fractions of a quarter minute of 8 seconds or more are stated as the succeeding quarter minute.

EXAMPLE-

0929:05 . . . . . time, zero niner two niner  
0929:10 . . . . . time, zero niner two niner and one-quarter

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

a. Arriving Aircraft.

1. Receiver inoperative.

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

REFERENCE-

AIM, Paragraph 4-3-13, Traffic Control Light Signals

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

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

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

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

occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.

**REFERENCE-**

14 CFR Section 91.125 and 14 CFR Section 91.129.

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

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

majority of FSSs as a common en route simplex frequency.

**NOTE-**

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

**EXAMPLE-**

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

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

#### 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/departure (*Runway XX APPCH/Runway XX DEP*) hold 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.

10. 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, Paragraph 7-3-1, General*

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.

**NOTE-**

*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 must 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, runway two seven, 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.”

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

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

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

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

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

command must notify ATC as soon as possible and obtain an amended clearance. In an emergency situation which does not result in a deviation from the rules prescribed in 14 CFR Part 91 but which requires ATC to give priority to an aircraft, the pilot of such aircraft must, when requested by ATC, make a report within 48 hours of such emergency situation to the manager of that ATC facility.

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

**EXAMPLE–**

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

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

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

**NOTE–**

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

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

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

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

#### **4–4–11. IFR Separation Standards**

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

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

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

**NOTE–**

*Certain separation standards are increased in the terminal environment when CENRAP is being utilized.*

#### **4–4–12. Speed Adjustments**

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

assigns a new speed, issues a vector, assigns a direct route, or issues an approach clearance.

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

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

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

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

**NOTE–**

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

FL 240–0.6

FL 250–0.61

FL 260–0.62

FL 270–0.64

FL 280–0.65

FL 290–0.66.

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

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

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

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

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

**4.** To departing aircraft:

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

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

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

**EXAMPLE–**

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

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

**NOTE–**

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

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

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

**EXAMPLE–**

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

**NOTE–**

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

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

**EXAMPLE–**

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

**CAUTION–**

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

**3.** Instruct the pilot to “resume published speed.” Resume published speed is issued to



terminate a speed adjustment where speed restrictions are published on a charted procedure.

**NOTE–**

When instructed to “comply with speed restrictions” or to “resume published speed,” ATC anticipates pilots will begin adjusting speed the minimum distance necessary prior to a published speed restriction so as to cross the waypoint/fix at the published speed. Once at the published speed, ATC expects pilots will maintain the published speed until additional adjustment is required to comply with further published or ATC assigned speed restrictions or as required to ensure compliance with 14 CFR Section 91.117.

**EXAMPLE–**

(An aircraft is flying a SID/STAR with published speed restrictions. ATC issues a speed adjustment and instructs the aircraft where the adjustment ends): “Maintain two two zero knots until BALTR then resume published speed.”

**NOTE–**

The ATC assigned speed assignment of two two zero knots would apply until BALTR. The aircraft would then comply with the published speed restrictions.

4. Advise the pilot to “delete speed restrictions” when either ATC assigned or published speed restrictions on a charted procedure are no longer required.

**EXAMPLE–**

(An aircraft is flying a SID with published speed restrictions designed to prevent aircraft overtake on departure. ATC determines there is no conflicting traffic and deletes the speed restriction): “Delete speed restrictions.”

**NOTE–**

When deleting published restrictions, ATC must ensure obstacle clearance until aircraft are established on a route where no published restrictions apply. This does not relieve the pilot of those speed restrictions which are applicable to 14 CFR Section 91.117.

5. Instruct the pilot to “climb via” or “descend via.” A climb via or descend via clearance cancels any previously issued speed restrictions and, once established on the depicted departure or arrival, to climb or descend, and to meet all published or assigned altitude and/or speed restrictions.

**EXAMPLE–**

1. (An aircraft is flying a SID with published speed restrictions. ATC has issued a speed restriction of 250 knots for spacing. ATC determines that spacing between aircraft is adequate and desires the aircraft to comply with published restrictions): “United 436, Climb via SID.”

2. (An aircraft is established on a STAR. ATC must slow an aircraft for the purposes of spacing and assigns it a speed of 280 knots. When spacing is adequate, ATC deletes the speed restriction and desires that the aircraft comply with all published restrictions on the STAR): “Gulfstream two three papa echo, descend via the TYLER One arrival.”

**NOTE–**

1. In example 1, when ATC issues a “Climb via SID” clearance, it deletes any previously issued speed and/or altitude restrictions. The pilot should then vertically navigate to comply with all speed and/or altitude restrictions published on the SID.

2. In example 2, when ATC issues a “Descend via <STAR name> arrival,” ATC has canceled any previously issued speed and/or altitude restrictions. The pilot should vertically navigate to comply with all speed and/or altitude restrictions published on the STAR.

**CAUTION–**

When descending on a STAR, pilots should not speed up excessively beyond the previously issued speed. Otherwise, adequate spacing between aircraft descending on the STAR that was established by ATC with the previous restriction may be lost.

g. Approach clearances supersede any prior speed adjustment assignments, and pilots are expected to make their own speed adjustments as necessary to complete the approach. However, under certain circumstances, it may be necessary for ATC to issue further speed adjustments after approach clearance is issued to maintain separation between successive arrivals. Under such circumstances, previously issued speed adjustments will be restated if that speed is to be maintained or additional speed adjustments are requested. Speed adjustments should not be assigned inside the final approach fix on final or a point 5 miles from the runway, whichever is closer to the runway.

h. The pilots retain the prerogative of rejecting the application of speed adjustment by ATC if the minimum safe airspeed for any particular operation is greater than the speed adjustment.

**NOTE–**

In such cases, pilots are expected to advise ATC of the speed that will be used.

i. Pilots are reminded that they are responsible for rejecting the application of speed adjustment by ATC if, in their opinion, it will cause them to exceed the maximum indicated airspeed prescribed by 14 CFR Section 91.117(a), (c) and (d). **IN SUCH CASES, THE PILOT IS EXPECTED TO SO INFORM ATC.**

Pilots operating at or above 10,000 feet MSL who are issued speed adjustments which exceed 250 knots IAS and are subsequently cleared below 10,000 feet MSL are expected to comply with 14 CFR Section 91.117(a).

**j.** Speed restrictions of 250 knots do not apply to U.S. registered aircraft operating beyond 12 nautical miles from the coastline within the U.S. Flight Information Region, in Class E airspace below 10,000 feet MSL. However, in airspace underlying a Class B airspace area designated for an airport, or in a VFR corridor designated through such as a Class B airspace area, pilots are expected to comply with the 200 knot speed limit specified in 14 CFR Section 91.117(c).

**k.** For operations in a Class C and Class D surface area, ATC is authorized to request or approve a speed greater than the maximum indicated airspeeds prescribed for operation within that airspace (14 CFR Section 91.117(b)).

**NOTE-**

*Pilots are expected to comply with the maximum speed of 200 knots when operating beneath Class B airspace or in a Class B VFR corridor (14 CFR Section 91.117(c) and (d)).*

**l.** When in communications with the ARTCC or approach control facility, pilots should, as a good operating practice, state any ATC assigned speed restriction on initial radio contact associated with an ATC communications frequency change.

#### 4-4-13. Runway Separation

Tower controllers establish the sequence of arriving and departing aircraft by requiring them to adjust flight or ground operation as necessary to achieve proper spacing. They may “HOLD” an aircraft short of the runway to achieve spacing between it and an arriving aircraft; the controller may instruct a pilot to “EXTEND DOWNWIND” in order to establish spacing from an arriving or departing aircraft. At times a clearance may include the word “IMMEDIATE.” For example: “CLEARED FOR IMMEDIATE TAKEOFF.” In such cases “IMMEDIATE” is used for purposes of *air traffic separation*. It is up to the pilot to refuse the clearance if, in the pilot’s opinion, compliance would adversely affect the operation.

**REFERENCE-**

*AIM, Paragraph 4-3-15, Gate Holding due to Departure Delays*

#### 4-4-14. Visual Separation

**a.** Visual separation is a means employed by ATC to separate aircraft in terminal areas and en route airspace in the NAS. There are two methods employed to effect this separation:

**1.** The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

**2.** A pilot sees the other aircraft involved and upon instructions from the controller provides separation by maneuvering the aircraft to avoid it. When pilots accept responsibility to maintain visual separation, they must maintain constant visual surveillance and not pass the other aircraft until it is no longer a factor.

**NOTE-**

*Traffic is no longer a factor when during approach phase the other aircraft is in the landing phase of flight or executes a missed approach; and during departure or en route, when the other aircraft turns away or is on a diverging course.*

**b.** A pilot’s acceptance of instructions to follow another aircraft or provide visual separation from it is an acknowledgment that the pilot will maneuver the aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. In operations conducted behind heavy aircraft, or a small aircraft behind a B757 or other large aircraft, it is also an acknowledgment that the pilot accepts the responsibility for wake turbulence separation. Visual separation is prohibited behind super aircraft.

**NOTE-**

*When a pilot has been told to follow another aircraft or to provide visual separation from it, the pilot should promptly notify the controller if visual contact with the other aircraft is lost or cannot be maintained or if the pilot cannot accept the responsibility for the separation for any reason.*

**c.** Scanning the sky for other aircraft is a key factor in collision avoidance. Pilots and copilots (or the right seat passenger) should continuously scan to cover all areas of the sky visible from the cockpit. Pilots must develop an effective scanning technique which maximizes one’s visual capabilities. Spotting a potential collision threat increases directly as more time is spent looking outside the aircraft. One must use timesharing techniques to effectively scan the surrounding airspace while monitoring instruments as well.

**d.** Since the eye can focus only on a narrow viewing area, effective scanning is accomplished

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

#### 4-4-15. Use of Visual Clearing Procedures

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

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

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

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

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

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

**1.** Pilots undergoing flight instruction at all levels should be requested to verbalize clearing procedures (call out “clear” left, right, above, or below) to instill and sustain the habit of vigilance during maneuvering.

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

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

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

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

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

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

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

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

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

**c.** Deviations from rules, policies, or clearances should be kept to the minimum necessary to satisfy an RA. Most RA maneuvering requires minimum excursion from assigned altitude.

**d.** The serving IFR air traffic facility is not responsible to provide approved standard IFR separation to an IFR aircraft, from other aircraft,

terrain, or obstructions after an RA maneuver until one of the following conditions exists:

1. The aircraft has returned to its assigned altitude and course.
2. Alternate ATC instructions have been issued.
3. A crew member informs ATC that the TCAS maneuver has been completed.

**NOTE—**

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

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

- a. TIS provides proximity warning only, to assist the pilot in the visual acquisition of intruder aircraft.

No recommended avoidance maneuvers are provided nor authorized as a direct result of a TIS intruder display or TIS alert. It is intended for use by aircraft in which TCAS is not required.

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

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

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

## Section 5. Surveillance Systems

### 4-5-1. Radar

#### a. Capabilities

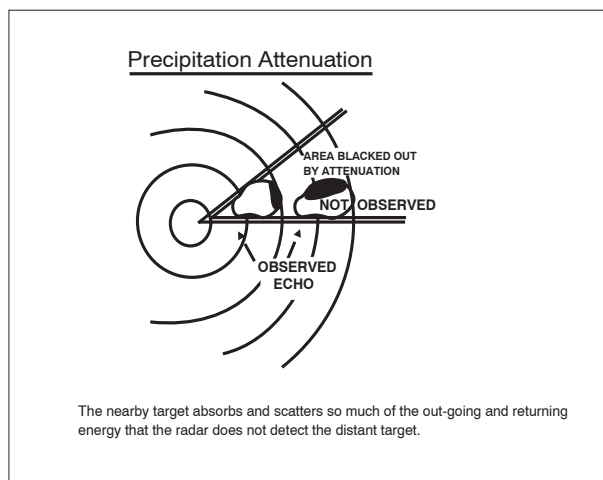
1. Radar is a method whereby radio waves are transmitted into the air and are then received when they have been reflected by an object in the path of the beam. Range is determined by measuring the time it takes (at the speed of light) for the radio wave to go out to the object and then return to the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

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

#### b. Limitations

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

FIG 4-5-1  
Limitations to Radar Service



(a) The characteristics of radio waves are such that they normally travel in a continuous straight line unless they are:

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

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

(3) Screened by high terrain features.

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

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

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

(e) There are several other factors which affect radar control. The amount of reflective surface of an aircraft will determine the size of the radar return. Therefore, a small light airplane or a sleek jet

fighter will be more difficult to see on primary radar than a large commercial jet or military bomber. Here again, the use of transponder or ADS-B equipment is invaluable. In addition, all FAA ATC facilities display automatically reported altitude information to the controller from appropriately equipped aircraft.

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

**REFERENCE-**

*Pilot/Controller Glossary Term- Radar.*

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

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

#### **4-5-2. Air Traffic Control Radar Beacon System (ATCRBS)**

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

**1. Interrogator.** Primary radar relies on a signal being transmitted from the radar antenna site and for this signal to be reflected or "bounced back"

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

**2. Transponder.** This airborne radar beacon transmitter-receiver automatically receives the signals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much stronger than a primary radar return.

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

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

1. Reinforcement of radar targets.
2. Rapid target identification.
3. Unique display of selected codes.

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

**NOTE-**

*Refer to figures with explanatory legends for an illustration of the target symbology depicted on radar scopes in the NAS Stage A (en route), the ARTS III (terminal) Systems, and other nonautomated (broadband) radar systems. (See FIG 4-5-2 and FIG 4-5-3.)*

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

**REFERENCE-**

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

### 4-5-3. Surveillance Radar

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

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

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

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 (ASDE-X)/Airport Surface Surveillance Capability (ASSC)

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

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

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

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

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

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

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

TBL 4-5-1

BWI	Baltimore Washington International
BOS	Boston Logan International
BDL	Bradley International
MDW	Chicago Midway
ORD	Chicago O’Hare International
CLT	Charlotte Douglas International
DFW	Dallas/Fort Worth International
DEN	Denver International
DTW	Detroit Metro Wayne County
FLL	Fort Lauderdale/Hollywood Intl
MKE	General Mitchell International
IAH	George Bush International
ATL	Hartsfield–Jackson Atlanta Intl
HNL	Honolulu International
JFK	John F. Kennedy International
SNA	John Wayne–Orange County
LGA	LaGuardia
STL	Lambert St. Louis International
LAS	Las Vegas McCarran International
LAX	Los Angeles International
SDF	Louisville International
MEM	Memphis International
MIA	Miami International
MSP	Minneapolis St. Paul International
EWR	Newark International
MCO	Orlando International
PHL	Philadelphia International
PHX	Phoenix Sky Harbor International
DCA	Ronald Reagan Washington National
SAN	San Diego International
SLC	Salt Lake City International
SEA	Seattle–Tacoma International
PVD	Theodore Francis Green State
IAD	Washington Dulles International
HOU	William P. Hobby International

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

TBL 4-5-2

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

**4-5-6. Traffic Information Service (TIS)**

**a. Introduction.**

The Traffic Information Service (TIS) provides information to the cockpit via data link, that is similar to VFR radar traffic advisories normally received over voice radio. Among the first FAA-provided data services, TIS is intended to improve the safety and efficiency of “see and avoid” flight through an automatic display that informs the pilot of nearby traffic and potential conflict situations. This traffic display is intended to assist the pilot in visual acquisition of these aircraft. TIS employs an enhanced capability of the terminal Mode S radar system, which contains the surveillance data, as well as the data link required to “uplink” this information to suitably-equipped aircraft (known as a TIS “client”). TIS provides estimated position, altitude, altitude trend, and ground track information for up to 8 intruder aircraft within 7 NM horizontally, +3,500 and -3,000 feet vertically of the client aircraft (see FIG 4-5-4, 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 a precise distance. TIS will alert the pilot to aircraft (under surveillance of the Mode S radar) that are estimated to be within 34 seconds of potential collision, regardless of distance or altitude. TIS surveillance data is derived from the same radar used by ATC; this data is uplinked to the client aircraft on each radar scan (nominally every 5 seconds).



2. The cockpit equipment functionality required by a TIS client aircraft to receive the service consists of the following (refer to FIG 4-5-6):

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

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

(c) Control–display unit.

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

**NOTE–**

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

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

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

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

**c. Capabilities.**

1. TIS provides ground–based surveillance information over the Mode S data link to properly equipped client aircraft to aid in visual acquisition of proximate air traffic. The actual avionics capability of each installation will vary and the supplemental handbook material must be consulted prior to using

TIS. A maximum of eight (8) intruder aircraft may be displayed; if more than eight aircraft match intruder parameters, the eight “most significant” intruders are uplinked. These “most significant” intruders are usually the ones in closest proximity and/or the greatest threat to the TIS client.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

**NOTE–**

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

**5.** Depending on avionics system design, TIS may be presented to the pilot in a variety of different displays, including text and/or graphics. Voice annunciation may also be used, either alone or in combination with a visual display. FIG 4–5–6, Traffic Information Service (TIS), Avionics Block Diagram, shows an example of a TIS display using symbology similar to the Traffic Alert and Collision Avoidance System (TCAS) installed on most passenger air carrier/commuter aircraft in the U.S. The small symbol in the center represents the client aircraft and the display is oriented “track up,” with the 12 o’clock position at the top. The range rings indicate 2 and 5 NM. Each intruder is depicted by a symbol positioned at the approximate relative bearing and range from the client aircraft. The circular symbol near the center indicates an “alert” intruder and the diamond symbols indicate “proximate” intruders.

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

**(a)** The intruder, located approximately four o’clock, three miles, is a “proximate” aircraft and currently not a collision threat to the client aircraft. This is indicated by the diamond symbol used in this example.

**(b)** The intruder ground track diverges to the right of the client aircraft, indicated by the small arrow.

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

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

**NOTE–**

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

**d. Limitations.**

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

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

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

**(b) TIS Client Altitude Reporting Requirement.** Altitude reporting is required by the TIS client aircraft in order to receive TIS. If the altitude encoder is inoperative or disabled, TIS will be unavailable, as TIS requests will not be honored by the ground system. As such, TIS requires altitude reporting to determine the Proximity Coverage Volume as indicated in FIG 4–5–4. 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, similar to a VOR or NDB, has a zenith cone, sometimes referred to as the cone of confusion or cone of silence. This is the area of ambiguity directly above the station where bearing information is unreliable. The zenith cone setting for TIS is 34 degrees: Any aircraft above that angle with respect to the radar horizon will lose TIS coverage from that radar until it is below this 34 degree angle. The aircraft may not actually lose service in areas of multiple radar coverage since an adjacent radar will

provide TIS. If no other TIS-capable radar is available, the “Good-bye” message will be received and TIS terminated until coverage is resumed.

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

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

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

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

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

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

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

**(h) Closely-Spaced Intruder Errors.**

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

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

**e. Reports of TIS Malfunctions.**

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

malfunctions be reported by radio or telephone to the nearest Flight Service Station (FSS) facility.

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

**a. Introduction.**

1. Automatic Dependent Surveillance-Broadcast (ADS-B) is a surveillance technology deployed throughout the NAS (see FIG 4-5-7). 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. (See FIG 4-5-8 and FIG 4-5-9.)

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 also associated with Mode A, C, and S transponder operations. 1090 MHz transponders with integrated ADS-B functionality extend the transponder message sets with additional ADS-B information. This additional information is known as an “extended squitter” message and is referred to as 1090ES. ADS-B equipment operating on 978 MHz is known as the Universal Access Transceiver (UAT).

3. ADS-B avionics can have the ability to both transmit and receive information. The transmission of ADS-B information from an aircraft is known as ADS-B Out. The receipt of ADS-B information by an aircraft is known as ADS-B In. All aircraft operating within the airspace defined in 14 CFR § 91.225 are required to transmit the information defined in § 91.227 using ADS-B Out avionics.

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

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

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

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

4. Aircraft that are equipped with ADS-B avionics on the UAT datalink have a feature that allows them to broadcast an anonymous 24-bit ICAO

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

5. ADS-B systems integrated with the transponder will automatically set the applicable emergency status when 7500, 7600, or 7700 are entered into the transponder. ADS-B systems not integrated with the transponder, or systems with optional emergency codes, will require that the appropriate emergency code is entered through a pilot interface. ADS-B is intended for inflight and airport surface use. Unless otherwise directed by ATC, transponder/ADS-B systems should be turned "on" and remain "on" whenever operating in the air or on the airport surface movement area.

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

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

##### **1. Preflight:**

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

##### **2. Inflight:**

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

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

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

**PHRASEOLOGY–**

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

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

**PHRASEOLOGY–**

*STOP ADS-B TRANSMISSIONS.*

(c) Other malfunctions and considerations:

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

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

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

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

the FAA will normally not take enforcement action for non-equipage in these circumstances.

**NOTE–**

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

**EXAMPLE–**

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

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

**ATC:** *“November Two Three Quebec, roger”*

*or*

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

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

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

**ATC:** *“November Four Alpha Tango, roger”*

*or*

*“November Four Alpha Tango, roger, cancel climb clearance, maintain eight thousand.”*

**REFERENCE–**

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

**e. ADS-B Limitations.**

The ADS-B cockpit display of traffic is NOT intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to “see and avoid” other aircraft. (See Paragraph 5-5-8, See and Avoid). ADS-B must not be used for avoidance maneuvers during IMC or other times when there is no visual contact with the intruder aircraft. ADS-B is intended only to assist in visual acquisition of other aircraft. No avoidance maneuvers are provided or authorized, as a direct result of an ADS-B target being displayed in the cockpit.

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

Users of ADS-B can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. Since ADS-B

performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone. Reporters should identify:

1. Condition observed.
2. Date and time of observation.
3. Altitude and location of observation.
4. Type and call sign of the aircraft.
5. Type and software version of avionics system.

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

##### **a. Introduction**

TIS-B is the broadcast of ATC derived traffic information to ADS-B equipped (1090ES or UAT) aircraft from ground radio stations. The source of this traffic information is derived from ground-based air traffic surveillance sensors. TIS-B service will be available throughout the NAS where there are both adequate surveillance coverage from ground sensors and adequate broadcast coverage from ADS-B ground radio stations. The quality level of traffic information provided by TIS-B is dependent upon the number and type of ground sensors available as TIS-B sources and the timeliness of the reported data. (See FIG 4-5-8 and FIG 4-5-9.)

##### **b. TIS-B Requirements.**

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

1. Aircraft must be equipped with an ADS-B transmitter/receiver or transceiver, and a cockpit display of traffic information (CDTI).
2. Aircraft must fly within the coverage volume of a compatible ground radio station that is configured for TIS-B uplinks. (Not all ground radio stations provide TIS-B due to a lack of radar coverage or because a radar feed is not available).
3. Aircraft must be within the coverage of and detected by at least one ATC radar serving the ground radio station in use.

##### **c. TIS-B Capabilities.**

1. TIS-B is intended to provide ADS-B equipped aircraft with a more complete traffic picture

in situations where not all nearby aircraft are equipped with ADS-B Out. This advisory-only application is intended to enhance a pilot's visual acquisition of other traffic.

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

##### **d. TIS-B Limitations.**

1. TIS-B is 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 14CFR §91.123. Uncoordinated deviations may place an aircraft in close proximity to other aircraft under ATC control not seen on the airborne equipment and may result in a pilot deviation or other incident.

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

Users of TIS-B can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. Since TIS-B performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone. Reporters should identify:

1. Condition observed.
2. Date and time of observation.
3. Altitude and location of observation.
4. Type and call sign of the aircraft.
5. Type and software version of avionics system.

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

#### a. Introduction.

FIS-B is a ground broadcast service provided through the ADS-B Services network over the 978 MHz UAT data link. The FAA FIS-B system provides pilots and flight crews of properly equipped aircraft with a cockpit display of certain aviation weather and aeronautical information. FIS-B reception is line-of-sight within the service volume of the ground infrastructure. (See FIG 4-5-8 and FIG 4-5-9.)

#### b. Weather Products.

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

#### REFERENCE-

AIM, Paragraph 7-1-11, *Flight Information Services Advisory Circular (AC) 00-63, "Use of Cockpit Displays of Digital Weather and Aeronautical Information"*

#### c. Reports of FIS-B Malfunctions.

Users of FIS-B can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. Since FIS-B performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone. Reporters should identify:

1. Condition observed.
2. Date and time of observation.
3. Altitude and location of observation.
4. Type and call sign of the aircraft.
5. Type and software version of avionics system.



TBL 4-5-3

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

Product	FIS-B Service Update Interval <sup>1</sup>	FIS-B Service Transmission Interval <sup>2</sup>
AIRMET	As available	5 minutes
Convective SIGMET	As available	5 minutes
METAR/SPECI	Hourly/as available	5 minutes
NEXRAD Reflectivity (CONUS)	5 minutes	15 minutes
NEXRAD Reflectivity (Regional)	5 minutes	2.5 minutes
NOTAM-D/FDC	As available	10 minutes
PIREP	As available	10 minutes
SIGMET	As available	5 minutes
SUA Status	As available	10 minutes
TAF/AMEND	8 hours/as available	10 minutes
Temperature Aloft	6 hours	10 minutes
Winds Aloft	6 hours	10 minutes

<sup>1</sup> The Update Interval is the rate at which the product data is available from the source.

<sup>2</sup> 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)****a. Introduction.**

ADS-R is a datalink translation function of the ADS-B ground system required to accommodate the two separate operating frequencies (978 MHz and 1090 ES). The ADS-B system receives the ADS-B messages transmitted on one frequency and ADS-R translates and reformats the information for rebroadcast and use on the other frequency. This allows ADS-B In equipped aircraft to see nearby ADS-B Out traffic regardless of the operating link of the other aircraft. Aircraft operating on the same ADS-B frequency exchange information directly and do not require the ADS-R translation function. (See FIG 4-5-8 and FIG 4-5-9.)

**b. Reports of ADS-R Malfunctions.**

Users of ADS-R can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. Since ADS-R performance is monitored by maintenance personnel rather than ATC, report malfunctions to the nearest Flight Service Station (FSS) facility by radio or telephone. Reporters should identify:

1. Condition observed.
2. Date and time of observation.
3. Altitude and location of observation.
4. Type and call sign of the aircraft.
5. Type and software version of avionics system.



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

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

**a. Applicability.** The policies, guidance and direction in this section apply to RVSM operations in the airspace over the lower 48 states, Alaska, Atlantic and Gulf of Mexico High Offshore Airspace and airspace in the San Juan FIR where VHF or UHF voice direct controller-pilot communication (DCPC) is normally available. Policies, guidance and direction for RVSM operations in oceanic airspace where VHF or UHF voice DCPC is not available and the airspace of other countries can be found in the Aeronautical Information Publication (AIP), Part II-En Route, ENR 1. General Rules and Procedures, and ENR 7.Oceanic Operations.

**b. Requirement.** The FAA implemented RVSM between flight level (FL) 290-410 (inclusive) in the following airspace: the airspace of the lower 48 states of the United States, Alaska, Atlantic and Gulf of Mexico High Offshore Airspace and the San Juan FIR. RVSM has been implemented worldwide and may be applied in all ICAO Flight Information Regions (FIR).

**c. RVSM Authorization.** In accordance with 14 CFR Section 91.180, with only limited exceptions, prior to operating in RVSM airspace, operators must comply with the standards of Part 91, Appendix G, and be authorized by the Administrator. If either the operator or the operator's aircraft have not met the applicable RVSM standards, the aircraft will be referred to as a "non-RVSM" aircraft. Paragraph 4-6-10 discusses ATC policies for accommodation of non-RVSM aircraft flown by the Department of Defense, Air Ambulance (MEDEVAC) operators, foreign State governments and aircraft flown for certification and development. Paragraph 4-6-11, Non-RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off, contains policies for non-RVSM aircraft climbing and descending through RVSM airspace to/from flight levels above RVSM airspace.

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

### 4-6-2. Flight Level Orientation Scheme

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

*FIG 4-6-1*  
**Flight Level Orientation Scheme**

Flight Level Orientation Scheme	
FL 430	←
FL 410	→
FL 400	←
FL 390	→
FL 380	←
FL 370	→
FL 360	←
FL 350	→
FL 340	←
FL 330	→
FL 320	←
FL 310	→
FL 300	←
FL 290	→

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

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

**a. RVSM Authority.** 14 CFR Section 91.180 applies to RVSM operations within the U.S. 14 CFR Section 91.706 applies to RVSM operations outside

the U.S. Both sections require that the operator be authorized prior to operating in RVSM airspace. For Domestic RVSM operations, an operator may choose to operate under the provisions of Part 91, Appendix G, Section 9; or if intending to operate outside U.S. airspace, hold a specific approval (OpSpec/MSpec/LOA) under the provisions of Section 3 of Part 91, Appendix G.

**b. Sources of Information.** Advisory Circular (AC) 91–85, Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum (RVSM) Airspace, and the FAA RVSM website.

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

**d. Aircraft Monitoring.** Operators are required to participate in the RVSM altitude-keeping performance monitoring program that is appropriate for the type of operation being conducted. The monitoring programs are described in AC 91–85. Monitoring is a quality control program that enables the FAA and other civil aviation authorities to assess the in-service altitude-keeping performance of aircraft and operators.

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

**f. Registration of U.S. Operators.** When U.S. operators and aircraft are granted specific RVSM authority, the Separation Standards Group at the FAA Technical Center obtains PTRS operator and aircraft information to update the FAA maintained U.S. Operator/Aircraft RVSM Approvals database. Basic database operator and aircraft information can be viewed on the RVSM Documentation web page in the “RVSM Approvals” section.

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

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

**b.** The operator will annotate the equipment block of the FAA or ICAO Flight Plan with an aircraft equipment suffix indicating RVSM capability only after determining that both the operator is authorized and its aircraft are RVSM-compliant.

**1.** An operator may operate in RVSM airspace under the provisions of Part 91, Appendix G, Section 9, without specific authorization and should file “/w” in accordance with paragraph d.

**2.** An operator must get an OpSpec/MSpec/LOA when intending to operate RVSM outside U.S. airspace. Once issued, that operator can file “/w” in accordance with paragraph d.

**3.** An operator should not file “/w” when intending to operate in RVSM airspace outside of the U.S., if they do not hold a valid OpSpec/MSpec/LOA.

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

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

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

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

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

**1.** Operators/aircraft that are RVSM-compliant and that file ICAO flight plans will file “/W” in block 10 (Equipment) to indicate RVSM authoriza-

tion and will also file the appropriate ICAO Flight Plan suffixes to indicate navigation and communication capabilities. The equipment suffixes in TBL 5-1-3 are for use only in an FAA Flight Plan (FAA Form 7233-1).

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

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

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

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

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

1. To issue or deny clearance into RVSM airspace.

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

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

g. Improperly changing an aircraft equipment suffix and/or adding “NON-RVSM” in the NOTES or REMARKS section (Field 18) while not removing the “W” from Field 10, will not provide air traffic control with the proper visual indicator necessary to detect Non-RVSM aircraft. To ensure information processes correctly for Non-RVSM aircraft, the “W” in Field 10 must be removed. Entry of information in the NOTES or REMARKS section (Field 18) will not affect the determination of RVSM capability and must not be used to indicate a flight is Non-RVSM.

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

a. **RVSM Mandate.** If either the operator is not authorized for RVSM operations or the aircraft is not RVSM-compliant, the pilot will neither request nor accept a clearance into RVSM airspace unless:

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

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

3. An emergency situation exists.

b. **Basic RVSM Operating Practices and Procedures.** AC 91-85 contains pilot practices and procedures for RVSM. Operators must incorporate applicable practices and procedures, as supplemented by the applicable paragraphs of this section, into operator training or pilot knowledge programs and operator documents containing RVSM operational policies.

c. AC 91-85 contains practices and procedures for flight planning, preflight procedures at the aircraft, procedures prior to RVSM airspace entry, inflight (en route) procedures, contingency procedures and post flight.

d. The following paragraphs either clarify or supplement AC 91-85 practices and procedures.

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

##### a. Introduction/Explanation

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

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

be remedied immediately in any phase of flight. Severe turbulence may be associated with MWA.

### 3. Mountain Wave Activity (MWA)

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

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

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

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

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

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

### 4. Priority for Controller Application of Merging Target Procedures

(a) **Explanation of Merging Target Procedures.** As described in subparagraph c3 below, ATC will use “merging target procedures” to mitigate the effects of both severe turbulence and MWA. The procedures in subparagraph c3 have been adapted from existing procedures published in FAA Order JO 7110.65, Air Traffic Control, Paragraph 5-1-8, Merging Target Procedures. Paragraph 5-1-8 calls for en route controllers to advise pilots of potential traffic that they perceive may fly directly above or below his/her aircraft at minimum vertical separation. In response, pilots are given the option of

requesting a radar vector to ensure their radar target will not merge or overlap with the traffic’s radar target.

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

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

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

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

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

<b>Transponder Failure</b>	
<p><b>Pilot will:</b></p> <ul style="list-style-type: none"> <li>•Contact ATC and request authority to continue to operate at cleared flight level</li> <li>•Comply with revised ATC clearance, if issued</li> </ul> <p><b>NOTE–</b> 14 CFR Section 91.215 (ATC transponder and altitude reporting equipment and use) regulates operation with the transponder inoperative.</p>	<p><b>Controller will:</b></p> <ul style="list-style-type: none"> <li>•Consider request to continue to operate at cleared flight level</li> <li>•Issue revised clearance, if necessary</li> </ul>

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

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

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

2. If the operator is not authorized or the aircraft is not RVSM–compliant, the aircraft will be referred to as a “non–RVSM” aircraft. 14 CFR Section 91.180 and Part 91, Appendix G, enable the FAA to authorize a deviation to operate a non–RVSM aircraft in RVSM airspace.

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

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

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

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

1. Department of Defense (DOD) aircraft.

2. Flights conducted for aircraft certification and development purposes.

3. Active air ambulance flights utilizing a “MEDEVAC” call sign.

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

5. Foreign State (government) aircraft.

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

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

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

**NOTE–**

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

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

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

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

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

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

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

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



# Chapter 5. Air Traffic Procedures

## Section 1. Preflight

### 5-1-1. Preflight Preparation

**a.** Every pilot is urged to receive a preflight briefing and to file a flight plan. This briefing should consist of the latest or most current weather, airport, and en route NAVAID information. Briefing service may be obtained from an FSS either by telephone or radio when airborne. Pilots within the contiguous U.S. may access Flight Service through **www.1800wxbrief.com** or by contacting them at 1-800-WX-Brief to obtain preflight weather data and to file IFR and VFR flight plans.

**NOTE-**

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

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

**REFERENCE-**

*AIM, Paragraph 5-1-4, Flight Plan- VFR Flights*

*AIM, Paragraph 5-1-8, Flight Plan- IFR Flights*

*AIM, Paragraph 5-1-9, International Flight Plan- IFR Flights*

**c.** Consult an FSS for preflight weather briefing.

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

**NOTE-**

*NOTAMs, graphic notices, and other information published in the Notices to Airmen Publication (NTAP) are not provided during a briefing unless specifically requested by the pilot since the FSS specialist has no way of knowing whether the pilot has already checked the NTAP prior to calling. Airway NOTAMs, procedural NOTAMs, and NOTAMs that are general in nature and not tied to a specific airport/facility (for example, flight advisories and restrictions, open duration special security instructions, and special flight rules areas) are briefed solely by pilot request. Remember to ask for NOTAMs and graphic notices published in the NTAP if you have not already reviewed this*

*information, and to request all pertinent NOTAMs specific to your flight.*

**REFERENCE-**

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

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

**REFERENCE-**

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

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

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

**g.** Prior to conducting a briefing, briefers are required to have the background information listed above so that they may tailor the briefing to the needs of the proposed flight. The objective is to communicate a “picture” of meteorological and aeronautical information necessary for the conduct of a safe and efficient flight. Briefers use all available weather and aeronautical information to summarize data applicable to the proposed flight. They do not read weather reports and forecasts verbatim unless specifically requested by the pilot. FSS briefers do not provide FDC NOTAM information for special

instrument approach procedures unless specifically asked. Pilots authorized by the FAA to use special instrument approach procedures must specifically request FDC NOTAM information for these procedures. Pilots who receive the information electronically will receive NOTAMs for special IAPs automatically.

**REFERENCE-**

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

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

**REFERENCE-**

*Chart Supplement U.S., Special Notices Section  
AIM, Paragraph 4-1-21, Airport Reservation Operations and Special Traffic Management Programs*

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

**REFERENCE-**

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

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

**REFERENCE-**

*AIM, Paragraph 4-2-4, Aircraft Call Signs  
FAA Order JO 7110.65, Paragraph 2-3-5a, Aircraft Identity  
FAA Order JO 7110.10, Paragraph 6-2-1b1, Flight Plan Recording*

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

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

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

**2.** File a flight plan. This is an excellent low cost insurance policy. The cost is the time it takes to fill it out. The insurance includes the knowledge that

someone will be looking for you if you become overdue at your destination.

**3.** Use current charts.

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

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

**6.** Estimate en route position times.

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

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

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

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

**a.** Time-critical aeronautical information that is of either a temporary nature or not sufficiently known in advance to permit publication on aeronautical charts or in other operational publications, receives immediate dissemination via the NOTAM System. When data appearing in a NOTAM is printed correctly in a publication or on a chart, or when a temporary condition is returned to normal status, the corresponding NOTAM is canceled. NOTAMs are eligible to be disseminated up to 7 days before the start of activity. Pilots can access NOTAM information via FSS or online via NOTAM Search at: <https://notams.aim.faa.gov/notamSearch/>.

**b.** In accordance with 14 CFR § 91.103, Preflight Action, prior to departure, pilots must become familiar with all available information concerning that flight, including NOTAMs. NOTAM information is aeronautical information that could affect a pilot's decision to make a flight and includes changes to:

**1.** Aerodromes.

**2.** Runways, taxiways, and ramp restrictions.

3. Obstructions.

4. Communications.

5. Airspace.

6. Status of navigational aids, ILSs, or radar service availability.

7. Other information essential to planned en route, terminal, or landing operations.

c. Pilots should ensure they review those NOTAMs contained under the ARTCC location (for example, ZDC, ZOB, etc.) that the flight is operating within as they can include NOTAMs relevant to all operations, including Central Altitude Reservation Function (CARF), Special Use Airspace (SUA), Temporary Flight Restrictions (TFR), Global Positioning System (GPS), Flight Data Center (FDC) changes to routes, wind turbine, and Unmanned Aircraft System (UAS).

**NOTE–**

*NOTAM information is transmitted using ICAO contractions to reduce transmission time. See TBL 5–1–2 for a listing of the most commonly used contractions, or go online to the following URL: <https://www.notams.faa.gov/downloads/contractions.pdf>. For a complete listing of approved NOTAM Contractions, see FAA JO Order 7340.2, Contractions.*

d. Due to the changeable nature of the NAS components, and frequent processing of NOTAM information, it is recommended, that while en route, pilots contact ATC or FSS and obtain updated information for their route of flight and destination. Pilots should be particularly vigilant when operating at locations without an operating control tower. Dynamic situations, such as snow removal, fire and rescue activities, construction, and wildlife encroachment, may pose hazards that may not reach the pilot prior to arrival/departure.

e. If a NAVAID fails or is removed from service prior to all airspace and procedural dependencies being removed, a NOTAM is published to inform pilots of the NAVAID being Unserviceable (U/S). Pilots must check NOTAMs to ensure any NAVAID required for the flight is in service. There can be considerable time between the NAVAID being U/S and ultimately its removal from the charts, which, during the transition period, means a NOTAM is the primary method of alerting pilots to its unavailability. It is recommended that pilots using VFR charts should regularly consult the Aeronautical Chart

Bulletin found in the back matter of the appropriate Chart Supplement U.S. This bulletin identifies any updates to the chart that have not yet been accounted for because of the extended six-month chart cycle for most VFR charts.

**NOTE–**

1. *Pilots should be alert for NAVAIDs having a dissimilar identifier from the airport(s) they serve and to use the Chart Supplement U.S. to identify the correct NAVAID NOTAM file. Flight planning should include review of NAVAIDs that aren't included for the departure/destination airport but may be part of the route of flight.*

2. *Charts may indicate a NAVAID's unavailability by depicting a crosshatch pattern through the frequency, which indicates its shutdown status.*

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

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

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

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

(c) Visual and radio navigational aids.

(d) Communication and services.

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

2. **FDC NOTAMs.** On those occasions when it becomes necessary to disseminate information that is

regulatory in nature, an FDC NOTAM is issued. FDC NOTAMs include NOTAMs such as:

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

(b) Temporary Flight Restrictions (TFR). Pilots should read NOTAMs in their entirety as some TFRs may allow pilots to fly through the flight restriction should they request permission to do so and subsequently receive it. Pilots are encouraged to use online preflight resources as they provide graphics and plain language interpretations for TFRs.

(c) High barometric pressure warning.

(d) Laser light activity.

(e) ADS-B, TIS-B, and FIS-B service availability.

(f) Satellite-based systems such as WAAS or GPS.

(g) Special Notices.

### 3. International NOTAMs.

(a) Distributed to more than one country, they are published in ICAO format under guidelines established in Annex 15. International NOTAMs issued by the U.S. NOTAM Office use Series A followed by 4 sequential numbers, a slant “/” and a 2-digit number representing the year the NOTAM was issued. For the most part, International NOTAMs duplicate data found in a U.S. Domestic NOTAM.

(b) Not every topic of a U.S. Domestic NOTAM is issued as an International NOTAM by the U.S. When possible, the U.S. International NOTAM will be linked to the appropriate U.S. Domestic NOTAM.

(c) International NOTAMs received by the FAA from other countries are stored in the U.S. NOTAM System.

(d) The International NOTAM format includes a “Q” Line that can be easily read/parsed by a computer and allows the NOTAM to be displayed digitally.

(1) Field A: ICAO location identifier or FIR affected by the NOTAM.

(2) Field B: Start of Validity.

(3) Field C: End of Validity (both in [Year][Month][Day][Hour][Minute] format).

(4) Field D: (when present) Schedule.

(5) Field E: Full NOTAM description.

(6) Field F: (when present) Lowest altitude, or “SFC.”

(7) Field G: (when present) Highest altitude, or “UNL.”

(e) For more on International format, please see Annex 15.

**4. Military NOTAMs.** NOTAMs originated by the U.S. Air Force, Army, Marine, or Navy, and pertaining to military or joint-use navigational aids/airports that are part of the NAS. Military NOTAMs are published in the International NOTAM format and should be reviewed by users of a military or joint-use facility.

**g. Notices to Airmen Publication (NTAP).** The NTAP is published every 28 days and is divided into two parts:

1. Part 1, International NOTAMs, is divided into two sections:

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

(b) Section 2, International Oceanic Airspace Notices.

2. Part 2, Graphic Notices, compiled from data provided by FAA service area offices and other lines of business, contains special notices and graphics pertaining to almost every aspect of aviation such as: military training areas, large scale sporting events, air show information, Special Traffic Management Programs (STMP), and airport-specific information. This part is comprised of 6 sections: General, Special Military Operations, Airport and Facility Notices, Major Sporting and Entertainment Events, Airshows, and Special Notices.

*TBL 5-1-1*  
**NOTAM Keywords**

<b>Keyword</b>	<b>Definition</b>
<b>RWY</b> ..... <i>Example</i>	<b>Runway</b> !BNA BNA RWY 18/36 CLSD YYMMDDHHMM-YYMMDDHHMM
<b>TWY</b> ..... <i>Example</i>	<b>Taxiway</b> !BTV BTV TWY C EDGE LGT OBSC YYMMDDHHMM-YYMMDDHHMM
<b>APRON</b> ..... <i>Example</i>	<b>Apron/Ramp</b> !BNA BNA APRON NORTH APN E 100FT CLSD YYMMDDHHMM-YYMMDDHHMM
<b>AD</b> ..... <i>Example</i>	<b>Aerodrome</b> !BET BET AD AP ELK NEAR MOVEMENT AREAS YYMMDDHHMM-YYMMDDHHMM
<b>OBST</b> ..... <i>Example</i>	<b>Obstruction</b> !SJT SJT OBST MOORED BALLOON WI AN AREA DEFINED AS 1NM RADIUS OF SJT 2430FT (510FT AGL) FLAGGED YYMMDDHHMM-YYMMDDHHMM
<b>NAV</b> ..... <i>Example</i>	<b>Navigation Aids</b> !SHV SHV NAV ILS RWY 32 110.3 COMMISSIONED YYMMDDHHMM-PERM
<b>COM</b> ..... <i>Example</i>	<b>Communications</b> !INW INW COM REMOTE COM OUTLET 122.6 U/S YYMMDDHHMM-YYMMDDHHMM EST (Note* EST will auto cancel)
<b>SVC</b> ..... <i>Example</i>	<b>Services</b> !ROA ROA SVC TWR COMMISSIONED YYMMDDHHMM-PERM
<b>AIRSPACE</b> .. <i>Example</i>	<b>Airspace</b> !MHV MHV AIRSPACE AEROBATIC ACFT WI AN AREA DEFINED AS 4.3NM RADIUS OF MHV 5500FT-10500FT AVOIDANCE ADZ CTC JOSHUA APP DLY YYMMDDHHMM-YYMMDDHHMM
<b>ODP</b> ..... <i>Example</i>	<b>Obstacle Departure Procedure</b> !FDC 2/9700 DIK ODP DICKINSON – THEODORE ROOSEVELT RGNL, DICKINSON, ND. TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES AMDT 1... DEPARTURE PROCEDURE: RWY 25, CLIMB HEADING 250 TO 3500 BEFORE TURNING LEFT. ALL OTHER DATA REMAINS AS PUBLISHED. THIS IS TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES, AMDT 1A. YYMMDDHHMM-PERM
<b>SID</b> ..... <i>Example</i>	<b>Standard Instrument Departure</b> !FDC x/xxxx DFW SID DALLAS/FORT WORTH INTL, DALLAS, TX. PODDE THREE DEPARTURE... CHANGE NOTES TO READ: RWYS 17C/R, 18L/R: DO NOT EXCEED 240KT UNTIL LARRN. RWYS 35L/C, 36L/R: DO NOT EXCEED 240KT UNTIL KMART YYMMDDHHMM-YYMMDDHHMM
<b>STAR</b> ..... <i>Example</i>	<b>Standard Terminal Arrival</b> !FDC x/xxxx DCA STAR RONALD REAGAN WASHINGTON NATIONAL, WASHINGTON, DC. WZRRD TWO ARRIVAL... SHAAR TRANSITION: ROUTE FROM DRUZZ INT TO WZRRD INT NOT AUTHORIZED. AFTER DRUZZ INT EXPECT RADAR VECTORS TO AML VORTAC YYMMDDHHMM-YYMDDHHMM
<b>CHART</b> ..... <i>Example</i>	<b>Chart</b> !FDC 2/9997 DAL IAP DALLAS LOVE FIELD, DALLAS, TX. ILS OR LOC RWY 31R, AMDT 5... CHART NOTE: SIMULTANEOUS APPROACH AUTHORIZED WITH RWY 31L. MISSED APPROACH: CLIMB TO 1000 THEN CLIMBING RIGHT TURN TO 5000 ON HEADING 330 AND CVE R-046 TO FINGER INT/ CVE 36.4 DME AND HOLD. CHART LOC RWY 31L. THIS IS ILS OR LOC RWY 31R, AMDT 5A. YYMDDHHMM-PERM
<b>DATA</b> ..... <i>Example</i>	<b>Data</b> !FDC 2/9700 DIK ODP DICKINSON – THEODORE ROOSEVELT RGNL, DICKINSON, ND. TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES AMDT 1... DEPARTURE PROCEDURE: RWY 25, CLIMB HEADING 250 TO 3500 BEFORE TURNING LEFT. ALL OTHER DATA REMAINS AS PUBLISHED. THIS IS TAKEOFF MINIMUMS AND (OBSTACLE) DEPARTURE PROCEDURES, AMDT 1A. YYMMDDHHMM-PERM

<b>Keyword</b>	<b>Definition</b>
<b>IAP</b> . . . . . <i>Example</i>	<b>Instrument Approach Procedure</b> !FDC 2/9997 DAL IAP DALLAS LOVE FIELD, DALLAS, TX. ILS OR LOC RWY 31R, AMDT 5... CHART NOTE: SIMULTANEOUS APPROACH AUTHORIZED WITH RWY 31L. MISSED APPROACH: CLIMB TO 1000 THEN CLIMBING RIGHT TURN TO 5000 ON HEADING 330 AND CVE R-046 TO FINGR INT/ CVE 36.4 DME AND HOLD. CHART LOC RWY 31L. THIS IS ILS OR LOC RWY 31R, AMDT 5A. YYM-MDDHHMM-PERM
<b>VFP</b> . . . . . <i>Example</i>	<b>Visual Flight Procedures</b> !FDC X/XXXX JFK VFP JOHN F KENNEDY INTL, NEW YORK, NY. PARKWAY VISUAL RWY 13L/R, ORIG...WEATHER MINIMUMS 3000 FOOT CEILING AND 3 MILES VISIBILITY. YYMMDDHHMM-YYMMDDHHMM
<b>ROUTE</b> . . . . . <i>Example</i>	<b>Route</b> !FDC x/xxxx ZFW ROUTE ZFW ZKC. V140 SAYRE (SYO) VORTAC, OK TO TULSA (TUL) VORTAC, OK MEA 4300. YYMMDDHHMM-YYMMDDHHMM EST
<b>SPECIAL</b> . . . <i>Example</i>	<b>Special</b> !FDC x/xxxx JNU SPECIAL JUNEAU INTERNATIONAL, JUNEAU, AK. LDA-2 RWY 8 AMDT 9 PROCEDURE TURN NA. YYMMDDHHMM-YYMMDDHHMM
<b>SECURITY</b> . . <i>Example</i>	<b>Security</b> !FDC x/xxxx FDC ...SPECIAL NOTICE... THIS IS A RESTATEMENT OF A PREVIOUSLY ISSUED ADVISORY NOTICE. IN THE INTEREST OF NATIONAL SECURITY AND TO THE EXTENT PRACTICABLE, PILOTS ARE STRONGLY ADVISED TO AVOID THE AIRSPACE ABOVE, OR IN PROXIMITY TO SUCH SITES AS POWER PLANTS (NUCLEAR, HYDRO-ELECTRIC, OR COAL), DAMS, REFINERIES, INDUSTRIAL COMPLEXES, MILITARY FACILITIES AND OTHER SIMILAR FACILITIES. PILOTS SHOULD NOT CIRCLE AS TO LOITER IN THE VICINITY OVER THESE TYPES OF FACILITIES.

TBL 5-1-2

## Contractions Commonly Found in NOTAMS

<b>A</b>	
ABN .....	Aerodrome Beacon
ACFT .....	Aircraft
ACT .....	Active
ADJ .....	Adjacent
AGL .....	Above Ground Level
ALS .....	Approach Light System
AP .....	Airport
APN .....	Apron
APP .....	Approach control office <i>or</i> approach control <i>or</i> approach control service
ARST .....	Arresting ( <i>specify (part of) aircraft arresting equipment</i> )
ASDA .....	Accelerate Stop Distance Available
ASPH .....	Asphalt
AUTH .....	Authorized <i>or</i> authorization
AVBL .....	Available <i>or</i> availability
AVGAS .....	Aviation gasoline
AWOS .....	Automatic Weather Observing System
AZM .....	Azimuth
<b>B</b>	
BA .....	Braking action
BCN .....	Beacon ( <i>aeronautical ground light</i> )
BCST .....	Broadcast
BDRY .....	Boundary
BLDG .....	Building
BLW .....	Below
BTN .....	Between
<b>C</b>	
C .....	Center ( <i>preceded by runway designator number to identify a parallel runway</i> )
CD .....	Clearance delivery
CIV .....	Civil
CL .....	Centerline
CLSD .....	Close <i>or</i> closed <i>or</i> closing
COM .....	Communication
CONC .....	Concrete
COND .....	Condition
CONS .....	Continuous
CONST .....	Construction <i>or</i> constructed
CPDLC .....	Controller Pilot Data Link Communications
CTC .....	Contact
CUST .....	Customs
<b>D</b>	
DA .....	Decision altitude
DEG .....	Degrees
DEP .....	Depart <i>or</i> Departure
DER .....	Departure end of the runway
DH .....	Decision Height
DIST .....	Distance
DLY .....	Daily
DP .....	Dew Point Temperature
DPT .....	Depth
DTHR .....	Displaced Runway Threshold

<b>E</b>	
E .....	East <i>or</i> eastern longitude
EB .....	Eastbound
EMERG .....	Emergency
ENE .....	East-northeast
EQPT .....	Equipment
ESE .....	East-southeast
EST .....	Estimate <i>or</i> estimated <i>or</i> estimation ( <i>message type designator</i> )
EXC .....	Except
<b>F</b>	
FL .....	Flight level
FREQ .....	Frequency
FRI .....	Friday
FSS .....	Flight Service Station
FST .....	First
FT .....	Feet ( <i>dimensional unit</i> )
<b>G</b>	
G .....	Green
GA .....	General aviation
GLD .....	Glider
GND .....	Ground
GP .....	Glide Path
GRVL .....	Gravel
<b>H</b>	
HEL .....	Helicopter
HGT .....	Height <i>or</i> height above
HLDG .....	Holding
HLP .....	Heliport
HVY .....	Heavy
<b>I</b>	
IFR .....	Instrument Flight Rules
ILS .....	Instrument Landing System
IM .....	Inner Marker
INOP .....	Inoperative
INT .....	Intersection
<b>K</b>	
KT .....	Knots
<b>L</b>	
L .....	Left ( <i>preceded by runway designator number to identify a parallel runway</i> )
LAT .....	Latitude
LDA .....	Landing Distance Available
LDG .....	Landing
LEN .....	Length
LGT .....	Light <i>or</i> lighting
LGTD .....	Lighted
LOC .....	Localizer
LONG .....	Longitude
<b>M</b>	
MAINT .....	Maintenance
MBST .....	Microburst
MIL .....	Military
MIN .....	Minutes
MNT .....	Monitor <i>or</i> monitoring <i>or</i> monitored
MON .....	Monday

MOV .....	Move <i>or</i> moving <i>or</i> movement
	<b>N</b>
N .....	North
NAVAID .....	Navigational aid
NB .....	Northbound
NDB .....	Nondirectional Radio Beacon
NE .....	Northeast
NEB .....	Northeast bound
NM .....	Nautical Mile/s
NNE .....	North-northeast
NNW .....	North-northwest
NOV .....	November
NW .....	Northwest
NWB .....	Northwest bound
	<b>O</b>
OBSC .....	Obscure <i>or</i> obscured <i>or</i> obscuring
OBST .....	Obstacle
OPN .....	Open <i>or</i> opening <i>or</i> opened
OPS .....	Operations
	<b>P</b>
PAPI .....	Precision Approach Path Indicator
PARL .....	Parallel
PAX .....	Passenger/s
PCL .....	Pilot Controlled Lighting
PCT .....	Percent
PERM .....	Permanent
PJE .....	Parachute Jumping Activities
PLA .....	Practice Low Approach
PPR .....	Prior Permission Required
PT .....	Procedure Turn
	<b>R</b>
R .....	Red
R .....	Right ( <i>preceded by runway designator number to identify a parallel runway</i> )
RAI .....	Runway Alignment Indicator
RCL .....	Runway Centerline
RCLL .....	Runway Centerline Light
REDL .....	Receive/Receiver
RLLS .....	Runway Lead-in Light System
RMK .....	Remark
RTS .....	Return to Service
RTZL .....	Runway Touchdown Zone Light(s)
RVR .....	Runway Visual Range
RWY .....	Runway
	<b>S</b>
S .....	South <i>or</i> southern latitude
SA .....	Sand
SAT .....	Saturday
SB .....	Southbound
SE .....	Southeast
SEC .....	Seconds
SFC .....	Surface
SN .....	Snow
SR .....	Sunrise
SS .....	Sunset
SSR .....	Secondary surveillance radar

SSW .....	South-southwest
STD .....	Standard
SUN .....	Sunday
SW .....	Southwest
SWB .....	Southwest bound
	<b>T</b>
TAR .....	Terminal area surveillance radar
TAX .....	Taxing <i>or</i> taxiing
TDZ .....	Touchdown Zone
TEMPO .....	Temporary <i>or</i> temporarily
TFC .....	Traffic
THR .....	Threshold
THU .....	Thursday
TKOF .....	Takeoff
TODA .....	Take-off Distance Available
TORA .....	Take-off Run Available
TRG .....	Training
TUE .....	Tuesday
TWR .....	Aerodrome Control Tower
TWY .....	Taxiway
TX .....	Taxilane
	<b>U</b>
U/S .....	Unserviceable
UAS .....	Unmanned Aircraft System
UNL .....	Unlimited
UNREL .....	Unreliable
	<b>V</b>
VIS .....	Visibility
VOR .....	VHF Omni-Directional Radio Range
VORTAC .....	VOR and TACAN (collocated)
VOT .....	VOR Test Facility
	<b>W</b>
W .....	West <i>or</i> western longitude
WB .....	Westbound
WDI .....	Wind Direction Indicator
WED .....	Wednesday
WI .....	Within
WID .....	Width <i>or</i> wide
WIP .....	Work in progress
WNW .....	West-northwest
WS .....	Wind shear
WSW .....	West-southwest

**5-1-4. Flight Plan - VFR Flights**

a. Except for operations in or penetrating an ADIZ, a flight plan is not required for VFR flight.

**REFERENCE-**  
 AIM, Chapter 5, Section 6, National Security and Interception Procedures

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, Paragraph 6-2-6, Search and Rescue, 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, Paragraph 5-1-8, Flight Plan- Domestic IFR Flights*

**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/ADS-B equipment is necessary in determining whether or not such computer tapes might prove effective.

FIG 5-1-1  
**FAA Flight Plan**  
**Form 7233-1 (8-82)**

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION		(FAA USE ONLY) <input type="checkbox"/> PILOT BRIEFING <input type="checkbox"/> VNR			TIME STARTED		SPECIALIST INITIALS	
<b>FLIGHT PLAN</b>		<input type="checkbox"/> STOPOVER						
<b>1. TYPE</b>	<b>2. AIRCRAFT IDENTIFICATION</b>	<b>3. AIRCRAFT TYPE/SPECIAL EQUIPMENT</b>	<b>4. TRUE AIRSPEED</b>	<b>5. DEPARTURE POINT</b>	<b>6. DEPARTURE TIME</b>		<b>7. CRUISING ALTITUDE</b>	
VFR			KTS		PROPOSED (Z)	ACTUAL (Z)		
IFR								
DVFR								
<b>8. ROUTE OF FLIGHT</b>								
<b>9. DESTINATION (Name of airport and city)</b>			<b>10. EST. TIME ENROUTE</b>		<b>11. REMARKS</b>			
			HOURS	MINUTES				
<b>12. FUEL ON BOARD</b>		<b>13. ALTERNATE AIRPORT(S)</b>		<b>14. PILOT'S NAME, ADDRESS &amp; TELEPHONE NUMBER &amp; AIRCRAFT HOME BASE</b>			<b>15. NUMBER ABOARD</b>	
HOURS	MINUTES							
				<b>17. DESTINATION CONTACT/TELEPHONE (OPTIONAL)</b>				
<b>16. COLOR OF AIRCRAFT</b>		<small>CIVIL AIRCRAFT PILOTS, FAR 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed \$1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.</small>						

FAA Form 7233-1 (8-82)      **CLOSE VFR FLIGHT PLAN WITH \_\_\_\_\_ FSS ON ARRIVAL**

k. Flight Plan Form – (See FIG 5-1-1).

**1. Explanation of VFR Flight Plan Items.**

**1. Block 1.** Check the type flight plan. Check both the VFR and IFR blocks if composite VFR/IFR.

**2. Block 2.** Enter your complete aircraft identification including the prefix “N” if applicable.

**3. Block 3.** Enter the designator for the aircraft, or if unknown, consult an FSS briefer.

**4. Block 4.** Enter your true airspeed (TAS).

**5. Block 5.** Enter the departure airport identifier code, or if unknown, the name of the airport.

**6. Block 6.** Enter the proposed departure time in Coordinated Universal Time (UTC) (Z). If airborne, specify the actual or proposed departure time as appropriate.

**7. Block 7.** Enter the appropriate VFR altitude (to assist the briefer in providing weather and wind information).

**8. Block 8.** Define the route of flight by using NAVAID identifier codes and airways.

**9. Block 9.** Enter the destination airport identifier code, or if unknown, the airport name.

**NOTE-**  
*Include the city name (or even the state name) if needed for clarity.*

**10. Block 10.** Enter your estimated time en route in hours and minutes.

**11. Block 11.** Enter only those remarks that may aid in VFR search and rescue, such as planned stops en route or student cross country, or remarks pertinent to the clarification of other flight plan information, such as the radiotelephony (call sign) associated with a designator filed in Block 2, if the radiotelephony is new, has changed within the last 60 days, or is a special FAA-assigned temporary radiotelephony. Items of a personal nature are not accepted.

**12. Block 12.** Specify the fuel on board in hours and minutes.

**13. Block 13.** Specify an alternate airport if desired.

**14. Block 14.** Enter your complete name, address, and telephone number. Enter sufficient information to identify home base, airport, or operator.

**NOTE–**

*This information is essential in the event of search and rescue operations.*

**15. Block 15.** Enter total number of persons on board (POB) including crew.

**16. Block 16.** Enter the predominant colors.

**17. Block 17.** Record the FSS name for closing the flight plan. If the flight plan is closed with a different FSS or facility, state the recorded FSS name that would normally have closed your flight plan.

**NOTE–**

**1. Optional–** record a destination telephone number to assist search and rescue contact should you fail to report or cancel your flight plan within 1/2 hour after your estimated time of arrival (ETA).

**2.** The information transmitted to the destination FSS will consist only of flight plan blocks 2, 3, 9, and 10. Estimated time en route (ETE) will be converted to the correct ETA.

### **5–1–5. Operational Information System (OIS)**

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

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

**1.** Advisories are normally issued for the following items:

- (a) Ground Stops.
- (b) Ground Delay Programs.

(c) Route Information.

(d) Plan of Operations.

(e) Facility Outages and Scheduled Facility Outages.

(f) Volcanic Ash Activity Bulletins.

(g) Special Traffic Management Programs.

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

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

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

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

### **5–1–6. Flight Plan– Defense VFR (DVFR) Flights**

VFR flights (except DOD or law enforcement flights) into an ADIZ are required to file DVFR flight plans for security purposes. Detailed ADIZ procedures are found in Section 6, National Security and Interception Procedures, of this chapter. (See 14 CFR Part 99, Security Control of Air Traffic)

### 5-1-7. Composite Flight Plan (VFR/IFR Flights)

a. Flight plans which specify VFR operation for one portion of a flight, and IFR for another portion, will be accepted by the FSS at the point of departure. If VFR flight is conducted for the first portion of the flight, pilots should report their departure time to the FSS with whom the VFR/IFR flight plan was filed; and, subsequently, close the VFR portion and request ATC clearance from the FSS nearest the point at which change from VFR to IFR is proposed. Regardless of the type facility you are communicating with (FSS, center, or tower), it is the pilot's responsibility to request that facility to "CLOSE VFR FLIGHT PLAN." The pilot must remain in VFR weather conditions until operating in accordance with the IFR clearance.

b. When a flight plan indicates IFR for the first portion of flight and VFR for the latter portion, the pilot will normally be cleared to the point at which the change is proposed. After reporting over the clearance limit and not desiring further IFR clearance, the pilot should advise ATC to cancel the IFR portion of the flight plan. Then, the pilot should contact the nearest FSS to activate the VFR portion of the flight plan. If the pilot desires to continue the IFR flight plan beyond the clearance limit, the pilot should contact ATC at least 5 minutes prior to the clearance limit and request further IFR clearance. If the requested clearance is not received prior to reaching the clearance limit fix, the pilot will be expected to enter into a standard holding pattern on the radial or course to the fix unless a holding pattern for the clearance limit fix is depicted on a U.S. Government or commercially produced (meeting FAA requirements) low or high altitude enroute, area or STAR chart. In this case the pilot will hold according to the depicted pattern.

### 5-1-8. Flight Plan (FAA Form 7233-1)- Domestic IFR Flights

#### NOTE-

1. Procedures outlined in this section apply to operators filing FAA Form 7233-1 (Flight Plan) and to flights that will be conducted entirely within U.S. domestic airspace.

2. Filers utilizing FAA Form 7233-1 may not be eligible for assignment of RNAV SIDs and STARs. Filers desiring assignment of these procedures should file using FAA Form

7233-4 (International Flight Plan), as described in paragraph 5-1-9.

#### a. General

1. Prior to departure from within, or prior to entering controlled airspace, a pilot must submit a complete flight plan and receive an air traffic clearance, if weather conditions are below VFR minimums. Instrument flight plans may be submitted to the nearest FSS or ATCT either in person or by telephone (or by radio if no other means are available). Pilots should file IFR flight plans at least 30 minutes prior to estimated time of departure to preclude possible delay in receiving a departure clearance from ATC. In order to provide FAA traffic management units strategic route planning capabilities, nonscheduled operators conducting IFR operations above FL 230 are requested to voluntarily file IFR flight plans at least 4 hours prior to estimated time of departure (ETD). To minimize your delay in entering Class B, Class C, Class D, and Class E surface areas at destination when IFR weather conditions exist or are forecast at that airport, an IFR flight plan should be filed before departure. Otherwise, a 30 minute delay is not unusual in receiving an ATC clearance because of time spent in processing flight plan data. Traffic saturation frequently prevents control personnel from accepting flight plans by radio. In such cases, the pilot is advised to contact the nearest FSS for the purpose of filing the flight plan.

#### NOTE-

1. There are several methods of obtaining IFR clearances at nontower, non-FSS, and outlying airports. The procedure may vary due to geographical features, weather conditions, and the complexity of the ATC system. To determine the most effective means of receiving an IFR clearance, pilots should ask the nearest FSS the most appropriate means of obtaining the IFR clearance.

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

2. When filing an IFR flight plan, include as a prefix to the aircraft type, the number of aircraft when more than one and/or heavy aircraft indicator "H/" if appropriate.

#### EXAMPLE-

H/DC10/A  
2/F15/A

3. When filing an IFR flight plan, identify the equipment capability by adding a suffix, preceded by a slant, to the AIRCRAFT TYPE, as shown in TBL 5-1-3, Aircraft Suffixes.

**NOTE-**

1. ATC issues clearances based on filed suffixes. Pilots should determine the appropriate suffix based upon desired services and/or routing. For example, if a desired route/procedure requires GPS, a pilot should file /G even if the aircraft also qualifies for other suffixes.

2. For procedures requiring GPS, if the navigation system does not automatically alert the flight crew of a loss of GPS, the operator must develop procedures to verify correct GPS operation.

3. The suffix is not to be added to the aircraft identification or be transmitted by radio as part of the aircraft

identification.

4. It is recommended that pilots file the maximum transponder/ADS-B and navigation capability of their aircraft in the equipment suffix. This will provide ATC with the necessary information to utilize all facets of navigational equipment and transponder capabilities available.

5. When filing an IFR flight plan via telephone or radio, it is highly recommended that the departure airport be clearly identified by stating the city name and state and/or airport location identifier. With cell phone use and flight service specialists covering larger areas of the country, clearly identifying the departure airport can prevent confusing your airport of departure with those of identical or similar names in other states.

**TBL 5-1-3  
Aircraft Equipment Suffixes**

	Navigation Capability	Transponder Capability	Suffix
<b>RVSM</b>	No GNSS, No RNAV	Transponder with Mode C	/W
	RNAV, No GNSS	Transponder with Mode C	/Z
	GNSS	Transponder with Mode C	/L
<b>No RVSM</b>	No DME	No Transponder	/X
		Transponder with no Mode C	/T
		Transponder with Mode C	/U
	DME	No Transponder	/D
		Transponder with no Mode C	/B
		Transponder with Mode C	/A
	TACAN	No Transponder	/M
		Transponder with no Mode C	/N
		Transponder with Mode C	/P
	RNAV, no GNSS	No Transponder	/Y
		Transponder with no Mode C	/C
		Transponder with Mode C	/I
	GNSS	No Transponder	/V
		Transponder with no Mode C	/S
		Transponder with Mode C	/G

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

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

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

### **EXAMPLE–**

#### **1. ALB J37 BUMPY J14 BHM**

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

#### **2. ALB J37 ENO J14 BHM**

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

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

### **EXAMPLE–**

#### **BWI V44 SWANN V433 DQO**

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

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

enough information should be included to clearly indicate the route requested.

### **EXAMPLE–**

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

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

### **REFERENCE–**

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

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

### **REFERENCE–**

*AIM, Paragraph 5–2–9, Instrument Departure Procedures (DP) – Obstacle Departure Procedures (ODP) and Standard Instrument Departures (SID)*

*AIM, Paragraph 5–4–1, Standard Terminal Arrival (STAR) Procedures*

### **NOTE–**

*Pilots not desiring a SID or STAR should so indicate in the remarks section of the flight plan as “no SID” or “no STAR.”*

## **c. Direct Flights**

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

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

### **REFERENCE–**

*AIM, Paragraph 1–1–8, Navigational Aid (NAVAID) Service Volumes*

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

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

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

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

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

4. Increasing use of self-contained airborne navigational systems which do not rely on the VOR/VORTAC/TACAN system has resulted in pilot requests for direct routes that exceed NAVAID service volume limits. With the exception of GNSS-equipped aircraft, these direct route requests will be approved only in a radar environment, with approval based on pilot responsibility for navigation on the authorized direct route. Radar flight following will be provided by ATC for ATC purposes. For GNSS-equipped aircraft, ATC may approve a direct route that exceeds ground based NAVAID service volume limits; however, in a non-radar environment, the routing must be “point-to-point,” defined as navigation from a published point to a published point, and navigational assistance will not be available. (See subparagraph 5-1-8d below.)

5. At times, ATC will initiate a direct route in a radar environment that exceeds NAVAID service volume limits. In such cases ATC will provide radar monitoring and navigational assistance as necessary. For GNSS-equipped aircraft, if the route is point-to-point, radar monitoring and navigational assistance is not required. (See subparagraph 5-1-8d below.)

6. Airway or jet route numbers, appropriate to the stratum in which operation will be conducted, may also be included to describe portions of the route to be flown.

**EXAMPLE–**

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

**NOTE–**

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

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

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

1. Except for GNSS-equipped aircraft, random impromptu routes can only be approved in a radar environment. A random impromptu route is a direct course initiated by ATC or requested by the pilot during flight. Aircraft are cleared from their present position to a NAVAID, waypoint, fix, or airport. Factors that will be considered by ATC in approving random impromptu routes include the capability to provide radar monitoring and compatibility with traffic volume and flow. ATC will radar monitor each flight; however, navigation on the random impromptu route is the responsibility of the pilot. GNSS-equipped aircraft are allowed to operate in a non-radar environment when the aircraft is cleared via, or is reported to be established on, a point-to-point route. The points must be published NAVAIDs, waypoints, fixes, or airports recallable from the aircraft’s database. The distance between the points cannot exceed 500 miles and navigational assistance will not be provided.

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

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

(b) File the appropriate aircraft equipment suffix in the flight plan.

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

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

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

(f) File a minimum of one route description waypoint for each ARTCC through whose area the random route will be flown.

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

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

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

**NOTE—**

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

**3.** Pilots of aircraft equipped with latitude/longitude coordinate navigation capability, independent of VOR/TACAN references, may file for random RNAV routes at and above FL 390 within the conterminous U.S. using the following procedures.

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

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

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

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

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

**EXAMPLE—**

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

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

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

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

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

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

*or*

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

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

<sup>2</sup> *Transition fix (pitch point).*

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

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

<sup>5</sup> *Los Angeles ARTCC waypoint (catch point).*

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

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

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

(f) Record latitude/longitude coordinates by four figures describing latitude in degrees and minutes followed by a solidus and five figures describing longitude in degrees and minutes.

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

(h) Fly all routes/route segments on Great Circle tracks or GPS-based tracks.



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

e. Flight Plan Form– See FIG 5–1–2.

**f. Explanation of IFR Flight Plan Items.**

**1. Block 1.** Check the type flight plan. Check both the VFR and IFR blocks if composite VFR/IFR.

**2. Block 2.** Enter your complete aircraft identification including the prefix “N” if applicable.

**3. Block 3.** Enter the designator for the aircraft, followed by a slant(/), and the transponder or DME equipment code letter; e.g., C–182/U. Heavy aircraft, add prefix “H” to aircraft type; example: H/DC10/U. Consult an FSS briefer for any unknown elements.

FIG 5–1–2  
**FAA Flight Plan**  
**Form 7233–1 (8–82)**

U.S. DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION		(FAA USE ONLY) <input type="checkbox"/> PILOT BRIEFING <input type="checkbox"/> VNR			TIME STARTED		SPECIALIST INITIALS	
<b>FLIGHT PLAN</b>		<input type="checkbox"/> STOPOVER						
<b>1. TYPE</b>	<b>2. AIRCRAFT IDENTIFICATION</b>	<b>3. AIRCRAFT TYPE/SPECIAL EQUIPMENT</b>	<b>4. TRUE AIRSPEED</b>	<b>5. DEPARTURE POINT</b>	<b>6. DEPARTURE TIME</b>		<b>7. CRUISING ALTITUDE</b>	
<input type="checkbox"/> VFR <input type="checkbox"/> IFR <input type="checkbox"/> DVFR			KTS		PROPOSED (Z)	ACTUAL (Z)		
<b>8. ROUTE OF FLIGHT</b>								
<b>9. DESTINATION</b> (Name of airport and city)			<b>10. EST. TIME ENROUTE</b>		<b>11. REMARKS</b>			
			HOURS	MINUTES				
<b>12. FUEL ON BOARD</b>		<b>13. ALTERNATE AIRPORT(S)</b>		<b>14. PILOT'S NAME, ADDRESS &amp; TELEPHONE NUMBER &amp; AIRCRAFT HOME BASE</b>			<b>15. NUMBER ABOARD</b>	
HOURS	MINUTES							
				<b>17. DESTINATION CONTACT/TELEPHONE (OPTIONAL)</b>				
<b>16. COLOR OF AIRCRAFT</b>		CIVIL AIRCRAFT PILOTS, FAR 91 requires you file an IFR flight plan to operate under instrument flight rules in controlled airspace. Failure to file could result in a civil penalty not to exceed \$1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended). Filing of a VFR flight plan is recommended as a good operating practice. See also Part 99 for requirements concerning DVFR flight plans.						
FAA Form 7233-1 (8-82)			CLOSE VFR FLIGHT PLAN WITH _____			FSS ON ARRIVAL		

**4. Block 4.** Enter your computed true airspeed (TAS).

**NOTE–**  
 If the average TAS changes plus or minus 5 percent or 10 knots, whichever is greater, advise ATC.

**5. Block 5.** Enter the departure airport identifier code (or the airport name, city and state, if the identifier is unknown).

**NOTE–**  
 Use of identifier codes will expedite the processing of your flight plan.

**6. Block 6.** Enter the proposed departure time in Coordinated Universal Time (UTC) (Z). If airborne, specify the actual or proposed departure time as appropriate.

**7. Block 7.** Enter the requested en route altitude or flight level.

**NOTE–**  
 Enter only the initial requested altitude in this block. When more than one IFR altitude or flight level is desired along the route of flight, it is best to make a subsequent request direct to the controller.

**8. Block 8.** Define the route of flight by using NAVAID identifier codes (or names if the code is unknown), airways, jet routes, and waypoints (for RNAV).

**NOTE–**

Use NAVAIDs or waypoints to define direct routes and radials/bearings to define other unpublished routes.

**9. Block 9.** Enter the destination airport identifier code (or name if the identifier is unknown).

**10. Block 10.** Enter your estimated time en route based on latest forecast winds.

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

**NOTE–**

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

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

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

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

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

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

**NOTE–**

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

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

**16. Block 16.** Enter the predominant colors.

**NOTE–**

Close IFR flight plans with tower, approach control, or ARTCC, or if unable, with FSS. When landing at an airport with a functioning control tower, IFR flight plans are automatically canceled.

**g.** The information transmitted to the ARTCC for IFR flight plans will consist of only flight plan blocks 2, 3, 4, 5, 6, 7, 8, 9, 10, and 11.

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

**a. General**

Use of FAA Form 7233–4 is:

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

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

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

**NOTE–**

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

[http://www.faa.gov/about/office\\_org/headquarters\\_offices/ato/service\\_units/enroute/flight\\_plan\\_filing/](http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/enroute/flight_plan_filing/)

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

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

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

**b. Explanation of Items Filed in FAA Form 7233-4**

Procedures and other information provided in this section are designed to assist operators using FAA Form 7233-4 to file IFR flight plans for flights that will be conducted entirely within U.S. domestic airspace. Requirements and procedures for operating outside U.S. domestic airspace may vary significantly from country to country. It is, therefore, recommended that operators planning flights outside U.S. domestic airspace become familiar with applicable international documents, including Aeronautical Information Publications (AIP); and ICAO Document 4444, Procedures for Air Navigation Services/Air Traffic Management, Appendix 2.

**NOTE-**

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

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

**EXAMPLE-**

*N235RA, AAL3342, BONGO33*

**NOTE-**

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

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

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

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

- (1) **S** if scheduled air service
- (2) **N** if non-scheduled air transport operation
- (3) **G** if general aviation

(4) **M** if military

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

**NOTE-**

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

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

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

**(b) Type of Aircraft.**

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

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

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

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

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

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

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

**4. Item 10. Equipment**

FIG 5-1-3  
FAA International Flight Plan Form 7233-4 (9-06)

Form Approved OMB No. 2120-0026  
09/30/2006

U.S. Department of Transportation Federal Aviation Administration		<b>International Flight Plan</b>	
PRIORITY <b>&lt;=FF</b>	ADDRESSEE(S) _____ _____		
FILING TIME ____	ORIGINATOR _____	<b>&lt;=</b>	
SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR _____			
3 MESSAGE TYPE <b>&lt;=(FPL</b>	7 AIRCRAFT IDENTIFICATION ____	8 FLIGHT RULES ____	TYPE OF FLIGHT ____ <b>&lt;=</b>
9 NUMBER ____	TYPE OF AIRCRAFT ____	WAKE TURBULENCE CAT. / ____	10 EQUIPMENT ____/____ <b>&lt;=</b>
13 DEPARTURE AERODROME ____		TIME ____	<b>&lt;=</b>
15 CRUISING SPEED ____	LEVEL ____	ROUTE ____	
16 DESTINATION AERODROME ____			TOTAL EET HR MIN ____
18 OTHER INFORMATION ____		ALTN AERODROME ____	2ND ALTN AERODROME ____ <b>&lt;=</b>
SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)			<b>&lt;=</b>
19 ENDURANCE HR MIN <b>E/</b> ____	PERSONS ON BOARD <b>P/</b> ____	EMERGENCY RADIO UHF VHF ELBA <b>R/</b> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
SURVIVAL EQUIPMENT POLAR DESERT MARITIME JUNGLE <input type="checkbox"/> / <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>		JACKETS LIGHT FLUORES UH VHF <input type="checkbox"/> / <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
DINGHIES NUMBER CAPACITY COVER <b>D/</b> ____	COLOR _____	<b>&lt;=</b>	
AIRCRAFT COLOR AND MARKINGS <b>A/</b> _____			
REMARKS <b>N/</b> _____			<b>&lt;=</b>
PILOT-IN-COMMAND <b>C/</b> _____		<b>)&lt;=</b>	
FILED BY	ACCEPTED BY	ADDITIONAL INFORMATION	

FAA Form 7233-4 (7-93)

**Pre-Flight Pilot Checklist**

Aircraft Identification			Time of Briefing			
Weather <small>(Destination) (Alternate)</small>	<input type="checkbox"/> Present	Remarks	<b>Report Weather Conditions Aloft</b>			
	<input type="checkbox"/> Forecast		<i>Report immediately weather conditions encountered--particularly cloud tops, upper cloud layers, thunderstorms, ice, turbulence, winds and temperature</i>			
			Position	Altitude	Time	Weather Conditions
Weather <small>(En Route)</small>	<input type="checkbox"/> Present					
	<input type="checkbox"/> Forecast					
	<input type="checkbox"/> Pireps					
Winds Aloft	Best Crzg. Alt.					
Nav. Aid & Comm. Status.	<input type="checkbox"/> Destination					
	<input type="checkbox"/> En Route					
Airport Conditions	<input type="checkbox"/> Destination					
	<input type="checkbox"/> Alternate					
ADIZ	<input type="checkbox"/> Airspace Restrictions					
<b>Civil Aircraft Pilots</b>						
<p>FAR Part 91 states that each person operating a civil aircraft of U.S. registry over the high seas shall comply with Annex 2 to the <u>Convention of International Civil Aviation, International Standards - Rules of the Air</u>. Annex 2 requires the submission of a flight plan containing items 1-19 prior to operating any flight across international waters. Failure to file could result in a civil penalty not to exceed \$1,000 for each violation (Section 901 of the Federal Aviation Act of 1958, as amended).</p>						
<i>International briefing information may not be current or complete. Data should be secured, at the first opportunity, from the country in whose airspace the flight will be conducted.</i>						
<p><b>Paperwork Reduction Act Statement:</b> Flight Plan information is collected for the protection and identification of aircraft and property and persons on the ground. Air Traffic uses the information to provide control services and search and rescue services. An individual respondent would require about 2.5 minutes to provide the information. FAR Part 91 requires an Instrument Flight Rules (IFR) flight plan to operate under IFR in controlled airspace. Filing a Visual Flight Rules flight plan is recommended but not mandatory. It is FAA policy to make factual information available to persons properly and directly concerned except information held confidential for good cause, i.e., pilot's address/telephone number. All flight plan data is destroyed when 15 days old except for data retained due to an accident/incident investigation. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control number associated with this collection is 2120-0026. Comments concerning the accuracy of this burden and suggestions for reducing the burden should be directed to the FAA at: 800 Independence Ave SW, Washington, DC 20591, Attn: Information Collection Clearance Officer, ABA-20</p>						

*TBL 5-1-4*  
**Aircraft COM, NAV, and Approach Equipment Qualifiers**

INSERT one letter as follows:

N if no COM/NAV/approach aid equipment for the route to be flown is carried, or the equipment is unserviceable,

(OR)

S if standard COM/NAV/approach aid equipment for the route to be flown is carried and serviceable (see Note 1),

(AND/OR)

INSERT one or more of the following letters to indicate the COM/NAV/approach aid equipment available and serviceable:

**NOTE-**

*The capabilities described below comprise the following elements:*

- a. Presence of relevant serviceable equipment on board the aircraft.*
- b. Equipment and capabilities commensurate with flight crew qualifications.*
- c. Where applicable, authorization from the appropriate authority.*

A	GBAS landing system	L	ILS
B	LPV (APV with SBAS)	M1	ATC RTF SATCOM (INMARSAT)
C	LORAN C	M2	ATC RTF (MTSAT)
D	DME	M3	ATC RTF (Iridium)
E1	FMC WPR ACARS	O	VOR
E2	D-FIS ACARS	P1	CPDLC RCP 400 (See Note 7.)
E3	PDC ACARS	P2	CPDLC RCP 240 (See Note 7.)
F	ADF	P3	SATVOICE RCP 400 (See Note 7.)
G	(GNSS) (See Note 2.)	P4- P9	Reserved for RCP
H	HF RTF	R	PBN approved (See Note 4.)
I	Inertial navigation	T	TACAN
J1	CPDLC ATN VDL Mode 2 (See Note 3.)	U	UHF RTF
J2	CPDLC FANS 1/A HF DL	V	VHF RTF
J3	CPDLC FANS 1/A VDL Mode 4	W	RVSM approved
J4	CPDLC FANS 1/A VDL Mode 2	X	MNPS approved/North Atlantic (NAT) High Level Airspace (HLA) approved
J5	CPDLC FANS 1/A SATCOM (INMARSAT)	Y	VHF with 8.33 kHz channel spacing capability
J6	CPDLC FANS 1/A SATCOM (MTSAT)	Z	Other equipment carried or other capabilities (See Note 5.)
J7	CPDLC FANS 1/A SATCOM (Iridium)		

**NOTE-**

- 1.** *If the letter S is used, standard equipment is considered to be VHF RTF, VOR, and ILS within U.S. domestic airspace.*
- 2.** *If the letter G is used, the types of external GNSS augmentation, if any, are specified in Item 18 following the indicator NAV/ and separated by a space.*
- 3.** *See RTCA/EUROCAE Interoperability Requirements Standard For ATN Baseline 1 (ATN B1 INTEROP Standard – DO-280B/ED-110B) for data link services air traffic control clearance and information/air traffic control communications management/air traffic control microphone check.*
- 4.** *If the letter R is used, the performance-based navigation levels that are authorized must be specified in Item 18 following the indicator PBN/. For further details, see Paragraph 5-1-9 b 8, Item 18 (c) and (d).*

5. If the letter Z is used, specify in Item 18 the other equipment carried, preceded by COM/, DAT/, and/or NAV/, as appropriate.
6. Information on navigation capability is provided to ATC for clearance and routing purposes.
7. Guidance on the application of performance-based communication, which prescribes RCP to an air traffic service in a specific area, is contained in the Performance-Based Communication and Surveillance (PBCS) Manual (Doc 9869).

**TBL 5-1-5**

**Aircraft Surveillance Equipment, Including Designators for Transponder, ADS-B, ADS-C, and Capabilities**

<i>INSERT N</i> if no surveillance equipment for the route to be flown is carried, or the equipment is unserviceable, OR <i>INSERT</i> one or more of the following descriptors, to a maximum of 20 characters, to describe the serviceable surveillance equipment and/or capabilities on board:	
<b>SSR Modes A and C</b>	
A	Transponder - Mode A (4 digits – 4096 codes)
C	Transponder - Mode A (4 digits – 4096 codes) and Mode C
<b>SSR Mode S</b>	
E	Transponder - Mode S, including aircraft identification, pressure-altitude and extended squitter (ADS-B) capability
H	Transponder - Mode S, including aircraft identification, pressure-altitude and enhanced surveillance capability
I	Transponder - Mode S, including aircraft identification, but no pressure-altitude capability
L	Transponder - Mode S, including aircraft identification, pressure-altitude, extended squitter (ADS B) and enhanced surveillance capability
P	Transponder - Mode S, including pressure-altitude, but no aircraft identification capability
S	Transponder - Mode S, including both pressure-altitude and aircraft identification capability
X	Transponder - Mode S with neither aircraft identification nor pressure-altitude capability
<b>NOTE–</b> <i>Enhanced surveillance capability is the ability of the aircraft to down-link aircraft derived data via a Mode S transponder.</i>	
<b>Followed by one or more of the following codes if the aircraft has ADS-B capability:</b>	
B1	ADS-B with dedicated 1090 MHz ADS-B “out” capability
B2	ADS-B with dedicated 1090 MHz ADS-B “out” and “in” capability
U1	ADS-B “out” capability using UAT
U2	ADS-B “out” and “in” capability using UAT
V1	ADS-B “out” capability using VDL Mode 4
V2	ADS-B “out” and “in” capability using VDL Mode 4
<b>NOTE–</b> <i>File no more than one code for each type of capability; for example, file B1 or B2, but not both.</i>	
<b>Followed by one or more of the following codes if the aircraft has ADS-C capability:</b>	
D1	ADS-C with FANS 1/A capabilities
G1	ADS-C with ATN capabilities

**EXAMPLE–**

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

### 5. Item 13. Departure Aerodrome/Time

(a) Insert the ICAO four-letter location indicator of the departure aerodrome, or

**NOTE-**

ICAO location indicators must consist of 4 letters. Airport identifiers such as 51A7, 39LL and Z40 are not in ICAO standard format.

(b) If no four-letter location indicator has been assigned to the departure aerodrome, insert ZZZZ and specify the non-ICAO location identifier, or fix/radial/distance from a nearby NAVAID, followed by the name of the aerodrome, in Item 18, following characters DEP/,

(c) Then, without a space, insert the estimated off-block time.

**EXAMPLE-**

1. KSMF2215

2. ZZZZ0330

### 6. Item 15. Cruise Speed, Level and Route

(a) Cruise Speed (maximum 5 characters). Insert the true airspeed for the first or the whole cruising portion of the flight, in terms of knots, expressed as N followed by 4 digits (e.g. N0485), or Mach number to the nearest hundredth of unit Mach, expressed as M followed by 3 digits (for example, M082).

(b) Cruising level (maximum 5 characters). Insert the planned cruising level for the first or the whole portion of the route to be flown, in terms of flight level, expressed as F followed by 3 figures (for example, F180; F330), or altitude in hundreds of feet, expressed as A followed by 3 figures (for example, A040; A170).

(c) Route. Insert the requested route of flight in accordance with guidance below.

**NOTE-**

Speed and/or altitude changes en route will be accepted by FAA computer systems, but will not be processed or forwarded to controllers. Pilots are expected to maintain the last assigned altitude and request revised altitude clearances directly from ATC.

(d) Insert the desired route of flight using a combination of published routes and/or fixes in the following formats:

(1) Consecutive fixes, NAVAIDs and waypoints should be separated by the characters “DCT”, meaning direct.

**EXAMPLE-**

FLACK DCT IRW DCT IRW125023

**NOTE-**

IRW125023 identifies the fix located on the Will Rogers VORTAC 125 radial at 23 DME.

(2) Combinations of published routes, and fixes, NAVAIDs or waypoints should be separated by a single space.

**EXAMPLE-**

WORTH5 MQP V66 ABI V385

(3) Although it is recommended that filed airway junctions be identified using a named junction fix when possible, there may be cases where it is necessary to file junctioning airways without a named fix. In these cases, separate consecutive airways with a space.

**EXAMPLE-**

V325 V49

**NOTE-**

This method of filing an airway junction may result in a processing ambiguity. This might cause the flight plan to be rejected in some cases.

### 7. Item 16. Destination Aerodrome, Total EET, Alternate and 2nd Alternate Aerodrome

(a) Destination Aerodrome and Total Estimated Elapsed Time (EET).

(1) Insert the ICAO four-letter location identifier for the destination aerodrome; or, if no ICAO location identifier has been assigned, (Location identifiers, such as WY66, A08, and 5B1, are not an ICAO standard format),

(2) Insert ZZZZ and specify the non-ICAO location identifier, or fix/radial/distance from a nearby NAVAID, followed the name of the aerodrome, in Item 18, following characters DEST/,

(3) Then, without a space, insert the total estimated time en route to the destination.

**EXAMPLE-**

1. KOKC0200

2. ZZZZ0330

(b) Alternate and 2nd Alternate Aerodrome (Optional).

(1) Following the intended destination, insert the ICAO four-letter location identifier(s) of



alternate aerodromes; or, if no location identifier(s) have been assigned;

(2) Insert ZZZZ and specify the name of the aerodrome in Item 18, following the characters ALTN/.

**EXAMPLE-**

1. KDFW0234 KPWA

2. KBOS0304 ZZZZ

**NOTE-**

Although alternate airport information filed in an FPL will be accepted by air traffic computer systems, it will not be presented to controllers. If diversion to an alternate airport becomes necessary, pilots are expected to notify ATC and request an amended clearance.

**8. Item 18. Other Information**

(a) Insert 0 (zero) if no other information; or, any other necessary information in the sequence shown below, in the form of the appropriate indicator followed by an oblique stroke and the information to be recorded:

**NOTE-**

1. Operators are warned that the use of indicators not included in the provisions may result in data being rejected, processed incorrectly, or lost.

2. Hyphens “-” or oblique strokes “/” should only be used as described.

3. Avoid use of any other special characters in Field 18 information- use only letters and numbers.

4. An indicator without any associated information will result in flight plan rejection.

(b) STS/ Reason for special handling by ATS as follows:

(1) ALTRV: For a flight operated in accordance with an altitude reservation.

(2) ATFMX: For a flight approved for exemption from ATFM measures by the appropriate ATS authority.

(3) FFR: Fire-fighting.

(4) FLTCK: Flight check for calibration of NAVAIDs.

(5) HAZMAT: For a flight carrying hazardous material.

(6) HEAD: A flight with Head of State status.

(7) HOSP: For a medical flight declared by medical authorities.

(8) HUM: For a flight operating on a humanitarian mission.

(9) MARSAS: For a flight for which a military entity assumes responsibility for separation of military aircraft.

(10) MEDEVAC: For a life critical medical emergency evacuation.

(11) NONRVSM: For a non-RVSM capable flight intending to operate in RVSM airspace.

(12) SAR: For a flight engaged in a search and rescue mission.

(13) STATE: For a flight engaged in military, customs, or police services.

**NOTE-**

Other reasons for special handling by ATS are denoted under the designator RMK/.

(c) PBN/ Indication of RNAV and/or RNP capabilities. Include as many of the descriptors below as apply to the flight, up to a maximum of 8 entries; that is a total of not more than 16 characters.

**TBL 5-1-6  
PBN/RNAV Specifications**

PBN/	RNAV SPECIFICATIONS
A1	RNAV 10 (RNP 10)
B1	RNAV 5 all permitted sensors
B2	RNAV 5 GNSS
B3	RNAV 5 DME/DME
B4	RNAV 5 VOR/DME
B5	RNAV 5 INS or IRS
B6	RNAV 5 LORAN C
C1	RNAV 2 all permitted sensors
C2	RNAV 2 GNSS
C3	RNAV 2 DME/DME
C4	RNAV 2 DME/DME/IRU
D1	RNAV 1 all permitted sensors
D2	RNAV 1 GNSS
D3	RNAV 1 DME/DME
D4	RNAV 1 DME/DME/IRU

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

**NOTE-**  
Combinations of alphanumeric characters not indicated above are reserved.

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

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

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

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

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

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

**EXAMPLE-**

1. NAV/RNVD1 or NAV/RNVD1E0A0 (Same meaning)
2. NAV/RNVA1 or NAV/RNVD0E0A1 (Same meaning)
3. NAV/RNVE2 or NAV/RNVD0E2A0 (Same meaning)
4. NAV/RNVD1A1 or NAV/RNVD1E0A1 (Same meaning)
5. NAV/RNVD1E2A1

**NOTE-**

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

2. Aircraft certification requirements for RNAV operations within U.S. airspace are defined in AC 20-138, Airworthiness Approval of Positioning and Navigation Systems, and AC 90-100, U.S. Terminal and En Route Area Navigation (RNAV) Operations.

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

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

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

(g) SUR/ Indicate surveillance capabilities not specified in Item 10b, when requested by an Air Navigation Service Provider.

(1) If ADS-B capability filed in Item 10 is compliant with RTCA DO-260B, include the item “260B” in SUR/. If ADS-B capability filed in Item 10 is compliant with RTCA DO-282B, include the item “282B” in SUR/.

**EXAMPLE-**

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

(2) When Required Surveillance Performance (RSP) Capability has been filed in SUR/, this can be conveyed by inserting the character “Z” in Item 10 and “SUR/” in field 18 followed by the appropriate RSP performance per the following:

[a] For RSP 180 – flight plan RSP180

[b] For RSP 400 – flight plan RSP400

**EXAMPLE-**

1. SUR/ RSP180
2. SUR/ RSP400
3. SUR/ RSP180 RSP400

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

**EXAMPLE-**

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

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

**EXAMPLE-**

1. DEST/T23 ALBANY MUNI

2. DEST/PIE335033 LEXI DUNES

3. DEST/4620N07805W

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

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

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

**EXAMPLE-**

EET/KZLA0745 KZAB0830

(m) SEL/ SELCAL code.

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

**EXAMPLE-**

1. TYP/Homebuilt

2. TYP/2 P51 B17 B24

(o) CODE/ Aircraft address (expressed in the form of an alphanumeric code of six hexadecimal characters) when required by the appropriate ATS authority. Include CODE/ when ADS-B capability is filed in Item 10.

**EXAMPLE-**

"F00001" is the lowest aircraft address contained in the specific block administered by ICAO.

(p) DLE/ En route delay or holding, insert the significant point(s) on the route where a delay is planned to occur, followed by the length of delay using four figure time in hours and minutes (hhmm).

**EXAMPLE-**

DLE/MDG0030

(q) OPR/ Name of the operator, if not obvious from the aircraft identification in Item 7.

(r) ORGN/ The originator's 8-letter AFTN address or other appropriate contact details, in cases where the originator of the flight plan may not be readily identified, as required by the appropriate ATS authority. The FAA does not require ORGN/ information.

**NOTE-**

In some areas, flight plan reception centers may insert the ORGN/ identifier and originator's AFTN address automatically.

(s) PER/ Aircraft performance data, indicated by a single letter as specified in the Procedures for Air Navigation Services - Aircraft Operations (PANS-OPS, Doc 8168), Volume I - Flight Procedures, if so prescribed by the appropriate ATS authority. Note that the FAA does not require PER/ information.

(t) ALTN/ Name of destination alternate aerodrome(s), if ZZZZ is inserted in Item 16.

**EXAMPLE-**

1. ALTN/F35 POSSUM KINGDOM

2. ALTN/TCC233016 LAZY S RANCH

(u) RALT/ ICAO 4-letter indicator(s) for en-route alternate(s), as specified in Doc 7910, Location Indicators, or name(s) of en-route alternate aerodrome(s), if no indicator is allocated. For aerodromes not listed in the relevant Aeronautical Information Publication, indicate location in LAT/LONG or bearing and distance from the nearest significant point, as described in DEP/ above.

(v) TALT/ ICAO 4-letter indicator(s) for take-off alternate, as specified in Doc 7910, Location Indicators, or name of take-off alternate aerodrome, if no indicator is allocated. For aerodromes not listed in the relevant Aeronautical Information Publication, indicate location in LAT/LONG or bearing and distance from the nearest significant point, as described in DEP/ above.

(w) RIF/ The route details to the revised destination aerodrome, followed by the ICAO four-letter location indicator of the aerodrome. The revised route is subject to reclearance in flight.

**EXAMPLE-**

1. RIF/DTA HEC KLAX

2. RIF/ESP G94 CLA YPPH

(x) RMK/ Any other plain-language remarks when required by the ATC or deemed necessary.

**EXAMPLE-****1. RMK/NRP****2. RMK/DRVSN**

(y) RVR/ The minimum RVR requirement of the flight in meters. This item is defined by Eurocontrol, not ICAO. The FAA does not require or use this item, but will accept it in a flight plan.

**NOTE-**

*This provision is detailed in the European Regional Supplementary Procedures (EUR SUPPs, Doc 7030), Chapter 2.*

(z) RFP/ Q followed by a digit to indicate the sequence of the replacement flight plan being submitted. This item is defined by Eurocontrol, not ICAO. The FAA will not use this item, but will accept it in a flight plan.

**NOTE-**

*This provision is detailed in the European Regional Supplementary Procedures (EUR SUPPs, Doc 7030), chapter 2.*

**9. Item 19. Supplementary Information****NOTE-**

*Item 19 data must be included when completing FAA Form 7233-4. This information will be retained by the facility/organization that transmits the flight plan to Air Traffic Control (ATC), for Search and Rescue purposes, but it will not be transmitted to ATC as part of the FPL.*

(a) E/ (ENDURANCE). Insert 4-digits group giving the fuel endurance in hours and minutes.

(b) P/ (PERSONS ON BOARD). Insert the total number of persons (passengers and crew) on board.

(c) Emergency and survival equipment

(1) R/ (RADIO).

[a] Cross out “UHF” if frequency 243.0 MHz is not available.

[b] Cross out “VHF” frequency 121.5 MHz is not available.

[c] Cross out “ELBA” if emergency locator transmitter (ELT) is not available.

(2) S/ (SURVIVAL EQUIPMENT).

[a] Cross out “POLAR” if polar survival equipment is not carried.

[b] Cross out “DESERT” if desert survival equipment is not carried.

[c] Cross out “MARITIME” if maritime survival equipment is not carried.

[d] Cross out J if “JUNGLE” survival equipment is not carried.

(3) J/ (JACKETS).

[a] Cross out “LIGHT” if life jackets are not equipped with lights.

[b] Cross out “FLUORES” if life jackets are not equipped with fluorescein.

[c] Cross out “UHF” or “VHF” or both as in R/ above to indicate radio capability of jackets, if any.

(4) D/ (DINGHIES).

[a] NUMBER. Cross out indicators “NUMBER” and “CAPACITY” if no dinghies are carried, or insert number of dinghies carried; and

[b] CAPACITY. Insert total capacity, in persons, of all dinghies carried; and

[c] COVER. Cross out indicator “COVER” if dinghies are not covered; and

[d] COLOR. Insert color of dinghies if carried.

(5) A/ (AIRCRAFT COLOR AND MARKINGS). Insert color of aircraft and significant markings.

(6) N/ (REMARKS). Cross out indicator N if no remarks, or indicate any other survival equipment carried and any other remarks regarding survival equipment.

(7) C/ (PILOT). Insert name of pilot-in-command.

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

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

**REFERENCE-**

*14 CFR Section 91.167.*

*AIM, Paragraph 4-1-19, Tower En Route Control (TEC)*

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

**1.** An IFR flight to an airport where the Minimum Descent Altitudes (MDAs) or landing visibility minimums for *all instrument approaches* are higher than the forecast weather minimums specified in 14 CFR Section 91.167(b). For example, there are 3 high altitude airports in the U.S. with approved instrument approach procedures where all of the MDAs are greater than 2,000 feet and/or the landing visibility minimums are greater than 3 miles (Bishop, California; South Lake Tahoe, California; and Aspen–Pitkin Co./Sardy Field, Colorado). In the case of these airports, it is possible for a pilot to elect, on the basis of forecasts, not to carry sufficient fuel to get to an alternate when the ceiling and/or visibility is actually lower than that necessary to complete the approach.

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

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

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

**a.** When conducting flights, particularly extended flights, outside the U.S. and its territories, full account should be taken of the amount and quality of air navigation services available in the airspace to be

traversed. Every effort should be made to secure information on the location and range of navigational aids, availability of communications and meteorological services, the provision of air traffic services, including alerting service, and the existence of search and rescue services.

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

#### **REFERENCE–**

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

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

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

**e.** Current NOTAMs for foreign locations must also be reviewed. The Notices to Airmen Publication (NTAP), published every 28 days, contains considerable information pertinent to foreign flight. For additional flight information at foreign locations,

pilots should also review the FAA's Prohibitions, Restrictions, and Notices website at [https://www.faa.gov/air\\_traffic/publications/us\\_restrictions/](https://www.faa.gov/air_traffic/publications/us_restrictions/).

**f.** When customs notification to foreign locations is required, it is the responsibility of the pilot to arrange for customs notification in a timely manner.

**g.** Aircraft arriving to locations in U.S. territorial airspace must meet the entry requirements as described in AIM Section 6, National Security and Interception Procedures.

### 5-1-12. Change in Flight Plan

**a.** In addition to altitude or flight level, destination and/or route changes, increasing or decreasing the speed of an aircraft constitutes a change in a flight plan. Therefore, at any time the average true airspeed at cruising altitude between reporting points varies or is expected to vary from that given in the flight plan by *plus or minus 5 percent, or 10 knots, whichever is greater*, ATC should be advised.

**b.** All changes to existing flight plans should be completed more than 46 minutes prior to the proposed departure time. Changes must be made with the initial flight plan service provider. If the initial flight plan's service provider is unavailable, filers may contact an ATC facility or FSS to make the necessary revisions. Any revision 46 minutes or less from the proposed departure time must be coordinated through an ATC facility or FSS.

### 5-1-13. Change in Proposed Departure Time

**a.** To prevent computer saturation in the en route environment, parameters have been established to delete proposed departure flight plans which have not been activated. Most centers have this parameter set so as to delete these flight plans a minimum of 2 hours after the proposed departure time or Expect Departure Clearance Time (EDCT). To ensure that a flight plan remains active, pilots whose actual departure time will be delayed 2 hours or more beyond their filed departure time, are requested to notify ATC of their new proposed departure time.

**b.** Due to traffic saturation, ATC personnel frequently will be unable to accept these revisions via

radio. It is recommended that you forward these revisions to a flight plan service provider or FSS.

### 5-1-14. Closing VFR/DVFR Flight Plans

A pilot is responsible for ensuring that his/her VFR or DVFR flight plan is canceled. You should close your flight plan with the nearest FSS, or if one is not available, you may request any ATC facility to relay your cancellation to the FSS. Control towers do not automatically close VFR or DVFR flight plans since they do not know if a particular VFR aircraft is on a flight plan. If you fail to report or cancel your flight plan within  $\frac{1}{2}$  hour after your ETA, search and rescue procedures are started.

#### REFERENCE-

14 CFR Section 91.153.

14 CFR Section 91.169.

### 5-1-15. Canceling IFR Flight Plan

**a.** 14 CFR Sections 91.153 and 91.169 include the statement "When a flight plan has been activated, the pilot-in-command, upon canceling or completing the flight under the flight plan, must notify an FAA Flight Service Station or ATC facility."

**b.** An IFR flight plan may be canceled at any time the flight is operating in VFR conditions outside Class A airspace by pilots stating "CANCEL MY IFR FLIGHT PLAN" to the controller or air/ground station with which they are communicating. Immediately after canceling an IFR flight plan, a pilot should take the necessary action to change to the appropriate air/ground frequency, VFR radar beacon code and VFR altitude or flight level.

**c.** ATC separation and information services will be discontinued, including radar services (where applicable). Consequently, if the canceling flight desires VFR radar advisory service, the pilot must specifically request it.

#### NOTE-

*Pilots must be aware that other procedures may be applicable to a flight that cancels an IFR flight plan within an area where a special program, such as a designated TRSA, Class C airspace, or Class B airspace, has been established.*

**d.** If a DVFR flight plan requirement exists, the pilot is responsible for filing this flight plan to replace the canceled IFR flight plan. If a subsequent IFR operation becomes necessary, a new IFR flight plan must be filed and an ATC clearance obtained before operating in IFR conditions.

e. If operating on an IFR flight plan to an airport with a functioning control tower, the flight plan is automatically closed upon landing.

f. If operating on an IFR flight plan to an airport where there is no functioning control tower, the pilot must initiate cancellation of the IFR flight plan. This can be done after landing if there is a functioning FSS or other means of direct communications with ATC. In the event there is no FSS and/or air/ground communications with ATC is not possible below a certain altitude, the pilot should, weather conditions permitting, cancel the IFR flight plan while still airborne and able to communicate with ATC by radio. This will not only save the time and expense of canceling the flight plan by telephone but will quickly release the airspace for use by other aircraft.

### 5-1-16. RNAV and RNP Operations

a. During the pre-flight planning phase the availability of the navigation infrastructure required for the intended operation, including any non-RNAV contingencies, must be confirmed for the period of intended operation. Availability of the onboard navigation equipment necessary for the route to be flown must be confirmed.

b. If a pilot determines a specified RNP level cannot be achieved, revise the route or delay the operation until appropriate RNP level can be ensured.

c. The onboard navigation database must be current and appropriate for the region of intended operation and must include the navigation aids, waypoints, and coded terminal airspace procedures for the departure, arrival and alternate airfields.

d. During system initialization, pilots of aircraft equipped with a Flight Management System or other RNAV-certified system, must confirm that the navigation database is current, and verify that the aircraft position has been entered correctly. Flight crews should crosscheck the cleared flight plan against charts or other applicable resources, as well as the navigation system textual display and the aircraft map display. This process includes confirmation of the waypoints sequence, reasonableness of track angles and distances, any altitude or speed constraints, and identification of fly-by or fly-over waypoints. A procedure must not be used if validity of the navigation database is in doubt.

e. Prior to commencing takeoff, the flight crew must verify that the RNAV system is operating correctly and the correct airport and runway data have been loaded.

f. During the pre-flight planning phase RAIM prediction must be performed if TSO-C129() equipment is used to solely satisfy the RNAV and RNP requirement. GPS RAIM availability must be confirmed for the intended route of flight (route and time) using current GPS satellite information. In the event of a predicted, continuous loss of RAIM of more than five (5) minutes for any part of the intended flight, the flight should be delayed, canceled, or re-routed where RAIM requirements can be met. Operators may satisfy the predictive RAIM requirement through any one of the following methods:

1. Operators may monitor the status of each satellite in its plane/slot position, by accounting for the latest GPS constellation status (for example, NOTAMs or NANUs), and compute RAIM availability using model-specific RAIM prediction software;

2. Operators may use the Service Availability Prediction Tool (SAPT) on the FAA en route and terminal RAIM prediction website;

3. Operators may contact a Flight Service Station to obtain non-precision approach RAIM;

4. Operators may use a third party interface, incorporating FAA/VOLPE RAIM prediction data without altering performance values, to predict RAIM outages for the aircraft's predicted flight path and times;

5. Operators may use the receiver's installed RAIM prediction capability (for TSO-C129a/Class A1/B1/C1 equipment) to provide non-precision approach RAIM, accounting for the latest GPS constellation status (for example, NOTAMs or NANUs). Receiver non-precision approach RAIM should be checked at airports spaced at intervals not to exceed 60 NM along the RNAV 1 procedure's flight track. "Terminal" or "Approach" RAIM must be available at the ETA over each airport checked; or,

6. Operators not using model-specific software or FAA/VOLPE RAIM data will need FAA operational approval.

**NOTE-**

*If TSO-C145/C146 equipment is used to satisfy the RNAV and RNP requirement, the pilot/operator need not perform the prediction if WAAS coverage is confirmed to be*

*available along the entire route of flight. Outside the U.S. or in areas where WAAS coverage is not available, operators using TSO-C145/C146 receivers are required to check GPS RAIM availability.*

### **5-1-17. Cold Temperature Operations**

Pilots should begin planning for operating into airports with cold temperatures during the preflight planning phase. Instrument approach charts will contain a snowflake symbol and a temperature when cold temperature correction must be applied. Pilots operating into airports requiring cold temperature corrections should request the lowest forecast temperature at the airport for departure and arrival times. If the temperature is forecast to be at or below any published cold temperature restriction, calculate an altitude correction for the appropriate segment(s)

and/or review procedures for operating automatic cold temperature compensating systems, as applicable. The pilot is responsible to calculate and apply the corrections to the affected segment(s) when the actual reported temperature is at or below any published cold temperature restriction, or pilots with automatic cold temperature compensating systems must ensure the system is on and operating on each designated segment. Advise ATC when intending to apply cold temperature correction and of the amount of correction required on initial contact (or as soon as possible) for the intermediate segment and/or the published missed approach. This information is required for ATC to provide aircraft appropriate vertical separation between known traffic.

**REFERENCE-**

*AIM, Paragraph 7-2-3, Altimeter Errors*

*AIM TBL 7-2-3, ICAO Cold Temperature Error*



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/ADS-B 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).*

**4. Expect Departure Clearance Time (EDCT).** The EDCT is the runway release time assigned to an aircraft included in traffic management programs. Aircraft are expected to depart no earlier than 5 minutes before, and no later than 5 minutes after the EDCT.

b. If practical, pilots departing uncontrolled airports should obtain IFR clearances prior to becoming airborne when two-way communications with the controlling ATC facility is available.

## 5–2–8. Departure Control

a. Departure Control is an approach control function responsible for ensuring separation between departures. So as to expedite the handling of departures, Departure Control may suggest a takeoff direction other than that which may normally have been used under VFR handling. Many times it is preferred to offer the pilot a runway that will require the fewest turns after takeoff to place the pilot on course or selected departure route as quickly as possible. At many locations particular attention is paid to the use of preferential runways for local noise abatement programs, and route departures away from congested areas.

b. Departure Control utilizing radar will normally clear aircraft out of the terminal area using DPs via radio navigation aids.

1. When a departure is to be vectored immediately following takeoff, the pilot will be advised prior to takeoff of the initial heading to be flown but may not be advised of the purpose of the heading. When the initial heading will take the aircraft off an assigned procedure (for example, an RNAV SID with a published lateral path to a waypoint and crossing restrictions from the departure end of runway), the controller will assign an altitude to maintain with the initial heading and, if necessary, a speed to maintain.

2. At some airports when a departure will fly an RNAV SID that begins at the runway, ATC may advise aircraft of the initial fix/waypoint on the RNAV route. The purpose of the advisory is to remind pilots to verify the correct procedure is programmed in the FMS before takeoff. Pilots must immediately advise ATC if a different RNAV SID is entered in the aircraft’s FMC. When this advisory is absent, pilots are still required to fly the assigned SID as published.

**EXAMPLE–**

*Delta 345 RNAV to MPASS, Runway26L, cleared for takeoff.*

**NOTE–**

1. *The SID transition is not restated as it is contained in the ATC clearance.*

2. *Aircraft cleared via RNAV SIDs designed to begin with a vector to the initial waypoint are assigned a heading before departure.*

3. Pilots operating in a radar environment are expected to associate departure headings or an RNAV departure advisory with vectors or the flight path to

their planned route or flight. When given a vector taking the aircraft off a previously assigned nonradar route, the pilot will be advised briefly what the vector is to achieve. Thereafter, radar service will be provided until the aircraft has been reestablished “on-course” using an appropriate navigation aid and the pilot has been advised of the aircraft’s position or a handoff is made to another radar controller with further surveillance capabilities.

c. Controllers will inform pilots of the departure control frequencies and, if appropriate, the transponder code before takeoff. Pilots must ensure their transponder/ADS-B is adjusted to the “on” or normal operating position as soon as practical and remain on during all operations unless otherwise requested to change to “standby” by ATC. Pilots should not change to the departure control frequency until requested. Controllers may omit the departure control frequency if a DP has or will be assigned and the departure control frequency is published on the DP.

### **5-2-9. Instrument Departure Procedures (DP) – Obstacle Departure Procedures (ODP), Standard Instrument Departures (SID), and Diverse Vector Areas (DVA)**

a. Instrument departure procedures are pre-planned instrument flight rule (IFR) procedures which provide obstruction clearance from the terminal area to the appropriate en route structure. There are two types of DPs, Obstacle Departure Procedures (ODP), printed either textually or graphically, and Standard Instrument Departures (SID), always printed graphically. All DPs, either textual or graphic may be designed using either conventional or RNAV criteria. RNAV procedures will have RNAV printed in the title; for example, SHEAD TWO DEPARTURE (RNAV). ODPs provide obstruction clearance via the least onerous route from the terminal area to the appropriate en route structure. ODPs are recommended for obstruction clearance and may be flown without ATC clearance unless an alternate departure procedure (SID or radar vector) has been specifically assigned by ATC. Graphic ODPs will have (OBSTACLE) printed in the procedure title; for example, GEYSR THREE DEPARTURE (OBSTACLE), or, CROWN ONE DEPARTURE (RNAV) (OBSTACLE). Standard Instrument Departures are air traffic control (ATC) procedures printed for pilot/controller use in

graphic form to provide obstruction clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement and to reduce pilot/controller workload. ATC clearance must be received prior to flying a SID. All DPs provide the pilot with a way to depart the airport and transition to the en route structure safely.

b. A Diverse Vector Area (DVA) is an area in which ATC may provide random radar vectors during an uninterrupted climb from the departure runway until above the MVA/MIA, established in accordance with the TERPS criteria for diverse departures. The DVA provides obstacle and terrain avoidance in lieu of taking off from the runway under IFR using an ODP or SID.

c. Pilots operating under 14 CFR Part 91 are strongly encouraged to file and fly a DP at night, during marginal Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC), when one is available. The following paragraphs will provide an overview of the DP program, why DPs are developed, what criteria are used, where to find them, how they are to be flown, and finally pilot and ATC responsibilities.

d. Why are DPs necessary? The primary reason is to provide obstacle clearance protection information to pilots. A secondary reason, at busier airports, is to increase efficiency and reduce communications and departure delays through the use of SIDs. When an instrument approach is initially developed for an airport, the need for DPs is assessed. The procedure designer conducts an obstacle analysis to support departure operations. If an aircraft may turn in any direction from a runway within the limits of the assessment area (see paragraph 5-2-9e3) and remain clear of obstacles, that runway passes what is called a diverse departure assessment and no ODP will be published. A SID may be published if needed for air traffic control purposes. However, if an obstacle penetrates what is called the 40:1 obstacle identification surface, then the procedure designer chooses whether to:

1. Establish a steeper than normal climb gradient; or

2. Establish a steeper than normal climb gradient with an alternative that increases takeoff minima to allow the pilot to visually remain clear of the obstacle(s); or

3. Design and publish a specific departure route;  
or
4. A combination or all of the above.
- e. What criteria is used to provide obstruction clearance during departure?

1. Unless specified otherwise, required obstacle clearance for all departures, including diverse, is based on the pilot crossing the departure end of the runway at least 35 feet above the departure end of runway elevation, climbing to 400 feet above the departure end of runway elevation before making the initial turn, and maintaining a minimum climb gradient of 200 feet per nautical mile (FPNM), unless required to level off by a crossing restriction, until the minimum IFR altitude. A greater climb gradient may be specified in the DP to clear obstacles or to achieve an ATC crossing restriction. If an initial turn higher than 400 feet above the departure end of runway elevation is specified in the DP, the turn should be commenced at the higher altitude. If a turn is specified at a fix, the turn must be made at that fix. Fixes may have minimum and/or maximum crossing altitudes that must be adhered to prior to passing the fix. In rare instances, obstacles that exist on the extended runway centerline may make an “early turn” more desirable than proceeding straight ahead. In these cases, the published departure instructions will include the language “turn left(right) as soon as practicable.” These departures will also include a ceiling and visibility minimum of at least 300 and 1. Pilots encountering one of these DPs should preplan the climb out to gain altitude and begin the turn as quickly as possible within the bounds of safe operating practices and operating limitations. This type of departure procedure is being phased out.

**NOTE-**  
“Practical” or “feasible” may exist in some existing departure text instead of “practicable.”

2. ODPs, SIDs, and DVAs assume normal aircraft performance, and that all engines are operating. Development of contingency procedures, required to cover the case of an engine failure or other emergency in flight that may occur after liftoff, is the responsibility of the operator. (More detailed information on this subject is available in Advisory Circular AC 120-91, Airport Obstacle Analysis, and in the “Departure Procedures” section of chapter 2 in the Instrument Procedures Handbook, FAA-H-8083-16.)

3. The 40:1 obstacle identification surface (OIS) begins at the departure end of runway (DER) and slopes upward at 152 FPNM until reaching the minimum IFR altitude or entering the en route structure. This assessment area is limited to 25 NM from the airport in nonmountainous areas and 46 NM in designated mountainous areas. Beyond this distance, the pilot is responsible for obstacle clearance if not operating on a published route, if below (having not reached) the MEA or MOCA of a published route, or an ATC assigned altitude. See FIG 5-2-1. (Ref 14 CFR 91.177 for further information on en route altitudes.)

**NOTE-**

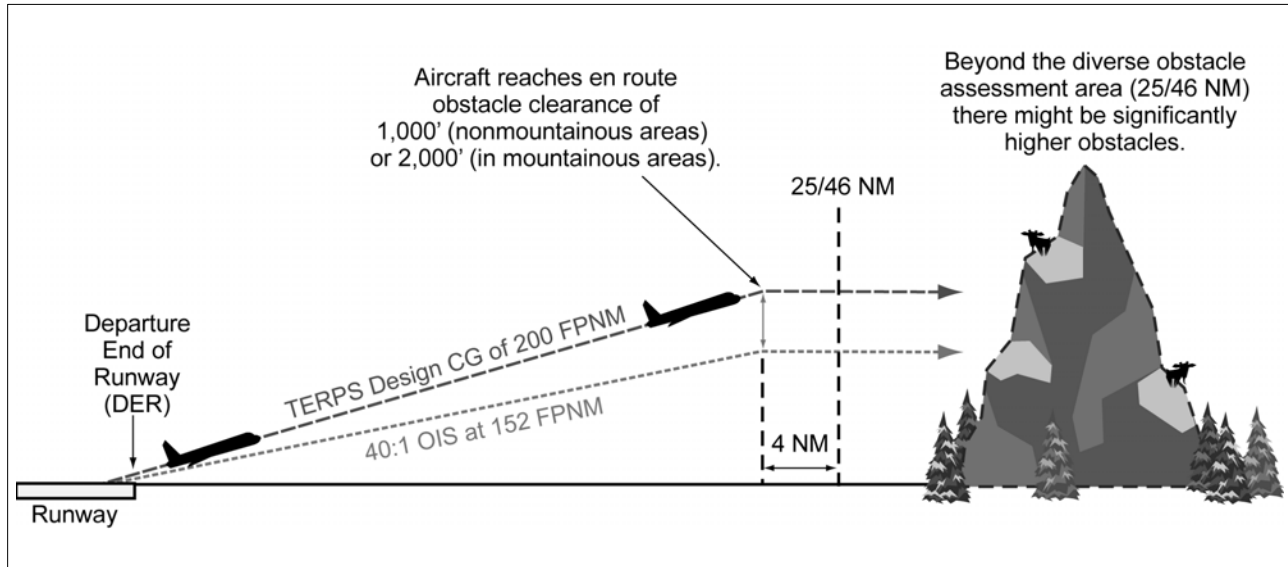
*ODPs are normally designed to terminate within these distance limitations, however, some ODPs will contain routes that may exceed 25/46 NM; these routes will ensure obstacle protection until reaching the end of the ODP.*

4. Obstacles that are located within 1 NM of the DER and penetrate the 40:1 OCS are referred to as “low, close-in obstacles.” The standard required obstacle clearance (ROC) of 48 feet per NM to clear these obstacles would require a climb gradient greater than 200 feet per NM for a very short distance, only until the aircraft was 200 feet above the DER. To eliminate publishing an excessive climb gradient, the obstacle AGL/MSL height and location relative to the DER is noted in the “Take-off Minimums and (OBSTACLE) Departure Procedures” section of a given Terminal Procedures Publication (TPP) booklet.

(a) Pilots must refer to the TPP booklet or the Graphic ODP for information on these obstacles. These obstacle notes will no longer be published on SIDs. Pilots assigned a SID for departure must refer to the airport entry in the TPP to obtain information on these obstacles.

(b) The purpose of noting obstacles in the “Take-off Minimums and (OBSTACLE) Departure Procedures” section of the TPP is to identify the obstacle(s) and alert the pilot to the height and location of the obstacle(s) so they can be avoided. This can be accomplished in a variety of ways; for example, the pilot may be able to see the obstruction and maneuver around the obstacle(s) if necessary; early liftoff/climb performance may allow the aircraft to cross well above the obstacle(s); or if the obstacle(s) cannot be visually acquired during departure, preflight planning should take into account what turns or other maneuvers may be necessary immediately after takeoff to avoid the obstruction(s).

FIG 5-2-1  
Diverse Departure Obstacle Assessment to 25/46 NM



**EXAMPLE-**

**TAKEOFF OBSTACLE NOTES:** Rwy 14, trees 2011' from DER, 29' left of centerline, 100' AGL/3829' MSL. Rwy 32, trees 1009' from DER, 697' left of centerline, 100' AGL/3839' MSL. Tower 4448' from DER, 1036' left of centerline, 165' AGL/3886' MSL.

**NOTE-**

Compliance with 14 CFR Part 121 or 135 one-engine-in-operative (OEI) departure performance requirements, or similar ICAO/State rules, cannot be assured by the sole use of "low, close-in" obstacle data as published in the TPP. Operators should refer to precise data sources (for example, GIS database, etc.) specifically intended for OEI departure planning for those operations.

5. Climb gradients greater than 200 FPNM are specified when required to support procedure design constraints, obstacle clearance, and/or airspace restrictions. Compliance with a climb gradient for these purposes is mandatory when the procedure is part of the ATC clearance, unless increased takeoff minimums are provided and weather conditions allow compliance with these minimums.

**NOTE-**

Climb gradients for ATC purposes are being phased out on SIDs.

**EXAMPLE-**

"Cross ALPHA intersection at or below 4000; maintain 6000." The pilot climbs at least 200 FPNM to 6000. If 4000 is reached before ALPHA, the pilot levels off at 4000 until passing ALPHA; then immediately resumes at least 200 FPNM climb.

**EXAMPLE-**

**"TAKEOFF MINIMUMS:** RWY 27, Standard with a minimum climb of 280' per NM to 2500." A climb of at least 280 FPNM is required to 2500 and is mandatory when the departure procedure is included in the ATC clearance.

**NOTE-**

Some SIDs still retain labeled "ATC" climb gradients published or have climb gradients that are established to meet a published altitude restriction that is not required for obstacle clearance or procedure design criteria. These procedures will be revised in the course of the normal procedure amendment process.

6. Climb gradients may be specified only to an altitude/fix, above which the normal gradient applies.

An ATC-required altitude restriction published at a fix, will not have an associated climb gradient published with that restriction. Pilots are expected to determine if crossing altitudes can be met, based on the performance capability of the aircraft they are operating.

**EXAMPLE-**

"Minimum climb 340 FPNM to ALPHA." The pilot climbs at least 340 FPNM to ALPHA, then at least 200 FPNM to MIA.

7. A Visual Climb Over Airport (VCOA) procedure is a departure option for an IFR aircraft, operating in visual meteorological conditions equal to or greater than the specified visibility and ceiling, to visually conduct climbing turns over the airport to the published "climb-to" altitude from which to proceed with the instrument portion of the departure. VCOA procedures are developed to avoid obstacles

greater than 3 statute miles from the departure end of the runway as an alternative to complying with climb gradients greater than 200 feet per nautical mile. Pilots are responsible to advise ATC as early as possible of the intent to fly the VCOA option prior to departure. These textual procedures are published in the Take-Off Minimums and (Obstacle) Departure Procedures section of the Terminal Procedures Publications and/or appear as an option on a Graphic ODP.

**EXAMPLE-**

*“Climb in visual conditions so as to cross the McElory Airport southbound, at or above 6000, then climb via Keemling radial zero three three to Keemling VORTAC.”*

f. Who is responsible for obstacle clearance? DPs are designed so that adherence to the procedure by the pilot will ensure obstacle protection. Additionally:

1. Obstacle clearance responsibility also rests with the pilot when he/she chooses to climb in visual conditions in lieu of flying a DP and/or depart under increased takeoff minima rather than fly the climb gradient. Standard takeoff minima are one statute mile for aircraft having two engines or less and one-half statute mile for aircraft having more than two engines. Specified ceiling and visibility minima (VCOA or increased takeoff minima) will allow visual avoidance of obstacles until the pilot enters the standard obstacle protection area. Obstacle avoidance is not guaranteed if the pilot maneuvers farther from the airport than the specified visibility minimum prior to reaching the specified altitude. DPs may also contain what are called Low Close in Obstacles. These obstacles are less than 200 feet above the departure end of runway elevation and within one NM of the runway end, and do not require increased takeoff minimums. These obstacles are identified on the SID chart or in the Take-off Minimums and (Obstacle) Departure Procedures section of the U. S. Terminal Procedure booklet. These obstacles are especially critical to aircraft that do not lift off until close to the departure end of the runway or which climb at the minimum rate. Pilots should also consider drift following lift-off to ensure sufficient clearance from these obstacles. That segment of the procedure that requires the pilot to see and avoid obstacles ends when the aircraft crosses the specified point at the required altitude. In all cases continued obstacle clearance is based on having

climbed a minimum of 200 feet per nautical mile to the specified point and then continuing to climb at least 200 foot per nautical mile during the departure until reaching the minimum en route altitude, unless specified otherwise.

2. ATC may vector the aircraft beginning with an ATC-assigned heading issued with the initial or takeoff clearance followed by subsequent vectors, if required, until reaching the minimum vectoring altitude by using a published Diverse Vector Area (DVA).

3. The DVA may be established below the Minimum Vectoring Altitude (MVA) or Minimum IFR Altitude (MIA) in a radar environment at the request of Air Traffic. This type of DP meets the TERPS criteria for diverse departures, obstacles, and terrain avoidance in which random radar vectors below the MVA/MIA may be issued to departing aircraft. The DVA has been assessed for departures which do not follow a specific ground track, but will remain within the specified area. Use of a DVA is valid only when aircraft are permitted to climb uninterrupted from the departure runway to the MVA/MIA (or higher). ATC will not assign an altitude below the MVA/MIA within a DVA.

(a) The existence of a DVA will be noted in the Takeoff Minimums and Obstacle Departure Procedure section of the U.S. Terminal Procedures Publication (TPP). The Takeoff Departure procedure will be listed first, followed by any applicable DVA.

**EXAMPLE-**

*DIVERSE VECTOR AREA (RADAR VECTORS)  
AMDT 1 14289 (FAA)*

*Rwy 6R, headings as assigned by ATC; requires minimum climb of 290' per NM to 400.*

*Rwys 6L, 7L, 7R, 24R, 25R, headings as assigned by ATC.*

(b) Pilots should be aware that a published climb gradient greater than the standard 200 FPNM can exist within a DVA. Pilots should note that the DVA has been assessed for departures which do not follow a specific ground track.

(c) ATC may also vector an aircraft off a previously assigned DP. If the aircraft is airborne and established on a SID or ODP and subsequently vectored off, ATC is responsible for terrain and obstruction clearance. In all cases, the minimum 200 FPNM climb gradient is assumed.

**NOTE—**

*As is always the case, when used by the controller during departure, the term “radar contact” should not be interpreted as relieving pilots of their responsibility to maintain appropriate terrain and obstruction clearance, which may include flying the obstacle DP.*

4. Pilots must preplan to determine if the aircraft can meet the climb gradient (expressed in feet per nautical mile) required by the departure procedure or DVA, and be aware that flying at a higher than anticipated ground speed increases the climb rate requirement in feet per minute. Higher than standard climb gradients are specified by a note on the departure procedure chart for graphic DPs, or in the Take-Off Minimums and (Obstacle) Departure Procedures section of the U.S. Terminal Procedures booklet for textual ODPs. The required climb gradient, or higher, must be maintained to the specified altitude or fix, then the standard climb gradient of 200 ft/NM can be resumed. A table for the conversion of climb gradient (feet per nautical mile) to climb rate (feet per minute), at a given ground speed, is included on the inside of the back cover of the U.S. Terminal Procedures booklets.

g. Where are DPs located? DPs and DVAs will be listed by airport in the IFR Takeoff Minimums and (Obstacle) Departure Procedures Section, Section L, of the Terminal Procedures Publications (TPP). If the DP is textual, it will be described in TPP Section L. SIDs and complex ODPs will be published graphically and named. The name will be listed by airport name and runway in Section L. Graphic ODPs will also have the term “(OBSTACLE)” printed in the charted procedure title, differentiating them from SIDs.

1. An ODP that has been developed solely for obstacle avoidance will be indicated with the symbol “T” on appropriate Instrument Approach Procedure (IAP) charts and DP charts for that airport. The “T” symbol will continue to refer users to TPP Section C. In the case of a graphic ODP, the TPP Section C will only contain the name of the ODP. Since there may be both a textual and a graphic DP, Section C should still be checked for additional information. The nonstandard takeoff minimums and minimum climb gradients found in TPP Section C also apply to charted DPs and radar vector departures unless different minimums are specified on the charted DP. Takeoff minimums and departure procedures apply to all runways unless otherwise specified. New graphic

DPs will have all the information printed on the graphic depiction. As a general rule, ATC will only assign an ODP from a non-towered airport when compliance with the ODP is necessary for aircraft to aircraft separation. Pilots may use the ODP to help ensure separation from terrain and obstacles.

**h. Responsibilities**

1. Each pilot, prior to departing an airport on an IFR flight should:

(a) Consider the type of terrain and other obstacles on or in the vicinity of the departure airport;

(b) Determine whether an ODP is available;

(c) Determine if obstacle avoidance can be maintained visually or if the ODP should be flown; and

(d) Consider the effect of degraded climb performance and the actions to take in the event of an engine loss during the departure. Pilots should notify ATC as soon as possible of reduced climb capability in that circumstance.

**NOTE—**

*Guidance concerning contingency procedures that address an engine failure on takeoff after  $V_1$  speed on a large or turbine-powered transport category airplane may be found in AC 120-91, Airport Obstacle Analysis.*

(e) Determine if a DVA is published and whether the aircraft is capable of meeting the published climb gradient. Advise ATC when requesting the IFR clearance, or as soon as possible, if unable to meet the DVA climb gradient.

(f) Check for Takeoff Obstacle Notes published in the TPP for the takeoff runway.

2. Pilots should not exceed a published speed restriction associated with a SID waypoint until passing that waypoint.

3. After an aircraft is established on a SID and subsequently vectored or cleared to deviate off of the SID or SID transition, pilots must consider the SID canceled, unless the controller adds “expect to resume SID;” pilots should then be prepared to rejoin the SID at a subsequent fix or procedure leg. If the SID contains published altitude and/or speed restrictions, those restrictions are canceled and pilots will receive an altitude to maintain and, if necessary, a speed. ATC may also interrupt the vertical navigation of a SID and provide alternate altitude instructions while the aircraft remains established on

the published lateral path. Aircraft may be vectored off of an ODP, or issued an altitude lower than a published altitude on an ODP, at which time the ODP is canceled. In these cases, ATC assumes responsibility for terrain and obstacle clearance. In all cases, the minimum 200 FPNM climb gradient is assumed.

4. Aircraft instructed to resume a SID procedure such as a DP or SID which contains speed and/or altitude restrictions, must be:

(a) Issued/reissued all applicable restrictions, or

(b) Advised to “Climb via SID” or resume published speed.

**EXAMPLE–**

“Resume the Solar One departure, Climb via SID.”

“Proceed direct CIROS, resume the Solar One departure, Climb via SID.”

5. A clearance for a SID which does not contain published crossing restrictions, and/or is a SID with a Radar Vector segment or a Radar Vector SID, will be issued using the phraseology “Maintain (*altitude*).”

6. A clearance for a SID which contains published altitude restrictions may be issued using the phraseology “climb via.” Climb via is an abbreviated clearance that requires compliance with the procedure lateral path, associated speed and altitude restrictions along the cleared route or procedure. Clearance to “climb via” authorizes the pilot to:

(a) When used in the IFR departure clearance, in a PDC, DCL or when cleared to a waypoint depicted on a SID, to join the procedure after departure or to resume the procedure.

(b) When vertical navigation is interrupted and an altitude is assigned to maintain which is not contained on the published procedure, to climb from that previously-assigned altitude at pilot’s discretion to the altitude depicted for the next waypoint.

(c) Once established on the depicted departure, to navigate laterally and climb to meet all published or assigned altitude and speed restrictions.

**NOTE–**

1. When otherwise cleared along a route or procedure that contains published speed restrictions, the pilot must comply with those speed restrictions independent of a climb via clearance.

2. ATC anticipates pilots will begin adjusting speed the minimum distance necessary prior to a published speed restriction so as to cross the waypoint/fix at the published speed. Once at the published speed ATC expects pilots will maintain the published speed until additional adjustment is required to comply with further published or ATC assigned speed restrictions or as required to ensure compliance with 14 CFR Section 91.117.

3. If ATC interrupts lateral/vertical navigation while an aircraft is flying a SID, ATC must ensure obstacle clearance. When issuing a “climb via” clearance to join or resume a procedure ATC must ensure obstacle clearance until the aircraft is established on the lateral and vertical path of the SID.

4. ATC will assign an altitude to cross if no altitude is depicted at a waypoint/fix or when otherwise necessary/required, for an aircraft on a direct route to a waypoint/fix where the SID will be joined or resumed.

5. SIDs will have a “top altitude;” the “top altitude” is the charted “maintain” altitude contained in the procedure description or assigned by ATC.

**REFERENCE–**

FAA Order JO 7110.65, Paragraph 5-6-2, Methods PCG, Climb Via, Top Altitude

**EXAMPLE–**

1. **Lateral route clearance:**

“Cleared Loop Six departure.”

**NOTE–**

The aircraft must comply with the SID lateral path, and any published speed restrictions.

2. **Routing with assigned altitude:**

“Cleared Loop Six departure, climb and maintain four thousand.”

**NOTE–**

The aircraft must comply with the SID lateral path, and any published speed restriction while climbing unrestricted to four thousand.

3. (A pilot filed a flight plan to the Johnston Airport using the Scott One departure, Jonez transition, then Q-145. The pilot filed for FL350. The Scott One includes altitude restrictions, a top altitude and instructions to expect the filed altitude ten minutes after departure). Before departure ATC uses PDC, DCL or clearance delivery to issue the clearance:

“Cleared to Johnston Airport, Scott One departure, Jonez transition, Q-OneForty-five. Climb via SID.”

**NOTE–**

In Example 3, the aircraft must comply with the Scott One departure lateral path and any published speed and altitude restrictions while climbing to the SID top altitude.

4. (Using the Example 3 flight plan, ATC determines the top altitude must be changed to FL180). The clearance will

read:

*“Cleared to Johnston Airport, Scott One departure, Jonez transition, Q-One Forty-five, Climb via SID except maintain flight level one eight zero.”*

**NOTE–**

*In Example 4, the aircraft must comply with the Scott One departure lateral path and any published speed and altitude restrictions while climbing to FL180. The aircraft must stop climb at FL180 until issued further clearance by ATC.*

**5.** *(An aircraft was issued the Suzan Two departure, “climb via SID” in the IFR departure clearance. After departure ATC must change a waypoint crossing restriction). The clearance will be:*

*“Climb via SID except cross Mkala at or above seven thousand.”*

**NOTE–**

*In Example 5, the aircraft will comply with the Suzan Two departure lateral path and any published speed and altitude restrictions and climb so as to cross Mkala at or above 7,000; remainder of the departure must be flown as published.*

**6.** *(An aircraft was issued the Teddd One departure, “climb via SID” in the IFR departure clearance. An interim altitude of 10,000 was issued instead of the published top altitude of FL 230). After departure ATC is able to issue the published top altitude. The clearance will be:*

*“Climb via SID.”*

**NOTE–**

*In Example 6, the aircraft will track laterally and vertically on the Teddd One departure and initially climb to 10,000; Once re-issued the “climb via” clearance the interim altitude is canceled aircraft will continue climb to FL230 while complying with published restrictions.*

**7.** *(An aircraft was issued the Bbear Two departure, “climb via SID” in the IFR departure clearance. An interim altitude of 16,000 was issued instead of the published top altitude of FL 190). After departure, ATC is able to issue a top altitude of FL300 and still requires compliance with the published SID restrictions. The clearance will be:*

*“Climb via SID except maintain flight level three zero zero.”*

**NOTE–**

*In Example 7, the aircraft will track laterally and vertically on the Bbear Two departure and initially climb to 16,000; Once re-issued the “climb via” clearance the interim altitude is canceled and the aircraft will continue climb to FL300 while complying with published restrictions.*

**8.** *(An aircraft was issued the Bizee Two departure, “climb via SID.” After departure, ATC vectors the aircraft off of*

*the SID, and then issues a direct routing to rejoin the SID at Rockr waypoint which does not have a published altitude restriction. ATC wants the aircraft to cross at or above 10,000). The clearance will read:*

*“Proceed direct Rockr, cross Rockr at or above one-zero thousand, climb via the Bizee Two departure.”*

**NOTE–**

*In Example 8, the aircraft will join the Bizee Two SID at Rockr at or above 10,000 and then comply with the published lateral path and any published speed or altitude restrictions while climbing to the SID top altitude.*

**9.** *(An aircraft was issued the Suzan Two departure, “climb via SID” in the IFR departure clearance. After departure ATC vectors the aircraft off of the SID, and then clears the aircraft to rejoin the SID at Dvine waypoint, which has a published crossing restriction). The clearance will read:*

*“Proceed direct Dvine, Climb via the Suzan Two departure.”*

**NOTE–**

*In Example 9, the aircraft will join the Suzan Two departure at Dvine, at the published altitude, and then comply with the published lateral path and any published speed or altitude restrictions.*

**7.** Pilots cleared for vertical navigation using the phraseology “climb via” must inform ATC, upon initial contact, of the altitude leaving and any assigned restrictions not published on the procedure.

**EXAMPLE–**

**1.** *(Cactus 711 is cleared to climb via the Laura Two departure. The Laura Two has a top altitude of FL190):*  
*“Cactus Seven Eleven leaving two thousand, climbing via the Laura Two departure.”*

**2.** *(Cactus 711 is cleared to climb via the Laura Two departure, but ATC changed the top altitude to 16,000):*  
*“Cactus Seven Eleven leaving two thousand for one-six thousand, climbing via the Laura Two departure.”*

**8.** If prior to or after takeoff an altitude restriction is issued by ATC, all previously issued “ATC” altitude restrictions are canceled including those published on a SID. Pilots must still comply with all speed restrictions and lateral path requirements published on the SID unless canceled by ATC.

**EXAMPLE–**

*Prior to takeoff or after departure ATC issues an altitude change clearance to an aircraft cleared to climb via a SID but ATC no longer requires compliance with published altitude restrictions:*

*“Climb and maintain flight level two four zero.”*

**NOTE–**

*The published SID altitude restrictions are canceled; The*



*aircraft should comply with the SID lateral path and begin an unrestricted climb to FL240. Compliance with published speed restrictions is still required unless specifically deleted by ATC.*

**9.** Altitude restrictions published on an ODP are necessary for obstacle clearance and/or design constraints. Crossing altitudes and speed restrictions on ODPs cannot be canceled or amended by ATC.

**i. PBN Departure Procedures**

**1.** All public PBN SIDs and graphic ODPs are normally designed using RNAV 1, RNP 1, or A-RNP NavSpecs. These procedures generally start with an initial track or heading leg near the departure end of runway (DER). In addition, these procedures require system performance currently met by GPS or DME/DME/IRU PBN systems that satisfy the criteria

discussed in the latest AC 90–100, U.S. Terminal and En Route Area Navigation (RNAV) Operations. RNAV 1 and RNP 1 procedures must maintain a total system error of not more than 1 NM for 95 percent of the total flight time. Minimum values for A-RNP procedures will be charted in the PBN box (for example, 1.00 or 0.30).

**2.** In the U.S., a specific procedure's PBN requirements will be prominently displayed in separate, standardized notes boxes. For procedures with PBN elements, the "PBN box" will contain the procedure's NavSpec(s); and, if required: specific sensors or infrastructure needed for the navigation solution, any additional or advanced functional requirements, the minimum RNP value, and any amplifying remarks. Items listed in this PBN box are REQUIRED for the procedure's PBN elements.



## TBL 5-3-5

## Level Downlink Message Elements (LVLD)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
DM6 REQUEST ( <i>altitude</i> ) <i>Note – Used for a single level</i>	DM6 REQUEST ( <i>level</i> )	Y	LVLD-1	Request to fly at the specified level or vertical range.	REQUEST ( <i>level</i> )
DM9 REQUEST CLIMB TO ( <i>altitude</i> )	DM9 REQUEST CLIMB TO ( <i>level</i> )	Y	LVLD-2	Request for a climb to the specified level or vertical range.	REQUEST CLIMB TO ( <i>level</i> )
DM10 REQUEST DESCENT TO ( <i>altitude</i> )	DM10 REQUEST DESCENT TO ( <i>level</i> )	Y	LVLD-3	Request for a descent to the specified level or vertical range.	REQUEST DESCENT TO ( <i>level</i> )
DM38 ASSIGNED LEVEL ( <i>altitude</i> ) <i>Note – Used for a single level</i>	DM38 ASSIGNED LEVEL ( <i>level</i> )	N	LVLD-11	Confirmation that the assigned level or vertical range is the specified level or vertical range.	ASSIGNED LEVEL ( <i>level</i> )
DM61 DESCENDING TO ( <i>altitude</i> ) <i>Note – urgent alert attribute</i>	N/A	N	LVLD-14	Report indicating descending to the specified level.	DESCENDING TO ( <i>level single</i> )

TBL 5-3-6

## Crossing Constraint Message Elements (CSTU)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
UM49 CROSS ( <i>position</i> ) AT AND MAINTAIN ( <i>altitude</i> ) <i>Note 1. – A vertical range cannot be provided.</i> <i>Note 2. – This message element is equivalent to CSTU-1 plus LVLU-5 in Doc 4444.</i>	N/A	W/U	CSTU-1	Instruction that the specified position is to be crossed at the specified level or within the specified vertical range.	CROSS ( <i>position</i> ) AT ( <i>level</i> )
UM61 CROSS ( <i>position</i> ) AT AND MAINTAIN ( <i>altitude</i> ) AT ( <i>speed</i> ) <i>Note 1. – A vertical range cannot be provided.</i> <i>Note 2. – This message element is equivalent to CSTU-14 plus LVLU-5 in Doc 4444.</i>	UM61 CROSS ( <i>position</i> ) AT AND MAINTAIN ( <i>level</i> ) AT ( <i>speed</i> )	W/U	CSTU-14	Instruction that the specified position is to be crossed at the level or within the vertical range, as specified, and at the specified speed.	CROSS ( <i>position</i> ) AT ( <i>level</i> ) AT ( <i>speed</i> )

TBL 5-3-7

## Air Traffic Advisory Uplink Message Elements

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
UM154 RADAR SERVICES TERMINATED	N/A	R	ADVU-2	<i>Advisory that the ATS surveillance service is terminated.</i>	SURVEILLANCE SERVICE TERMINATED

TBL 5-3-13

## Standard Response Downlink Message Elements (RSPD)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
DM0 WILCO	DM0 WILCO	N	RSPD-1	Indication that the instruction is understood and will be complied with.	WILCO
DM1 UNABLE	DM1 UNABLE	N	RSPD-2	Indication that the message cannot be complied with.	UNABLE
DM2 STANDBY	DM2 STANDBY	N	RSPD-3	Indication that the message will be responded to shortly.	STANDBY
DM3 ROGER <i>Note – ROGER is the only correct response to an uplink free text message.</i>	DM3 ROGER	N	RSPD-4	Indication that the message is received.	ROGER

TBL 5-3-14

## Supplemental Uplink Message Elements (SUPU)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
UM166 DUE TO TRAFFIC	N/A	N	SUPU-2	Indication that the associated message is issued due to the specified reason.	DUE TO <i>(specified reason uplink)</i>
UM167 DUE TO AIRSPACE RESTRICTION					

TBL 5-3-15

## Supplemental Downlink Message Elements (SUPD)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
DM65 DUE TO WEATHER	DM65 DUE TO WEATHER	N	SUPD-1	Indication that the associated message is issued due to the specified reason.	DUE TO <i>(specified reason downlink)</i>
DM66 DUE TO AIRCRAFT PERFORMANCE	DM66 DUE TO AIRCRAFT PERFORMANCE				

TBL 5-3-16

## Free Text Uplink Message Elements (TXTU)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
UM169 ( <i>free text</i> )	UM203 ( <i>free text</i> )	R	TXTU-1		( <i>free text</i> ) Note-M alert attribute.
UM169 ( <i>free text</i> ) CPDLC NOT IN USE UNTIL FURTHER NOTIFICATION	N/A	R	See Note		( <i>free text</i> )
UM169 ( <i>free text</i> ) “[facility designation]” LOCAL ALTIMETER (for Altimeter Reporting Station)	N/A	R	See Note		( <i>free text</i> )
UM169 ( <i>free text</i> ) “[facility designation]” LOCAL ALTIMETER MORE THAN ONE HOUR” OLD	N/A	R	See Note		( <i>free text</i> )
UM169 ( <i>free text</i> ) DUE TO WEATHER	N/A	R	See Note		( <i>free text</i> )
UM169 ( <i>free text</i> ) REST OF ROUTE UN- CHANGED	N/A	R	See Note		( <i>free text</i> )
UM169 ( <i>free text</i> ) TRAFFIC FLOW MANAGEMENT REROUTE	N/A	R	See Note		( <i>free text</i> )

**NOTE-**

These are FAA scripted free text messages with no GOLD equivalent.

## Section 4. Arrival Procedures

### 5-4-1. Standard Terminal Arrival (STAR) Procedures

a. A STAR is an ATC coded IFR arrival route established for application to arriving IFR aircraft destined for certain airports. STARs simplify clearance delivery procedures, and also facilitate transition between en route and instrument approach procedures.

1. STAR procedures may have mandatory speeds and/or crossing altitudes published. Other STARs may have planning information depicted to inform pilots what clearances or restrictions to “**expect.**” “**Expect**” altitudes/speeds are not considered STAR procedures crossing restrictions unless verbally issued by ATC. Published speed restrictions are independent of altitude restrictions and are mandatory unless modified by ATC. Pilots should plan to cross waypoints with a published speed restriction, at the published speed, and should not exceed this speed past the associated waypoint unless authorized by ATC or a published note to do so.

#### NOTE-

The “**expect**” altitudes/speeds are published so that pilots may have the information for planning purposes. These altitudes/speeds must not be used in the event of lost communications unless ATC has specifically advised the pilot to expect these altitudes/speeds as part of a further clearance.

#### REFERENCE-

14 CFR Section 91.185(c)(2)(iii).

2. Pilots navigating on, or navigating a published route inbound to, a STAR procedure must maintain last assigned altitude until receiving authorization to descend so as to comply with all published/issued restrictions. This authorization will contain the phraseology “DESCEND VIA.” If vectored or cleared to deviate off a STAR, pilots must consider the STAR canceled, unless the controller adds “expect to resume STAR”; pilots should then be prepared to rejoin the STAR at a subsequent fix or procedure leg. If a descent clearance has been received that included a crossing restriction, pilots should expect the controller to issue an altitude to maintain. If the STAR contains published altitude and/or speed restrictions, those restrictions are

canceled and pilots will receive an altitude to maintain and, if necessary, a speed.

(a) Clearance to “descend via” authorizes pilots to:

(1) Descend at pilot’s discretion to meet published restrictions and laterally navigate on a STAR.

(2) When cleared to a waypoint depicted on a STAR, to descend from a previously assigned altitude at pilot’s discretion to the altitude depicted at that waypoint.

(3) Once established on the depicted arrival, to descend and to meet all published or assigned altitude and/or speed restrictions.

#### NOTE-

1. When otherwise cleared along a route or procedure that contains published speed restrictions, the pilot must comply with those speed restrictions independent of any descend via clearance.

2. ATC anticipates pilots will begin adjusting speed the minimum distance necessary prior to a published speed restriction so as to cross the waypoint/fix at the published speed. Once at the published speed, ATC expects pilots will maintain the published speed until additional adjustment is required to comply with further published or ATC assigned speed restrictions or as required to ensure compliance with 14 CFR Section 91.117.

3. The “descend via” is used in conjunction with STARs to reduce phraseology by not requiring the controller to restate the altitude at the next waypoint/fix to which the pilot has been cleared.

4. Air traffic will assign an altitude to cross the waypoint/fix, if no altitude is depicted at the waypoint/fix, for aircraft on a direct routing to a STAR. Air traffic must ensure obstacle clearance when issuing a “descend via” instruction to the pilot.

5. Minimum en route altitudes (MEA) are not considered restrictions; however, pilots must remain above all MEAs, unless receiving an ATC instruction to descend below the MEA.

#### EXAMPLE-

1. **Lateral/routing clearance only.**

“Cleared Tyler One arrival.”

#### NOTE-

In Example 1, pilots are cleared to fly the lateral path of the procedure. Compliance with any published speed restrictions is required. No descent is authorized.

## 2. Routing with assigned altitude.

“Cleared Tyler One arrival, descend and maintain flight level two four zero.”

“Cleared Tyler One arrival, descend at pilot’s discretion, maintain flight level two four zero.”

### NOTE–

In Example 2, the first clearance requires the pilot to descend to FL 240 as directed, comply with any published speed restrictions, and maintain FL 240 until cleared for further vertical navigation with a newly assigned altitude or a “descend via” clearance.

The second clearance authorizes the pilot to descend to FL 240 at his discretion, to comply with any published speed restrictions, and then maintain FL 240 until issued further instructions.

## 3. Lateral/routing and vertical navigation clearance.

“Descend via the Eagul Five arrival.”

“Descend via the Eagul Five arrival, except, cross Vnmom at or above one two thousand.”

### NOTE–

In Example 3, the first clearance authorized the aircraft to descend at pilot’s discretion on the Eagul Five arrival; the pilot must descend so as to comply with all published altitude and speed restrictions.

The second clearance authorizes the same, but requires the pilot to descend so as to cross at Vnmom at or above 12,000.

## 4. Lateral/routing and vertical navigation clearance when assigning altitude not published on procedure.

“Descend via the Eagul Five arrival, except after Geeno, maintain one zero thousand.”

“Descend via the Eagul Five arrival, except cross Geeno at one one thousand then maintain seven thousand.”

### NOTE–

In Example 4, the first clearance authorized the aircraft to track laterally on the Eagul Five Arrival and to descend at pilot’s discretion so as to comply with all altitude and speed restrictions until reaching Geeno and then maintain 10,000. Upon reaching 10,000, aircraft should maintain 10,000 until cleared by ATC to continue to descend.

The second clearance requires the same, except the aircraft must cross Geeno at 11,000 and is then authorized to continue descent to and maintain 7,000.

## 5. Direct routing to intercept a STAR and vertical navigation clearance.

“Proceed direct Leoni, descend via the Leoni One arrival.”

“Proceed direct Denis, cross Denis at or above flight level two zero zero, then descend via the Mmell One arrival.”

### NOTE–

In Example 5, in the first clearance an altitude is published at Leoni; the aircraft proceeds to Leoni, crosses Leoni at the published altitude and then descends via the arrival. If a speed restriction is published at Leoni, the aircraft will slow to comply with the published speed.

In the second clearance, there is no altitude published at Denis; the aircraft must cross Denis at or above FL200, and then descends via the arrival.

(b) Pilots cleared for vertical navigation using the phraseology “descend via” must inform ATC upon initial contact with a new frequency, of the altitude leaving, “descending via (procedure name),” the runway transition or landing direction if assigned, and any assigned restrictions not published on the procedure.

### EXAMPLE–

1. Delta 121 is cleared to descend via the Eagul Five arrival, runway 26 transition: “Delta One Twenty One leaving flight level one niner zero, descending via the Eagul Five arrival runway two-six transition.”

2. Delta 121 is cleared to descend via the Eagul Five arrival, but ATC has changed the bottom altitude to 12,000: “Delta One Twenty One leaving flight level one niner zero for one two thousand, descending via the Eagul Five arrival, runway two-six transition.”

3. (JetBlue 602 is cleared to descend via the Ivane Two arrival, landing south): “JetBlue six zero two leaving flight level two one zero descending via the Ivane Two arrival landing south.”

b. Pilots of IFR aircraft destined to locations for which STARs have been published may be issued a clearance containing a STAR whenever ATC deems it appropriate.

c. Use of STARs requires pilot possession of at least the approved chart. RNAV STARs must be retrievable by the procedure name from the aircraft database and conform to charted procedure. As with any ATC clearance or portion thereof, it is the responsibility of each pilot to accept or refuse an issued STAR. Pilots should notify ATC if they do not wish to use a STAR by placing “NO STAR” in the remarks section of the flight plan or by the less desirable method of verbally stating the same to ATC.

d. STAR charts are published in the Terminal Procedures Publications (TPP) and are available on subscription from the National Aeronautical Charting Office.



**e. PBN STAR.**

1. Public PBN STARs are normally designed using RNAV 1, RNP 1, or A–RNP NavSpecs. These procedures require system performance currently met by GPS or DME/DME/IRU PBN systems that satisfy the criteria discussed in AC 90–100A, U.S. Terminal and En Route Area Navigation (RNAV) Operations. These procedures, using RNAV 1 and RNP 1 NavSpecs, must maintain a total system error of not more than 1 NM for 95% of the total flight time. Minimum values for A–RNP procedures will be charted in the PBN box (for example, 1.00 or 0.30).

2. In the U.S., a specific procedure’s PBN requirements will be prominently displayed in separate, standardized notes boxes. For procedures with PBN elements, the “PBN box” will contain the procedure’s NavSpec(s); and, if required: specific sensors or infrastructure needed for the navigation solution, any additional or advanced functional requirements, the minimum RNP value, and any amplifying remarks. Items listed in this PBN box are REQUIRED for the procedure’s PBN elements.

**5–4–2. Local Flow Traffic Management Program**

a. This program is a continuing effort by the FAA to enhance safety, minimize the impact of aircraft noise and conserve aviation fuel. The enhancement of safety and reduction of noise is achieved in this program by minimizing low altitude maneuvering of arriving turbojet and turboprop aircraft weighing more than 12,500 pounds and, by permitting departure aircraft to climb to higher altitudes sooner, as arrivals are operating at higher altitudes at the points where their flight paths cross. The application of these procedures also reduces exposure time between controlled aircraft and uncontrolled aircraft at the lower altitudes in and around the terminal environment. Fuel conservation is accomplished by absorbing any necessary arrival delays for aircraft included in this program operating at the higher and more fuel efficient altitudes.

b. A fuel efficient descent is basically an uninterrupted descent (except where level flight is required for speed adjustment) from cruising altitude to the point when level flight is necessary for the pilot to stabilize the aircraft on final approach. The procedure for a fuel efficient descent is based on an altitude loss which is most efficient for the majority

of aircraft being served. This will generally result in a descent gradient window of 250–350 feet per nautical mile.

c. When crossing altitudes and speed restrictions are issued verbally or are depicted on a chart, ATC will expect the pilot to descend first to the crossing altitude and then reduce speed. Verbal clearances for descent will normally permit an uninterrupted descent in accordance with the procedure as described in paragraph b above. Acceptance of a charted fuel efficient descent (Runway Profile Descent) clearance requires the pilot to adhere to the altitudes, speeds, and headings depicted on the charts unless otherwise instructed by ATC. PILOTS RECEIVING A CLEARANCE FOR A FUEL EFFICIENT DESCENT ARE EXPECTED TO ADVISE ATC IF THEY DO NOT HAVE RUNWAY PROFILE DESCENT CHARTS PUBLISHED FOR THAT AIRPORT OR ARE UNABLE TO COMPLY WITH THE CLEARANCE.

**5–4–3. Approach Control**

a. Approach control is responsible for controlling all instrument flight operating within its area of responsibility. Approach control may serve one or more airfields, and control is exercised primarily by direct pilot and controller communications. Prior to arriving at the destination radio facility, instructions will be received from ARTCC to contact approach control on a specified frequency.

**b. Radar Approach Control.**

1. Where radar is approved for approach control service, it is used not only for radar approaches (Airport Surveillance Radar [ASR] and Precision Approach Radar [PAR]) but is also used to provide vectors in conjunction with published nonradar approaches based on radio NAVAIDs (ILS, VOR, NDB, TACAN). Radar vectors can provide course guidance and expedite traffic to the final approach course of any established IAP or to the traffic pattern for a visual approach. Approach control facilities that provide this radar service will operate in the following manner:

(a) Arriving aircraft are either cleared to an outer fix most appropriate to the route being flown with vertical separation and, if required, given holding information or, when radar handoffs are effected between the ARTCC and approach control, or between two approach control facilities, aircraft

are cleared to the airport or to a fix so located that the handoff will be completed prior to the time the aircraft reaches the fix. When radar handoffs are utilized, successive arriving flights may be handed off to approach control with radar separation in lieu of vertical separation.

(b) After release to approach control, aircraft are vectored to the final approach course (ILS, RNAV, GLS, VOR, ADF, etc.). Radar vectors and altitude or flight levels will be issued as required for spacing and separating aircraft. *Therefore, pilots must not deviate from the headings issued by approach control.* Aircraft will normally be informed when it is necessary to vector across the final approach course for spacing or other reasons. If approach course crossing is imminent and the pilot has not been informed that the aircraft will be vectored across the final approach course, the pilot should query the controller.

(c) The pilot is not expected to turn inbound on the final approach course unless an approach clearance has been issued. This clearance will normally be issued with the final vector for interception of the final approach course, and the vector will be such as to enable the pilot to establish the aircraft on the final approach course prior to reaching the final approach fix.

(d) In the case of aircraft already inbound on the final approach course, approach clearance will be issued prior to the aircraft reaching the final approach fix. When established inbound on the final approach course, radar separation will be maintained and the pilot will be expected to complete the approach utilizing the approach aid designated in the clearance (ILS, RNAV, GLS, VOR, radio beacons, etc.) as the primary means of navigation. Therefore, once established on the final approach course, pilots must not deviate from it unless a clearance to do so is received from ATC.

(e) After passing the final approach fix on final approach, aircraft are expected to continue inbound on the final approach course and complete the approach or effect the missed approach procedure published for that airport.

2. ARTCCs are approved for and may provide approach control services to specific airports. The radar systems used by these centers do not provide the same precision as an ASR/PAR used by approach

control facilities and towers, and the update rate is not as fast. Therefore, pilots may be requested to report established on the final approach course.

3. Whether aircraft are vectored to the appropriate final approach course or provide their own navigation on published routes to it, radar service is automatically terminated when the landing is completed or when instructed to change to advisory frequency at uncontrolled airports, whichever occurs first.

#### 5-4-4. Advance Information on Instrument Approach

a. When landing at airports with approach control services and where two or more IAPs are published, pilots will be provided in advance of their arrival with the type of approach to expect or that they may be vectored for a visual approach. This information will be broadcast either by a controller or on ATIS. It will not be furnished when the visibility is three miles or better and the ceiling is at or above the highest initial approach altitude established for any low altitude IAP for the airport.

b. The purpose of this information is to aid the pilot in planning arrival actions; however, it is not an ATC clearance or commitment and is subject to change. Pilots should bear in mind that fluctuating weather, shifting winds, blocked runway, etc., are conditions which may result in changes to approach information previously received. It is important that pilots advise ATC immediately they are unable to execute the approach ATC advised will be used, or if they prefer another type of approach.

c. Aircraft destined to uncontrolled airports, which have automated weather data with broadcast capability, should monitor the ASOS/AWOS frequency to ascertain the current weather for the airport. The pilot must advise ATC when he/she has received the broadcast weather and state his/her intentions.

#### NOTE-

1. ASOS/AWOS should be set to provide one-minute broadcast weather updates at uncontrolled airports that are without weather broadcast capability by a human observer.

2. Controllers will consider the long line disseminated weather from an automated weather system at an uncontrolled airport as trend and planning information only and will rely on the pilot for current weather

*information for the airport. If the pilot is unable to receive the current broadcast weather, the last long line disseminated weather will be issued to the pilot. When receiving IFR services, the pilot/aircraft operator is responsible for determining if weather/visibility is adequate for approach/landing.*

**d.** When making an IFR approach to an airport not served by a tower or FSS, after ATC advises “CHANGE TO ADVISORY FREQUENCY APPROVED” you should broadcast your intentions, including the type of approach being executed, your position, and when over the final approach fix inbound (nonprecision approach) or when over the outer marker or fix used in lieu of the outer marker inbound (precision approach). Continue to monitor the appropriate frequency (UNICOM, etc.) for reports from other pilots.

#### **5-4-5. Instrument Approach Procedure (IAP) Charts**

**a.** 14 CFR Section 91.175(a), Instrument approaches to civil airports, requires the use of SIAPs prescribed for the airport in 14 CFR Part 97 unless otherwise authorized by the Administrator (including ATC). If there are military procedures published at a civil airport, aircraft operating under 14 CFR Part 91 must use the civil procedure(s). Civil procedures are defined with “FAA” in parenthesis; e.g., (FAA), at the top, center of the procedure chart. DOD procedures are defined using the abbreviation of the applicable military service in parenthesis; e.g., (USAF), (USN), (USA). 14 CFR Section 91.175(g), Military airports, requires civil pilots flying into or out of military airports to comply with the IAPs and takeoff and landing minimums prescribed by the authority having jurisdiction at those airports. Unless an emergency exists, civil aircraft operating at military airports normally require advance authorization, commonly referred to as “Prior Permission Required” or “PPR.” Information on obtaining a PPR for a particular military airport can be found in the Chart Supplement U.S.

#### **NOTE-**

*Civil aircraft may conduct practice VFR approaches using DOD instrument approach procedures when approved by the air traffic controller.*

**1.** IAPs (standard and special, civil and military) are based on joint civil and military criteria contained in the U.S. Standard for TERPS. The design of IAPs

based on criteria contained in TERPS, takes into account the interrelationship between airports, facilities, and the surrounding environment, terrain, obstacles, noise sensitivity, etc. Appropriate altitudes, courses, headings, distances, and other limitations are specified and, once approved, the procedures are published and distributed by government and commercial cartographers as instrument approach charts.

**2.** Not all IAPs are published in chart form. Radar IAPs are established where requirements and facilities exist but they are printed in tabular form in appropriate U.S. Government Flight Information Publications.

**3.** The navigation equipment required to join and fly an instrument approach procedure is indicated by the title of the procedure and notes on the chart.

**(a)** Straight-in IAPs are identified by the navigational system providing the final approach guidance and the runway to which the approach is aligned (e.g., VOR RWY 13). Circling only approaches are identified by the navigational system providing final approach guidance and a letter (e.g., VOR A). More than one navigational system separated by a slash indicates that more than one type of equipment must be used to execute the final approach (e.g., VOR/DME RWY 31). More than one navigational system separated by the word “or” indicates either type of equipment may be used to execute the final approach (e.g., VOR or GPS RWY 15).

**(b)** In some cases, other types of navigation systems including radar may be required to execute other portions of the approach or to navigate to the IAF (e.g., an NDB procedure turn to an ILS, an NDB in the missed approach, or radar required to join the procedure or identify a fix). When radar or other equipment is required for procedure entry from the en route environment, a note will be charted in the planview of the approach procedure chart (e.g., RADAR REQUIRED or ADF REQUIRED). When radar or other equipment is required on portions of the procedure outside the final approach segment, including the missed approach, a note will be charted in the notes box of the pilot briefing portion of the approach chart (e.g., RADAR REQUIRED or DME REQUIRED). Notes are not charted when VOR is required outside the final approach segment. Pilots should ensure that the

aircraft is equipped with the required NAVAID(s) in order to execute the approach, including the missed approach.

**NOTE—**

Some military (i.e., U.S. Air Force and U.S. Navy) IAPs have these “additional equipment required” notes charted only in the planview of the approach procedure and do not conform to the same application standards used by the FAA.

(c) The FAA has initiated a program to provide a new notation for LOC approaches when charted on an ILS approach requiring other navigational aids to fly the final approach course. The LOC minimums will be annotated with the NAVAID required (e.g., “DME Required” or “RADAR Required”). During the transition period, ILS approaches will still exist without the annotation.

(d) Many ILS approaches having minima based on RVR are eligible for a landing minimum of RVR 1800. Some of these approaches are to runways that have touchdown zone and centerline lights. For many runways that do not have touchdown and centerline lights, it is still possible to allow a landing minimum of RVR 1800. For these runways, the normal ILS minimum of RVR 2400 can be annotated with a single or double asterisk or the dagger symbol “†”; for example “\*\* 696/24 200 (200/1/2).” A note is included on the chart stating “\*\* RVR 1800 authorized with use of FD or AP or HUD to DA.” The pilot must use the flight director, or autopilot with an approved approach coupler, or head up display to decision altitude or to the initiation of a missed approach. In the interest of safety, single pilot operators should not fly approaches to 1800 RVR minimums on runways without touchdown and centerline lights using only a flight director, unless accompanied by the use of an autopilot with an approach coupler.

(e) The naming of multiple approaches of the same type to the same runway is also changing. Multiple approaches with the same guidance will be annotated with an alphabetical suffix beginning at the end of the alphabet and working backwards for subsequent procedures (e.g., ILS Z RWY 28, ILS Y RWY 28, etc.). The existing annotations such as ILS 2 RWY 28 or Silver ILS RWY 28 will be phased out and replaced with the new designation. The Cat II and Cat III designations are used to differentiate

between multiple ILSs to the same runway unless there are multiples of the same type.

(f) RNAV (GPS) approaches to LNAV, LP, LNAV/VNAV and LPV lines of minima using WAAS and RNAV (GPS) approaches to LNAV and LNAV/VNAV lines of minima using GPS are charted as RNAV (GPS) RWY (Number) (e.g., RNAV (GPS) RWY 21).

(g) Performance-Based Navigation (PBN) Box. As charts are updated, a procedure’s PBN requirements and conventional equipment requirements will be prominently displayed in separate, standardized notes boxes. For procedures with PBN elements, the PBN box will contain the procedure’s navigation specification(s); and, if required: specific sensors or infrastructure needed for the navigation solution, any additional or advanced functional requirements, the minimum Required Navigation Performance (RNP) value, and any amplifying remarks. Items listed in this PBN box are REQUIRED for the procedure’s PBN elements. For example, an ILS with an RNAV missed approach would require a specific capability to fly the missed approach portion of the procedure. That required capability will be listed in the PBN box. The separate Equipment Requirements box will list ground-based equipment requirements. On procedures with both PBN elements and equipment requirements, the PBN requirements box will be listed first. The publication of these notes will continue incrementally until all charts have been amended to comply with the new standard.

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 k, Vertical Descent Angle (VDA) on Nonprecision Approaches, some approach procedures may provide a Vertical Descent Angle as an aid in flying a stabilized approach, without requiring its use in order to fly the procedure. This does not make the approach an APV procedure, since it must still be flown to an MDA and has not been evaluated with a glidepath.

**b.** The method used to depict prescribed altitudes on instrument approach charts differs according to techniques employed by different chart publishers. Prescribed altitudes may be depicted in four different configurations: minimum, maximum, mandatory, and recommended. The U.S. Government distributes charts produced by National Geospatial-Intelligence Agency (NGA) and FAA. Altitudes are depicted on these charts in the profile view with underscore, overscore, both or none to identify them as minimum, maximum, mandatory or recommended.

**1.** Minimum altitude will be depicted with the altitude value underscored. Aircraft are required to maintain altitude at or above the depicted value, e.g., 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.*

**3.** *Approaches used for simultaneous (parallel) independent and simultaneous close parallel operations procedurally require descending on the glideslope from the altitude at which the approach clearance is issued (refer to 5-4-15 and 5-4-16). For simultaneous close parallel (PRM) approaches, the Attention All Users Page (AAUP) may publish a note which indicates that descending on the glideslope/glidepath meets all crossing restrictions. However, if no such note is published, and for simultaneous independent approaches (4300 and greater runway separation) where an AAUP is not published, pilots are cautioned to monitor their descent on the glideslope/path outside of the PFAF to ensure compliance with published crossing restrictions during simultaneous operations.*

**4.** *When parallel approach courses are less than 2500 feet apart and reduced in-trail spacing is authorized for simultaneous dependent operations, a chart note will indicate that simultaneous operations require use of vertical guidance and that the pilot should maintain last assigned altitude until established on glide slope. These approaches procedurally require utilization of the ILS glide slope for wake turbulence mitigation. Pilots should not confuse these simultaneous dependent operations with (SOIA) simultaneous close parallel PRM approaches, where PRM appears in the approach title.*

**5.** Altitude restrictions depicted at stepdown

fixes within the final approach segment are applicable only when flying a Non-Precision Approach to a straight-in or circling line of minima identified as a MDA(H). Stepdown fix altitude restrictions within the final approach segment do not apply to pilots using Precision Approach (ILS) or Approach with Vertical Guidance (LPV, LNAV/VNAV) lines of minima identified as a DA(H), since obstacle clearance on these approaches are based on the aircraft following the applicable vertical guidance. Pilots are responsible for adherence to stepdown fix altitude restrictions when outside the final approach segment (i.e., initial or intermediate segment), regardless of which type of procedure the pilot is flying. (See FIG 5-4-1.)

**c. Minimum Safe Altitudes (MSA)** are published for emergency use on IAP charts. MSAs provide 1,000 feet of clearance over all obstacles, but do not necessarily assure acceptable navigation signal coverage. The MSA depiction on the plan view of an approach chart contains the identifier of the center point of the MSA, the applicable radius of the MSA, a depiction of the sector(s), and the minimum altitudes above mean sea level which provide obstacle clearance. For conventional navigation systems, the MSA is normally based on the primary omnidirectional facility on which the IAP is predicated, but may be based on the airport reference point (ARP) if no suitable facility is available. For RNAV approaches, the MSA is based on an RNAV waypoint. MSAs normally have a 25 NM radius; however, for conventional navigation systems, this radius may be expanded to 30 NM if necessary to encompass the airport landing surfaces. A single sector altitude is normally established, however when the MSA is based on a facility and it is necessary to obtain relief from obstacles, an MSA with up to four sectors may be established.

miles from the fix. ATC must issue a straight-in approach clearance when clearing an aircraft direct to an IAF/IF with a procedure turn or hold-in-lieu of a procedure turn, and ATC does not want the aircraft to execute the course reversal.

**NOTE—**

*Refer to 14 CFR 91.175 (i).*

7. RNAV aircraft may be issued a clearance direct to the FAF that is also charted as an IAF, in which case the pilot is expected to execute the depicted procedure turn or hold-in-lieu of procedure turn. ATC will not issue a straight-in approach clearance. If the pilot desires a straight-in approach, they must request vectors to the final approach course outside of the FAF or fly a published “NoPT” route. When visual approaches are in use, ATC may clear an aircraft direct to the FAF.

**NOTE—**

1. *In anticipation of a clearance by ATC to any fix published on an instrument approach procedure, pilots of RNAV aircraft are advised to select an appropriate IAF or feeder fix when loading an instrument approach procedure into the RNAV system.*

2. *Selection of “Vectors-to-Final” or “Vectors” option for an instrument approach may prevent approach fixes located outside of the FAF from being loaded into an RNAV system. Therefore, the selection of these options is discouraged due to increased workload for pilots to reprogram the navigation system.*

f. An RF leg is defined as a constant radius circular path around a defined turn center that starts and terminates at a fix. An RF leg may be published as part of a procedure. Since not all aircraft have the capability to fly these leg types, pilots are responsible for knowing if they can conduct an RNAV approach with an RF leg. Requirements for RF legs will be indicated on the approach chart in the notes section or at the applicable initial approach fix. Controllers will clear RNAV-equipped aircraft for instrument approach procedures containing RF legs:

1. Via published transitions, or
2. In accordance with paragraph e6 above, and
3. ATC will not clear aircraft direct to any waypoint beginning or within an RF leg, and will not assign fix/waypoint crossing speeds in excess of charted speed restrictions.

**EXAMPLE—**

*Controllers will not clear aircraft direct to THIRD because*

*that waypoint begins the RF leg, and aircraft cannot be vectored or cleared to TURN or vectored to intercept the approach segment at any point between THIRD and FORTH because this is the RF leg. (See FIG 5-4-15.)*

g. When necessary to cancel a previously issued approach clearance, the controller will advise the pilot “Cancel Approach Clearance” followed by any additional instructions when applicable.

## 5-4-7. Instrument Approach Procedures

a. Aircraft approach category means a grouping of aircraft based on a speed of  $V_{REF}$  at the maximum certified landing weight, if specified, or if  $V_{REF}$  is not specified,  $1.3V_{SO}$  at the maximum certified landing weight.  $V_{REF}$ ,  $V_{SO}$ , and the maximum certified landing weight are those values as established for the aircraft by the certification authority of the country of registry. A pilot must maneuver the aircraft within the circling approach protected area (see FIG 5-4-29) to achieve the obstacle and terrain clearances provided by procedure design criteria.

b. In addition to pilot techniques for maneuvering, one acceptable method to reduce the risk of flying out of the circling approach protected area is to use either the minima corresponding to the category determined during certification or minima associated with a higher category. Helicopters may use Category A minima. If it is necessary to operate at a speed in excess of the upper limit of the speed range for an aircraft’s category, the minimums for the higher category should be used. This may occur with certain aircraft types operating in heavy/gusty wind, icing, or non-normal conditions. For example, an airplane which fits into Category B, but is circling to land at a speed of 145 knots, should use the approach Category D minimums. As an additional example, a Category A airplane (or helicopter) which is operating at 130 knots on a straight-in approach should use the approach Category C minimums.

c. A pilot who chooses an alternative method when it is necessary to maneuver at a speed that exceeds the category speed limit (for example, where higher category minimums are not published) should consider the following factors that can significantly affect the actual ground track flown:

1. Bank angle. For example, at 165 knots groundspeed, the radius of turn increases from 4,194 feet using 30 degrees of bank to 6,654 feet when using 20 degrees of bank. When using a

shallower bank angle, it may be necessary to modify the flightpath or indicated airspeed to remain within the circling approach protected area. Pilots should be aware that excessive bank angle can lead to a loss of aircraft control.

**2.** Indicated airspeed. Procedure design criteria typically utilize the highest speed for a particular category. If a pilot chooses to operate at a higher speed, other factors should be modified to ensure that the aircraft remains within the circling approach protected area.

**3.** Wind speed and direction. For example, it is not uncommon to maneuver the aircraft to a downwind leg where the groundspeed will be considerably higher than the indicated airspeed. Pilots must carefully plan the initiation of all turns to ensure that the aircraft remains within the circling approach protected area.

**4.** Pilot technique. Pilots frequently have many options with regard to flightpath when conducting circling approaches. Sound planning and judgment are vital to proper execution. The lateral and vertical path to be flown should be carefully considered using current weather and terrain information to ensure that the aircraft remains within the circling approach protected area.

**d.** It is important to remember that 14 CFR Section 91.175(c) requires that “where a DA/DH or MDA is applicable, no pilot may operate an aircraft below the authorized MDA or continue an approach below the authorized DA/DH unless the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and for operations conducted under Part 121 or Part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing.”

**e.** See the following category limits:

- 1.** Category A: Speed less than 91 knots.
- 2.** Category B: Speed 91 knots or more but less than 121 knots.
- 3.** Category C: Speed 121 knots or more but less than 141 knots.
- 4.** Category D: Speed 141 knots or more but less than 166 knots.

**5.** Category E: Speed 166 knots or more.

**NOTE—**

*V<sub>REF</sub> in the above definition refers to the speed used in establishing the approved landing distance under the airworthiness regulations constituting the type certification basis of the airplane, regardless of whether that speed for a particular airplane is 1.3 V<sub>SO</sub>, 1.23 V<sub>SR</sub>, or some higher speed required for airplane controllability. This speed, at the maximum certificated landing weight, determines the lowest applicable approach category for all approaches regardless of actual landing weight.*

**f.** When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, must, in addition to complying with the minimum altitudes for IFR operations (14 CFR Section 91.177), maintain the last assigned altitude unless a different altitude is assigned by ATC, or until the aircraft is established on a segment of a published route or IAP. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Notwithstanding this pilot responsibility, for aircraft operating on unpublished routes or while being radar vectored, ATC will, except when conducting a radar approach, issue an IFR approach clearance only after the aircraft is established on a segment of a published route or IAP, or assign an altitude to maintain until the aircraft is established on a segment of a published route or instrument approach procedure. For this purpose, the procedure turn of a published IAP must not be considered a segment of that IAP until the aircraft reaches the initial fix or navigation facility upon which the procedure turn is predicated.

**EXAMPLE—**

*Cross Redding VOR at or above five thousand, cleared VOR runway three four approach.*

*or*

*Five miles from outer marker, turn right heading three three zero, maintain two thousand until established on the localizer, cleared ILS runway three six approach.*

**NOTE—**

**1.** *The altitude assigned will assure IFR obstruction clearance from the point at which the approach clearance is issued until established on a segment of a published route or IAP. If uncertain of the meaning of the clearance, immediately request clarification from ATC.*

**2.** *An aircraft is not established on an approach while below published approach altitudes. If the MVA/MIA allows, and ATC assigns an altitude below an IF or IAF*



*altitude, the pilot will be issued an altitude to maintain until past a point that the aircraft is established on the approach.*

**g.** Several IAPs, using various navigation and approach aids may be authorized for an airport. ATC may advise that a particular approach procedure is being used, primarily to expedite traffic. If issued a clearance that specifies a particular approach procedure, notify ATC immediately if a different one is desired. In this event it may be necessary for ATC to withhold clearance for the different approach until such time as traffic conditions permit. However, a pilot involved in an emergency situation will be given priority. If the pilot is not familiar with the specific approach procedure, ATC should be advised and they will provide detailed information on the execution of the procedure.

**REFERENCE—**

*AIM, Paragraph 5-4-4, Advance Information on Instrument Approach*

**h.** The name of an instrument approach, as published, is used to identify the approach, even though a component of the approach aid, such as the glideslope on an Instrument Landing System, is inoperative or unreliable. The controller will use the name of the approach as published, but must advise the aircraft at the time an approach clearance is issued that the inoperative or unreliable approach aid component is unusable, except when the title of the published approach procedures otherwise allows, for example, ILS or LOC.

**i.** Except when being radar vectored to the final approach course, when cleared for a specifically prescribed IAP; i.e., “cleared ILS runway one niner approach” or when “cleared approach” i.e., execution of any procedure prescribed for the airport, pilots must execute the entire procedure commencing at an IAF or an associated feeder route as described on the IAP chart unless an appropriate new or revised ATC clearance is received, or the IFR flight plan is canceled.

**j.** Pilots planning flights to locations which are private airfields or which have instrument approach procedures based on private navigation aids should obtain approval from the owner. In addition, the pilot must be authorized by the FAA to fly special instrument approach procedures associated with private navigation aids (see paragraph 5-4-8). Owners of navigation aids that are not for public use may elect to turn off the signal for whatever reason they may have; for example, maintenance, energy

conservation, etc. Air traffic controllers are not required to question pilots to determine if they have permission to land at a private airfield or to use procedures based on privately owned navigation aids, and they may not know the status of the navigation aid. Controllers presume a pilot has obtained approval from the owner and the FAA for use of special instrument approach procedures and is aware of any details of the procedure if an IFR flight plan was filed to that airport.

**k.** Pilots should not rely on radar to identify a fix unless the fix is indicated as “RADAR” on the IAP. Pilots may request radar identification of an OM, but the controller may not be able to provide the service due either to workload or not having the fix on the video map.

**l.** If a missed approach is required, advise ATC and include the reason (unless initiated by ATC). Comply with the missed approach instructions for the instrument approach procedure being executed, unless otherwise directed by ATC.

**REFERENCE—**

*AIM, Paragraph 5-4-21, Missed Approach*

*AIM, Paragraph 5-5-5, Missed Approach,*

## **5-4-8. Special Instrument Approach Procedures**

Instrument Approach Procedure (IAP) charts reflect the criteria associated with the U.S. Standard for Terminal Instrument [Approach] Procedures (TERP), which prescribes standardized methods for use in developing IAPs. Standard IAPs are published in the Federal Register (FR) in accordance with Title 14 of the Code of Federal Regulations, Part 97, and are available for use by appropriately qualified pilots operating properly equipped and airworthy aircraft in accordance with operating rules and procedures acceptable to the FAA. Special IAPs are also developed using TERPS but are not given public notice in the FR. The FAA authorizes only certain individual pilots and/or pilots in individual organizations to use special IAPs, and may require additional crew training and/or aircraft equipment or performance, and may also require the use of landing aids, communications, or weather services not available for public use. Additionally, IAPs that service private use airports or heliports are generally special IAPs. FDC NOTAMs for Specials, FDC T-NOTAMs, may also be used to promulgate safety-of-flight information relating to Specials

provided the location has a valid landing area identifier and is serviced by the United States NOTAM system. Pilots may access NOTAMs online or through an FAA Flight Service Station (FSS). FSS specialists will not automatically provide NOTAM information to pilots for special IAPs during telephone pre-flight briefings. Pilots who are authorized by the FAA to use special IAPs must specifically request FDC NOTAM information for the particular special IAP they plan to use.

#### **5-4-9. Procedure Turn and Hold-in-lieu of Procedure Turn**

a. A procedure turn is the maneuver prescribed when it is necessary to reverse direction to establish the aircraft inbound on an intermediate or final approach course. The procedure turn or hold-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 5-4-16). Newer procedures will simply depict an “at or above” altitude at the PT fix without a chart note (See FIG 5-4-17). Both are there to ensure required obstacle clearance is provided in the procedure turn entry zone (See FIG 5-4-18). Absence of a chart note or specified minimum altitude adjacent to the PT fix is an indication that descent to the procedure turn altitude can commence immediately upon crossing over the PT fix, regardless of the direction of flight. This is because the minimum altitudes in the PT entry zone and the PT maneuvering zone are the same.

FIG 5-4-15  
Example of an RNAV Approach with RF Leg

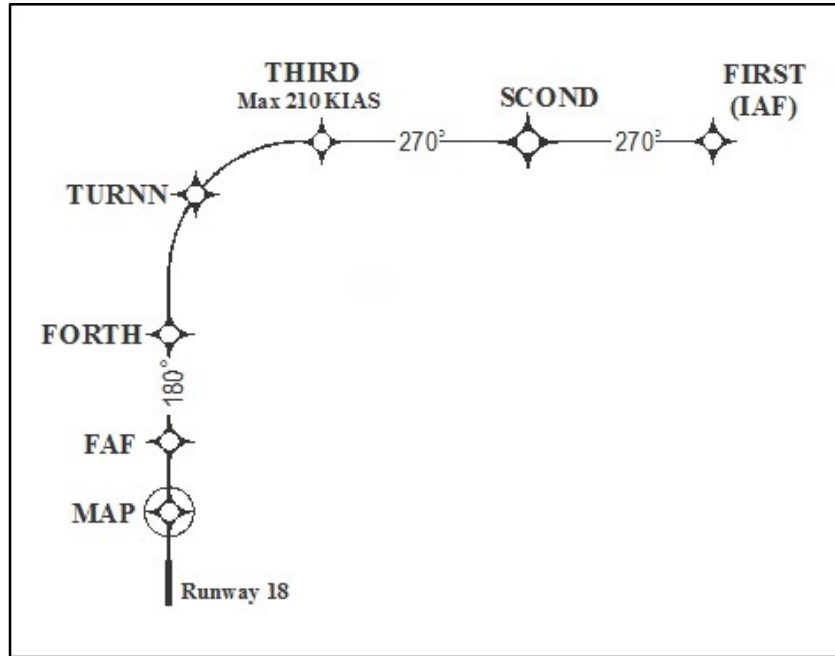


FIG 5-4-16

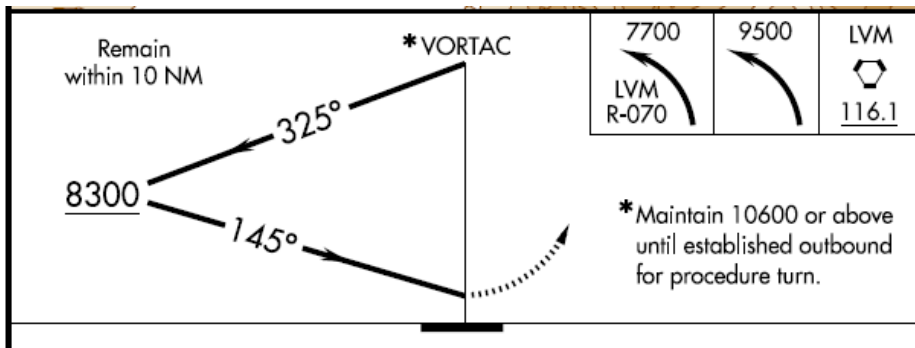


FIG 5-4-17

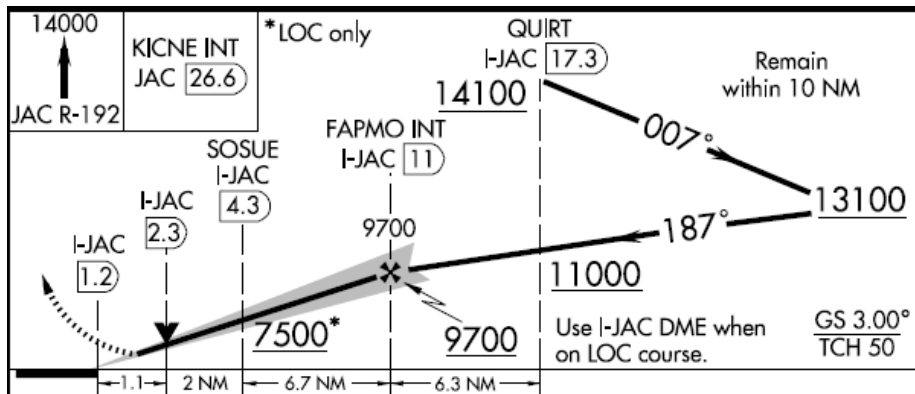
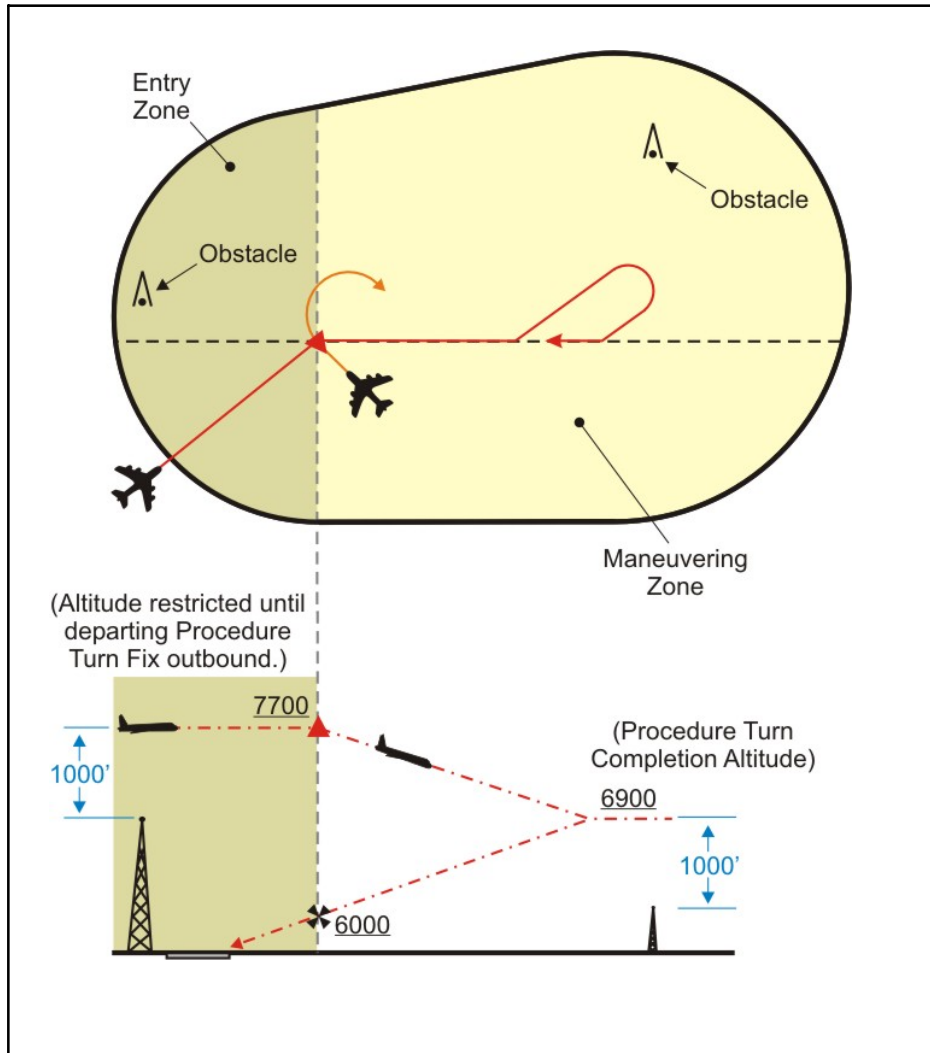


FIG 5-4-18



3. When the approach procedure involves a procedure turn, a maximum speed of not greater than 200 knots (IAS) should be observed from first overheading the course reversal IAF through the procedure turn maneuver to ensure containment within the obstruction clearance area. Pilots should begin the outbound turn immediately after passing the procedure turn fix. The procedure turn maneuver must be executed within the distance specified in the profile view. The normal procedure turn distance is 10 miles. This may be reduced to a minimum of 5 miles where only Category A or helicopter aircraft are to be operated or increased to as much as 15 miles to accommodate high performance aircraft.

4. A teardrop procedure or penetration turn may be specified in some procedures for a required course reversal. The teardrop procedure consists of departure from an initial approach fix on an outbound course followed by a turn toward and intercepting the inbound course at or prior to the intermediate fix or point. Its purpose is to permit an aircraft to reverse direction and lose considerable altitude within reasonably limited airspace. Where no fix is available to mark the beginning of the intermediate segment, it must be assumed to commence at a point 10 miles prior to the final approach fix. When the facility is located on the airport, an aircraft is considered to be on final approach upon completion of the penetration turn. However, the final approach segment begins on the final approach course 10 miles from the facility.

5. A holding pattern in lieu of procedure turn may be specified for course reversal in some procedures. In such cases, the holding pattern is established over an intermediate fix or a final approach fix. The holding pattern distance or time specified in the profile view must be observed. For a hold-in-lieu-of-PT, the holding pattern direction must be flown as depicted and the specified leg length/timing must not be exceeded. Maximum holding airspeed limitations as set forth for all holding patterns apply. The holding pattern maneuver is completed when the aircraft is established on the inbound course after executing the appropriate entry. If cleared for the approach prior to returning to the holding fix, and the aircraft is at the prescribed altitude, additional circuits of the holding pattern are not necessary nor expected by ATC. If pilots elect to make additional circuits to lose excessive altitude or to become better established on course, it is their

responsibility to so advise ATC upon receipt of their approach clearance.

**NOTE—**

*Some approach charts have an arrival holding pattern depicted at the IAF using a “thin line” holding symbol. It is charted where holding is frequently required prior to starting the approach procedure so that detailed holding instructions are not required. The arrival holding pattern is not authorized unless assigned by Air Traffic Control. Holding at the same fix may also be depicted on the en route chart. A hold-in-lieu of procedure turn is depicted by a “thick line” symbol, and is part of the instrument approach procedure as described in paragraph 5-4-9. (See U. S. Terminal Procedures booklets page E1 for both examples.)*

6. A procedure turn is not required when an approach can be made directly from a specified intermediate fix to the final approach fix. In such cases, the term “NoPT” is used with the appropriate course and altitude to denote that the procedure turn is not required. If a procedure turn is desired, and when cleared to do so by ATC, descent below the procedure turn altitude should not be made until the aircraft is established on the inbound course, since some NoPT altitudes may be lower than the procedure turn altitudes.

**b. Limitations on Procedure Turns**

1. In the case of a radar initial approach to a final approach fix or position, or a timed approach from a holding fix, or where the procedure specifies NoPT, no pilot may make a procedure turn unless, when final approach clearance is received, the pilot so advises ATC and a clearance is received to execute a procedure turn.

2. When a teardrop procedure turn is depicted and a course reversal is required, this type turn must be executed.

3. When a holding pattern replaces a procedure turn, the holding pattern must be followed, except when RADAR VECTORING is provided or when NoPT is shown on the approach course. The recommended entry procedures will ensure the aircraft remains within the holding pattern’s protected airspace. As in the procedure turn, the descent from the minimum holding pattern altitude to the final approach fix altitude (when lower) may not commence until the aircraft is established on the inbound course. Where a holding pattern is established in-lieu-of a procedure turn, the maximum holding pattern airspeeds apply.

*REFERENCE—  
AIM, Paragraph 5-3-8 j2, Holding*

4. The absence of the procedure turn barb in the plan view indicates that a procedure turn is not authorized for that procedure.

#### **5-4-10. Timed Approaches from a Holding Fix**

a. **TIMED APPROACHES** may be conducted when the following conditions are met:

1. A control tower is in operation at the airport where the approaches are conducted.

2. Direct communications are maintained between the pilot and the center or approach controller until the pilot is instructed to contact the tower.

3. If more than one missed approach procedure is available, none require a course reversal.

4. If only one missed approach procedure is available, the following conditions are met:

(a) Course reversal is not required; and,

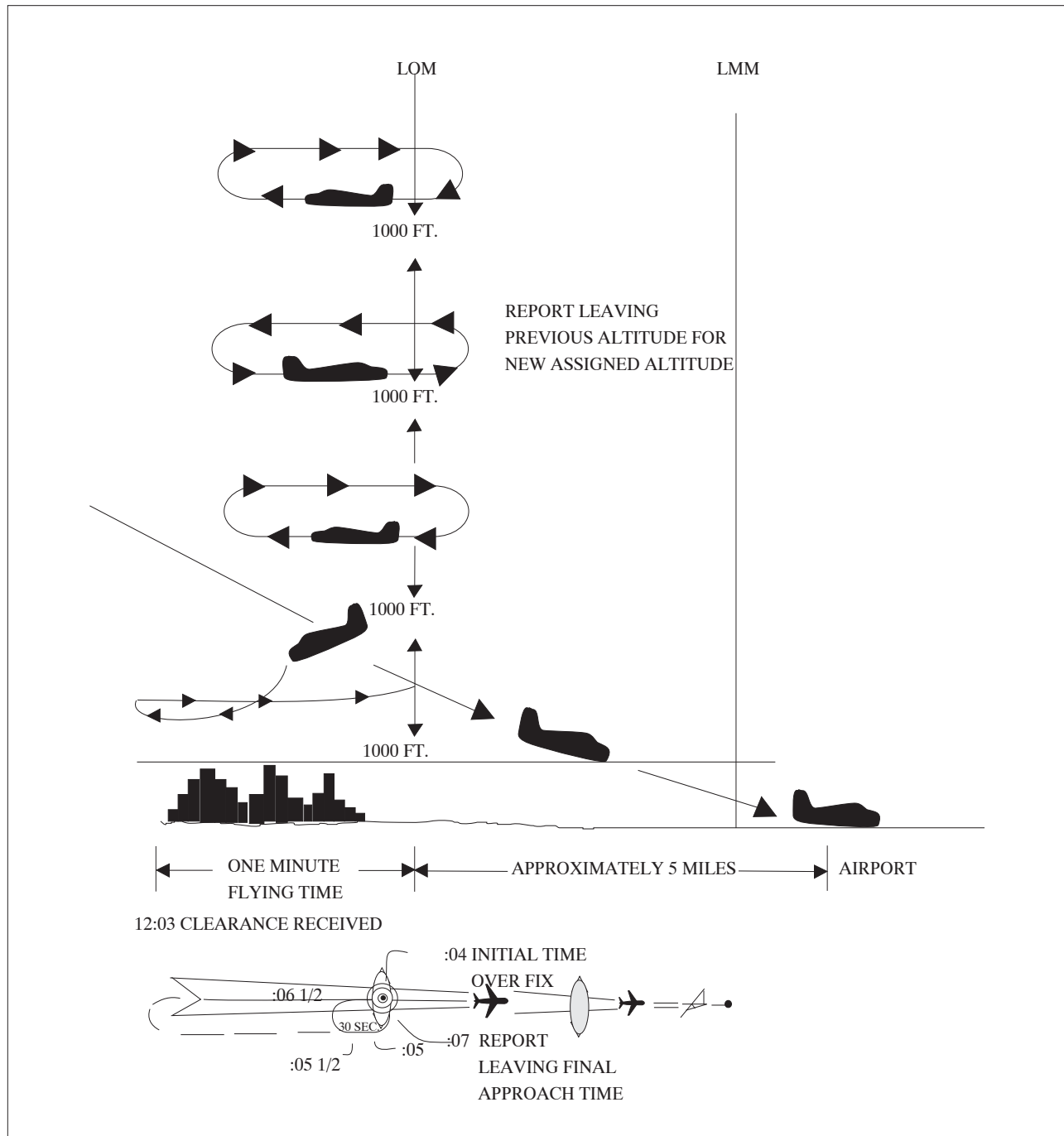
(b) Reported ceiling and visibility are equal to or greater than the highest prescribed circling minimums for the IAP.

5. When cleared for the approach, pilots must not execute a procedure turn. (14 CFR Section 91.175.)

b. Although the controller will not specifically state that “timed approaches are in use,” the assigning of a time to depart the final approach fix inbound (nonprecision approach) or the outer marker or fix used in lieu of the outer marker inbound (precision approach) is indicative that timed approach procedures are being utilized, or in lieu of holding, the controller may use radar vectors to the Final Approach Course to establish a mileage interval between aircraft that will ensure the appropriate time sequence between the final approach fix/outer marker or fix used in lieu of the outer marker and the airport.

c. Each pilot in an approach sequence will be given advance notice as to the time they should leave the holding point on approach to the airport. When a time to leave the holding point has been received, the pilot should adjust the flight path to leave the fix as closely as possible to the designated time. (See FIG 5-4-19.)

**FIG 5-4-19  
Timed Approaches from a Holding Fix**



**EXAMPLE-**

At 12:03 local time, in the example shown, a pilot holding, receives instructions to leave the fix inbound at 12:07. These instructions are received just as the pilot has completed turn at the outbound end of the holding pattern and is proceeding inbound towards the fix. Arriving back over the fix, the pilot notes that the time is 12:04 and that there are 3 minutes to lose in order to leave the fix at the assigned time. Since the time remaining is more than two minutes, the pilot plans to fly a race track pattern rather than a 360 degree turn, which would use up 2 minutes. The turns at the ends of the race track pattern will consume approximately 2 minutes. Three minutes to go, minus 2 minutes required for the turns, leaves 1 minute for level flight. Since two portions of level flight will be required to get back to the fix inbound, the pilot halves the 1 minute remaining

*and plans to fly level for 30 seconds outbound before starting the turn back to the fix on final approach. If the winds were negligible at flight altitude, this procedure would bring the pilot inbound across the fix precisely at the specified time of 12:07. However, if expecting headwind on final approach, the pilot should shorten the 30 second outbound course somewhat, knowing that the wind will carry the aircraft away from the fix faster while outbound and decrease the ground speed while returning to the fix. On the other hand, compensating for a tailwind on final approach, the pilot should lengthen the calculated 30 second outbound heading somewhat, knowing that the wind would tend to hold the aircraft closer to the fix while outbound and increase the ground speed while returning to the fix.*

#### **5-4-11. Radar Approaches**

a. The only airborne radio equipment required for radar approaches is a functioning radio transmitter and receiver. The radar controller vectors the aircraft to align it with the runway centerline. The controller continues the vectors to keep the aircraft on course until the pilot can complete the approach and landing by visual reference to the surface. There are two types of radar approaches: Precision (PAR) and Surveillance (ASR).

b. A radar approach may be given to any aircraft upon request and may be offered to pilots of aircraft in distress or to expedite traffic, however, an ASR might not be approved unless there is an ATC operational requirement, or in an unusual or emergency situation. Acceptance of a PAR or ASR by a pilot does not waive the prescribed weather minimums for the airport or for the particular aircraft operator concerned. The decision to make a radar approach when the reported weather is below the established minimums rests with the pilot.

c. PAR and ASR minimums are published on separate pages in the FAA Terminal Procedures Publication (TPP).

**1. Precision Approach (PAR).** A PAR is one in which a controller provides highly accurate navigational guidance in azimuth and elevation to a pilot. Pilots are given headings to fly, to direct them to, and keep their aircraft aligned with the extended centerline of the landing runway. They are told to anticipate glidepath interception approximately 10 to 30 seconds before it occurs and when to start descent. The published Decision Height will be given only if the pilot requests it. If the aircraft is observed to deviate above or below the glidepath, the pilot is given the relative amount of deviation by use of terms “slightly” or “well” and is expected to adjust the aircraft’s rate of descent/ascent to return to the glidepath. Trend information is also issued with respect to the elevation of the aircraft and may be modified by the terms “rapidly” and “slowly”; e.g., “well above glidepath, coming down rapidly.”

Range from touchdown is given at least once each mile. If an aircraft is observed by the controller to proceed outside of specified safety zone limits in azimuth and/or elevation and continue to operate outside these prescribed limits, the pilot will be directed to execute a missed approach or to fly a specified course unless the pilot has the runway environment (runway, approach lights, etc.) in sight. Navigational guidance in azimuth and elevation is provided the pilot until the aircraft reaches the published Decision Height (DH). Advisory course and glidepath information is furnished by the controller until the aircraft passes over the landing threshold, at which point the pilot is advised of any deviation from the runway centerline. Radar service is automatically terminated upon completion of the approach.

**2. Surveillance Approach (ASR).** An ASR is one in which a controller provides navigational guidance in azimuth only. The pilot is furnished headings to fly to align the aircraft with the extended centerline of the landing runway. Since the radar information used for a surveillance approach is considerably less precise than that used for a precision approach, the accuracy of the approach will not be as great and higher minimums will apply. Guidance in elevation is not possible but the pilot will be advised when to commence descent to the Minimum Descent Altitude (MDA) or, if appropriate, to an intermediate step-down fix Minimum Crossing Altitude and subsequently to the prescribed MDA. In addition, the pilot will be advised of the location of the Missed Approach Point (MAP) prescribed for the procedure and the aircraft’s position each mile on final from the runway, airport or heliport or MAP, as appropriate. If requested by the pilot, recommended altitudes will be issued at each mile, based on the descent gradient established for the procedure, down to the last mile that is at or above the MDA. Normally, navigational guidance will be provided until the aircraft reaches the MAP. Controllers will terminate guidance and instruct the pilot to execute a missed approach unless at the MAP the pilot has the runway,



airport or heliport in sight or, for a helicopter point-in-space approach, the prescribed visual reference with the surface is established. Also, if, at any time during the approach the controller considers that safe guidance for the remainder of the approach cannot be provided, the controller will terminate guidance and instruct the pilot to execute a missed approach. Similarly, guidance termination and missed approach will be effected upon pilot request and, for civil aircraft only, controllers may terminate guidance when the pilot reports the runway, airport/heliport or visual surface route (point-in-space approach) in sight or otherwise indicates that continued guidance is not required. Radar service is automatically terminated at the completion of a radar approach.

**NOTE-**

**1.** *The published MDA for straight-in approaches will be issued to the pilot before beginning descent. When a surveillance approach will terminate in a circle-to-land maneuver, the pilot must furnish the aircraft approach category to the controller. The controller will then provide the pilot with the appropriate MDA.*

**2.** *ASR APPROACHES ARE NOT AVAILABLE WHEN AN ATC FACILITY IS USING CENRAP.*

**3. NO-GYRO Approach.** This approach is available to a pilot under radar control who experiences circumstances wherein the directional gyro or other stabilized compass is inoperative or inaccurate. When this occurs, the pilot should so advise ATC and request a No-Gyro vector or approach. Pilots of aircraft not equipped with a directional gyro or other stabilized compass who desire radar handling may also request a No-Gyro vector or approach. The pilot should make all turns at standard rate and should execute the turn immediately upon receipt of instructions. For example, "TURN RIGHT," "STOP TURN." When a surveillance or precision approach is made, the pilot will be advised after the aircraft has been turned onto final approach to make turns at half standard rate.

## **5-4-12. Radar Monitoring of Instrument Approaches**

**a.** PAR facilities operated by the FAA and the military services at some joint-use (civil and

military) and military installations monitor aircraft on instrument approaches and issue radar advisories to the pilot when weather is below VFR minimums (1,000 and 3), at night, or when requested by a pilot. This service is provided only when the PAR Final Approach Course coincides with the final approach of the navigational aid and only during the operational hours of the PAR. The radar advisories serve only as a secondary aid since the pilot has selected the navigational aid as the primary aid for the approach.

**b.** Prior to starting final approach, the pilot will be advised of the frequency on which the advisories will be transmitted. If, for any reason, radar advisories cannot be furnished, the pilot will be so advised.

**c.** Advisory information, derived from radar observations, includes information on:

**1.** Passing the final approach fix inbound (nonprecision approach) or passing the outer marker or fix used in lieu of the outer marker inbound (precision approach).

**NOTE-**

*At this point, the pilot may be requested to report sighting the approach lights or the runway.*

**2.** Trend advisories with respect to elevation and/or azimuth radar position and movement will be provided.

**NOTE-**

*Whenever the aircraft nears the PAR safety limit, the pilot will be advised that the aircraft is well above or below the glidepath or well left or right of course. Glidepath information is given only to those aircraft executing a precision approach, such as ILS. Altitude information is not transmitted to aircraft executing other than precision approaches because the descent portions of these approaches generally do not coincide with the depicted PAR glidepath.*

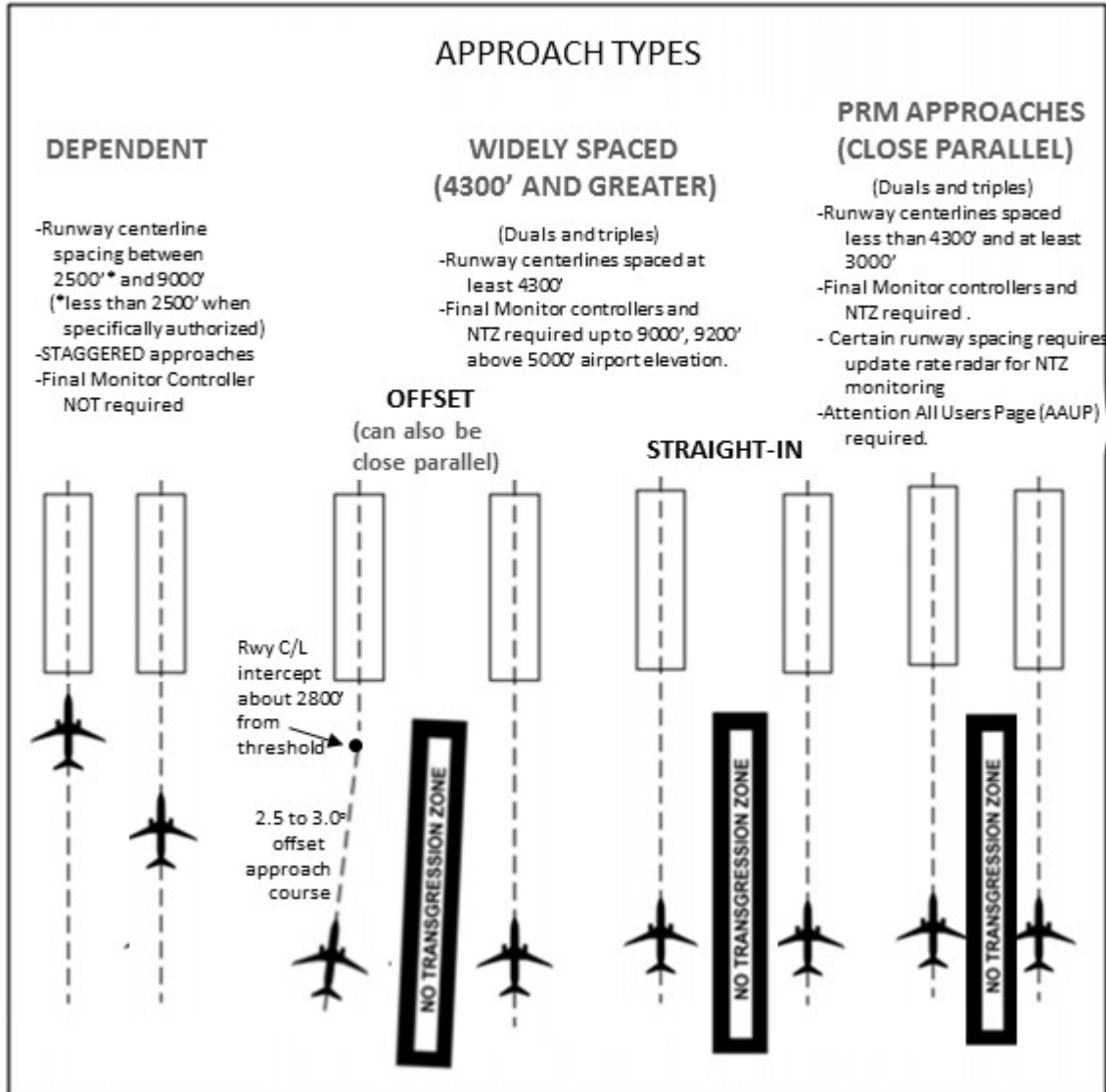
**3.** If, after repeated advisories, the aircraft proceeds outside the PAR safety limit or if a radical deviation is observed, the pilot will be advised to execute a missed approach unless the prescribed visual reference with the surface is established.

**d.** Radar service is automatically terminated upon completion of the approach.

### 5-4-13. Simultaneous Approaches to Parallel Runways

FIG 5-4-20

#### Simultaneous Approaches (Approach Courses Parallel and Offset between 2.5 and 3.0 degrees)



**a.** ATC procedures permit ILS/RNAV/GLS instrument approach operations to dual or triple parallel runway configurations. ILS/RNAV/GLS approaches to parallel runways are grouped into three classes: Simultaneous Dependent Approaches; Simultaneous Independent Approaches; and Simultaneous Close Parallel PRM Approaches. RNAV approach procedures that are approved for simultaneous operations require GPS as the sensor for position updating. VOR/DME, DME/DME and IRU RNAV updating is not authorized. The classification of a parallel runway approach procedure is dependent on adjacent parallel runway centerline separation, ATC procedures, and airport ATC final approach radar monitoring and communications capabilities. At some airports, one or more approach courses may be offset up to 3 degrees. ILS approaches with offset localizer configurations result in loss of Category II/III capabilities and an increase in decision altitude/height (50').

**b.** Depending on weather conditions, traffic volume, and the specific combination of runways being utilized for arrival operations, a runway may be used for different types of simultaneous operations, including closely spaced dependent or independent approaches. Pilots should ensure that they understand the type of operation that is being conducted, and ask ATC for clarification if necessary.

**c.** Parallel approach operations demand heightened pilot situational awareness. A thorough Approach Procedure Chart review should be conducted with, as a minimum, emphasis on the following approach chart information: name and number of the approach, localizer frequency, inbound localizer/azimuth course, glideslope/glidepath intercept altitude, glideslope crossing altitude at the final approach fix, decision height, missed approach instructions, special notes/procedures, and the assigned runway location/proximity to adjacent runways. Pilots are informed by ATC or through the ATIS that simultaneous approaches are in use.

**d.** The close proximity of adjacent aircraft conducting simultaneous independent approaches, especially simultaneous close parallel PRM ap-

proaches mandates strict pilot compliance with all ATC clearances. ATC assigned airspeeds, altitudes, and headings must be complied with in a timely manner. Autopilot coupled approaches require pilot knowledge of procedures necessary to comply with ATC instructions. Simultaneous independent approaches, particularly simultaneous close parallel PRM approaches necessitate precise approach course tracking to minimize final monitor controller intervention, and unwanted No Transgression Zone (NTZ) penetration. In the unlikely event of a breakout, ATC will not assign altitudes lower than the minimum vectoring altitude. Pilots should notify ATC immediately if there is a degradation of aircraft or navigation systems.

**e.** Strict radio discipline is mandatory during simultaneous independent and simultaneous close parallel PRM approach operations. This includes an alert listening watch and the avoidance of lengthy, unnecessary radio transmissions. Attention must be given to proper call sign usage to prevent the inadvertent execution of clearances intended for another aircraft. Use of abbreviated call signs must be avoided to preclude confusion of aircraft with similar sounding call signs. Pilots must be alert to unusually long periods of silence or any unusual background sounds in their radio receiver. A stuck microphone may block the issuance of ATC instructions on the tower frequency by the final monitor controller during simultaneous independent and simultaneous close parallel PRM approaches. In the case of PRM approaches, the use of a second frequency by the monitor controller mitigates the "stuck mike" or other blockage on the tower frequency.

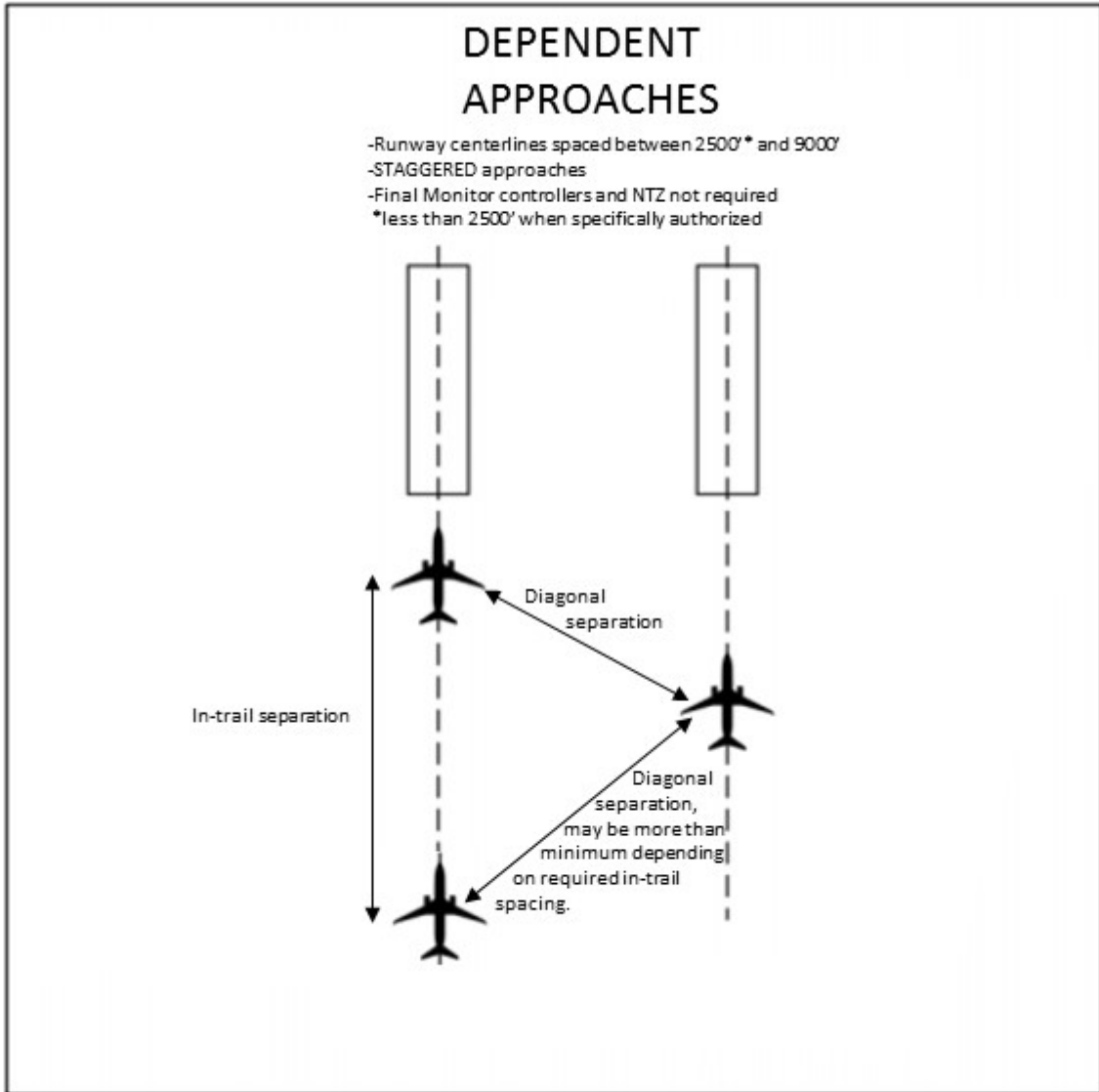
**REFERENCE—**

*AIM, Chapter 4, Section 2, Radio Communications Phraseology and Techniques, gives additional communications information.*

**f.** Use of Traffic Collision Avoidance Systems (TCAS) provides an additional element of safety to parallel approach operations. Pilots should follow recommended TCAS operating procedures presented in approved flight manuals, original equipment manufacturer recommendations, professional newsletters, and FAA publications.

5-4-14. Simultaneous Dependent Approaches

FIG 5-4-21  
Simultaneous Approaches  
(Parallel Runways and Approach Courses)



**a.** Simultaneous dependent approaches are an ATC procedure permitting approaches to airports having parallel runway centerlines separated by at least 2,500 feet up to 9,000 feet. Integral parts of a total system are ILS or other system providing approach navigation, radar, communications, ATC procedures, and required airborne equipment. RNAV equipment in the aircraft or GLS equipment on the ground and in the aircraft may replace the required airborne and ground based ILS equipment. Although non-precision minimums may be published, pilots must only use those procedures specifically authorized by chart note. For example, the chart note “LNAV NA during simultaneous operations,” requires vertical guidance. When given a choice, pilots should always fly a precision approach whenever possible.

**b.** A simultaneous dependent approach differs from a simultaneous independent approach in that, the minimum distance between parallel runway centerlines may be reduced; there is no requirement for radar monitoring or advisories; and a staggered separation of aircraft on the adjacent final course is required.

**c.** A minimum of 1.0 NM radar separation (diagonal) is required between successive aircraft on the adjacent final approach course when runway centerlines are at least 2,500 feet but no more than 3,600 feet apart. A minimum of 1.5 NM radar separation (diagonal) is required between successive aircraft on the adjacent final approach course when runway centerlines are more than 3,600 feet but no more than 8,300 feet apart. When runway centerlines are more than 8,300 feet but no more than 9,000 feet apart a minimum of 2 NM diagonal radar separation is provided. Aircraft on the same final approach course within 10 NM of the runway end are provided a minimum of 3 NM radar separation, reduced to 2.5 NM in certain circumstances. In addition, a minimum of 1,000 feet vertical or a minimum of three miles radar separation is provided between aircraft during turn on to the parallel final approach course.

**d.** Whenever parallel approaches are in use, pilots are informed by ATC or via the ATIS that approaches to both runways are in use. The charted IAP also notes

which runways may be used simultaneously. In addition, the radar controller will have the interphone capability of communicating with the tower controller where separation responsibility has not been delegated to the tower.

**NOTE–**

*ATC will not specifically identify these operations as being dependent when advertised on the ATIS.*

**EXAMPLE–**

*Simultaneous ILS Runway 19 right and ILS Runway 19 left in use.*

**e.** At certain airports, simultaneous dependent approaches are permitted to runways spaced less than 2,500 feet apart. In this case, ATC will provide no less than the minimum authorized diagonal separation with the leader always arriving on the same runway. The trailing aircraft is permitted reduced diagonal separation, instead of the single runway separation normally utilized for runways spaced less than 2,500 feet apart. For wake turbulence mitigation reasons:

1. Reduced diagonal spacing is only permitted when certain aircraft wake category pairings exist; typically when the leader is either in the large or small wake turbulence category, and

2. All aircraft must descend on the glideslope from the altitude at which they were cleared for the approach during these operations.

When reduced separation is authorized, the IAP briefing strip indicates that simultaneous operations require the use of vertical guidance and that the pilot should maintain last assigned altitude until intercepting the glideslope. No special pilot training is required to participate in these operations.

**NOTE–**

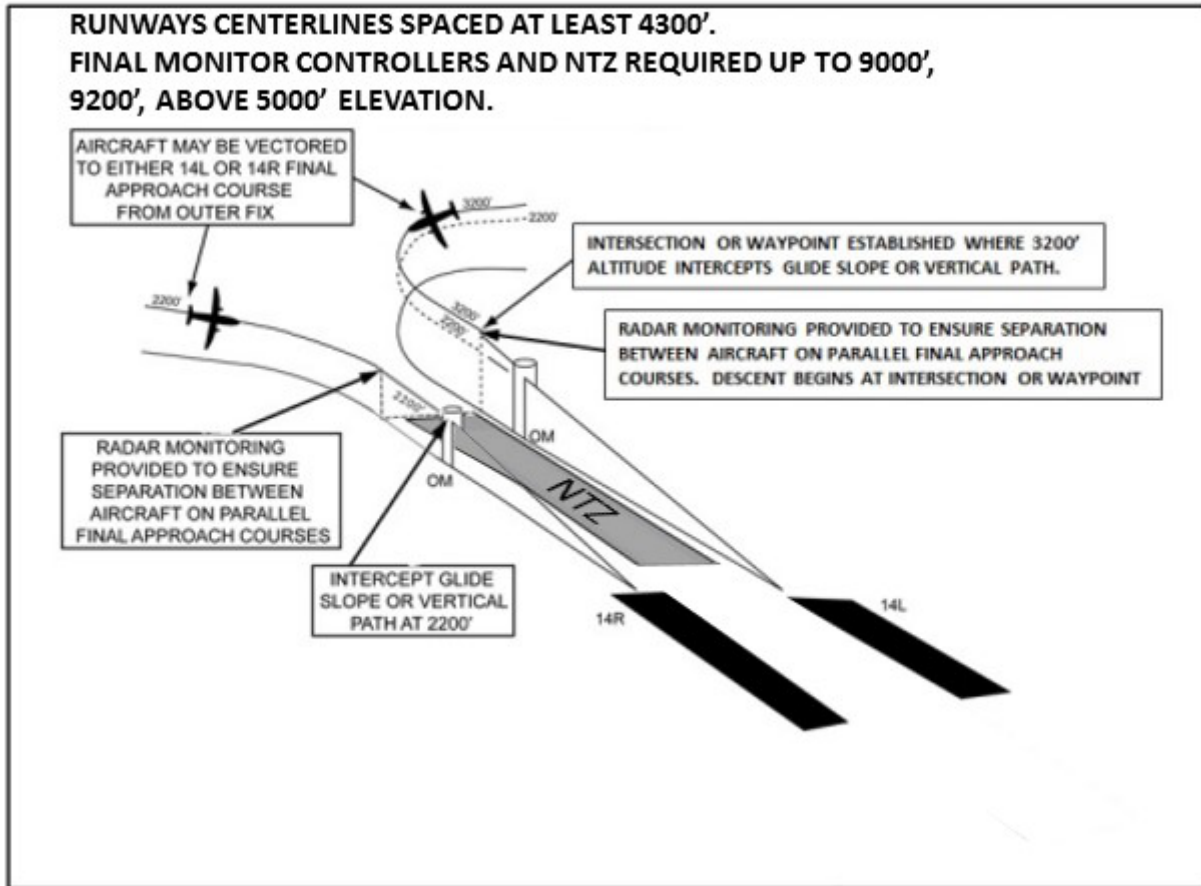
*Either simultaneous dependent approaches with reduced separation or SOIA PRM approaches may be conducted to Runways 28R and 28L at KSFO spaced 750 feet apart, depending on weather conditions and traffic volume. Pilots should use caution so as not to confuse these operations. Plan for SOIA procedures only when ATC assigns a PRM approach or the ATIS advertises PRM approaches are in use. KSFO is the only airport where both procedures are presently conducted.*

**REFERENCE–**

*AIM, Paragraph 5–4–16, Simultaneous Close Parallel PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA)*

**5-4-15. Simultaneous Independent ILS/RNAV/GLS Approaches**

*FIG 5-4-22*  
**Simultaneous Independent ILS/RNAV/GLS Approaches**



**a. System.** An approach system permitting simultaneous approaches to parallel runways with centerlines separated by at least 4,300 feet. Separation between 4,300 and 9,000 feet (9,200' for airports above 5,000') utilizing NTZ final monitor controllers. Simultaneous independent approaches require NTZ radar monitoring to ensure separation between aircraft on the adjacent parallel approach course. Aircraft position is tracked by final monitor controllers who will issue instructions to aircraft observed deviating from the assigned final approach course. Staggered radar separation procedures are not utilized. Integral parts of a total system are radar, communications, ATC procedures, and ILS or other required airborne equipment. A chart note identifies that the approach is authorized for simultaneous use. When simultaneous operations are in use, it will be

advertised on the ATIS. When advised that simultaneous approaches are in use, pilots must advise approach control immediately of malfunctioning or inoperative receivers, or if a simultaneous approach is not desired. Although non-precision minimums may be published, pilots must only use those procedures specifically authorized by chart note. For example, the chart note "LNAV NA during simultaneous operations," requires vertical guidance. When given a choice, pilots should always fly a precision approach whenever possible.

**NOTE-**  
 ATC does not use the word *independent* or *parallel* when advertising these operations on the ATIS.

**EXAMPLE-**  
 Simultaneous ILS Runway 24 left and ILS Runway 24 right approaches in use.

**b. Radar Services.** These services are provided for each simultaneous independent approach.

**1.** During turn on to parallel final approach, aircraft are normally provided 3 miles radar separation or a minimum of 1,000 feet vertical separation. The assigned altitude must be maintained until intercepting the glidepath, unless cleared otherwise by ATC. Aircraft will not be vectored to intercept the final approach course at an angle greater than thirty degrees.

**NOTE–**

*Some simultaneous operations permit the aircraft to track an RNAV course beginning on downwind and continuing in a turn to intercept the final approach course. In this case, separation with the aircraft on the adjacent final approach course is provided by the monitor controller with reference to an NTZ.*

**2.** The final monitor controller will have the capability of overriding the tower controller on the tower frequency.

**3.** Pilots will be instructed to contact the tower frequency prior to the point where NTZ monitoring begins.

**4.** Aircraft observed to overshoot the turn–on or to continue on a track which will penetrate the NTZ will be instructed to return to the correct final approach course immediately. The final monitor controller may cancel the approach clearance, and issue missed approach or other instructions to the deviating aircraft.

**PHRASEOLOGY–**

*“(Aircraft call sign) YOU HAVE CROSSED THE FINAL APPROACH COURSE. TURN (left/right) IMMEDIATELY AND RETURN TO THE FINAL APPROACH COURSE,”*

*or*

*“(aircraft call sign) TURN (left/right) AND RETURN TO THE FINAL APPROACH COURSE.”*

**5.** If a deviating aircraft fails to respond to such instructions or is observed penetrating the NTZ, the aircraft on the adjacent final approach course (if threatened), will be issued a breakout instruction.

**PHRASEOLOGY–**

*“TRAFFIC ALERT (aircraft call sign) TURN (left/right) IMMEDIATELY HEADING (degrees), (climb/descend) AND MAINTAIN (altitude).”*

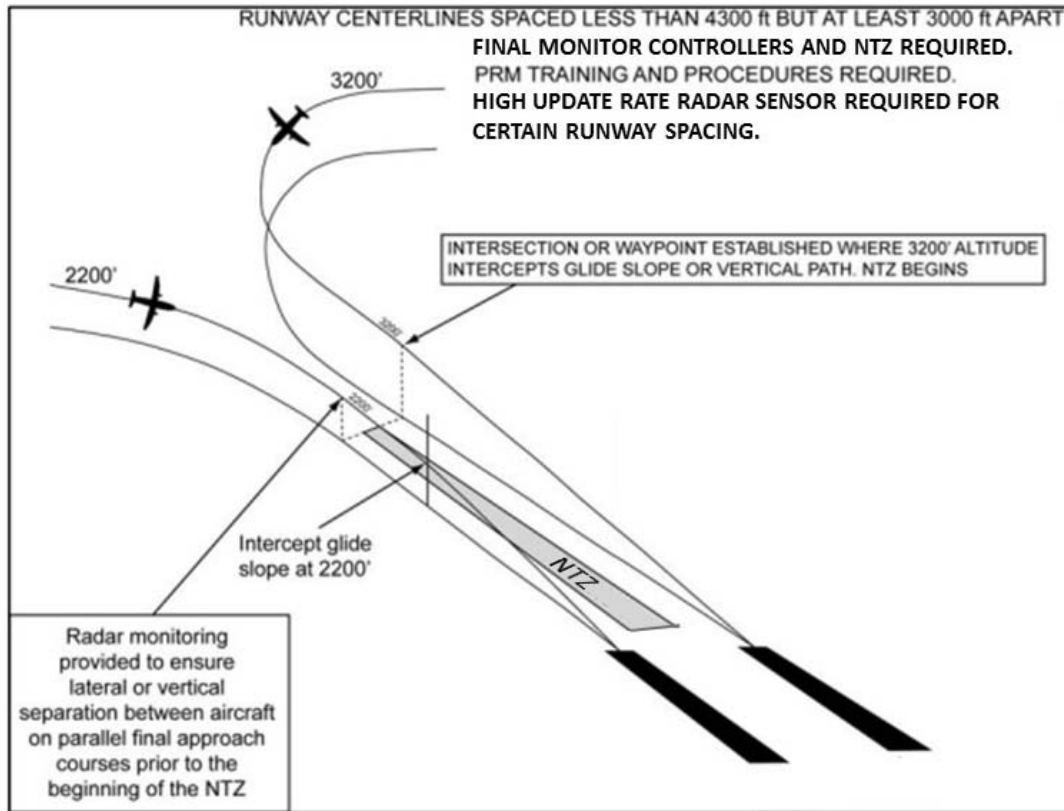
**6.** Radar monitoring will automatically be terminated when visual separation is applied, the aircraft reports the approach lights or runway in sight, or the aircraft is 1 NM or less from the runway threshold. Final monitor controllers will not advise pilots when radar monitoring is terminated.

**NOTE–**

*Simultaneous independent approaches conducted to runways spaced greater than 9,000 feet (or 9,200’ at airports above 5,000’) do not require an NTZ. However, from a pilot’s perspective, the same alerts relative to deviating aircraft will be provided by ATC as are provided when an NTZ is being monitored. Pilots may not be aware as to whether or not an NTZ is being monitored.*

## 5-4-16. Simultaneous Close Parallel PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA)

FIG 5-4-23  
PRM Approaches  
Simultaneous Close Parallel



### a. System.

1. PRM is an acronym for the high update rate Precision Runway Monitor surveillance system which is required to monitor the No Transgression Zone (NTZ) for specific parallel runway separations used to conduct simultaneous close parallel approaches. PRM is also published in the title as part of the approach name for IAPs used to conduct Simultaneous Close Parallel approaches. "PRM" alerts pilots that specific airborne equipment, training, and procedures are applicable.

Because Simultaneous Close Parallel PRM approaches are independent, the NTZ and normal operating zone (NOZ) airspace between the final approach courses is monitored by two monitor controllers, one for each approach course. The NTZ monitoring system (final monitor aid) consists of a high resolution ATC radar display with automated tracking software which provides monitor controllers with aircraft identification, position, speed, and a

ten-second projected position, as well as visual and aural NTZ penetration alerts. A PRM high update rate surveillance sensor is a component of this system only for specific runway spacing. Additional procedures for simultaneous independent approaches are described in Paragraph 5-4-15, Simultaneous Independent ILS/RNAV/GLS Approaches.

2. Simultaneous Close Parallel PRM approaches, whether conducted utilizing a high update rate PRM surveillance sensor or not, must meet all of the following requirements: pilot training, PRM in the approach title, NTZ monitoring utilizing a final monitor aid, radar display, publication of an AAUP, and use of a secondary PRM communications frequency. PRM approaches are depicted on a separate IAP titled (Procedure type) PRM Rwy XXX (Simultaneous Close Parallel or Close Parallel).

#### NOTE-

ATC does not use the word "independent" when advertising these operations on the ATIS.



**EXAMPLE–**

*Simultaneous ILS PRM Runway 33 left and ILS PRM Runway 33 right approaches in use.*

(a) The pilot may request to conduct a different type of PRM approach to the same runway other than the one that is presently being used; for example, RNAV instead of ILS. However, pilots must always obtain ATC approval to conduct a different type of approach. Also, in the event of the loss of ground-based NAVAIDS, the ATIS may advertise other types of PRM approaches to the affected runway or runways.

(b) The Attention All Users Page (AAUP) will address procedures for conducting PRM approaches.

**b. Requirements and Procedures.** Besides system requirements and pilot procedures as identified in subparagraph a1 above, all pilots must have completed special training before accepting a clearance to conduct a PRM approach.

**1. Pilot Training Requirement.** Pilots must complete special pilot training, as outlined below, before accepting a clearance for a simultaneous close parallel PRM approach.

(a) For operations under 14 CFR Parts 121, 129, and 135, pilots must comply with FAA-approved company training as identified in their Operations Specifications. Training includes the requirement for pilots to view the FAA training slide presentation, “Precision Runway Monitor (PRM) Pilot Procedures.” Refer to [https://www.faa.gov/training\\_testing/training/prm/](https://www.faa.gov/training_testing/training/prm/) or search key words “FAA PRM” for additional information and to view or download the slide presentation.

(b) For operations under Part 91:

(1) Pilots operating transport category aircraft must be familiar with PRM operations as contained in this section of the AIM. In addition, pilots operating transport category aircraft must view the slide presentation, “Precision Runway Monitor (PRM) Pilot Procedures.” Refer to [https://www.faa.gov/training\\_testing/training/prm/](https://www.faa.gov/training_testing/training/prm/) or search key words “FAA PRM” for additional information and to view or download the slide presentation.

(2) Pilots *not* operating transport category aircraft must be familiar with PRM and SOIA

operations as contained in this section of the AIM. The FAA strongly recommends that pilots *not* involved in transport category aircraft operations view the FAA training slide presentation, “Precision Runway Monitor (PRM) Pilot Procedures.” Refer to [https://www.faa.gov/training\\_testing/training/prm/](https://www.faa.gov/training_testing/training/prm/) or search key words “FAA PRM” for additional information and to view or download the slide presentation.

**NOTE–**

*Depending on weather conditions, traffic volume, and the specific combination of runways being utilized for arrival operations, a runway may be used for different types of simultaneous operations, including closely spaced dependent or independent approaches. Use PRM procedures only when the ATIS advertises their use. For other types of simultaneous approaches, see paragraphs 5–4–14 and 5–4–15.*

**c. ATC Directed Breakout.** An ATC directed “breakout” is defined as a vector off the final approach course of a threatened aircraft in response to another aircraft penetrating the NTZ.

**d. Dual Communications.** The aircraft flying the PRM approach must have the capability of enabling the pilot/s to listen to two communications frequencies simultaneously. To avoid blocked transmissions, each runway will have two frequencies, a primary and a PRM monitor frequency. The tower controller will transmit on both frequencies. The monitor controller’s transmissions, if needed, will override both frequencies. Pilots will **ONLY** transmit on the tower controller’s frequency, but will listen to both frequencies. Select the PRM monitor frequency audio only when instructed by ATC to contact the tower. The volume levels should be set about the same on both radios so that the pilots will be able to hear transmissions on the PRM frequency if the tower is blocked. Site-specific procedures take precedence over the general information presented in this paragraph. Refer to the AAUP for applicable procedures at specific airports.

**e. Radar Services.**

**1.** During turn on to parallel final approach, aircraft will be provided 3 miles radar separation or a minimum of 1,000 feet vertical separation. The assigned altitude must be maintained until intercepting the glideslope/glidepath, unless cleared otherwise by ATC. Aircraft will not be vectored to intercept the final approach course at an angle greater than thirty degrees.

2. The final monitor controller will have the capability of overriding the tower controller on the tower frequency as well as transmitting on the PRM frequency.

3. Pilots will be instructed to contact the tower frequency prior to the point where NTZ monitoring begins. Pilots will begin monitoring the secondary PRM frequency at that time (see Dual VHF Communications Required below).

4. To ensure separation is maintained, and in order to avoid an imminent situation during PRM approaches, pilots must immediately comply with monitor controller instructions.

5. Aircraft observed to overshoot the turn or to continue on a track which will penetrate the NTZ will be instructed to return to the correct final approach course immediately. The final monitor controller may cancel the approach clearance, and issue missed approach or other instructions to the deviating aircraft.

**PHRASEOLOGY–**

*“(Aircraft call sign) YOU HAVE CROSSED THE FINAL APPROACH COURSE. TURN (left/right) IMMEDIATELY AND RETURN TO THE FINAL APPROACH COURSE,”*

*or*

*“(Aircraft call sign) TURN (left/right) AND RETURN TO THE FINAL APPROACH COURSE.”*

6. If a deviating aircraft fails to respond to such instructions or is observed penetrating the NTZ, the aircraft on the adjacent final approach course (if threatened) will be issued a breakout instruction.

**PHRASEOLOGY–**

*“TRAFFIC ALERT (aircraft call sign) TURN (left/right) IMMEDIATELY HEADING (degrees), (climb/descend) AND MAINTAIN (altitude).”*

7. Radar monitoring will automatically be terminated when visual separation is applied, or the

aircraft reports the approach lights or runway in sight or within 1 NM of the runway threshold. Final monitor controllers will not advise pilots when radar monitoring is terminated.

**f. Attention All Users Page (AAUP).** At airports that conduct PRM operations, the AAUP informs pilots under the “General” section of information relative to all the PRM approaches published at a specific airport, and this section must be briefed in its entirety. Under the “Runway Specific” section, only items relative to the runway to be used for landing need be briefed. (See FIG 5–4–24.) A single AAUP is utilized for multiple PRM approach charts at the same airport, which are listed on the AAUP. The requirement for informing ATC if the pilot is unable to accept a PRM clearance is also presented. The “General” section of AAUP addresses the following:

1. Review of the procedure for executing a climbing or descending breakout;

2. Breakout phraseology beginning with the words, “Traffic Alert;”

3. Descending on the glideslope/glidepath meets all crossing restrictions;

4. Briefing the PRM approach also satisfies the non-PRM approach briefing of the same type of approach to the same runway; and

5. Description of the dual communications procedure.

The “Runway Specific” section of the AAUP addresses those issues which only apply to certain runway ends that utilize PRM approaches. There may be no Runway Specific procedures, a single item applicable to only one runway end, or multiple items for a single or multiple runway end/s. Examples of SOIA runway specific procedures are as follows:

*FIG 5-4-24*  
**PRM Attention All Users Page (AAUP)**

15288 PRM APPROACH AAUP	AL 166 (FAA)	USA INTL (USA) USA CITY
<p style="text-align: center;"><b><u>ATTENTION ALL USERS PAGE (AAUP)</u></b>  <b>(PRM CLOSE PARALLEL)</b></p> <p>Pilots who are unable to participate will be afforded appropriate arrival services as operational conditions permit and must notify the controlling ATC facility as soon as practical, but at least 120 miles from destination.</p> <p style="text-align: center;">ILS PRM or LOC PRM RwyS 10R, 10C, 28L, 28C  RNAV (GPS) PRM RWYS 10R, 10C, 28L, 28C</p> <p><b>General</b></p> <ul style="list-style-type: none"> <li>- Review procedure for executing a climbing and descending PRM breakout.</li> <li>- Breakout phraseology: "TRAFFIC ALERT (call sign) TURN (left/right) IMMEDIATELY HEADING (degrees) CLIMB/DESCEND AND MAINTAIN (altitude)."</li> <li>- All breakouts: Hand flown, initiate immediately.</li> <li>- Descending on the glideslope/glidepath ensures compliance with any charted crossing restrictions.</li> <li>- Dual VHF COMM: When assigned or planning a specific PRM approach, tune a second receiver to the PRM monitor frequency or, if silent, other active frequency (i.e., ATIS), set the volume, retune the PRM frequency if necessary, then deselect the audio. When directed by ATC, immediately switch to the tower frequency and select the secondary radio audio to ON.</li> <li>- If later assigned the same runway, non-PRM approach, consider it briefed provided the same minimums are utilized. PRM related chart notes and frequency no longer apply.</li> <li>- TCAS during breakout: Follow TCAS climb/descend if it differs from ATC, while executing the breakout turn.</li> </ul> <p><b>Runway Specific</b></p> <ul style="list-style-type: none"> <li>- Runway 10R: Exit at taxiway Tango whenever practical.</li> </ul>		
PRM APPROACH AAUP	41°59'N-87°54'W	USA INTL (USA) USA CITY

**g. Simultaneous Offset Instrument Approach (SOIA).**

1. SOIA is a procedure used to conduct simultaneous approaches to runways spaced less than 3,000 feet, but at least 750 feet apart. The SOIA procedure utilizes a straight-in PRM approach to one runway, and a PRM offset approach with glides-

lope/glidepath to the adjacent runway. In SOIA operations, aircraft are paired, with the aircraft conducting the straight-in PRM approach always positioned slightly ahead of the aircraft conducting the offset PRM approach.

2. The straight-in PRM approach plates used in SOIA operations are identical to other straight-in

PRM approach plates, with an additional note, which provides the separation between the two runways used for simultaneous SOIA approaches. The offset PRM approach plate displays the required notations for closely spaced approaches as well as depicts the visual segment of the approach.

**3.** Controllers monitor the SOIA PRM approaches in exactly the same manner as is done for other PRM approaches. The procedures and system requirements for SOIA PRM approaches are identical with those used for simultaneous close parallel PRM approaches until near the offset PRM approach missed approach point (MAP), where visual acquisition of the straight-in aircraft by the aircraft conducting the offset PRM approach occurs. Since SOIA PRM approaches are identical to other PRM approaches (except for the visual segment in the offset approach), an understanding of the procedures for conducting PRM approaches is essential before conducting a SOIA PRM operation.

**4.** In SOIA, the approach course separation (instead of the runway separation) meets established close parallel approach criteria. (See FIG 5-4-25 for the generic SOIA approach geometry.) A visual segment of the offset PRM approach is established between the offset MAP and the runway threshold. Aircraft transition in visual conditions from the offset course, beginning at the offset MAP, to align with the runway and can be stabilized by 500 feet above ground level (AGL) on the extended runway centerline. A cloud ceiling for the approach is established so that the aircraft conducting the offset approach has nominally at least 30 seconds or more to acquire the leading straight-in aircraft prior to reaching the offset MAP. If visual acquisition is not accomplished prior to crossing the offset MAP, a missed approach must be executed.

**5.** Flight Management System (FMS) coding of the offset RNAV PRM and GLS PRM approaches in a SOIA operation is different than other RNAV and GLS approach coding in that it does not match the initial missed approach procedure published on the charted IAP. In the SOIA design of the offset approach, lateral course guidance terminates at the

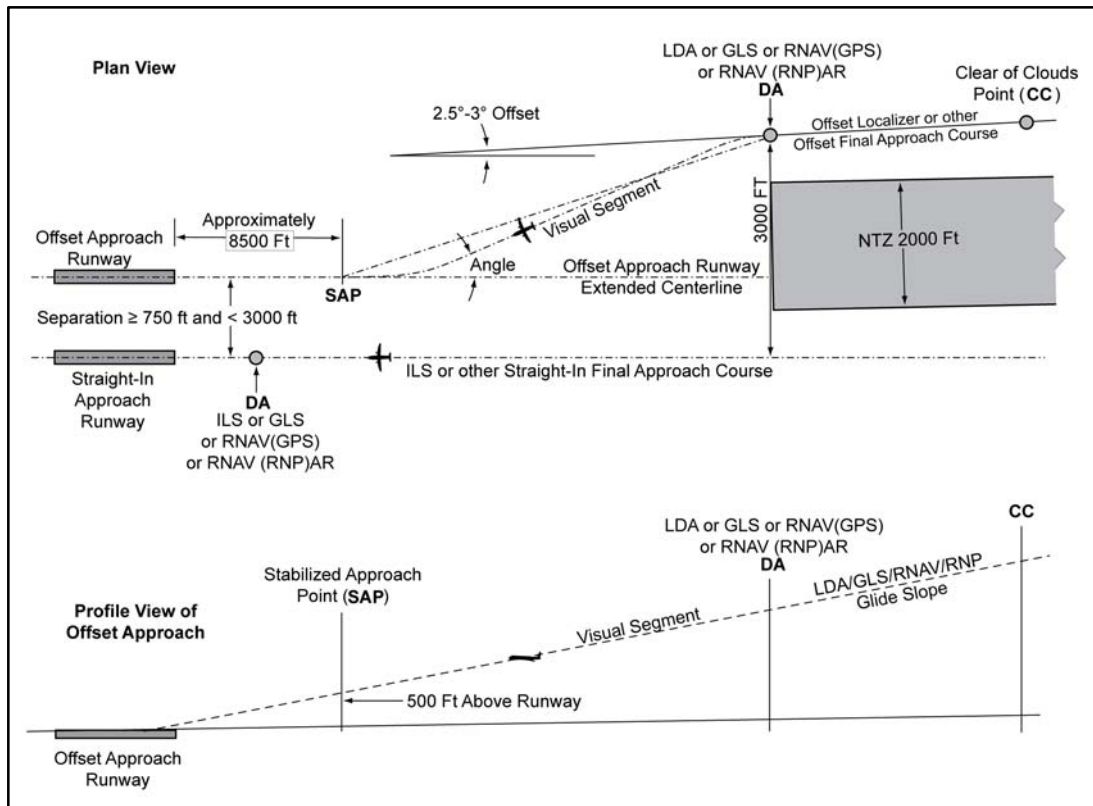
fictitious threshold point (FTP), which is an extension of the final approach course beyond the offset MAP to a point near the runway threshold. The FTP is designated in the approach coding as the MAP so that vertical guidance is available to the pilot to the runway threshold, just as vertical guidance is provided by the offset LDA glideslope. No matter what type of offset approach is being conducted, reliance on lateral guidance is discontinued at the charted MAP and replaced by visual maneuvering to accomplish runway alignment.

**(a)** As a result of this approach coding, when executing a missed approach at and after passing the charted offset MAP, a heading must initially be flown (either hand-flown or using autopilot “heading mode”) before engaging LNAV. If the pilot engages LNAV immediately, the aircraft may continue to track toward the FTP instead of commencing a turn toward the missed approach holding fix. Notes on the charted IAP and in the AAUP make specific reference to this procedure.

**(b)** Some FMSs do not code waypoints inside of the FAF as part of the approach. Therefore, the depicted MAP on the charted IAP may not be included in the offset approach coding. Pilots utilizing those FMSs may identify the location of the waypoint by noting its distance from the FTP as published on the charted IAP. In those same FMSs, the straight-in SOIA approach will not display a waypoint inside the PFAF. The same procedures may be utilized to identify an uncoded waypoint. In this case, the location is determined by noting its distance from the runway waypoint or using an authorized distance as published on the charted IAP.

**(c)** Because the FTP is coded as the MAP, the FMS map display will depict the initial missed approach course as beginning at the FTP. This depiction does not match the charted initial missed approach procedure on the IAP. Pilots are reminded that charted IAP guidance is to be followed, not the map display. Once the aircraft completes the initial turn when commencing a missed approach, the remainder of the procedure coding is standard and can be utilized as with any other IAP.

FIG 5-4-25  
SOIA Approach Geometry



**NOTE –**

**SAP** The stabilized approach point is a design point along the extended centerline of the intended landing runway on the glide slope/glide path at 500 feet above the runway threshold elevation. It is used to verify a sufficient distance is provided for the visual maneuver after the offset course approach DA to permit the pilots to conform to approved, stabilized approach criteria. The SAP is not published on the IAP.

**Offset Course DA** The point along the LDA, or other offset course, where the course separation with the adjacent ILS, or other straight-in course, reaches the minimum distance permitted to conduct closely spaced approaches. Typically that minimum distance will be 3,000 feet without the use of high update radar; with high update radar, course separation of less than 3,000 ft may be used when validated by a safety study. The altitude of the glide slope/glide path at that point determines the offset course approach decision altitude and is where the NTZ terminates. Maneuvering inside the DA is done in visual conditions.

**Visual Segment Angle** Angle, as determined by the SOIA design tool, formed by the extension of the straight segment of the calculated flight track (between the offset course MAP/DA and the SAP) and the extended runway centerline. The size of the angle is dependent on the aircraft approach categories (Category D or only selected categories/speeds) that are authorized to use the offset course approach and the spacing between the runways.

**Visibility** Distance from the offset course approach DA to runway threshold in statute mile.

**Procedure** *The aircraft on the offset course approach must see the runway-landing environment and, if ATC has advised that traffic on the straight-in approach is a factor, the offset course approach aircraft must visually acquire the straight-in approach aircraft and report it in sight to ATC prior to reaching the DA for the offset course approach.*

**CC** *The Clear of Clouds point is the position on the offset final approach course where aircraft first operate in visual meteorological conditions below the ceiling, when the actual weather conditions are at, or near, the minimum ceiling for SOIA operations. Ceiling is defined by the Aeronautical Information Manual.*

6. SOIA PRM approaches utilize the same dual communications procedures as do other PRM approaches.

**NOTE-**

*At KSFO, pilots conducting SOIA operations select the monitor frequency audio when communicating with the final radar controller, not the tower controller as is customary. In this special case, the monitor controller's transmissions, if required, override the final controller's frequency. This procedure is addressed on the AAUP.*

(a) SOIA utilizes the same AAUP format as do other PRM approaches. The minimum weather conditions that are required are listed. Because of the more complex nature of instructions for conducting SOIA approaches, the "Runway Specific" items are more numerous and lengthy.

(b) Examples of SOIA offset runway specific notes:

(1) Aircraft must remain on the offset course until passing the offset MAP prior to maneuvering to align with the centerline of the offset approach runway.

(2) Pilots are authorized to continue past the offset MAP to align with runway centerline when:

[a] the straight-in approach traffic is in sight and is expected to remain in sight,

[b] ATC has been advised that "traffic is in sight." (ATC is not required to acknowledge this transmission),

[c] the runway environment is in sight. Otherwise, a missed approach must be executed. Between the offset MAP and the runway threshold, pilots conducting the offset PRM approach must not pass the straight-in aircraft and are responsible for separating themselves visually from traffic conducting the straight-in PRM approach to the adjacent runway, which means maneuvering the aircraft as necessary to avoid that traffic until landing, and

providing wake turbulence avoidance, if applicable. Pilots maintaining visual separation should advise ATC, as soon as practical, if visual contact with the aircraft conducting the straight-in PRM approach is lost and execute a missed approach unless otherwise instructed by ATC.

(c) Examples of SOIA straight-in runway specific notes:

(1) To facilitate the offset aircraft in providing wake mitigation, pilots should descend on, not above, the glideslope/glidepath.

(2) Conducting the straight-in approach, pilots should be aware that the aircraft conducting the offset approach will be approaching from the right/left rear and will be operating in close proximity to the straight-in aircraft.

**7. Recap.**

The following are differences between widely spaced simultaneous approaches (at least 4,300 feet between the runway centerlines) and Simultaneous PRM close parallel approaches which are of importance to the pilot:

(a) **Runway Spacing.** Prior to PRM simultaneous close parallel approaches, most ATC-directed breakouts were the result of two aircraft in-trail on the same final approach course getting too close together. Two aircraft going in the same direction did not mandate quick reaction times. With PRM closely spaced approaches, two aircraft could be alongside each other, navigating on courses that are separated by less than 4,300 feet and as close as 3,000 feet. In the unlikely event that an aircraft "blunders" off its course and makes a worst case turn of 30 degrees toward the adjacent final approach course, closing speeds of 135 feet per second could occur that constitute the need for quick reaction. A blunder has to be recognized by the monitor controller, and breakout instructions issued to the endangered aircraft. The pilot will not have any warning that a

breakout is imminent because the blundering aircraft will be on another frequency. It is important that, when a pilot receives breakout instructions, the assumption is made that a blundering aircraft is about to (or has penetrated the NTZ) and is heading toward his/her approach course. The pilot must initiate a breakout as soon as safety allows. While conducting PRM approaches, pilots must maintain an increased sense of awareness in order to immediately react to an ATC (breakout) instruction and maneuver (as instructed by ATC) away from a blundering aircraft.

**(b) Communications.** Dual VHF communications procedures should be carefully followed. One of the assumptions made that permits the safe conduct of PRM approaches is that there will be no blocked communications.

**(c) Hand-flown Breakouts.** The use of the autopilot is encouraged while flying a PRM approach, but the autopilot must be disengaged in the rare event that a breakout is issued. Simulation studies of breakouts have shown that a hand-flown breakout can be initiated consistently faster than a breakout performed using the autopilot.

**(d) TCAS.** The ATC breakout instruction is the primary means of conflict resolution. TCAS, if installed, provides another form of conflict resolution in the unlikely event other separation standards would fail. TCAS is not required to conduct a closely spaced approach.

The TCAS provides only vertical resolution of aircraft conflicts, while the ATC breakout instruction provides both vertical and horizontal guidance for conflict resolutions. Pilots should always immediately follow the TCAS Resolution Advisory (RA), whenever it is received. Should a TCAS RA be received before, during, or after an ATC breakout instruction is issued, the pilot should follow the RA, even if it conflicts with the climb/descent portion of the breakout maneuver. If following an RA requires deviating from an ATC clearance, the pilot must advise ATC as soon as practical. While following an RA, it is extremely important that the pilot also comply with the turn portion of the ATC breakout instruction unless the pilot determines safety to be a factor. Adhering to these procedures assures the pilot that acceptable “breakout” separation margins will always be provided, even in the face of a normal procedural or system failure.

#### **5-4-17. Simultaneous Converging Instrument Approaches**

**a.** ATC may conduct instrument approaches simultaneously to converging runways; i.e., runways having an included angle from 15 to 100 degrees, at airports where a program has been specifically approved to do so.

**b.** The basic concept requires that dedicated, separate standard instrument approach procedures be developed for each converging runway included. These approaches can be identified by the letter “V” in the title; for example, “ILS V Rwy 17 (CONVERGING)”. Missed Approach Points must be at least 3 miles apart and missed approach procedures ensure that missed approach protected airspace does not overlap.

**c.** Other requirements are: radar availability, nonintersecting final approach courses, precision approach capability for each runway and, if runways intersect, controllers must be able to apply visual separation as well as intersecting runway separation criteria. Intersecting runways also require minimums of at least 700 foot ceilings and 2 miles visibility. Straight in approaches and landings must be made.

**d.** Whenever simultaneous converging approaches are in use, aircraft will be informed by the controller as soon as feasible after initial contact or via ATIS. Additionally, the radar controller will have direct communications capability with the tower controller where separation responsibility has not been delegated to the tower.

#### **5-4-18. RNP AR Instrument Approach Procedures**

These procedures require authorization analogous to the special authorization required for Category II or III ILS procedures. Authorization required (AR) procedures are to be conducted by aircrews meeting special training requirements in aircraft that meet the specified performance and functional requirements.

##### **a. Unique characteristics of RNP AR Approaches**

**1. RNP value.** Each published line of minima has an associated RNP value. The indicated value defines the lateral and vertical performance requirements. A minimum RNP type is documented as part of the RNP AR authorization for each operator and may vary depending on aircraft configuration or

operational procedures (e.g., GPS inoperative, use of flight director vice autopilot).

**2. Curved path procedures.** Some RNP approaches have a curved path, also called a radius-to-a-fix (RF) leg. Since not all aircraft have the capability to fly these arcs, pilots are responsible for knowing if they can conduct an RNP approach with an arc or not. Aircraft speeds, winds and bank angles have been taken into consideration in the development of the procedures.

**3. RNP required for extraction or not.** Where required, the missed approach procedure may use RNP values less than RNP-1. The reliability of the navigation system has to be very high in order to conduct these approaches. Operation on these procedures generally requires redundant equipment, as no single point of failure can cause loss of both approach and missed approach navigation.

**4. Non-standard speeds or climb gradients.** RNP AR approaches are developed based on standard approach speeds and a 200 ft/NM climb gradient in the missed approach. Any exceptions to these standards will be indicated on the approach procedure, and the operator should ensure they can comply with any published restrictions before conducting the operation.

**5. Temperature Limits.** For aircraft using barometric vertical navigation (without temperature compensation) to conduct the approach, low and high-temperature limits are identified on the procedure. Cold temperatures reduce the glidepath angle while high temperatures increase the glidepath angle. Aircraft using baro VNAV with temperature compensation or aircraft using an alternate means for vertical guidance (e.g., SBAS) may disregard the temperature restrictions. The charted temperature limits are evaluated for the final approach segment only. Regardless of charted temperature limits or temperature compensation by the FMS, the pilot may need to manually compensate for cold temperature on minimum altitudes and the decision altitude.

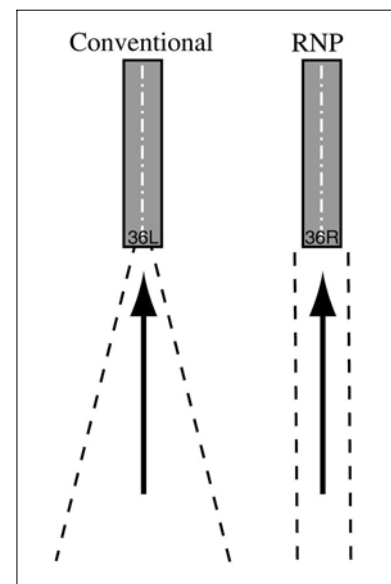
**6. Aircraft size.** The achieved minimums may be dependent on aircraft size. Large aircraft may require higher minimums due to gear height and/or wingspan. Approach procedure charts will be annotated with applicable aircraft size restrictions.

## b. Types of RNP AR Approach Operations

**1. RNP Stand-alone Approach Operations.** RNP AR procedures can provide access to runways regardless of the ground-based NAVAID infrastructure, and can be designed to avoid obstacles, terrain, airspace, or resolve environmental constraints.

**2. RNP Parallel Approach (RPA) Operations.** RNP AR procedures can be used for parallel approaches where the runway separation is adequate (See FIG 5-4-26). Parallel approach procedures can be used either simultaneously or as stand-alone operations. They may be part of either independent or dependent operations depending on the ATC ability to provide radar monitoring.

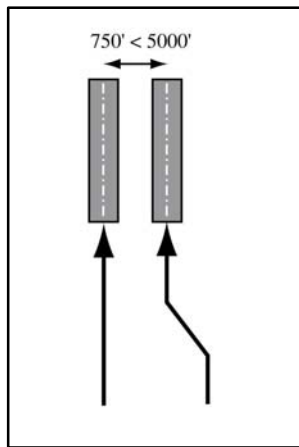
FIG 5-4-26



**3. RNP Parallel Approach Runway Transitions (RPAT) Operations.** RPAT approaches begin as a parallel IFR approach operation using simultaneous independent or dependent procedures. (See FIG 5-4-27). Visual separation standards are used in the final segment of the approach after the final approach fix, to permit the RPAT aircraft to transition in visual conditions along a predefined lateral and vertical path to align with the runway centerline.

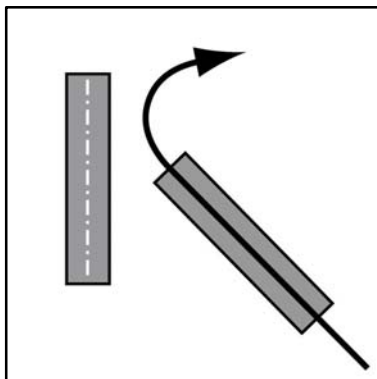


FIG 5-4-27



**4. RNP Converging Runway Operations.** At airports where runways converge, but may or may not intersect, an RNP AR approach can provide a precise curved missed approach path that conforms to aircraft separation minimums for simultaneous operations (See FIG 5-4-28). By flying this curved missed approach path with high accuracy and containment provided by RNP, dual runway operations may continue to be used to lower ceiling and visibility values than currently available. This type of operation allows greater capacity at airports where it can be applied.

FIG 5-4-28



**5-4-19. Side-step Maneuver**

a. ATC may authorize a standard instrument approach procedure which serves either one of parallel runways that are separated by 1,200 feet or

less followed by a straight-in landing on the adjacent runway.

b. Aircraft that will execute a side-step maneuver will be cleared for a specified approach procedure and landing on the adjacent parallel runway. Example, “cleared ILS runway 7 left approach, side-step to runway 7 right.” Pilots are expected to commence the side-step maneuver as soon as possible after the runway or runway environment is in sight. Compliance with minimum altitudes associated with stepdown fixes is expected even after the side-step maneuver is initiated.

**NOTE-**

*Side-step minima are flown to a Minimum Descent Altitude (MDA) regardless of the approach authorized.*

c. Landing minimums to the adjacent runway will be based on nonprecision criteria and therefore higher than the precision minimums to the primary runway, but will normally be lower than the published circling minimums.

**5-4-20. Approach and Landing Minimums**

a. **Landing Minimums.** The rules applicable to landing minimums are contained in 14 CFR Section 91.175. TBL 5-4-1 may be used to convert RVR to ground or flight visibility. For converting RVR values that fall between listed values, use the next higher RVR value; do not interpolate. For example, when converting 1800 RVR, use 2400 RVR with the resultant visibility of 1/2 mile.

b. **Obstacle Clearance.** Final approach obstacle clearance is provided from the start of the final segment to the runway or missed approach point, whichever occurs last. Side-step obstacle protection is provided by increasing the width of the final approach obstacle clearance area.

TBL 5-4-1

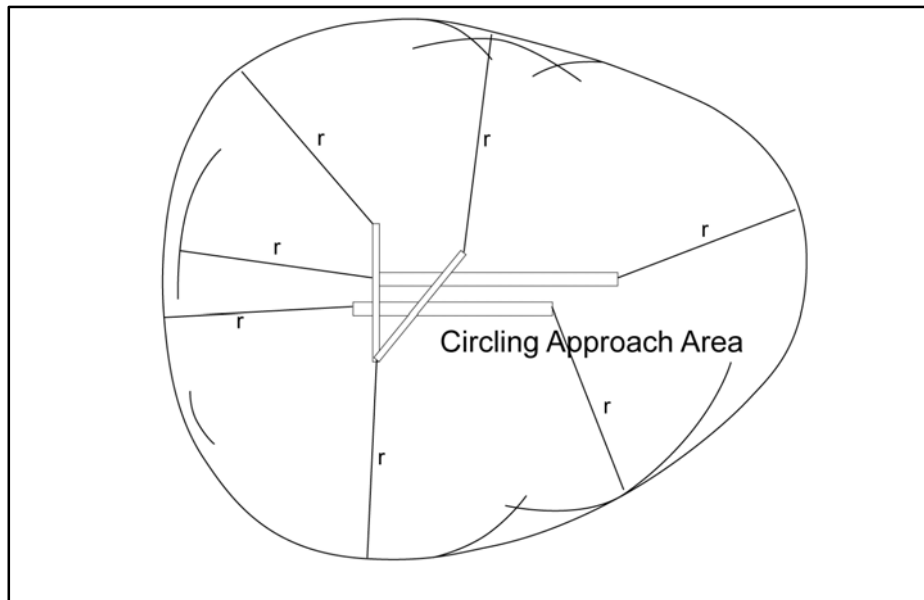
**RVR Value Conversions**

RVR	Visibility (statute miles)
1600	1/4
2400	1/2
3200	5/8
4000	3/4
4500	7/8
5000	1
6000	1 1/4

1. Circling approach protected areas are defined by the tangential connection of arcs drawn from each runway end (see FIG 5-4-29). Circling approach protected areas developed prior to late 2012 used fixed radius distances, dependent on aircraft approach category, as shown in the table on page B2 of the U.S. TPP. The approaches using standard circling approach areas can be identified by the absence of the “negative C” symbol on the circling line of minima. Circling approach protected areas developed after late 2012 use the radius distance shown in the table on page B2 of the U.S. TPP, dependent on aircraft approach category, and the altitude of the circling MDA, which accounts for true airspeed increase with altitude. The approaches using expanded circling approach areas can be identified by the presence of the “negative C” symbol on the circling line of minima (see FIG 5-4-30). Because of obstacles near the airport, a portion of the circling

area may be restricted by a procedural note; for example, “Circling NA E of RWY 17-35.” Obstacle clearance is provided at the published minimums (MDA) for the pilot who makes a straight-in approach, side-steps, or circles. Once below the MDA the pilot must see and avoid obstacles. Executing the missed approach after starting to maneuver usually places the aircraft beyond the MAP. The aircraft is clear of obstacles when at or above the MDA while inside the circling area, but simply joining the missed approach ground track from the circling maneuver may not provide vertical obstacle clearance once the aircraft exits the circling area. Additional climb inside the circling area may be required before joining the missed approach track. See Paragraph 5-4-21, Missed Approach, for additional considerations when starting a missed approach at other than the MAP.

**FIG 5-4-29  
Final Approach Obstacle Clearance**



**NOTE-**  
Circling approach area radii vary according to approach category and MSL circling altitude due to TAS changes – see FIG 5-4-30.

FIG 5-4-30

**Standard and Expanded Circling Approach Radii in the U.S. TPP**

**STANDARD CIRCLING APPROACH MANEUVERING RADIUS**

Circling approach protected areas developed prior to late 2012 used the radius distances shown in the following table, expressed in nautical miles (NM), dependent on aircraft approach category. The approaches using standard circling approach areas can be identified by the absence of the **C** symbol on the circling line of minima.

Circling MDA in feet MSL	Approach Category and Circling Radius (NM)				
	CAT A	CAT B	CAT C	CAT D	CAT E
All Altitudes	1.3	1.5	1.7	2.3	4.5

**C EXPANDED CIRCLING APPROACH MANEUVERING AIRSPACE RADIUS**

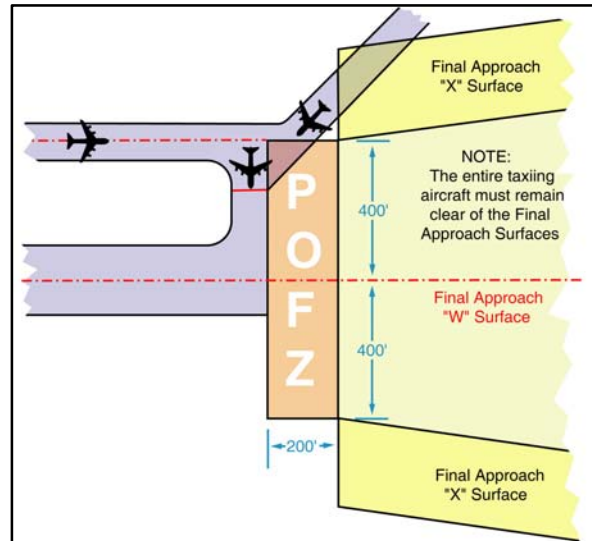
Circling approach protected areas developed after late 2012 use the radius distance shown in the following table, expressed in nautical miles (NM), dependent on aircraft approach category, and the altitude of the circling MDA, which accounts for true airspeed increase with altitude. The approaches using expanded circling approach areas can be identified by the presence of the **C** symbol on the circling line of minima.

Circling MDA in feet MSL	Approach Category and Circling Radius (NM)				
	CAT A	CAT B	CAT C	CAT D	CAT E
1000 or less	1.3	1.7	2.7	3.6	4.5
1001-3000	1.3	1.8	2.8	3.7	4.6
3001-5000	1.3	1.8	2.9	3.8	4.8
5001-7000	1.3	1.9	3.0	4.0	5.0
7001-9000	1.4	2.0	3.2	4.2	5.3
9001 and above	1.4	2.1	3.3	4.4	5.5

**2. Precision Obstacle Free Zone (POFZ).** A volume of airspace above an area beginning at the runway threshold, at the threshold elevation, and centered on the extended runway centerline. The POFZ is 200 feet (60m) long and 800 feet (240m) wide. The POFZ must be clear when an aircraft on a vertically guided final approach is within 2 nautical miles of the runway threshold and the official weather observation is a ceiling below 250 feet or visibility less than  $\frac{3}{4}$  statute mile (SM) (or runway visual range below 4,000 feet). If the POFZ is not clear, the MINIMUM authorized height above touchdown (HAT) and visibility is 250 feet and  $\frac{3}{4}$  SM. The POFZ is considered clear even if the wing of the aircraft holding on a taxiway waiting for runway clearance penetrates the POFZ; however, neither the fuselage nor the tail may infringe on the POFZ. The POFZ is applicable at all runway ends including displaced thresholds.

FIG 5-4-31

**Precision Obstacle Free Zone (POFZ)**



**c. Straight-in Minimums** are shown on the IAP when the final approach course is within 30 degrees of the runway alignment (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 step-down 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 must be conducted in accordance with the procedures and minimums approved by the military agency having jurisdiction over the airport.

### 5-4-21. Missed Approach

**a.** When a landing cannot be accomplished, advise ATC and, upon reaching the missed approach point defined on the approach procedure chart, the pilot must comply with the missed approach instructions for the procedure being used or with an alternate missed approach procedure specified by ATC.

**b.** Obstacle protection for missed approach is predicated on the missed approach being initiated at the decision altitude/decision height (DA/DH) or at the missed approach point and not lower than minimum descent altitude (MDA). A climb gradient of at least 200 feet per nautical mile is required, (except for Copter approaches, where a climb of at least 400 feet per nautical mile is required), unless a higher climb gradient is published in the notes section of the approach procedure chart. When higher than standard climb gradients are specified, the end point of the non-standard climb will be specified at either an altitude or a fix. Pilots must preplan to ensure that the aircraft can meet the climb gradient (expressed in feet per nautical mile) required by the procedure in the event of a missed approach, and be aware that flying at a higher than anticipated ground speed increases the climb rate requirement (feet per minute). Tables for the conversion of climb gradients (feet per nautical mile) to climb rate (feet per minute), based on ground speed, are included on page D1 of the U.S. Terminal Procedures booklets. Reasonable buffers are provided for normal maneuvers. However, no consideration is given to an abnormally early turn. Therefore, when an early missed approach is executed, pilots should, unless otherwise cleared by ATC, fly the IAP as specified on the approach plate to the missed approach point at or above the MDA or DH before executing a turning maneuver.

**c.** If visual reference is lost while circling-to-land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless an alternate missed approach procedure is specified by ATC). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn toward the landing runway and continue the turn until established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft

position at the time visual reference is lost. Adherence to the procedure will help assure that an aircraft will remain laterally within the circling and missed approach obstruction clearance areas. Refer to paragraph h concerning vertical obstruction clearance when starting a missed approach at other than the MAP. (See FIG 5-4-32.)

**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 5-4-33.)

**e.** Some locations may have a preplanned alternate missed approach procedure for use in the event the primary NAVAID used for the missed approach procedure is unavailable. To avoid confusion, the alternate missed approach instructions are not published on the chart. However, the alternate missed approach holding pattern will be depicted on the instrument approach chart for pilot situational awareness and to assist ATC by not having to issue detailed holding instructions. The alternate missed approach may be based on NAVAIDs not used in the approach procedure or the primary missed approach. When the alternate missed approach procedure is implemented by NOTAM, it becomes a mandatory part of the procedure. The NOTAM will specify both the textual instructions and any additional equipment requirements necessary to complete the procedure. Air traffic may also issue instructions for the alternate missed approach when necessary, such as when the primary missed approach NAVAID fails during the approach. Pilots may reject an ATC clearance for an alternate missed approach that requires equipment not necessary for the published approach procedure when the alternate missed approach is issued after beginning the approach. However, when the alternate missed approach is issued prior to beginning the approach the pilot must either accept the entire procedure (including the alternate missed approach), request a different approach procedure, or coordinate with ATC for alternative action to be taken, i.e., proceed to an alternate airport, etc.

**f.** When approach has been missed, request clearance for specific action; i.e., to alternative airport, another approach, etc.

**g.** Pilots must ensure that they have climbed to a safe altitude prior to proceeding off the published missed approach, especially in nonradar environments. Abandoning the missed approach prior to reaching the published altitude may not provide

adequate terrain clearance. Additional climb may be required after reaching the holding pattern before proceeding back to the IAF or to an alternate.

**h.** A clearance for an instrument approach procedure includes a clearance to fly the published missed approach procedure, unless otherwise instructed by ATC. The published missed approach procedure provides obstacle clearance only when the missed approach is conducted on the missed approach segment from or above the missed approach point, and assumes a climb rate of 200 feet/NM or higher, as published. If the aircraft initiates a missed approach at a point other than the missed approach point (see paragraph 5-4-5b), from below MDA or DA (H), or on a circling approach, obstacle clearance is not necessarily provided by following the published missed approach procedure, nor is separation assured from other air traffic in the vicinity.

FIG 5-4-32

**Circling and Missed Approach Obstruction Clearance Areas**

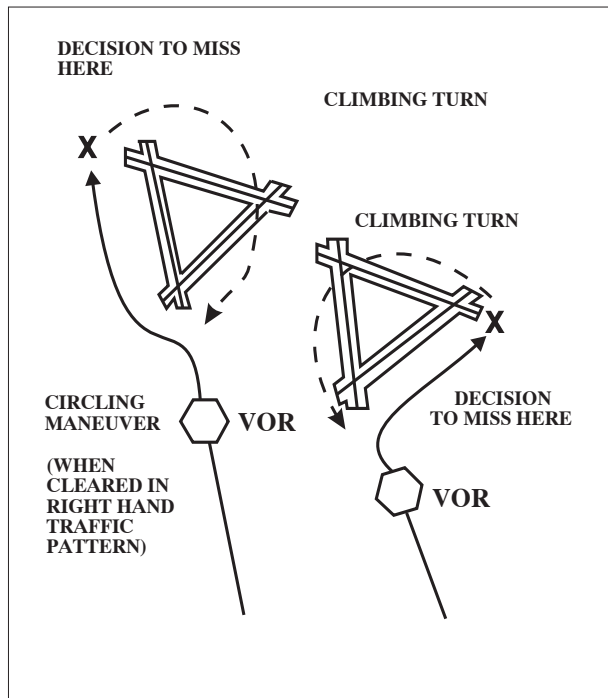
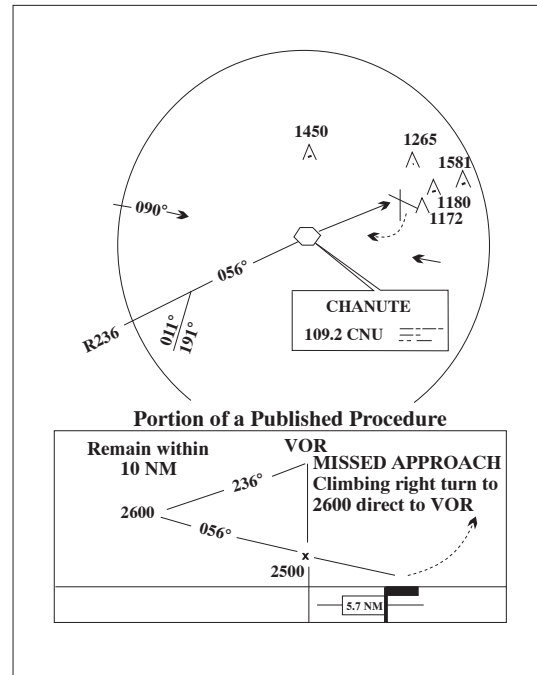


FIG 5-4-33  
**Missed Approach**



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 clear-

ance, but it does not necessarily consider separation from other air traffic. The pilot must consider other factors such as the aircraft's geographical location with respect to the prescribed missed approach point, direction of flight, and/or minimum turning altitudes in the prescribed missed approach procedure. The pilot must also consider aircraft performance, visual climb restrictions, charted obstacles, published obstacle departure procedure, takeoff visual climb requirements as expressed by nonstandard takeoff minima, other traffic expected to be in the vicinity, or other factors not specifically expressed by the approach procedures.

#### 5-4-22. Use of Enhanced Flight Vision Systems (EFVS) on Instrument Approaches

**a. Introduction.** During an instrument approach, an EFVS can enable a pilot to see the approach lights, visual references associated with the runway environment, and other objects or features that might not be visible using natural vision alone. An EFVS uses a head-up display (HUD), or an equivalent display that is a head-up presentation, to combine flight information, flight symbology, navigation guidance, and a real-time image of the external scene to the pilot. Combining the flight information, navigation guidance, and sensor imagery on a HUD

(or equivalent display) allows the pilot to continue looking forward along the flightpath throughout the entire approach, landing, and rollout.

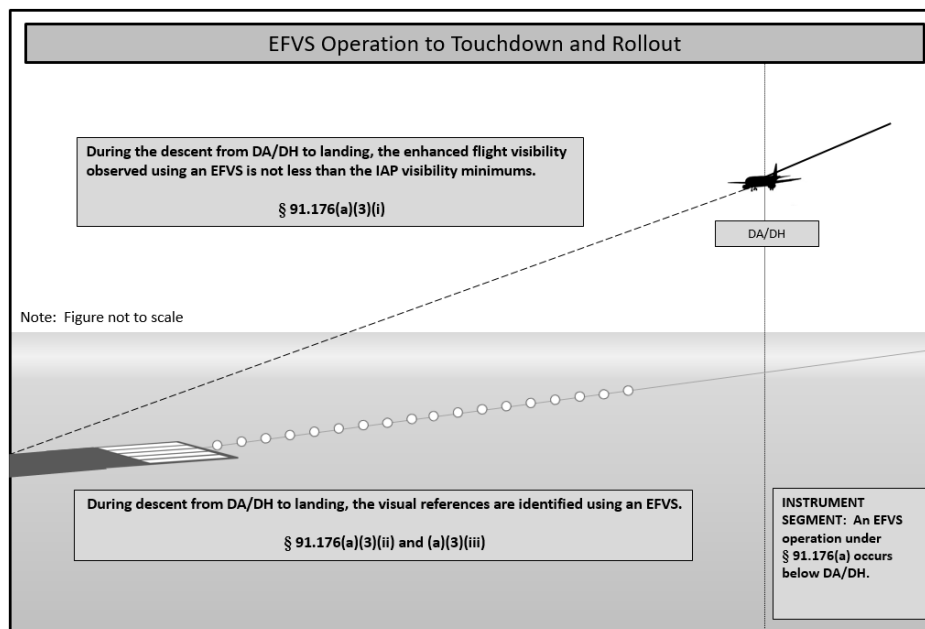
An EFVS operation is an operation in which visibility conditions require an EFVS to be used in lieu of natural vision to perform an approach or landing, determine enhanced flight visibility, identify required visual references, or conduct a rollout. There are two types of EFVS operations:

1. EFVS operations to touchdown and rollout.
2. EFVS operations to 100 feet above the touchdown zone elevation (TDZE).

**b. EFVS Operations to Touchdown and Rollout.** An EFVS operation to touchdown and rollout is an operation in which the pilot uses the enhanced vision imagery provided by an EFVS in lieu of natural vision to descend below DA or DH to touchdown and rollout. (See FIG 5-4-34.) These operations may be conducted only on Standard Instrument Approach Procedures (SIAP) or special IAPs that have a DA or DH (for example, precision or APV approach). An EFVS operation to touchdown and rollout may not be conducted on an approach that has circling minimums. The regulations for EFVS operations to touchdown and rollout can be found in 14 CFR § 91.176(a).

FIG 5-4-34

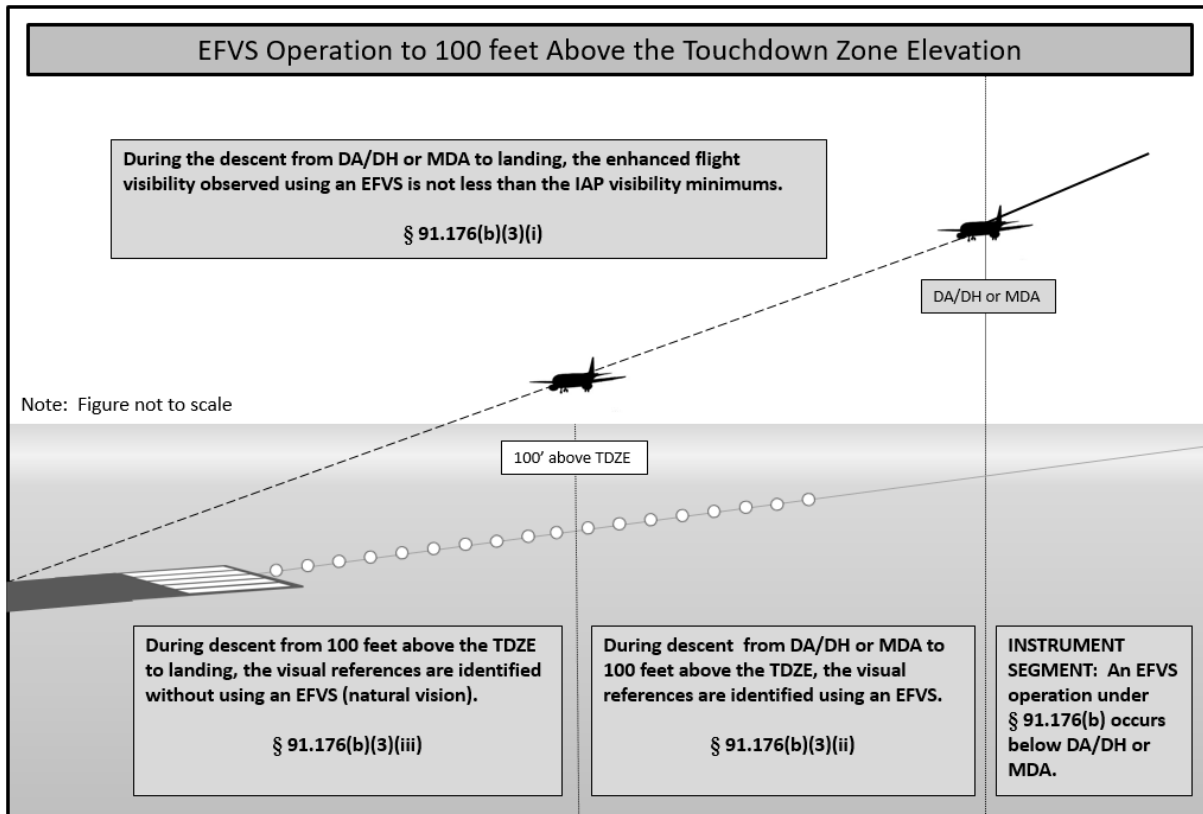
#### EFVS Operation to Touchdown and Rollout



**c. EFVS Operations to 100 Feet Above the TDZE.** An EFVS operation to 100 feet above the TDZE is an operation in which the pilot uses the enhanced vision imagery provided by an EFVS in lieu of natural vision to descend below DA/DH or MDA down to 100 feet above the TDZE. (See FIG 5-4-35.) To continue the approach below 100 feet above the TDZE, a pilot must have sufficient flight visibility to identify the required visual references using natural vision and must continue to

use the EFVS to ensure the enhanced flight visibility meets the visibility requirements of the IAP being flown. These operations may be conducted on SIAPs or special IAPs that have a DA/DH or MDA. An EFVS operation to 100 feet above the TDZE may not be conducted on an approach that has circling minimums. The regulations for EFVS operations to 100 feet above the TDZE can be found in 14 CFR § 91.176(b).

FIG 5-4-35  
EFVS Operation to 100 ft Above the TDZE



**d. EFVS Equipment Requirements.** An EFVS that is installed on a U.S.–registered aircraft and is used to conduct EFVS operations must conform to an FAA–type design approval (i.e., a type certificate (TC), amended TC, or supplemental type certificate (STC)). A foreign–registered aircraft used to conduct EFVS operations that does not have an FAA–type design approval must be equipped with an EFVS that has been approved by either the State of the Operator or the State of Registry to meet the requirements of ICAO Annex 6. Equipment requirements for an

EFVS operation to touchdown and rollout can be found in 14 CFR § 91.176(a)(1), and the equipment requirements for an EFVS operation to 100 feet above the TDZE can be found in 14 CFR § 91.176(b)(1). An operator can determine the eligibility of their aircraft to conduct EFVS operations by referring to the Airplane Flight Manual, Airplane Flight Manual Supplement, Rotorcraft Flight Manual, or Rotorcraft Flight Manual Supplement as applicable.



**e. Operating Requirements.** Any operator who conducts EFVS operations to touchdown and rollout (14 CFR § 91.176(a)) must have an OpSpec, MSpec, or LOA that specifically authorizes those operations. Parts 91K, 121, 125, 129, and 135 operators who conduct EFVS operations to 100 feet above the TDZE (14 CFR § 91.176(b)) must have an OpSpec, MSpec, or LOA that specifically authorizes the operation. Part 91 operators (other than 91K operators) are not required to have an LOA to conduct EFVS operations to 100 feet above the TDZE in the United States. However, an optional LOA is available to facilitate operational approval from foreign Civil Aviation Authorities (CAA). To conduct an EFVS operation to touchdown and rollout during an authorized Category II or III operation, the operator must have:

1. An OpSpec, MSpec, or LOA authorizing EFVS operations to touchdown and rollout (14 CFR § 91.176(a)); and
2. An OpSpec, MSpec, or LOA authorizing Category II or Category III operations.

**f. EFVS Operations in Rotorcraft.** Currently, EFVS operations in rotorcraft can only be conducted on IAPs that are flown to a runway. Instrument approach criteria, procedures, and appropriate visual references have not yet been developed for straight-in landing operations below DA/DH or MDA under IFR to heliports or platforms. An EFVS cannot be used in lieu of natural vision to descend below published minimums on copter approaches to a point in space (PinS) followed by a “proceed visual flight rules (VFR)” visual segment, or on approaches designed to a specific landing site using a “proceed visually” visual segment.

**g. EFVS Pilot Requirements.** A pilot who conducts EFVS operations must receive ground and flight training specific to the EFVS operation to be conducted. The training must be obtained from an authorized training provider under a training program approved by the FAA. Additionally, recent flight experience and proficiency or competency check requirements apply to EFVS operations. These requirements are addressed in 14 CFR §§ 61.66, 91.1065, 121.441, Appendix F to Part 121, 125.287, and 135.293.

**h. Enhanced Flight Visibility and Visual Reference Requirements.** To descend below

DA/DH or MDA during EFVS operations under 14 CFR § 91.176(a) or (b), a pilot must make a determination that the enhanced flight visibility observed by using an EFVS is not less than what is prescribed by the IAP being flown. In addition, the visual references required in 14 CFR § 91.176(a) or (b) must be distinctly visible and identifiable to the pilot using the EFVS. The determination of enhanced flight visibility is a separate action from that of identifying required visual references, and is different from ground-reported visibility. Even though the reported visibility or the visibility observed using natural vision may be less, as long as the EFVS provides the required enhanced flight visibility and a pilot meets all of the other requirements, the pilot can continue descending below DA/DH or MDA using the EFVS. Suitable enhanced flight visibility is necessary to ensure the aircraft is in a position to continue the approach and land. It is important to understand that using an EFVS does not result in obtaining lower minima with respect to the visibility or the DA/DH or MDA specified in the IAP. An EFVS simply provides another means of operating in the visual segment of an IAP. The DA/DH or MDA and the visibility value specified in the IAP to be flown do not change.

**i. Flight Planning and Beginning or Continuing an Approach Under IFR.** A Part 121, 125, or 135 operator’s OpSpec or LOA for EFVS operations may authorize an EFVS operational credit dispatching or releasing a flight and for beginning or continuing an instrument approach procedure. When a pilot reaches DA/DH or MDA, the pilot conducts the EFVS operation in accordance with 14 CFR § 91.176(a) or (b) and their authorization to conduct EFVS operations.

**j. Missed Approach Considerations.** In order to conduct an EFVS operation, the EFVS must be operable. In the event of a failure of any required component of an EFVS at any point in the approach to touchdown, a missed approach is required. However, this provision does not preclude a pilot’s authority to continue an approach if continuation of an approach is considered by the pilot to be a safer course of action.

**k. Light Emitting Diode (LED) Airport Lighting Impact on EFVS Operations.** Incandescent lamps are being replaced with LEDs at some airports in threshold lights, taxiway edge lights, taxiway centerline lights, low intensity runway edge lights,

windcone lights, beacons, and some obstruction lighting. Additionally, there are plans to replace incandescent lamps with LEDs in approach lighting systems. Pilots should be aware that LED lights cannot be sensed by infrared-based EFVSs. Further, the FAA does not currently collect or disseminate information about where LED lighting is installed.

**l. Other Vision Systems.** Unlike an EFVS that meets the equipment requirements of 14 CFR § 91.176, a Synthetic Vision System (SVS) or Synthetic Vision Guidance System (SVGS) does not provide a real-time sensor image of the outside scene and also does not meet the equipment requirements for EFVS operations. A pilot cannot use a synthetic vision image on a head-up or a head-down display in lieu of natural vision to descend below DA/DH or MDA. An EFVS can, however, be integrated with an SVS, also known as a Combined Vision System (CVS). A CVS can be used to conduct EFVS operations if all of the requirements for an EFVS are satisfied and the SVS image does not interfere with the pilot's ability to see the external scene, to identify the required visual references, or to see the sensor image.

**m. Additional Information.** Operational criteria for EFVS can be found in Advisory Circular (AC) 90-106, Enhanced Flight Vision System Operations, and airworthiness criteria for EFVS can be found in AC 20-167, Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment.

### 5-4-23. Visual Approach

**a.** A visual approach is conducted on an IFR flight plan and authorizes a pilot to proceed visually and clear of clouds to the airport. The pilot must have either the airport or the preceding identified aircraft in sight. This approach must be authorized and controlled by the appropriate air traffic control facility. Reported weather at the airport must have a ceiling at or above 1,000 feet and visibility 3 miles or greater. ATC may authorize this type of approach when it will be operationally beneficial. Visual approaches are an IFR procedure conducted under IFR in visual meteorological conditions. Cloud clearance requirements of 14 CFR Section 91.155 are not applicable, unless required by operation specifications. When conducting visual approaches,

pilots are encouraged to use other available navigational aids to assist in positive lateral and vertical alignment with the runway.

**b. Operating to an Airport Without Weather Reporting Service.** ATC will advise the pilot when weather is not available at the destination airport. ATC may initiate a visual approach provided there is a reasonable assurance that weather at the airport is a ceiling at or above 1,000 feet and visibility 3 miles or greater (e.g., area weather reports, PIREPs, etc.).

**c. Operating to an Airport With an Operating Control Tower.** Aircraft may be authorized to conduct a visual approach to one runway while other aircraft are conducting IFR or VFR approaches to another parallel, intersecting, or converging runway. 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. Once the aircraft are established within 30 degrees of final, or on the final, these 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 Paragraph 5-1-15, Canceling IFR Flight Plan*

**h.** Radar service is automatically terminated, without advising the pilot, when the aircraft is instructed to change to advisory frequency.

#### **5-4-24. Charted Visual Flight Procedure (CVFP)**

**a.** CVFPs are charted visual approaches established for environmental/noise considerations, and/or when necessary for the safety and efficiency of air traffic operations. The approach charts depict prominent landmarks, courses, and recommended altitudes to specific runways. CVFPs are designed to be used primarily for turbojet aircraft.

**b.** These procedures will be used only at airports with an operating control tower.

**c.** Most approach charts will depict some NAVAID information which is for supplemental navigational guidance only.

**d.** Unless indicating a Class B airspace floor, all depicted altitudes are for noise abatement purposes and are recommended only. Pilots are not prohibited from flying other than recommended altitudes if operational requirements dictate.

**e.** When landmarks used for navigation are not visible at night, the approach will be annotated "*PROCEDURE NOT AUTHORIZED AT NIGHT.*"

**f.** CVFPs usually begin within 20 flying miles from the airport.

**g.** Published weather minimums for CVFPs are based on minimum vectoring altitudes rather than the recommended altitudes depicted on charts.

**h.** CVFPs are not instrument approaches and do not have missed approach segments.

**i.** ATC will not issue clearances for CVFPs when the weather is less than the published minimum.

**j.** ATC will clear aircraft for a CVFP after the pilot reports 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.

**l.** When conducting visual approaches, pilots are encouraged to use other available navigational aids to assist in positive lateral and vertical alignment with the assigned runway.

#### **5-4-25. Contact Approach**

**a.** Pilots operating in accordance with an IFR flight plan, provided they are clear of clouds and have at least 1 mile flight visibility and can reasonably expect to continue to the destination airport in those conditions, may request ATC authorization for a contact approach.

**b.** Controllers may authorize a contact approach provided:

**1.** The contact approach is specifically requested by the pilot. ATC cannot initiate this approach.

**EXAMPLE—**  
*Request contact approach.*

**2.** The reported ground visibility at the destination airport is at least 1 statute mile.

**3.** The contact approach will be made to an airport having a standard or special instrument approach procedure.

**4.** Approved separation is applied between aircraft so cleared and between these aircraft and other IFR or special VFR aircraft.

**EXAMPLE—**  
*Cleared contact approach (and, if required) at or below (altitude) (routing) if not possible (alternative procedures) and advise.*

c. A contact approach is an approach procedure that may be used by a pilot (with prior authorization from ATC) in lieu of conducting a standard or special IAP to an airport. It is not intended for use by a pilot on an IFR flight clearance to operate to an airport not having a published and functioning IAP. Nor is it intended for an aircraft to conduct an instrument approach to one airport and then, when “in the clear,” discontinue that approach and proceed to another airport. In the execution of a contact approach, the pilot assumes the responsibility for obstruction clearance. If radar service is being received, it will automatically terminate when the pilot is instructed to change to advisory frequency.

**5-4-26. Landing Priority**

A clearance for a specific type of approach (ILS, RNAV, GLS, ADF, VOR or Visual Approach) to an aircraft operating on an IFR flight plan does not mean that landing priority will be given over other traffic. ATCTs handle all aircraft, regardless of the type of flight plan, on a “first-come, first-served” basis. Therefore, because of local traffic or runway in use, it may be necessary for the controller in the interest of safety, to provide a different landing sequence. In any case, a landing sequence will be issued to each aircraft as soon as possible to enable the pilot to properly adjust the aircraft’s flight path.

**5-4-27. Overhead Approach Maneuver**

a. Pilots operating in accordance with an IFR flight plan in Visual Meteorological 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 canceled when the aircraft reaches the initial point on the initial approach portion of the maneuver. (See FIG 5-4-36.) The existence of a standard overhead maneuver pattern does not eliminate the possible requirement for an aircraft to conform to conventional rectangular patterns if an overhead maneuver cannot be approved. Aircraft operating to an airport without a functioning control tower must initiate cancellation of an IFR flight plan prior to executing the overhead maneuver. Cancellation of the IFR flight plan must be accomplished after crossing the landing threshold on the initial portion of the maneuver or after landing. Controllers may authorize an overhead maneuver and issue the following to arriving aircraft:

1. Pattern altitude and direction of traffic. This information may be omitted if either is standard.

**PHRASEOLOGY-**  
*PATTERN ALTITUDE (altitude). RIGHT TURNS.*

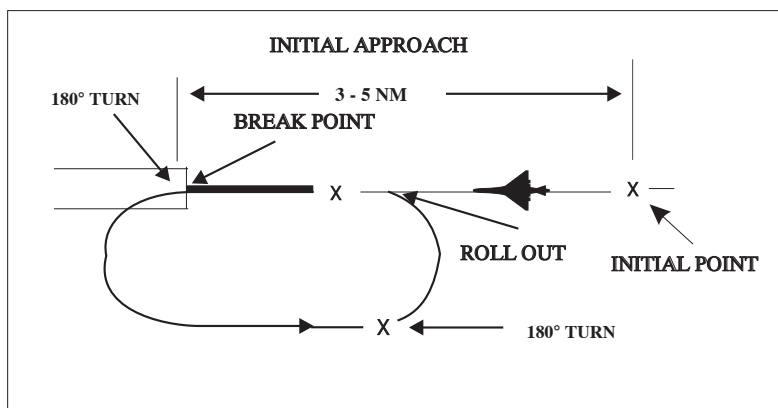
2. Request for a report on initial approach.

**PHRASEOLOGY-**  
*REPORT INITIAL.*

3. “Break” information and a request for the pilot to report. The “Break Point” will be specified if nonstandard. Pilots may be requested to report “break” if required for traffic or other reasons.

**PHRASEOLOGY-**  
*BREAK AT (specified point).*  
*REPORT BREAK.*

**FIG 5-4-36  
Overhead Maneuver**



### 5-5-5. Missed Approach

#### a. Pilot.

1. Executes a missed approach when one of the following conditions exist:

(a) Arrival at the Missed Approach Point (MAP) or the Decision Height (DH) and visual reference to the runway environment is insufficient to complete the landing.

(b) Determines that a safe approach or landing is not possible (see subparagraph 5-4-21h).

(c) Instructed to do so by ATC.

2. Advises ATC that a missed approach will be made. Include the reason for the missed approach unless the missed approach is initiated by ATC.

3. Complies with the missed approach instructions for the IAP being executed from the MAP, unless other missed approach instructions are specified by ATC.

4. 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.

5. When applicable, apply cold temperature correction to the published missed approach segment. Advise ATC when intending to apply cold temperature correction and of the amount of correction required on initial contact (or as soon as possible). This information is required for ATC to provide aircraft appropriate vertical separation between known traffic. The pilot must not apply an altitude correction to an assigned altitude when provided an initial heading to fly or radar vector in lieu of published missed approach procedures, unless approved by ATC.

#### REFERENCE-

*AIM, Paragraph 7-2-3, Altimeter Errors*

*AIM, TBL 7-2-3, ICAO Cold Temperature Error*

6. 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.

1. 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.

2. May vector a radar identified aircraft executing a missed approach when operationally advantageous to the pilot or the controller.

3. 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.

1. Promptly complies with headings and altitudes assigned to you by the controller.

2. Questions any assigned heading or altitude believed to be incorrect.

3. 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.

1. 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.

2. Vectors aircraft in Class A, Class B, Class C, Class D, Class E, and Class G airspace when requested by the pilot.

3. Vectors IFR aircraft at or above minimum vectoring altitudes.

4. May vector aircraft off assigned procedures. When published altitude or speed restrictions are included, controllers must assign an altitude, or if necessary, a speed.

5. 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.

1. Initiates appropriate action if a safety alert is received from ATC.

2. 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.

1. 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.

2. 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 FAA Order 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 5 knots or multiples thereof.

5. Terminates ATC-assigned speed adjustments when no longer required by issuing further instructions to pilots in the following manner:

(a) Advises pilots to "resume normal speed" when the aircraft is on a heading, random routing, charted procedure, or route without published speed restrictions.

(b) Instructs pilots to "comply with speed restrictions" when the aircraft is joining or resuming

a charted procedure or route with published speed restrictions.

**CAUTION–**

*The phraseology “Climb via SID” requires compliance with all altitude and/or speed restrictions depicted on the procedure.*

(c) Instructs pilots to “resume published speed” when aircraft are cleared via a charted instrument flight procedure that contains published speed restrictions.

(d) Advises aircraft to “delete speed restrictions” when ATC assigned or published speed restrictions on a charted procedure are no longer required.

(e) Clears pilots for approach without restating previously issued speed adjustments.

**REFERENCE–**

*Pilot/Controller Glossary Term– Resume Normal Speed  
Pilot/Controller Glossary Term– Resume Published Speed*

6. Gives due consideration to aircraft capabilities to reduce speed while descending.

7. Does not assign speed adjustments to aircraft at or above FL 390 without pilot consent.

**5–5–10. Traffic Advisories (Traffic Information)**

**a. Pilot.**

1. Acknowledges receipt of traffic advisories.

2. Informs controller if traffic in sight.

3. Advises ATC if a vector to avoid traffic is desired.

4. Does not expect to receive radar traffic advisories on all traffic. Some aircraft may not appear on the radar display. Be aware that the controller may be occupied with higher priority duties and unable to issue traffic information for a variety of reasons.

5. Advises controller if service is not desired.

**b. Controller.**

1. Issues radar traffic to the maximum extent consistent with higher priority duties except in Class A airspace.

2. Provides vectors to assist aircraft to avoid observed traffic when requested by the pilot.

3. Issues traffic information to aircraft in the Class B, Class C, and Class D surface areas for sequencing purposes.

4. Controllers are required to issue to each aircraft operating on intersecting or nonintersecting converging runways where projected flight paths will cross.

**5–5–11. Visual Approach**

**a. Pilot.**

1. If a visual approach is not desired, advises ATC.

2. Complies with controller’s instructions for vectors toward the airport of intended landing or to a visual position behind a preceding aircraft.

3. The pilot must, at all times, have either the airport or the preceding aircraft in sight. After being cleared for a visual approach, proceed to the airport in a normal manner or follow the preceding aircraft. Remain clear of clouds while conducting a visual approach.

4. If the pilot accepts a visual approach clearance to visually follow a preceding aircraft, you are required to establish a safe landing interval behind the aircraft you were instructed to follow. You are responsible for wake turbulence separation.

5. Advise ATC immediately if the pilot is unable to continue following the preceding aircraft, cannot remain clear of clouds, needs to climb, or loses sight of the airport.

6. Be aware that radar service is automatically terminated, without being advised by ATC, when the pilot is instructed to change to advisory frequency.

7. Be aware that there may be other traffic in the traffic pattern and the landing sequence may differ from the traffic sequence assigned by approach control or ARTCC.

**b. Controller.**

1. Do not clear an aircraft for a visual approach unless reported weather at the airport is ceiling at or above 1,000 feet and visibility is 3 miles or greater. When weather is not available for the destination airport, inform the pilot and do not initiate a visual approach to that airport unless there is reasonable assurance that descent and flight to the airport can be made visually.

2. Issue visual approach clearance when the pilot reports sighting either the airport or a preceding aircraft which is to be followed.

3. Provide separation except when visual separation is being applied by the pilot.

4. Continue flight following and traffic information until the aircraft has landed or has been instructed to change to advisory frequency.

5. For all aircraft, inform the pilot when the preceding aircraft is a heavy. Inform the pilot of a small aircraft when the preceding aircraft is a B757. Visual separation is prohibited behind super aircraft.

6. When weather is available for the destination airport, do not initiate a vector for a visual approach unless the reported ceiling at the airport is 500 feet or more above the MVA and visibility is 3 miles or more. If vectoring weather minima are not available but weather at the airport is ceiling at or above 1,000 feet and visibility of 3 miles or greater, visual approaches may still be conducted.

## 5-5-12. Visual Separation

### a. Pilot.

1. Acceptance of instructions to follow another aircraft or to provide visual separation from it is an acknowledgment that the pilot will maneuver the aircraft as necessary to avoid the other aircraft or to maintain in-trail separation. Pilots are responsible to maintain visual separation until flight paths (altitudes and/or courses) diverge.

2. If instructed by ATC to follow another aircraft or to provide visual separation from it, promptly notify the controller if you lose sight of that aircraft, are unable to maintain continued visual contact with it, or cannot accept the responsibility for your own separation for any reason.

3. The pilot also accepts responsibility for wake turbulence separation under these conditions.

### b. Controller. Applies visual separation only:

1. Within the terminal area when a controller has both aircraft in sight or by instructing a pilot who sees the other aircraft to maintain visual separation from it.

2. Pilots are responsible to maintain visual separation until flight paths (altitudes and/or courses) diverge.

3. Within en route airspace when aircraft are on opposite courses and one pilot reports having seen the other aircraft and that the aircraft have passed each other.

## 5-5-13. VFR-on-top

### a. Pilot.

1. This clearance must be requested by the pilot on an IFR flight plan, and if approved, allows the pilot the choice (subject to any ATC restrictions) to select an altitude or flight level in lieu of an assigned altitude.

#### NOTE-

*VFR-on-top is not permitted in certain airspace areas, such as Class A airspace, certain restricted areas, etc. Consequently, IFR flights operating VFR-on-top will avoid such airspace.*

#### REFERENCE-

*AIM, Paragraph 4-4-8, IFR Clearance VFR-on-top*

*AIM, Paragraph 4-4-11, IFR Separation Standards*

*AIM, Paragraph 5-3-2, Position Reporting*

*AIM, Paragraph 5-3-3, Additional Reports*

2. By requesting a VFR-on-top clearance, the pilot assumes the sole responsibility to be vigilant so as to see and avoid other aircraft and to:

(a) Fly at the appropriate VFR altitude as prescribed in 14 CFR Section 91.159.

(b) Comply with the VFR visibility and distance from clouds criteria in 14 CFR Section 91.155, *Basic VFR Weather Minimums*.

(c) Comply with instrument flight rules that are applicable to this flight; i.e., minimum IFR altitudes, position reporting, radio communications, course to be flown, adherence to ATC clearance, etc.

3. Should advise ATC prior to any altitude change to ensure the exchange of accurate traffic information.

### b. Controller.

1. May clear an aircraft to maintain VFR-on-top if the pilot of an aircraft on an IFR flight plan requests the clearance.

2. Informs the pilot of an aircraft cleared to climb to VFR-on-top the reported height of the tops or that no top report is available; issues an alternate



clearance if necessary; and once the aircraft reports reaching VFR-on-top, reclears the aircraft to maintain VFR-on-top.

3. Before issuing clearance, ascertain that the aircraft is not in or will not enter Class A airspace.

#### 5-5-14. Instrument Departures

##### a. Pilot.

1. Prior to departure considers the type of terrain and other obstructions on or in the vicinity of the departure airport.

2. Determines if obstruction avoidance can be maintained visually or that the departure procedure should be followed.

3. Determines whether an obstacle departure procedure (ODP) and/or DP is available for obstruction avoidance. One option may be a Visual Climb Over Airport (VCOA). Pilots must advise ATC as early as possible of the intent to fly the VCOA prior to departure.

4. At airports where IAPs have not been published, hence no published departure procedure, determines what action will be necessary and takes such action that will assure a safe departure.

##### b. Controller.

1. At locations with airport traffic control service, when necessary, specifies direction of takeoff, turn, or initial heading to be flown after takeoff, consistent with published departure procedures (DP) or diverse vector areas (DVA), where applicable.

2. At locations without airport traffic control service but within Class E surface area when necessary to specify direction of takeoff, turn, or initial heading to be flown, obtains pilot's concurrence that the procedure will allow the pilot to comply with local traffic patterns, terrain, and obstruction avoidance.

3. When the initial heading will take the aircraft off an assigned procedure (for example, an RNAV SID with a published lateral path to a waypoint and crossing restrictions from the departure end of runway), the controller will assign an altitude to maintain with the initial heading.

4. Includes established departure procedures as part of the ATC clearance when pilot compliance is necessary to ensure separation.

#### 5-5-15. Minimum Fuel Advisory

##### a. Pilot.

1. Advise ATC of your minimum fuel status when your fuel supply has reached a state where, upon reaching destination, you cannot accept any undue delay.

2. Be aware this is not an emergency situation, but merely an advisory that indicates an emergency situation is possible should any undue delay occur.

3. On initial contact the term "minimum fuel" should be used after stating call sign.

##### EXAMPLE-

*Salt Lake Approach, United 621, "minimum fuel."*

4. Be aware a minimum fuel advisory does not imply a need for traffic priority.

5. If the remaining usable fuel supply suggests the need for traffic priority to ensure a safe landing, you should declare an emergency due to low fuel and report fuel remaining in minutes.

##### REFERENCE-

*Pilot/Controller Glossary Term- Fuel Remaining.*

##### b. Controller.

1. When an aircraft declares a state of minimum fuel, relay this information to the facility to whom control jurisdiction is transferred.

2. Be alert for any occurrence which might delay the aircraft.

#### 5-5-16. RNAV and RNP Operations

##### a. Pilot.

1. If unable to comply with the requirements of an RNAV or RNP procedure, pilots must advise air traffic control as soon as possible. For example, "N1234, failure of GPS system, unable RNAV, request amended clearance."

2. Pilots are not authorized to fly a published RNAV or RNP procedure (instrument approach, departure, or arrival procedure) unless it is retrievable by the procedure name from the current aircraft navigation database and conforms to the charted procedure. The system must be able to retrieve the

procedure by name from the aircraft navigation database, not just as a manually entered series of waypoints.

3. Whenever possible, RNAV routes (Q- or T-route) should be extracted from the database in their entirety, rather than loading RNAV route waypoints from the database into the flight plan individually. However, selecting and inserting individual, named fixes from the database is permitted, provided all fixes along the published route to be flown are inserted.

4. Pilots must not change any database waypoint type from a fly-by to fly-over, or vice versa. No other modification of database waypoints or the creation of user-defined waypoints on published RNAV or RNP procedures is permitted, except to:

(a) Change altitude and/or airspeed waypoint constraints to comply with an ATC clearance/instruction.

(b) Insert a waypoint along the published route to assist in complying with ATC instruction, example, “Descend via the WILMS arrival except cross 30 north of BRUCE at/or below FL 210.” This is limited only to systems that allow along-track waypoint construction.

5. Pilots of FMS-equipped aircraft, who are assigned an RNAV DP or STAR procedure and subsequently receive a change of runway, transition or procedure, must verify that the appropriate changes are loaded and available for navigation.

6. For RNAV 1 DPs and STARs, pilots must use a CDI, flight director and/or autopilot, in lateral navigation mode. Other methods providing an equivalent level of performance may also be acceptable.

7. For RNAV 1 DPs and STARs, pilots of aircraft without GPS, using DME/DME/IRU, must ensure the aircraft navigation system position is confirmed, within 1,000 feet, at the start point of take-off roll. The use of an automatic or manual runway update is an acceptable means of compliance with this requirement. Other methods providing an equivalent level of performance may also be acceptable.

8. For procedures or routes requiring the use of GPS, if the navigation system does not automatically alert the flight crew of a loss of GPS, the operator must develop procedures to verify correct GPS operation.

9. RNAV terminal procedures (DP and STAR) may be amended by ATC issuing radar vectors and/or clearances direct to a waypoint. Pilots should avoid premature manual deletion of waypoints from their active “legs” page to allow for rejoining procedures.

10. RAIM Prediction: If TSO-C129 equipment is used to solely satisfy the RNAV and RNP requirement, GPS RAIM availability must be confirmed for the intended route of flight (route and time). If RAIM is not available, pilots need an approved alternate means of navigation.

**REFERENCE-**

*AIM, Paragraph 5-1-16, RNAV and RNP Operations*

**11. Definition of “established” for RNAV and RNP operations.** An aircraft is considered to be established on-course during RNAV and RNP operations anytime it is within 1 times the required accuracy for the segment being flown. For example, while operating on a Q-Route (RNAV 2), the aircraft is considered to be established on-course when it is within 2 NM of the course centerline.

**NOTE-**

1. *Pilots must be aware of how their navigation system operates, along with any AFM limitations, and confirm that the aircraft’s lateral deviation display (or map display if being used as an allowed alternate means) is suitable for the accuracy of the segment being flown. Automatic scaling and alerting changes are appropriate for some operations. For example, TSO-C129 systems change within 30 miles of destination and within 2 miles of FAF to support approach operations. For some navigation systems and operations, manual selection of scaling will be necessary.*

2. *Pilots flying FMS equipped aircraft with barometric vertical navigation (Baro-VNAV) may descend when the aircraft is established on-course following FMS leg transition to the next segment. Leg transition normally occurs at the turn bisector for a fly-by waypoint (reference paragraph 1-2-1 for more on waypoints). When using full automation, pilots should monitor the aircraft to ensure the aircraft is turning at appropriate lead times and descending once established on-course.*

3. *Pilots flying TSO-C129 navigation system equipped aircraft without full automation should use normal lead points to begin the turn. Pilots may descend when established on-course on the next segment of the approach.*

pilot from complying with (a) or (b) above, the pilot must report immediately after departure: the time of departure, the altitude, and the estimated time of arrival over the first reporting point along the flight route.

**3. Foreign civil aircraft.** If the pilot of a foreign civil aircraft that intends to enter the U.S. through an ADIZ cannot comply with the reporting requirements in subparagraphs c1 or c2 above, as applicable, the pilot must report the position of the aircraft to the appropriate aeronautical facility not less than 1 hour and not more than 2 hours average direct cruising distance from the U.S.

**d. Land-Based ADIZ.** Land-Based ADIZ are activated and deactivated over U.S. metropolitan areas as needed, with dimensions, activation dates and other relevant information disseminated via NOTAM. Pilots unable to comply with all NOTAM requirements must remain clear of Land-Based ADIZ. Pilots entering a Land-Based ADIZ without authorization or who fail to follow all requirements risk interception by military fighter aircraft.

**e. Exceptions to ADIZ requirements.**

1. Except for the national security requirements in paragraph 5-6-2, transponder requirements in subparagraph 5-6-4b1, and position reporting in subparagraph 5-6-4c, the ADIZ requirements in 14 CFR Part 99 described in this section do not apply to the following aircraft operations pursuant to Section 99.1(b), Applicability:

(a) Within the 48 contiguous States or within the State of Alaska, on a flight which remains within 10 NM of the point of departure;

(b) Operating at true airspeed of less than 180 knots in the Hawaii ADIZ or over any island, or within 12 NM of the coastline of any island, in the Hawaii ADIZ;

(c) Operating at true airspeed of less than 180 knots in the Alaska ADIZ while the pilot maintains a continuous listening watch on the appropriate frequency; or

(d) Operating at true airspeed of less than 180 knots in the Guam ADIZ.

2. An FAA air route traffic control center (ARTCC) may exempt certain aircraft operations on a local basis in concurrence with the DOD or pursuant to an agreement with a U.S. Federal security or

intelligence agency. (See 14 CFR 99.1 for additional information.)

f. A VFR flight plan filed inflight makes an aircraft subject to interception for positive identification when entering an ADIZ. Pilots are therefore urged to file the required DVFR flight plan either in person or by telephone prior to departure when able.

**5-6-5. Civil Aircraft Operations To or From U.S. Territorial Airspace**

a. Civil aircraft, except as described in subparagraph 5-6-5b below, are authorized to operate to or from U.S. territorial airspace if in compliance with all of the following conditions:

1. File and are on an active flight plan (IFR, VFR, or DVFR);

2. Are equipped with an operational transponder with altitude reporting capability, and continuously squawk an ATC assigned transponder code;

3. Maintain two-way radio communications with ATC;

4. Comply with all other applicable ADIZ requirements described in paragraph 5-6-4 and any other national security requirements in paragraph 5-6-2;

5. Comply with all applicable U.S. Customs and Border Protection (CBP) requirements, including Advance Passenger Information System (APIS) requirements (see subparagraph 5-6-5c below for CBP APIS information), in accordance with 19 CFR Part 122, *Air Commerce Regulations*; and

6. Are in receipt of, and are operating in accordance with, an FAA routing authorization if the aircraft is registered in a U.S. State Department-designated special interest country or is operating with the ICAO three letter designator (3LD) of a company in a country listed as a U.S. State Department-designated special interest country, unless the operator holds valid FAA Part 129 operations specifications. VFR and DVFR flight operations are prohibited for any aircraft requiring an FAA routing authorization. (See paragraph 5-6-11 for FAA routing authorization information).

b. Civil aircraft registered in the U.S., Canada, or Mexico with a maximum certificated takeoff gross weight of 100,309 pounds (45,500 kgs) or less that are

operating without an operational transponder, and/or the ability to maintain two-way radio communications with ATC, are authorized to operate to or from U.S. territorial airspace over Alaska if in compliance with all of the following conditions:

1. Depart and land at an airport within the U.S. or Canada;
2. Enter or exit U.S. territorial airspace over Alaska north of the fifty-fourth parallel;
3. File and are on an active flight plan;
4. Comply with all other applicable ADIZ requirements described in paragraph 5-6-4 and any other national security requirements in paragraph 5-6-2;
5. Squawk 1200 if VFR and equipped with a transponder; and
6. Comply with all applicable U.S. CBP requirements, including Advance Passenger Information System (APIS) requirements (see subparagraph 5-6-5c below for CBP APIS information), in accordance with 19 CFR Part 122, *Air Commerce Regulations*.

**c. CBP APIS Information.** Information about U.S. CBP APIS requirements is available at <http://www.cbp.gov>.

### 5-6-6. Civil Aircraft Operations Within U.S. Territorial Airspace

**a.** Civil aircraft with a maximum certificated takeoff gross weight less than or equal to 100,309 pounds (45,500 kgs) are authorized to operate within U.S. territorial airspace in accordance with all applicable regulations and VFR in airport traffic pattern areas of U.S. airports near the U.S. border, except for those described in subparagraph 5-6-6b below.

**b.** Civil aircraft with a maximum certificated takeoff gross weight less than or equal to 100,309 pounds (45,500 kgs) and registered in a U.S. State Department-designated special interest country or operating with the ICAO 3LD of a company in a country listed as a U.S. State Department-designated special interest country, unless the operator holds valid FAA Part 129 operations specifications, must operate within U.S. territorial airspace in accordance with the same requirements as civil aircraft with a

maximum certificated takeoff gross weight greater than 100,309 pounds (45,500 kgs), as described in subparagraph 5-6-6c below.

**c.** Civil aircraft with a maximum certificated takeoff gross weight greater than 100,309 pounds (45,500 kgs) are authorized to operate within U.S. territorial airspace if in compliance with all of the following conditions:

1. File and are on an active flight plan (IFR or VFR);
2. Equipped with an operational transponder with altitude reporting capability, and continuously squawk an ATC assigned transponder code;
3. Equipped with an operational ADS-B Out when operating in airspace specified in 14 CFR 91.225;
4. Maintain two-way radio communications with ATC;
5. Aircraft not registered in the U.S. must operate under an approved Transportation Security Administration (TSA) aviation security program (see paragraph 5-6-10 for TSA aviation security program information) or in accordance with an FAA/TSA airspace waiver (see paragraph 5-6-9 for FAA/TSA airspace waiver information), except as authorized in 5-6-6c6. below;
6. Are in receipt of, and are operating in accordance with an FAA routing authorization and an FAA/TSA airspace waiver if the aircraft is registered in a U.S. State Department-designated special interest country or is operating with the ICAO 3LD of a company in a country listed as a U.S. State Department-designated special interest country, unless the operator holds valid FAA Part 129 operations specifications. VFR and DVFR flight operations are prohibited for any aircraft requiring an FAA routing authorization. (See paragraph 5-6-11 for FAA routing authorization information.); and
7. Aircraft not registered in the U.S., when conducting post-maintenance, manufacturer, production, or acceptance flight test operations, are exempt from the requirements in 5-6-6c4 above if all of the following requirements are met:
  - (a) A U.S. company must have operational control of the aircraft;
  - (b) An FAA-certificated pilot must serve as pilot in command;

(c) Only crewmembers are permitted onboard the aircraft; and

(d) “Maintenance Flight” is included in the remarks section of the flight plan.

### **5–6–7. Civil Aircraft Operations Transiting U.S. Territorial Airspace**

a. Civil aircraft (except those operating in accordance with subparagraphs 5–6–7b, 5–6–7c, 5–6–7d, and 5–6–7e) are authorized to transit U.S. territorial airspace if in compliance with all of the following conditions:

1. File and are on an active flight plan (IFR, VFR, or DVFR);

2. Equipped with an operational transponder with altitude reporting capability and continuously squawk an ATC assigned transponder code;

3. Equipped with an operational ADS–B Out when operating in airspace specified in 14 CFR 91.225;

4. Maintain two–way radio communications with ATC;

5. Comply with all other applicable ADIZ requirements described in paragraph 5–6–4 and any other national security requirements in paragraph 5–6–2;

6. Are operating under an approved TSA aviation security program (see paragraph 5–6–10 for TSA aviation security program information) or are operating with and in accordance with an FAA/TSA airspace waiver (see paragraph 5–6–9 for FAA/TSA airspace waiver information), if:

(a) The aircraft is not registered in the U.S.; or

(b) The aircraft is registered in the U.S. and its maximum takeoff gross weight is greater than 100,309 pounds (45,500 kgs);

7. Are in receipt of, and are operating in accordance with, an FAA routing authorization if the aircraft is registered in a U.S. State Department–designated special interest country or is operating with the ICAO 3LD of a company in a country listed as a U.S. State Department–designated special interest country, unless the operator holds valid FAA Part 129 operations specifications. VFR and DVFR flight operations are prohibited for any aircraft requiring an

FAA routing authorization. (See paragraph 5–6–11 for FAA routing authorization information.)

b. Civil aircraft registered in Canada or Mexico, and engaged in operations for the purposes of air ambulance, firefighting, law enforcement, search and rescue, or emergency evacuation are authorized to transit U.S. territorial airspace within 50 NM of their respective borders with the U.S., with or without an active flight plan, provided they have received and continuously transmit an ATC–assigned transponder code.

c. Civil aircraft registered in Canada, Mexico, Bahamas, Bermuda, Cayman Islands, or the British Virgin Islands with a maximum certificated takeoff gross weight of 100,309 pounds (45,500 kgs) or less are authorized to transit U.S. territorial airspace if in compliance with all of the following conditions:

1. File and are on an active flight plan (IFR, VFR, or DVFR) that enters U.S. territorial airspace directly from any of the countries listed in this subparagraph 5–6–7c. Flights that include a stop in a non–listed country prior to entering U.S. territorial airspace must comply with the requirements prescribed by subparagraph 5–6–7a above, including operating under an approved TSA aviation security program (see paragraph 5–6–10 for TSA aviation security program information) or operating with, and in accordance with, an FAA/TSA airspace waiver (see paragraph 5–6–9 for FAA/TSA airspace waiver information).

2. Equipped with an operational transponder with altitude reporting capability and continuously squawk an ATC assigned transponder code;

3. Equipped with an operational ADS–B Out when operating in airspace specified in 14 CFR 91.225;

4. Maintain two–way radio communications with ATC; and

5. Comply with all other applicable ADIZ requirements described in paragraph 5–6–4 and any other national security requirements in paragraph 5–6–2.

d. Civil aircraft registered in Canada, Mexico, Bahamas, Bermuda, Cayman Islands, or the British Virgin Islands with a maximum certificated takeoff gross weight greater than 100,309 pounds (45,500 kgs) must comply with the requirements subparagraph 5–6–7a, including operating under an

approved TSA aviation security program (see paragraph 5-6-10 for TSA aviation program information) or operating with, and in accordance with, an FAA/TSA airspace waiver (see paragraph 5-6-9 for FAA/TSA airspace waiver information).

**e.** Civil aircraft registered in the U.S., Canada, or Mexico with a maximum certificated takeoff gross weight of 100,309 pounds (45,500 kgs) or less that are operating without an operational transponder and/or the ability to maintain two-way radio communications with ATC, are authorized to transit U.S. territorial airspace over Alaska if in compliance with all of the following conditions:

1. Enter and exit U.S. territorial airspace over Alaska north of the fifty-fourth parallel;
2. File and are on an active flight plan;
3. Squawk 1200 if VFR and equipped with a transponder.
4. Comply with all other applicable ADIZ requirements described in paragraph 5-6-4 and any other national security requirements in paragraph 5-6-2.

### 5-6-8. Foreign State Aircraft Operations

**a.** Foreign state aircraft are authorized to operate in U.S. territorial airspace if in compliance with all of the following conditions:

1. File and are on an active IFR flight plan;
2. Equipped with an operational transponder with altitude reporting capability and continuously squawk an ATC assigned transponder code;
3. Equipped with an operational ADS-B Out when operating in airspace specified in 14 CFR 91.225;
4. Maintain two-way radio communications with ATC; and
5. Comply with all other applicable ADIZ requirements described in paragraph 5-6-4 and any other national security requirements in paragraph 5-6-2.

**b. Diplomatic Clearances.** Foreign state aircraft may operate to or from, within, or in transit of U.S. territorial airspace only when authorized by the U.S. State Department by means of a diplomatic

clearance, except as described in subparagraph 5-6-8h below.

1. Information about diplomatic clearances is available at the U.S. State Department website <http://www.state.gov/t/pm/iso/c56895.htm> (lower case only).

2. A diplomatic clearance may be initiated by contacting the U.S. State Department via email at [DCAS@state.gov](mailto:DCAS@state.gov) or via phone at (202) 663-3390.

**NOTE-**

*A diplomatic clearance is not required for foreign state aircraft operations that transit U.S. controlled oceanic airspace but do not enter U.S. territorial airspace. (See subparagraph 5-6-8d for flight plan information.)*

**c.** An FAA routing authorization for state aircraft operations of special interest countries listed in subparagraph 5-6-11b. is required before the U.S. State Department will issue a diplomatic clearance for such operations. (See subparagraph 5-6-11 for FAA routing authorizations information).

**d.** Foreign state aircraft operating with a diplomatic clearance must navigate U.S. territorial airspace on an active IFR flight plan, unless specifically approved for VFR flight operations by the U.S. State Department in the diplomatic clearance.

**NOTE-**

*Foreign state aircraft operations to or from, within, or transiting U.S. territorial airspace; or transiting any U.S. controlled oceanic airspace, should enter ICAO code M in Item 8 of the flight plan to assist in identification of the aircraft as a state aircraft.*

**e.** A foreign aircraft that operates to or from, within, or in transit of U.S. territorial airspace while conducting a state aircraft operation is not authorized to change its status as a state aircraft during any portion of the approved, diplomatically cleared itinerary.

**f.** A foreign aircraft described in subparagraph 5-6-8e above may operate from or within U.S. territorial airspace as a civil aircraft operation, once it has completed its approved, diplomatically cleared itinerary, if the aircraft operator is:

1. A foreign air carrier that holds valid FAA Part 129 operations specifications; and

2. Is in compliance with all other requirements applied to foreign civil aircraft operations from or within U.S. territorial airspace. (See paragraphs 5-6-5 and 5-6-6.)

**g.** Foreign state aircraft operations are not authorized to or from Ronald Reagan Washington National Airport (KDCA).

**h. Diplomatic Clearance Exceptions.** State aircraft operations on behalf of the governments of Canada and Mexico conducted for the purposes of air ambulance, firefighting, law enforcement, search and rescue, or emergency evacuation are authorized to transit U.S. territorial airspace within 50 NM of their respective borders with the U.S., with or without an active flight plan, provided they have received and continuously transmit an ATC assigned transponder code. State aircraft operations on behalf of the governments of Canada and Mexico conducted under this subparagraph 5–6–8h are not required to obtain a diplomatic clearance from the U.S. State Department.

#### **5–6–9. FAA/TSA Airspace Waivers**

**a.** Operators may submit requests for FAA/TSA airspace waivers at <https://waivers.faa.gov> by selecting “international” as the waiver type.

**b.** Information regarding FAA/TSA airspace waivers can be found at: <http://www.tsa.gov/for-industry/general-aviation> or can be obtained by contacting TSA at (571) 227–2071.

**c.** All existing FAA/TSA waivers issued under previous FDC NOTAMS remain valid until the expiration date specified in the waiver, unless sooner superseded or rescinded.

#### **5–6–10. TSA Aviation Security Programs**

**a.** Applicants for U.S. air operator certificates will be provided contact information for TSA aviation security programs by the U.S. Department of Transportation during the certification process.

**b.** For information about applicable TSA security programs:

**1.** U.S. air carriers and commercial operators must contact their TSA Principal Security Specialist (PSS); and

**2.** Foreign air carriers must contact their International Industry Representative (IIR).

#### **5–6–11. FAA Flight Routing Authorizations**

**a.** Information about FAA routing authorizations for U.S. State Department–designated special interest country flight operations to or from, within, or transiting U.S. territorial airspace is available by country at:

**1.** FAA website [http://www.faa.gov/air\\_traffic/publications/us\\_restrictions/](http://www.faa.gov/air_traffic/publications/us_restrictions/); or

**2.** Phone by contacting the FAA System Operations Support Center (SOSC) at (202) 267–8115.

**b.** Special Interest Countries. The U.S. State Department–designated special interest countries are Cuba, Iran, The Democratic People’s Republic of Korea (North Korea), The People’s Republic of China, The Russian Federation, Sudan, and Syria.

#### **NOTE–**

*FAA flight routing authorizations are not required for aircraft registered in Hong Kong, Taiwan, or Macau.*

**c.** Aircraft operating with the ICAO 3LD assigned to a company or entity from a country listed as a State Department–designated special interest country and holding valid FAA Part 129 operations specifications do not require FAA flight routing authorization.

**d.** FAA routing authorizations will only be granted for IFR operations. VFR and DVFR flight operations are prohibited for any aircraft requiring an FAA routing authorization.

#### **5–6–12. Emergency Security Control of Air Traffic (ESCAT)**

**a.** During defense emergency or air defense emergency conditions, additional special security instructions may be issued in accordance with 32 CFR Part 245, *Plan for the Emergency Security Control of Air Traffic (ESCAT)*.

**b.** Under the provisions of 32 CFR Part 245, the military will direct the action to be taken in regard to landing, grounding, diversion, or dispersal of aircraft in the defense of the U.S. during emergency conditions.

**c.** At the time a portion or all of ESCAT is implemented, ATC facilities will broadcast appropriate instructions received from the Air Traffic Control System Command Center (ATCSCC) over available ATC frequencies. Depending on instructions received from the ATCSCC, VFR flights may be

directed to land at the nearest available airport, and IFR flights will be expected to proceed as directed by ATC.

**d.** Pilots on the ground may be required to file a flight plan and obtain an approval (through FAA) prior to conducting flight operation.

### **5-6-13. Interception Procedures**

#### **a. General.**

**1.** In conjunction with the FAA, Air Defense Sectors monitor air traffic and could order an intercept in the interest of national security or defense. Intercepts during peacetime operations are vastly different than those conducted under increased states of readiness. The interceptors may be fighters or rotary wing aircraft. The reasons for aircraft intercept include, but are not limited to:

- (a)** Identify an aircraft;
- (b)** Track an aircraft;
- (c)** Inspect an aircraft;
- (d)** Divert an aircraft;
- (e)** Establish communications with an aircraft.

**2.** When specific information is required (i.e., markings, serial numbers, etc.) the interceptor pilot(s) will respond only if, in their judgment, the request can be conducted in a safe manner. Intercept procedures are described in some detail in the paragraphs below. In all situations, the interceptor pilot will consider safety of flight for all concerned throughout the intercept procedure. The interceptor pilot(s) will use caution to avoid startling the intercepted crew or passengers and understand that maneuvers considered normal for interceptor aircraft may be considered hazardous to other aircraft.

**3.** All aircraft operating in US national airspace are highly encouraged to maintain a listening watch on VHF/UHF guard frequencies (121.5 or 243.0 MHz). If subjected to a military intercept, it is incumbent on civilian aviators to understand their responsibilities and to comply with ICAO standard signals relayed from the intercepting aircraft. Specifically, aviators are expected to contact air traffic control without delay (if able) on the local operating frequency or on VHF/UHF guard. Noncompliance may result in the use of force.

#### **b. Fighter intercept phases (See FIG 5-6-1).**

##### **1. Approach Phase.**

As standard procedure, intercepted aircraft are approached from behind. Typically, interceptor aircraft will be employed in pairs, however, it is not uncommon for a single aircraft to perform the intercept operation. Safe separation between interceptors and intercepted aircraft is the responsibility of the intercepting aircraft and will be maintained at all times.

##### **2. Identification Phase.**

Interceptor aircraft will initiate a controlled closure toward the aircraft of interest, holding at a distance no closer than deemed necessary to establish positive identification and to gather the necessary information. The interceptor may also fly past the intercepted aircraft while gathering data at a distance considered safe based on aircraft performance characteristics.

##### **3. Post Intercept Phase.**

An interceptor may attempt to establish communications via standard ICAO signals. In time-critical situations where the interceptor is seeking an immediate response from the intercepted aircraft or if the intercepted aircraft remains non-compliant to instruction, the interceptor pilot may initiate a divert maneuver. In this maneuver, the interceptor flies across the intercepted aircraft's flight path (minimum 500 feet separation and commencing from slightly below the intercepted aircraft altitude) in the general direction the intercepted aircraft is expected to turn. The interceptor will rock its wings (daytime) or flash external lights/select afterburners (night) while crossing the intercepted aircraft's flight path. The interceptor will roll out in the direction the intercepted aircraft is expected to turn before returning to verify the aircraft of interest is complying. The intercepted aircraft is expected to execute an immediate turn to the direction of the intercepting aircraft. If the aircraft of interest does not comply, the interceptor may conduct a second climbing turn across the intercepted aircraft's flight path (minimum 500 feet separation and commencing from slightly below the intercepted aircraft altitude) while expending flares as a warning signal to the intercepted aircraft to comply immediately and to turn in the direction indicated and to leave the area. The interceptor is responsible to maintain safe separation during these and all intercept maneuvers. Flight safety is paramount.



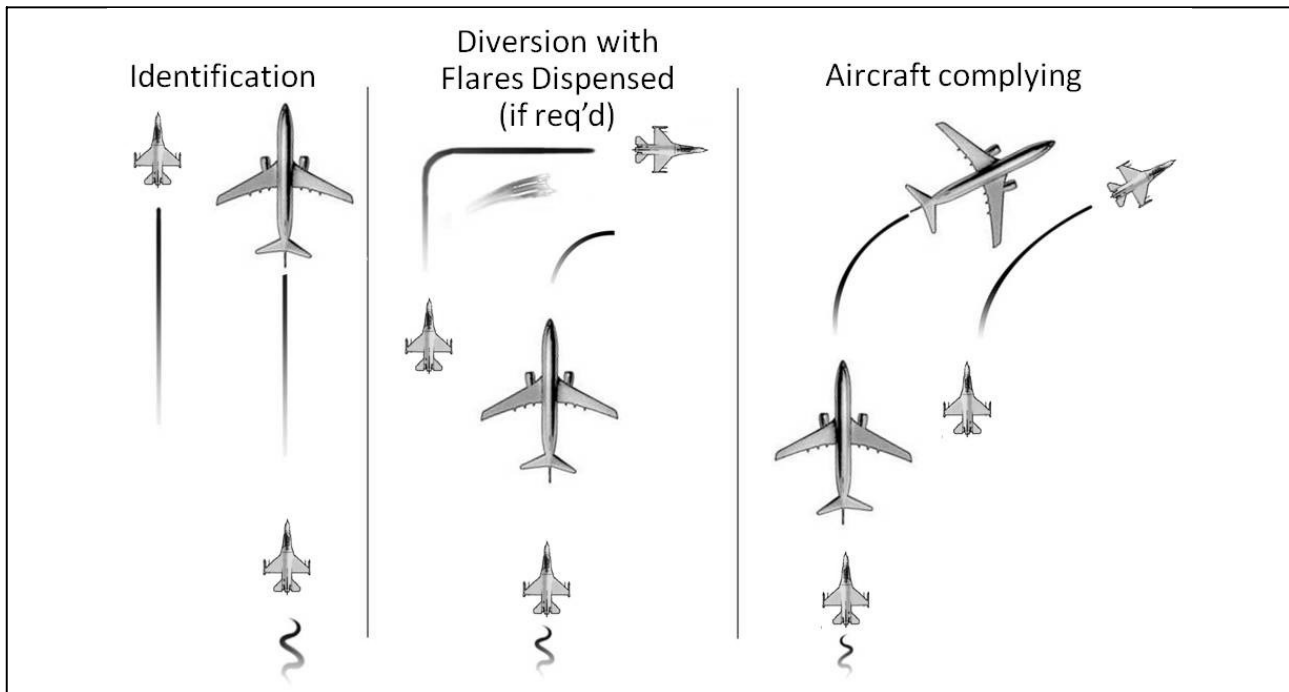
**NOTE-**

1. NORAD interceptors will take every precaution to preclude the possibility of the intercepted aircraft experiencing jet wash/wake turbulence; however, there is

a potential that this condition could be encountered.

2. During Night/IMC, the intercept will be from below flight path.

**FIG 5-6-1**  
**Intercept Procedures**



### c. Helicopter Intercept phases (See FIG 5-6-2)

#### 1. Approach Phase.

Aircraft intercepted by helicopter may be approached from any direction, although the helicopter should close for identification and signaling from behind. Generally, the helicopter will approach off the left side of the intercepted aircraft. Safe separation between the helicopter and the unidentified aircraft will be maintained at all times.

#### 2. Identification Phase.

The helicopter will initiate a controlled closure toward the aircraft of interest, holding at a distance no closer than deemed necessary to establish positive identification and gather the necessary information. The intercepted pilot should expect the interceptor helicopter to take a position off his left wing slightly forward of abeam.

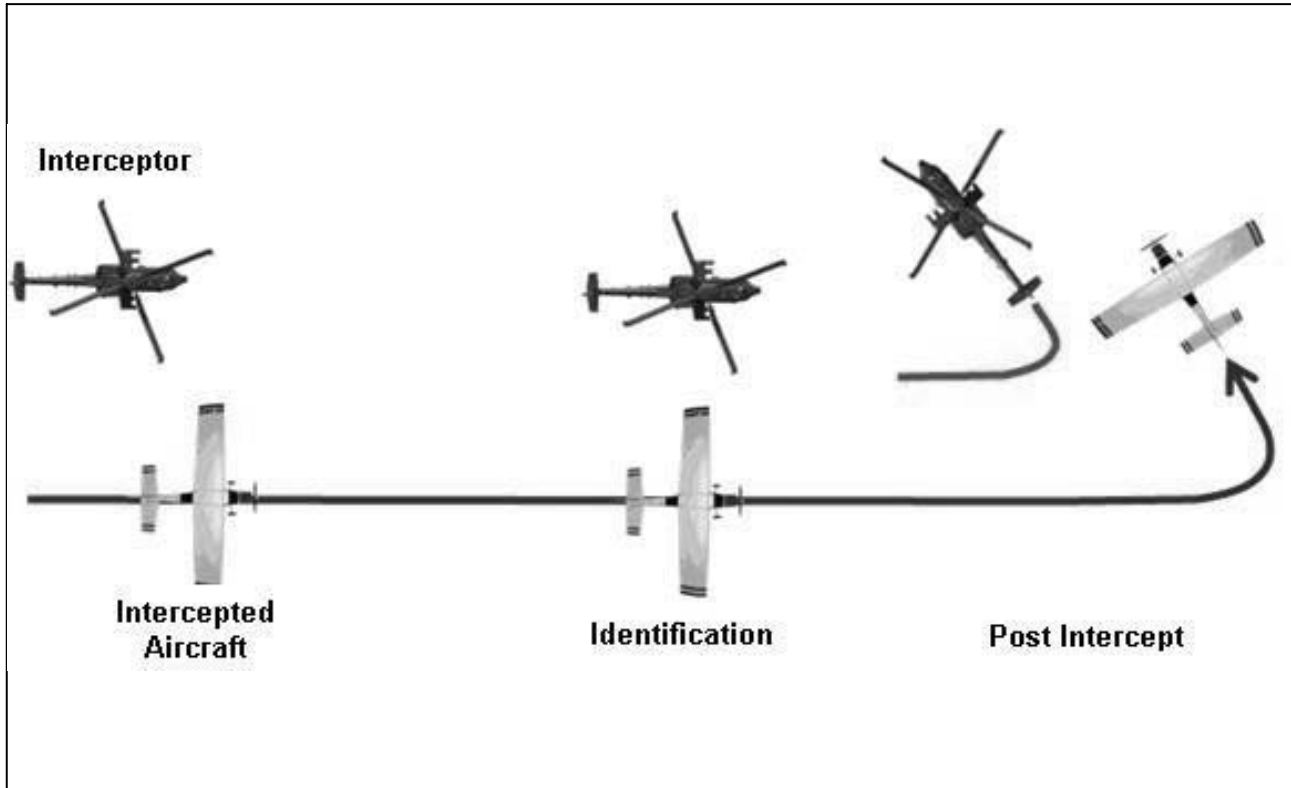
#### 3. Post Intercept Phase.

Visual signaling devices may be used in an attempt to communicate with the intercepted aircraft. Visual signaling devices may include, but are not limited to, LED scrolling signboards or blue flashing lights. If compliance is not attained through the use of radios or signaling devices, standard ICAO intercept signals (Table 5-6-1) may be employed. In order to maintain safe aircraft separation, it is incumbent upon the pilot of the intercepted aircraft not to fall into a trail position (directly behind the helicopter) if instructed to follow the helicopter. This is because the helicopter pilot may lose visual contact with the intercepted aircraft.

**NOTE-**

*Intercepted aircraft must not follow directly behind the helicopter thereby allowing the helicopter pilot to maintain visual contact with the intercepted aircraft and ensuring safe separation is maintained.*

FIG 5-6-2  
**Helicopter Intercept Procedures**



d. Summary of Intercepted Aircraft Actions. An intercepted aircraft must, without delay:

1. Adhere to instructions relayed through the use of visual devices, visual signals, and radio communications from the intercepting aircraft.
2. Attempt to establish radio communications with the intercepting aircraft or with the appropriate air traffic control facility by making a general call on guard frequencies (121.5 or 243.0 MHz), giving the identity, position, and nature of the flight.
3. If transponder equipped, select Mode 3/A Code 7700 unless otherwise instructed by air traffic control.

**NOTE-**  
*If instruction received from any agency conflicts with that given by the intercepting aircraft through visual or radio communications, the intercepted aircraft must seek immediate clarification.*

4. The crew of the intercepted aircraft must continue to comply with interceptor aircraft signals and instructions until positively released.

**5-6-14. Law Enforcement Operations by Civil and Military Organizations**

**a. Special law enforcement operations.**

1. Special law enforcement operations include in-flight identification, surveillance, interdiction, and pursuit activities performed in accordance with official civil and/or military mission responsibilities.
2. To facilitate accomplishment of these special missions, exemptions from specified sections of the CFRs have been granted to designated departments and agencies. However, it is each organization’s responsibility to apprise ATC of their intent to operate under an authorized exemption before initiating actual operations.
3. Additionally, some departments and agencies that perform special missions have been assigned coded identifiers to permit them to apprise ATC of ongoing mission activities and solicit special air traffic assistance.

information. The FAA has determined that operators and pilots may utilize the following approved sources of aviation weather information:

**1. Federal Government.** The FAA and NWS collect raw weather data, analyze the observations, and produce forecasts. The FAA and NWS disseminate meteorological observations, analyses, and forecasts through a variety of systems. In addition, the Federal Government is the only approval authority for sources of weather observations; for example, contract towers and airport operators may be approved by the Federal Government to provide weather observations.

**2. Enhanced Weather Information System (EWINS).** An EWINS is an FAA authorized, proprietary system for tracking, evaluating, reporting, and forecasting the presence or lack of adverse weather phenomena. The FAA authorizes a certificate holder to use an EWINS to produce flight movement forecasts, adverse weather phenomena forecasts, and other meteorological advisories. For more detailed information regarding EWINS, see the Aviation Weather Services Advisory Circular 00-45 and the Flight Standards Information Management System 8900.1.

**3. Commercial Weather Information Providers.** In general, commercial providers produce proprietary weather products based on NWS/FAA products with formatting and layout modifications but no material changes to the weather information itself. This is also referred to as “repackaging.” In addition, commercial providers may produce analyses, forecasts, and other proprietary weather products that substantially alter the information contained in government-produced products. However, those proprietary weather products that substantially alter government-produced weather products or information, may only be approved for use by 14 CFR Part 121 and Part 135 certificate holders if the commercial provider is EWINS qualified.

**NOTE—**

*Commercial weather information providers contracted by FAA to provide weather observations, analyses, and forecasts (e.g., contract towers) are included in the Federal Government category of approved sources by virtue of maintaining required technical and quality assurance standards under Federal Government oversight.*

## **7-1-4. Graphical Forecasts for Aviation (GFA)**

**a.** The GFA website is intended to provide the necessary aviation weather information to give users a complete picture of the weather that may affect flight in the continental United States (CONUS). The website includes observational data, forecasts, and warnings that can be viewed from 14 hours in the past to 15 hours in the future, including thunderstorms, clouds, flight category, precipitation, icing, turbulence, and wind. Hourly model data and forecasts, including information on clouds, flight category, precipitation, icing, turbulence, wind, and graphical output from the National Weather Service’s (NWS) National Digital Forecast Data (NDFD) are available. Wind, icing, and turbulence forecasts are available in 3,000 ft increments from the surface up to 30,000 ft MSL, and in 6,000 ft increments from 30,000 ft MSL to 48,000 ft MSL. Turbulence forecasts are also broken into low (below 18,000 ft MSL) and high (at or above 18,000 ft MSL) graphics. A maximum icing graphic and maximum wind velocity graphic (regardless of altitude) are also available. Built with modern geospatial information tools, users can pan and zoom to focus on areas of greatest interest. Target users are commercial and general aviation pilots, operators, briefers, and dispatchers.

### **b. Weather Products.**

**1.** The Aviation Forecasts include gridded displays of various weather parameters as well as NWS textual weather observations, forecasts, and warnings. Icing, turbulence, and wind gridded products are three-dimensional. Other gridded products are two-dimensional and may represent a “composite” of a three-dimensional weather phenomenon or a surface weather variable, such as horizontal visibility. The following are examples of aviation forecasts depicted on the GFA:

- (a)** Terminal Aerodrome Forecast (TAF)
- (b)** Ceiling & Visibility (CIG/VIS)
- (c)** Clouds
- (d)** Precipitation / Weather (PCPN/WX)
- (e)** Thunderstorm (TS)
- (f)** Winds
- (g)** Turbulence
- (h)** Ice

## 2. Observations & Warnings (Obs/Warn).

The Obs/Warn option provides an option to display weather data for the current time and the previous 14 hours (rounded to the nearest hour). Users may advance through time using the arrow buttons or by clicking on the desired hour. Provided below are the Obs/Warn product tabs available on the GFA website:

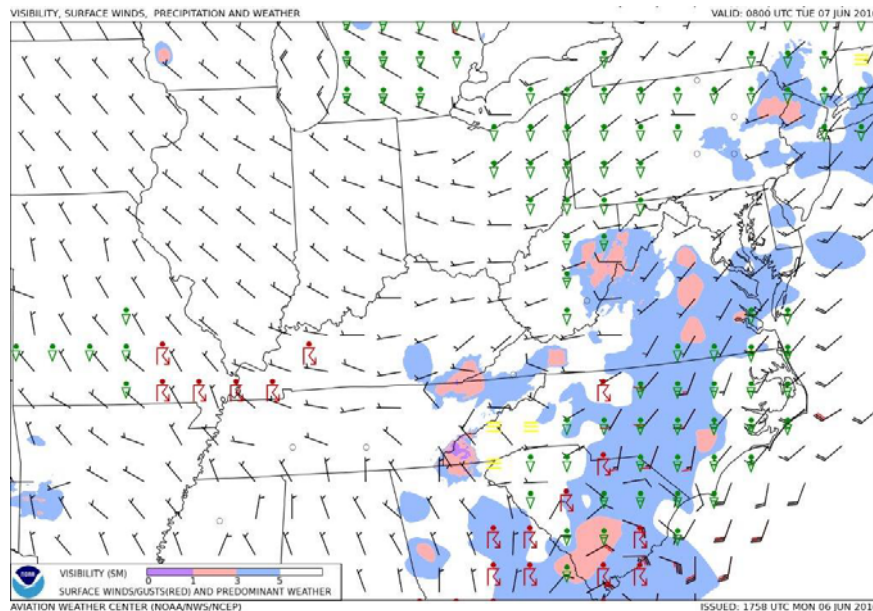
- (a) METAR
- (b) Precipitation/Weather (PCPN/WX)
- (c) Ceiling & Visibility (CIG/VIS)
- (d) Pilot Reports (PIREP)
- (e) Radar & Satellite (RAD/SAT)

3. The GFA will be continuously updated and available online at <http://aviationweather.gov/gfa>. Upon clicking the link above, select INFO on the top right corner of the map display. The next screen presents the option of selecting Overview, Products, and Tutorial. Simply select the tab of interest to explore the enhanced digital and graphical weather products designed to replace the legacy FA. Users

should also refer to AC 00–45, *Aviation Weather Services*, for more detailed information on the GFA.

4. **GFA Static Images.** Some users with limited internet connectivity may access static images via the Aviation Weather Center (AWC) at: <http://www.aviationweather.gov/gfa/plot>. There are two static graphical images available, titled *Aviation Cloud Forecast* and *Aviation Surface Forecast*. The Aviation Cloud Forecast provides cloud coverage, bases, layers, and tops with Airmet Sierra for mountain obscuration and Airmet Zulu for icing overlaid. The Aviation Surface Forecast provides visibility, weather phenomena, and winds (including wind gusts) with Airmet Sierra for instrument flight rules conditions and Airmet Tango for sustained surface winds of 30 knots or more overlaid. These images are presented on ten separate maps providing forecast views for the entire CONUS on one and nine regional views which provide more detail for the user. They are updated every 3 hours and provide forecast snapshots for 3, 6, 9, 12, 15, and 18 hours into the future. (See FIG 7–1–2 and FIG 7–1–3.)

FIG 7–1–2  
Aviation Surface Forecast



**EXAMPLE–**

See FIG 7–1–6 for an example of the G–AIRMET graphical product.

**g. Watch Notification Messages**

The Storm Prediction Center (SPC) in Norman, OK, issues Watch Notification Messages to provide an area threat alert for forecast organized severe thunderstorms that may produce tornadoes, large hail, and/or convective damaging winds within the CONUS. SPC issues three types of watch notification messages: Aviation Watch Notification Messages, Public Severe Thunderstorm Watch Notification Messages, and Public Tornado Watch Notification Messages.

It is important to note the difference between a Severe Thunderstorm (or Tornado) Watch and a Severe Thunderstorm (or Tornado) Warning. A watch means severe weather is possible during the next few hours, while a warning means that severe weather has been observed, or is expected within the hour. Only the SPC issues Severe Thunderstorm and Tornado Watches, while only NWS Weather Forecasts Offices issue Severe Thunderstorm and Tornado Warnings.

**1. The Aviation Watch Notification Message.**

The Aviation Watch Notification Message product is an approximation of the area of the Public Severe Thunderstorm Watch or Public Tornado Watch. The area may be defined as a rectangle or parallelogram using VOR navigational aides as coordinates.

The Aviation Watch Notification Message was formerly known as the Alert Severe Weather Watch Bulletin (AWW). The NWS no longer uses that title or acronym for this product. The NWS uses the acronym SAW for the Aviation Watch Notification Message, but retains AWW in the product header for processing by weather data systems.

**EXAMPLE–**

*Example of an Aviation Watch Notification Message:*

WWUS30 KWNS 271559

SAW2

SPC AWW 271559

WW 568 TORNADO AR LA MS 271605Z - 280000Z

AXIS..65 STATUTE MILES EAST AND WEST OF LINE..

45ESE HEZ/NATCHEZ MS/ - 50N TUP/TUPELO MS/

..AVIATION COORDS.. 55NM E/W /18WNW MCB - 60E

MEM/

HAIL SURFACE AND ALOFT..3 INCHES. WIND GUSTS..70 KNOTS. MAX TOPS TO 550. MEAN STORM MOTION VECTOR 26030.

LAT...LON 31369169 34998991 34998762 31368948

*THIS IS AN APPROXIMATION TO THE WATCH AREA. FOR A COMPLETE DEPICTION OF THE WATCH SEE WOUS64 KWNS FOR WOU2.*

**2. Public Severe Thunderstorm Watch Notification Messages** describe areas of expected severe thunderstorms. (Severe thunderstorm criteria are 1-inch hail or larger and/or wind gusts of 50 knots [58 mph] or greater). A Public Severe Thunderstorm Watch Notification Message contains the area description and axis, the watch expiration time, a description of hail size and thunderstorm wind gusts expected, the definition of the watch, a call to action statement, a list of other valid watches, a brief discussion of meteorological reasoning and technical information for the aviation community.

**3. Public Tornado Watch Notification Messages** describe areas where the threat of tornadoes exists. A Public Tornado Watch Notification Message contains the area description and axis, watch expiration time, the term “damaging tornadoes,” a description of the largest hail size and strongest thunderstorm wind gusts expected, the definition of the watch, a call to action statement, a list of other valid watches, a brief discussion of meteorological reasoning and technical information for the aviation community. SPC may enhance a Public Tornado Watch Notification Message by using the words “THIS IS A PARTICULARLY DANGEROUS SITUATION” when there is a likelihood of multiple strong (damage of EF2 or EF3) or violent (damage of EF4 or EF5) tornadoes.

**4. Public severe thunderstorm and tornado watch notification messages** were formerly known as the Severe Weather Watch Bulletins (WW). The NWS no longer uses that title or acronym for this product but retains WW in the product header for processing by weather data systems.

**EXAMPLE–**

*Example of a Public Tornado Watch Notification Message:*

WWUS20 KWNS 050550

SEL2

SPC WW 051750

URGENT - IMMEDIATE BROADCAST REQUESTED

TORNADO WATCH NUMBER 243

NWS STORM PREDICTION CENTER NORMAN OK

1250 AM CDT MON MAY 5 2011

THE NWS STORM PREDICTION CENTER HAS ISSUED

A

\*TORNADO WATCH FOR PORTIONS OF WESTERN AND CENTRAL ARKANSAS

*SOUTHERN MISSOURI  
 FAR EASTERN OKLAHOMA  
 \*EFFECTIVE THIS MONDAY MORNING FROM 1250  
 AM UNTIL 600 AM CDT.  
 ...THIS IS A PARTICULARLY DANGEROUS SITUATION...  
 \*PRIMARY THREATS INCLUDE  
 NUMEROUS INTENSE TORNADOES LIKELY  
 NUMEROUS SIGNIFICANT DAMAGING WIND GUSTS  
 TO 80 MPH LIKELY  
 NUMEROUS VERY LARGE HAIL TO 4 INCHES IN  
 DIAMETER LIKELY  
 THE TORNADO WATCH AREA IS APPROXIMATELY  
 ALONG AND 100 STATUTE MILES EAST AND WEST OF  
 A LINE FROM 15 MILES WEST NORTHWEST OF FORT  
 LEONARD WOOD MISSOURI TO 45 MILES SOUTH-  
 WEST OF HOT SPRINGS ARKANSAS. FOR A  
 COMPLETE DEPICTION OF THE WATCH SEE THE  
 ASSOCIATED WATCH OUTLINE UPDATE (WOUS64  
 KWNS WOU2).  
 REMEMBER...A TORNADO WATCH MEANS CONDI-  
 TIONS ARE FAVORABLE FOR TORNADOES AND  
 SEVERE THUNDERSTORMS IN AND CLOSE TO THE  
 WATCH AREA. PERSONS IN THESE AREAS SHOULD  
 BE ON THE LOOKOUT FOR THREATENING WEATH-  
 ER CONDITIONS AND LISTEN FOR LATER  
 STATEMENTS AND POSSIBLE WARNINGS.  
 OTHER WATCH INFORMATION...THIS TORNADO  
 WATCH REPLACES TORNADO WATCH NUMBER 237.  
 WATCH NUMBER 237 WILL NOT BE IN EFFECT  
 AFTER  
 1250 AM CDT. CONTINUE...WW 239...WW 240...WW  
 241...WW 242...  
 DISCUSSION...SRN MO SQUALL LINE EXPECTED TO  
 CONTINUE EWD...WHERE LONG/HOOKED  
 HODOGRAPHS SUGGEST THREAT FOR EMBEDDED  
 SUPERCELLS/POSSIBLE TORNADOES. FARTHER  
 S...MORE WIDELY SCATTERED  
 SUPERCELLS WITH A THREAT FOR TORNADOES  
 WILL PERSIST IN VERY STRONGLY DEEP SHEARED/  
 LCL ENVIRONMENT IN AR.  
 AVIATION...TORNADOES AND A FEW SEVERE THUN-  
 DERSTORMS WITH HAIL SURFACE AND ALOFT TO 4  
 INCHES. EXTREME TURBULENCE AND SURFACE  
 WIND GUSTS TO 70 KNOTS. A FEW CUMULONIMBI  
 WITH MAXIMUM TOPS TO 500. MEAN STORM  
 MOTION VECTOR 26045.*

**5.** Status reports are issued as needed to show progress of storms and to delineate areas no longer under the threat of severe storm activity. Cancellation bulletins are issued when it becomes evident that no severe weather will develop or that storms have subsided and are no longer severe.

#### **h. Center Weather Advisories (CWAs)**

**1.** CWAs are unscheduled inflight, flow control, air traffic, and air crew advisory. By nature of its short lead time, the CWA is not a flight planning product. It is generally a nowcast for conditions beginning within the next two hours. CWAs will be issued:

**(a)** As a supplement to an existing SIGMET, Convective SIGMET or AIRMET.

**(b)** When an Inflight Advisory has not been issued but observed or expected weather conditions meet SIGMET/AIRMET criteria based on current pilot reports and reinforced by other sources of information about existing meteorological conditions.

**(c)** When observed or developing weather conditions do not meet SIGMET, Convective SIGMET, or AIRMET criteria; e.g., in terms of intensity or area coverage, but current pilot reports or other weather information sources indicate that existing or anticipated meteorological phenomena will adversely affect the safe flow of air traffic within the ARTCC area of responsibility.

**2.** The following example is a CWA issued from the Kansas City, Missouri, ARTCC. The “3” after ZKC in the first line denotes this CWA has been issued for the third weather phenomena to occur for the day. The “301” in the second line denotes the phenomena number again (3) and the issuance number (01) for this phenomena. The CWA was issued at 2140Z and is valid until 2340Z.

#### **EXAMPLE-**

ZKC3 CWA 032140

ZKC CWA 301 VALID UNTIL 032340

ISOLD SVR TSTM over KCOU MOVG SWWD  
 10 KTS ETC.

#### **7-1-7. Categorical Outlooks**

**a.** Categorical outlook terms, describing general ceiling and visibility conditions for advanced planning purposes are used only in area forecasts and are defined as follows:

**1. LIFR (Low IFR).** Ceiling less than 500 feet and/or visibility less than 1 mile.

**2. IFR.** Ceiling 500 to less than 1,000 feet and/or visibility 1 to less than 3 miles.

**3. MVFR (Marginal VFR).** Ceiling 1,000 to 3,000 feet and/or visibility 3 to 5 miles inclusive.

**4. VFR.** Ceiling greater than 3,000 feet and visibility greater than 5 miles; includes sky clear.

b. The cause of LIFR, IFR, or MVFR is indicated by either ceiling or visibility restrictions or both. The contraction “CIG” and/or weather and obstruction to vision symbols are used. If winds or gusts of 25 knots or greater are forecast for the outlook period, the word “WIND” is also included for all categories including VFR.

**EXAMPLE–**

1. *LIFR CIG–low IFR due to low ceiling.*
2. *IFR FG–IFR due to visibility restricted by fog.*
3. *MVFR CIG HZ FU–marginal VFR due to both ceiling and visibility restricted by haze and smoke.*
4. *IFR CIG RA WIND–IFR due to both low ceiling and visibility restricted by rain; wind expected to be 25 knots or greater.*

**7–1–8. Telephone Information Briefing Service (TIBS) (Alaska Only)**

a. TIBS, provided by FSS, is a system of automated telephone recordings of meteorological and aeronautical information available in Alaska. Based on the specific needs of each area, TIBS provides route and/or area briefings in addition to airspace procedures and special announcements concerning aviation interests that may be available. Depending on user demand, other items may be provided; for example, surface weather observations, terminal forecasts, wind and temperatures aloft forecasts, etc.

b. TIBS is not intended to be a substitute for specialist–provided preflight briefings from FSS. TIBS is recommended as a preliminary briefing and often will be valuable in helping you to make a “go” or “no go” decision.

c. Pilots are encouraged to utilize TIBS, which can be accessed by dialing the FSS toll–free telephone number, 1–800–WX–BRIEF (992–7433) or specific published TIBS telephone numbers in certain areas. Consult the “FSS Telephone Numbers” section of the Chart Supplement U.S. or the Chart Supplement Alaska or Pacific.

**NOTE–**

*A touch–tone telephone is necessary to fully utilize TIBS.*

**7–1–9. Transcribed Weather Broadcast (TWEB) (Alaska Only)**

Equipment is provided in Alaska by which meteorological and aeronautical data are recorded on tapes and broadcast continuously over selected L/MF and VOR facilities. Broadcasts are made from a series

of individual tape recordings, and changes, as they occur, are transcribed onto the tapes. The information provided varies depending on the type equipment available. Generally, the broadcast contains a summary of adverse conditions, surface weather observations, pilot weather reports, and a density altitude statement (if applicable). At the discretion of the broadcast facility, recordings may also include a synopsis, winds aloft forecast, en route and terminal forecast data, and radar reports. At selected locations, telephone access to the TWEB has been provided (TEL–TWEB). Telephone numbers for this service are found in the Chart Supplement Alaska. These broadcasts are made available primarily for preflight and inflight planning, and as such, should not be considered as a substitute for specialist–provided preflight briefings.

**7–1–10. Inflight Weather Advisory Broadcasts**

a. ARTCCs broadcast a Severe Weather Forecast Alert (AWW), Convective SIGMET, SIGMET, AIRMET, Urgent Pilot Report, or CWA alert once on all frequencies, except emergency, when any part of the area described is within 150 miles of the airspace under their jurisdiction. These broadcasts advise pilots of the availability of hazardous weather advisories and to contact the nearest Flight Service facility for additional details.

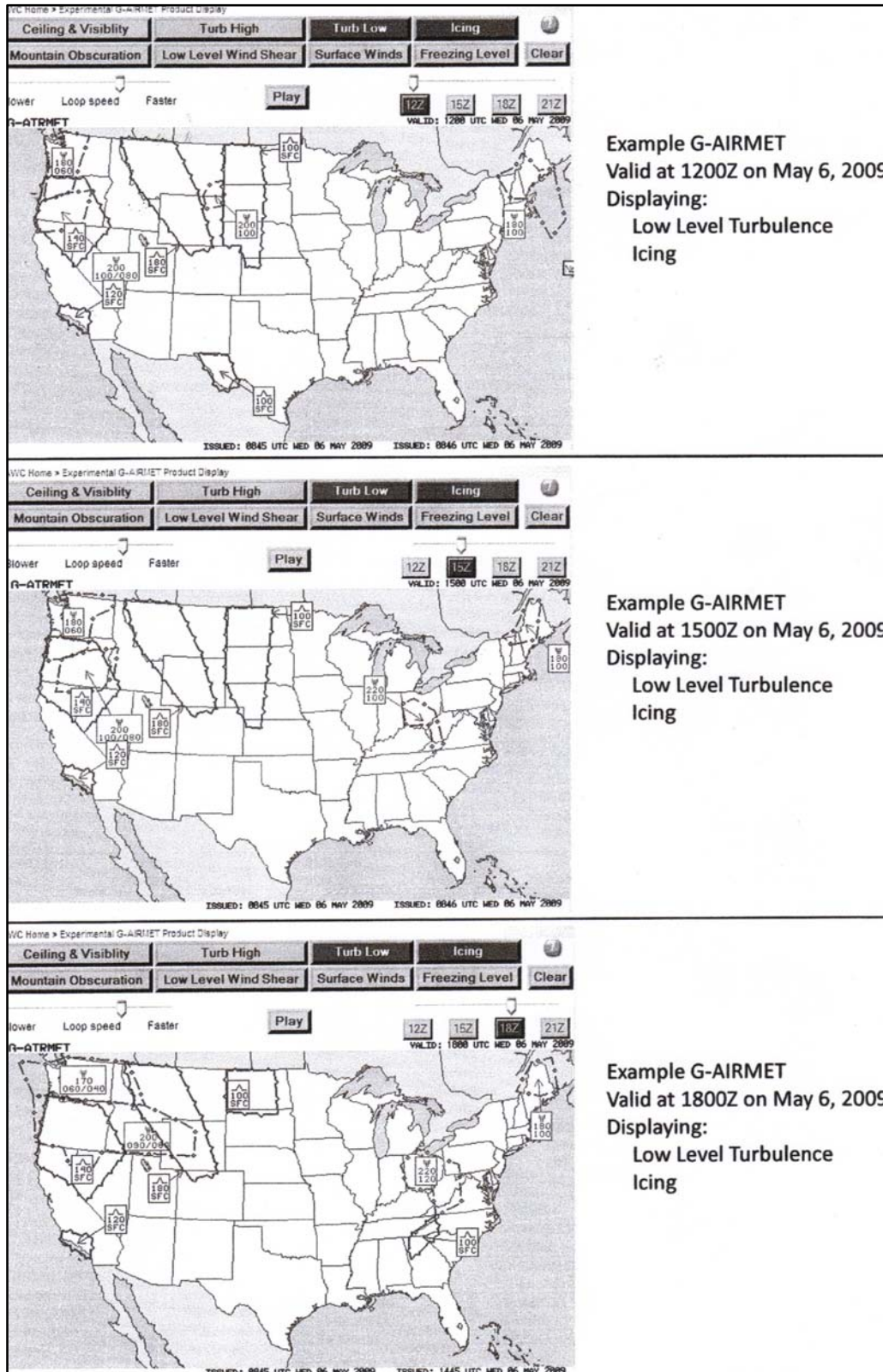
**EXAMPLE–**

1. *Attention all aircraft, SIGMET Delta Three, from Myton to Tuba City to Milford, severe turbulence and severe clear icing below one zero thousand feet. Expected to continue beyond zero three zero zero zulu.*
2. *Attention all aircraft, convective SIGMET Two Seven Eastern. From the vicinity of Elmira to Phillipsburg. Scattered embedded thunderstorms moving east at one zero knots. A few intense level five cells, maximum tops four five zero.*
3. *Attention all aircraft, Kansas City Center weather advisory one zero three. Numerous reports of moderate to severe icing from eight to nine thousand feet in a three zero mile radius of St. Louis. Light or negative icing reported from four thousand to one two thousand feet remainder of Kansas City Center area.*

**NOTE–**

*Terminal control facilities have the option to limit the AWW, convective SIGMET, SIGMET, or CWA broadcast as follows: local control and approach control positions may opt to broadcast SIGMET or CWA alerts only when any part of the area described is within 50 miles of the airspace under their jurisdiction.*

FIG 7-1-6  
G-AIRMET Graphical Product





## 7-1-11. Flight Information Services (FIS)

**a. FIS.** FIS is a method of disseminating meteorological (MET) and aeronautical information (AI) to displays in the cockpit in order to enhance pilot situational awareness, provide decision support tools, and improve safety. FIS augments traditional pilot voice communication with Flight Service Stations (FSSs), ATC facilities, or Airline Operations Control Centers (AOCCs). FIS is not intended to replace traditional pilot and controller/flight service specialist/aircraft dispatcher preflight briefings or inflight voice communications. FIS, however, can provide textual and graphical information that can help abbreviate and improve the usefulness of such communications. FIS enhances pilot situational awareness and improves safety.

**1. Data link Service Providers (DLSP) - DLSP** deploy and maintain airborne, ground-based, and, in some cases, space-based infrastructure that supports the transmission of AI/MET information over one or more physical links. DLSP may provide a free of charge or for-fee service that permits end users to uplink and downlink AI/MET and other information. The following are examples of DLSP:

**(a) FAA FIS-B.** A ground-based broadcast service provided through the ADS-B Universal Access Transceiver (UAT) network. The service provides users with a 978 MHz data link capability when operating within range and line-of-sight of a transmitting ground station. FIS-B enables users of properly equipped aircraft to receive and display a suite of broadcast weather and aeronautical information products.

**(b) Non-FAA FIS Systems.** Several commercial vendors provide customers with FIS data over both the aeronautical spectrum and on other frequencies using a variety of data link protocols. Services available from these providers vary greatly and may include tier based subscriptions. Advancements in bandwidth technology permits preflight as well as inflight access to the same MET and AI information available on the ground. Pilots and operators using non-FAA FIS for MET and AI information should be knowledgeable regarding the weather services being provided as some commercial vendors may be repackaging NWS sourced weather, while other commercial vendors may alter the weather information to produce vendor-tailored or vendor-specific weather reports and forecasts.

**2. Three Data Link Modes.** There are three data link modes that may be used for transmitting AI and MET information to aircraft. The intended use of the AI and/or MET information will determine the most appropriate data link service.

**(a) Broadcast Mode:** A one-way interaction in which AI and/or MET updates or changes applicable to a designated geographic area are continuously transmitted (or transmitted at repeated periodic intervals) to all aircraft capable of receiving the broadcast within the service volume defined by the system network architecture.

**(b) Contract/Demand Mode:** A two-way interaction in which AI and/or MET information is transmitted to an aircraft in response to a specific request.

**(c) Contract/Update Mode:** A two-way interaction that is an extension of the Demand Mode. Initial AI and/or MET report(s) are sent to an aircraft and subsequent updates or changes to the AI and/or MET information that meet the contract criteria are automatically or manually sent to an aircraft.

**3. To ensure airman compliance with Federal Aviation Regulations,** manufacturer's operating manuals should remind airmen to contact ATC controllers, FSS specialists, operator dispatchers, or airline operations control centers for general and mission critical aviation weather information and/or NAS status conditions (such as NOTAMs, Special Use Airspace status, and other government flight information). If FIS products are systemically modified (for example, are displayed as abbreviated plain text and/or graphical depictions), the modification process and limitations of the resultant product should be clearly described in the vendor's user guidance.

**4. Operational Use of FIS.** Regardless of the type of FIS system being used, several factors must be considered when using FIS:

**(a) Before using FIS for inflight operations,** pilots and other flight crewmembers should become familiar with the operation of the FIS system to be used, the airborne equipment to be used, including its system architecture, airborne system components, coverage service volume and other limitations of the particular system, modes of operation and indications of various system failures. Users should also be familiar with the specific content and format of the services available from the FIS provider(s). Sources

of information that may provide this specific guidance include manufacturer's manuals, training programs, and reference guides.

**(b)** FIS should not serve as the sole source of aviation weather and other operational information. ATC, FSSs, and, if applicable, AOCC VHF/HF voice remain as a redundant method of communicating aviation weather, NOTAMs, and other operational information to aircraft in flight. FIS augments these traditional ATC/FSS/AOCC services and, for some products, offers the advantage of being displayed as graphical information. By using FIS for orientation, the usefulness of information received from conventional means may be enhanced. For example, FIS may alert the pilot to specific areas of concern that will more accurately focus requests made to FSS or AOCC for inflight updates or similar queries made to ATC.

**(c)** The airspace and aeronautical environment is constantly changing. These changes occur quickly and without warning. Critical operational decisions should be based on use of the most current and appropriate data available. When differences exist between FIS and information obtained by voice communication with ATC, FSS, and/or AOCC (if applicable), pilots are cautioned to use the most recent data from the most authoritative source.

**(d)** FIS aviation weather products (for example, graphical ground-based radar precipitation depictions) are not appropriate for tactical (typical timeframe of less than 3 minutes) avoidance of severe weather such as negotiating a path through a weather hazard area. FIS supports strategic (typical timeframe of 20 minutes or more) weather decisionmaking such as route selection to avoid a weather hazard area in its entirety. The misuse of information beyond its applicability may place the pilot and aircraft in jeopardy. In addition, FIS should never be used in lieu of an individual preflight weather and flight planning briefing.

**(e)** DLSP offer numerous MET and AI products with information that can be layered on top of each other. Pilots need to be aware that too much information can have a negative effect on their cognitive work load. Pilots need to manage the amount of information to a level that offers the most pertinent information to that specific flight without creating a cockpit distraction. Pilots may need to

adjust the amount of information based on numerous factors including, but not limited to, the phase of flight, single pilot operation, autopilot availability, class of airspace, and the weather conditions encountered.

**(f)** FIS NOTAM products, including Temporary Flight Restriction (TFR) information, are advisory-use information and are intended for situational awareness purposes only. Cockpit displays of this information are not appropriate for tactical navigation – pilots should stay clear of any geographic area displayed as a TFR NOTAM. Pilots should contact FSSs and/or ATC while en route to obtain updated information and to verify the cockpit display of NOTAM information.

**(g)** FIS supports better pilot decisionmaking by increasing situational awareness. Better decision-making is based on using information from a variety of sources. In addition to FIS, pilots should take advantage of other weather/NAS status sources, including, briefings from Flight Service Stations, data from other air traffic control facilities, airline operation control centers, pilot reports, as well as their own observations.

**(h)** FAA's Flight Information Service–Broadcast (FIS–B).

**(1)** FIS–B is a ground-based broadcast service provided through the FAA's Automatic Dependent Surveillance–Broadcast (ADS–B) Services Universal Access Transceiver (UAT) network. The service provides users with a 978 MHz data link capability when operating within range and line-of-sight of a transmitting ground station. FIS–B enables users of properly-equipped aircraft to receive and display a suite of broadcast weather and aeronautical information products.

**(2)** The following list represents the initial suite of text and graphical products available through FIS–B and provided free-of-charge. Detailed information concerning FIS–B meteorological products can be found in Advisory Circular 00–45, Aviation Weather Services, and AC 00–63, Use of Cockpit Displays of Digital Weather and Aeronautical Information. Information on Special Use Airspace (SUA), Temporary Flight Restriction (TFR), and Notice to Airmen (NOTAM) products can be found in Chapters 3, 4 and 5 of this manual.

**[a] Text:** Aviation Routine Weather Report (METAR) and Special Aviation Report (SPECI);

**[b] Text:** Pilot Weather Report (PIREP);

**[c] Text:** Winds and Temperatures Aloft;

**[d] Text:** Terminal Aerodrome Forecast (TAF) and amendments;

**[e] Text:** Notice to Airmen (NOTAM) Distant and Flight Data Center;

**[f] Text/Graphic:** Airmen's Meteorological Conditions (AIRMET);

**[g] Text/Graphic:** Significant Meteorological Conditions (SIGMET);

**[h] Text/Graphic:** Convective SIGMET;

**[i] Text/Graphic:** Special Use Airspace (SUA);

**[j] Text/Graphic:** Temporary Flight Restriction (TFR) NOTAM; and

**[k] Graphic:** NEXRAD Composite Reflectivity Products (Regional and National).

(3) Users of FIS-B should familiarize themselves with the operational characteristics and limitations of the system, including: system architecture; service environment; product lifecycles; modes of operation; and indications of system failure.

**NOTE-**

*The NOTAM-D and NOTAM-FDC products broadcast via FIS-B are limited to those issued or effective within the past 30 days. Except for TFRs, NOTAMs older than 30 days are not provided. The pilot in command is responsible for reviewing all necessary information prior to flight.*

(4) FIS-B products are updated and transmitted at specific intervals based primarily on product issuance criteria. Update intervals are defined as the rate at which the product data is available from the source for transmission. Transmission intervals are defined as the amount of time within which a new or updated product transmission must be completed and/or the rate or repetition interval at which the product is rebroadcast. Update and transmission intervals for each product are provided in TBL 7-1-1.

(5) Where applicable, FIS-B products include a look-ahead range expressed in nautical

miles (NM) for three service domains: Airport Surface; Terminal Airspace; and Enroute/Gulf-of-Mexico (GOMEX). TBL 7-1-2 provides service domain availability and look-ahead ranging for each FIS-B product.

(6) Prior to using this capability, users should familiarize themselves with the operation of FIS-B avionics by referencing the applicable User's Guides. Guidance concerning the interpretation of information displayed should be obtained from the appropriate avionics manufacturer.

(7) FIS-B malfunctions not attributed to aircraft system failures or covered by active NOTAM should be reported by radio or telephone to the nearest FSS facility.

**b. Non-FAA FIS Systems.** Several commercial vendors also provide customers with FIS data over both the aeronautical spectrum and on other frequencies using a variety of data link protocols. In some cases, the vendors provide only the communications system that carries customer messages, such as the Aircraft Communications Addressing and Reporting System (ACARS) used by many air carrier and other operators.

1. Operators using non-FAA FIS data for inflight weather and other operational information should ensure that the products used conform to FAA/NWS standards. Specifically, aviation weather and NAS status information should meet the following criteria:

(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.

*TBL 7-1-1*  
**FIS-B Over UAT Product Update and Transmission Intervals**

<b>Product</b>	<b>FIS-B Over UAT Service Update Intervals<sup>1</sup></b>	<b>FIS-B Service Transmission Intervals<sup>2</sup></b>
AIRMET	As Available	5 minutes
Convective SIGMET	As Available	5 minutes
METARs/SPECIs	1 minute/As Available	5 minutes
NEXRAD Composite Reflectivity (CONUS)	15 minutes	15 minutes
NEXRAD Composite Reflectivity (Regional)	5 minutes	2.5 minutes
NOTAMs-D/FDC/TFR	As Available	10 minutes
PIREP	As Available	10 minutes
SIGMET	As Available	5 minutes
SUA Status	As Available	10 minutes
TAF/AMEND	8 Hours/As Available	10 minutes
Temperatures Aloft	12 Hours	10 minutes
Winds Aloft	12 Hours	10 minutes

<sup>1</sup> The Update Interval is the rate at which the product data is available from the source.

<sup>2</sup> 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.

■ <sup>3</sup> NOTAM-D and NOTAM-FDC products broadcast via FIS-B are limited to those issued or effective within the past 30 days.

*TBL 7-1-2*  
**Product Parameters for Low/Medium/High Altitude Tier Radios**

Product	Surface Radios	Low Altitude Tier	Medium Altitude Tier	High Altitude Tier
CONUS NEXRAD	N/A	CONUS NEXRAD not provided	CONUS NEXRAD imagery	CONUS NEXRAD imagery
Winds & Temps Aloft	500 NM look-ahead range	500 NM look-ahead range	750 NM look-ahead range	1,000 NM look-ahead range
METAR	100 NM look-ahead range	250 NM look-ahead range	375 NM look-ahead range	CONUS: CONUS Class B & C airport METARs and 500 NM look-ahead range  Outside of CONUS: 500 NM look-ahead range
TAF	100 NM look-ahead range	250 NM look-ahead range	375 NM look-ahead range	CONUS: CONUS Class B & C airport TAFs and 500 NM look-ahead range  Outside of CONUS: 500 NM look-ahead range
AIRMET, SIGMET, PIREP, and SUA/SAA	100 NM look-ahead range. PIREP/SUA/SAA is N/A.	250 NM look-ahead range	375 NM look-ahead range	500 NM look-ahead range
Regional NEXRAD	150 NM look-ahead range	150 NM look-ahead range	200 NM look-ahead range	250 NM look-ahead range
NOTAMs D, FDC, and TFR	100 NM look-ahead range	100 NM look-ahead range	100 NM look-ahead range	100 NM look-ahead range

## 7-1-12. Weather Observing Programs

**a. Manual Observations.** With only a few exceptions, these reports are from airport locations staffed by FAA personnel who manually observe, perform calculations, and enter these observations into the (WMSCR) communication system. The format and coding of these observations are contained in Paragraph 7-1-30, Key to Aviation Routine Weather Report (METAR) and Aerodrome Forecasts (TAF).

### **b. Automated Weather Observing System (AWOS).**

**1.** Automated weather reporting systems are increasingly being installed at airports. These systems consist of various sensors, a processor, a computer-generated voice subsystem, and a transmit-

ter 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 Chart Supplement U.S. Augmentation is identified in the observation as "OBSERVER WEATHER." The AWOS wind speed, direction and gusts, temperature,

dew point, and altimeter setting are exactly the same as for manual observations. The AWOS will also report density altitude when it exceeds the field elevation by more than 1,000 feet. The reported visibility is derived from a sensor near the touchdown of the primary instrument runway. The visibility sensor output is converted to a visibility value using a 10-minute harmonic average. The reported sky condition/ceiling is derived from the ceilometer located next to the visibility sensor. The AWOS algorithm integrates the last 30 minutes of ceilometer data to derive cloud layers and heights. This output may also differ from the observer sky condition in that the AWOS is totally dependent upon the cloud advection over the sensor site.

**3.** These real-time systems are operationally classified into nine basic levels:

(a) **AWOS-A** only reports altimeter setting;

**NOTE-**

*Any other information is advisory only.*

(b) **AWOS-AV** reports altimeter and visibility;

**NOTE-**

*Any other information is advisory only.*

(c) **AWOS-I** usually reports altimeter setting, wind data, temperature, dew point, and density altitude;

(d) **AWOS-2** provides the information provided by AWOS-I 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 Chart Supplement U.S., 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  $\frac{1}{4}$ .” 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.

**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 ... observed weather ... thunderstorm moderate rain showers and fog ... thunderstorm overhead.”*

(c) If an automated parameter is “missing” and no manual input for that parameter is available, the parameter is announced as “MISSING.” For example, a report with the dew point “missing” and no manual input available, would be announced as follows:

**EXAMPLE-**

*“Ceiling one thousand overcast ... visibility three ... precipitation ... temperature three zero, dew point missing ... wind calm ... altimeter three zero zero one.”*

(d) “REMARKS” are announced in the following order of priority:

- (1) Automated “REMARKS.”
  - [a] Density Altitude.
  - [b] Variable Visibility.
  - [c] Variable Wind Direction.
- (2) Manual Input “REMARKS.”
  - [a] Sky Condition.
  - [b] Visibility.
  - [c] Weather and Obstructions to Vision.
  - [d] Temperature.
  - [e] Dew Point.
  - [f] Wind; and
  - [g] Altimeter Setting.

**EXAMPLE—**

*“Remarks ... density altitude, two thousand five hundred ... visibility variable between one and two ... wind direction variable between two four zero and three one zero ... observer ceiling estimated two thousand broken ... observer temperature two, dew point minus five.”*

**d. Automated Surface Observing System (ASOS)/Automated Weather Observing System (AWOS)** The ASOS/AWOS is the primary surface weather observing system of the U.S. (See Key to Decode an ASOS/AWOS (METAR) Observation, FIG 7-1-7 and FIG 7-1-8.) The program to install and operate these systems throughout the U.S. is a joint effort of the NWS, the FAA and the Department of Defense. ASOS/AWOS is designed to support aviation operations and weather forecast activities. The ASOS/AWOS will provide continuous minute-by-minute observations and perform the basic observing functions necessary to generate an aviation routine weather report (METAR) and other aviation weather information. The information may be transmitted over a discrete VHF radio frequency or the voice portion of a local NAVAID. ASOS/AWOS transmissions on a discrete VHF radio frequency are engineered to be receivable to a maximum of 25 NM from the ASOS/AWOS site and a maximum altitude of 10,000 feet AGL. At many locations, ASOS/AWOS signals may be received on the surface of the airport, but local conditions may limit the maximum reception distance and/or altitude. While the automated system and the human may differ in their methods of data collection and interpretation, both produce an observation quite similar in form and

content. For the “objective” elements such as pressure, ambient temperature, dew point temperature, wind, and precipitation accumulation, both the automated system and the observer use a fixed location and time-averaging technique. The quantitative differences between the observer and the automated observation of these elements are negligible. For the “subjective” elements, however, observers use a fixed time, spatial averaging technique to describe the visual elements (sky condition, visibility and present weather), while the automated systems use a fixed location, time averaging technique. Although this is a fundamental change, the manual and automated techniques yield remarkably similar results within the limits of their respective capabilities.

### 1. System Description.

(a) The ASOS/AWOS at each airport location consists of four main components:

- (1) Individual weather sensors.
- (2) Data collection and processing units.
- (3) Peripherals and displays.

(b) The ASOS/AWOS sensors perform the basic function of data acquisition. They continuously sample and measure the ambient environment, derive raw sensor data and make them available to the collection and processing units.

### 2. Every ASOS/AWOS will contain the following basic set of sensors:

- (a) Cloud height indicator (one or possibly three).
- (b) Visibility sensor (one or possibly three).
- (c) Precipitation identification sensor.
- (d) Freezing rain sensor (at select sites).
- (e) Pressure sensors (two sensors at small airports; three sensors at large airports).
- (f) Ambient temperature/Dew point temperature sensor.
- (g) Anemometer (wind direction and speed sensor).
- (h) Rainfall accumulation sensor.
- (i) Automated Lightning Detection and Reporting System (ALDARS) (excluding Alaska and Pacific Island sites).



**3. The ASOS/AWOS data outlets include:**

- (a) Those necessary for on-site airport users.
- (b) National communications networks.
- (c) Computer-generated voice (available through FAA radio broadcast to pilots, and dial-in telephone line).

**NOTE—**

*Wind direction broadcast over FAA radios is in reference to magnetic north.*

**4.** An ASOS/AWOS report without human intervention will contain only that weather data capable of being reported automatically. The modifier for this METAR report is “AUTO.” When

an observer augments or backs-up an ASOS/AWOS site, the “AUTO” modifier disappears.

**5.** There are two types of automated stations, AO1 for automated weather reporting stations without a precipitation discriminator, and AO2 for automated stations with a precipitation discriminator. As appropriate, “AO1” and “AO2” must appear in remarks. (A precipitation discriminator can determine the difference between liquid and frozen/freezing precipitation).

**NOTE—**

*To decode an ASOS/AWOS report, refer to FIG 7-1-7 and FIG 7-1-8.*

**REFERENCE—**

*A complete explanation of METAR terminology is located in AIM, Paragraph 7-1-30, Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR).*

FIG 7-1-7

Key to Decode an ASOS/AWOS (METAR) Observation (Front)

METAR KABC 121755Z AUTO 21016G24KT 180V240 1SM R11/P6000FT -RA BR BKN015 OVC025 06/04 A2990  
 RMK A02 PK WND 20032/25 WSHFT 1715 VIS 3/4V1 1/2 VIS 3/4 RWY11 RAB07 CIG 013V017 CIG 017 RWY11 PRESFR  
 SLP125 P0003 6009 T00640036 10066 21012 58033 TSNO \$

<b>TYPE OF REPORT</b>	METAR: hourly (scheduled report; SPECI: special (unscheduled) report.	METAR
<b>STATION IDENTIFIER</b>	Four alphabetic characters; ICAO location identifiers.	KABC
<b>DATE/TIME</b>	All dates and times in UTC using a 24-hour clock; two-digit date and four-digit time; always appended with <u>Z</u> to indicate UTC.	121755Z
<b>REPORT MODIFIER</b>	Fully automated report, no human intervention; removed when observer signed-on.	AUTO
<b>WIND DIRECTION AND SPEED</b>	Direction in tens of degrees from true north (first three digits); next two digits: speed in whole knots; as needed <u>G</u> usts (character) followed by maximum observed speed; always appended with <u>KT</u> to indicate knots; 0000KT for calm; if direction varies by 60° or more a <u>V</u> ariable wind direction group is reported.	21016G24KT 108V240
<b>VISIBILITY</b>	Prevailing visibility in statute miles and fractions (space between whole miles and fractions); always appended with <u>SM</u> to indicate statute miles.	1SM
<b>RUNWAY VISUAL RANGE</b>	10-minute RVR value in hundreds of feet; reported if prevailing visibility is ≤ one mile or RVR ≤6000 feet; always appended with <u>FT</u> to indicate feet; value prefixed with <u>M</u> or <u>P</u> to indicate value is lower or higher than the reportable RVR value.	R11/P6000FT
<b>WEATHER PHENOMENA</b>	RA: liquid precipitation that does not freeze; SN: frozen precipitation other than hail; UP: precipitation of unknown type; intensity prefixed to precipitation: light (-), moderate (no sign), heavy (+); FG: fog; FZFG: freezing fog (temperature below 0°C); BR: mist; HZ: haze; SQ: squall; maximum of three groups reported; augmented by observer: FC (funnel cloud/tornado/waterspout); TS(thunderstorm); GR (hail); GS (small hail; <1/4 inch); FZRA (intensity; freezing rain); VA (volcanic ash).	-RA BR
<b>SKY CONDITION</b>	Cloud amount and height: CLR (no clouds detected below 12000 feet); FEW (few); SCT (scattered); BKN (broken); OVC (overcast); followed by 3-digit height in hundreds of feet; or vertical visibility ( <u>VV</u> ) followed by height for indefinite ceiling.	BKN015 OVC025
<b>TEMPERATURE/DEW POINT</b>	Each is reported in whole degrees Celsius using two digits; values are separated by a solidus; sub-zero values are prefixed with an <u>M</u> (minus).	06/04
<b>ALTIMETER</b>	Altimeter always prefixed with an <u>A</u> indicating inches of mercury; reported using four digits: tens, units, tenths, and hundredths.	A2990

FIG 7-1-8

Key to Decode an ASOS/AWOS (METAR) Observation (Back)

REMARKS IDENTIFIER: RMK	RMK
<b>TORNADIC ACTIVITY:</b> Augmented; report should include TORNADO, FUNNEL CLOUD, or WATERSPOUT, time begin/end, location, movement; e.g., TORNADO B25 N MOV E.	
<b>TYPE OF AUTOMATED STATION:</b> AO2; automated station with precipitation discriminator.	AO2
<b>PEAK WIND:</b> PK WND dddff(f)/(hh)mm; direction in tens of degrees, speed in whole knots, and time.	PK WND 20032/25
<b>WIND SHIFT:</b> WSHFT (hh)mm	WSHFT 1715
<b>TOWER OR SURFACE VISIBILITY:</b> TWR VIS vvvvv: visibility reported by tower personnel, e.g., TWR VIS 2; SFC VIS vvvvv: visibility reported by ASOS, e.g., SFC VIS 2.	
<b>VARIABLE PREVAILING VISIBILITY:</b> VIS v <sub>n</sub> v <sub>n</sub> v <sub>n</sub> v <sub>n</sub> v <sub>n</sub> v <sub>n</sub> Vv <sub>x</sub> Vx Vx Vx Vx; reported if prevailing visibility is <3 miles and variable.	VIS 3/4V1 1/2
<b>VISIBILITY AT SECOND LOCATION:</b> VIS vvvvv [LOC]; reported if different than the reported prevailing visibility in body of report.	VIS 3/4 RWY11
<b>LIGHTNING:</b> [FREQ] LTG [LOC]; when detected the frequency and location is reported, e.g., FRQ LTG NE.	
<b>BEGINNING AND ENDING OF PRECIPITATION AND THUNDERSTORMS:</b> w'w'B(hh)mmE(hh)mm; TSB(hh)mmE(hh)mm	RAB07
<b>VIRGA:</b> Augmented; precipitation not reaching the ground, e.g., VIRGA.	
<b>VARIABLE CEILING HEIGHT:</b> CIG h <sub>n</sub> h <sub>n</sub> Vh <sub>x</sub> h <sub>x</sub> h <sub>x</sub> ; reported if ceiling in body of report is <3000 feet and variable.	CIG 013V017
<b>CEILING HEIGHT AT SECOND LOCATION:</b> CIG hhh [LOC]; Ceiling height reported if secondary ceilometer site is different than the ceiling height in the body of the report.	CIG 017 RWY11
<b>PRESSURE RISING OR FALLING RAPIDLY:</b> PRESRR or PRESFR; pressure rising or falling rapidly at time of observation.	PRESFR
<b>SEA-LEVEL PRESSURE:</b> SLPppp; tens, units, and tenths of SLP in hPa.	SLPI25
<b>HOURLY PRECIPITATION AMOUNT:</b> Prrrr; in .01 inches since last METAR; a trace is P0000.	P0003
<b>3- AND 6-HOUR PRECIPITATION AMOUNT:</b> 6RRRR; precipitation amount in .01 inches for past 6 hours reported in 00, 06, 12, and 18 UTC observations and for past 3 hours in 03, 09, 15, and 21 UTC observations; a trace is 60000.	60009
<b>24-HOUR PRECIPITATION AMOUNT:</b> 7R <sub>24</sub> R <sub>24</sub> R <sub>24</sub> ; precipitation amount in .01 inches for past 24 hours reported in 12 UTC observation, e.g., 70015.	
<b>HOURLY TEMPERATURE AND DEW POINT:</b> T <sub>s</sub> T <sub>a</sub> T <sub>a</sub> T <sub>s</sub> T <sub>a</sub> T <sub>a</sub> T <sub>s</sub> T <sub>a</sub> T <sub>s</sub> T <sub>a</sub> T <sub>s</sub> T <sub>a</sub> ; tenth of degree Celsius; s <sub>n</sub> : 1 if temperature below 0° C and 0 if temperature 0° C or higher.	T00640036
<b>6-HOUR MAXIMUM TEMPERATURE:</b> 1s <sub>n</sub> T <sub>x</sub> T <sub>x</sub> T <sub>x</sub> ; tenth of degree Celsius; 00, 06, 12, 18 UTC; s <sub>n</sub> : 1 if temperature below 0° C and 0 if temperature 0° C or higher.	10066
<b>6-HOUR MINIMUM TEMPERATURE:</b> 2s <sub>n</sub> T <sub>n</sub> T <sub>n</sub> T <sub>n</sub> ; tenth of degree Celsius; 00, 06, 12, 18 UTC; s <sub>n</sub> : 1 if temperature below 0° C and 0 if temperature 0° C or higher.	21012
<b>24-HOUR MAXIMUM AND MINIMUM TEMPERATURE:</b> 4s <sub>n</sub> T <sub>x</sub> T <sub>x</sub> T <sub>x</sub> T <sub>n</sub> T <sub>n</sub> T <sub>n</sub> T <sub>n</sub> ; tenth of degree Celsius; reported at midnight local standard time; 1 if temperature below 0° C and 0 if temperature 0° C or higher, e.g., 400461006.	
<b>PRESSURE TENDENCY:</b> 5app; the character (a) and change in pressure (ppp; tenths of hPa) the past 3 hours.	58033
<b>SENSOR STATUS INDICATORS:</b> RVRNO: RVR missing; PWINO: precipitation identifier information not available; PNO: precipitation amount not available; FZRANO: freezing rain information not available; TSNO: thunderstorm information not available; VISNO [LOC]: visibility at secondary location not available, e.g., VISNO RWY06; CHINO [LOC]: (cloud-height-indicator) sky condition at secondary location not available, e.g., CHINO RWY06.	TSNO
<b>MAINTENANCE CHECK INDICATOR:</b> Maintenance needed on the system. If an element or phenomena does not occur, is missing, or cannot be observed, the corresponding group and space are omitted (body and/or remarks) from that particular report, except for Sea-Level Pressure (SLPppp). SLPNO shall be reported in a METAR when the SLP is not available.	\$

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e. TBL 7–1–3 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 7–1–4.

**1. Service Level D** defines the minimum acceptable level of service. It is a completely automated service in which the ASOS/AWOS 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/AWOS elements in the event of an ASOS/AWOS malfunction or an unrepresentative ASOS/AWOS report. In backup, the human observer

inserts the correct or missing value for the automated ASOS/AWOS 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/AWOS. 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.

TBL 7–1–3  
Weather Observing Programs

Element Reported Type	Wind	Visibility	Temperature Dew Point	Altimeter	Density Altimeter	Cloud/Ceiling	Precipitation Identification	Thunderstorm/ Lightning	Precipitation Occurrence	Rainfall Accumulation	Runway Surface Condition	Freezing Rain Occurrence	Remarks
ASOS	X	X	X	X	X	X	X			X		X	X
AWOS–A				X									
AWOS–A/V		X		X									
AWOS–1	X		X	X	X								
AWOS–2	X	X	X	X	X								
AWOS–3	X	X	X	X	X	X							
AWOS–3P	X	X	X	X	X	X	X						
AWOS–3T	X	X	X	X	X	X		X					
AWOS–3P/T	X	X	X	X	X	X	X	X					
AWOS–4	X	X	X	X	X	X	X	X	X	X	X	X	
Manual	X	X	X	X		X	X						X

REFERENCE– FAA Order JO 7900.5, Surface Weather Observing, for element reporting.

TBL 7-1-4

<b>SERVICE LEVEL A</b>	
Service Level A consists of all the elements of Service Levels B, C and D plus the elements listed to the right, if observed.	10 minute longline RVR at precedented sites or additional visibility increments of 1/8, 1/16 and 0 Sector visibility Variable sky condition Cloud layers above 12,000 feet and cloud types Widespread dust, sand and other obscurations Volcanic eruptions
<b>SERVICE LEVEL B</b>	
Service Level B consists of all the elements of Service Levels C and D plus the elements listed to the right, if observed.	Longline RVR at precedented sites (may be instantaneous readout) Freezing drizzle versus freezing rain Ice pellets Snow depth & snow increasing rapidly remarks Thunderstorm and lightning location remarks Observed significant weather not at the station remarks
<b>SERVICE LEVEL C</b>	
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.	Thunderstorms Tornadoes Hail Virga Volcanic ash Tower visibility Operationally significant remarks as deemed appropriate by the observer
<b>SERVICE LEVEL D</b>	
This level of service consists of an ASOS or AWOS continually measuring the atmosphere at a point near the runway. The ASOS or AWOS senses and measures the weather parameters listed to the right.	Wind Visibility Precipitation/Obstruction to vision Cloud height Sky cover Temperature Dew point Altimeter

**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 7-1-9  
NEXRAD Coverage

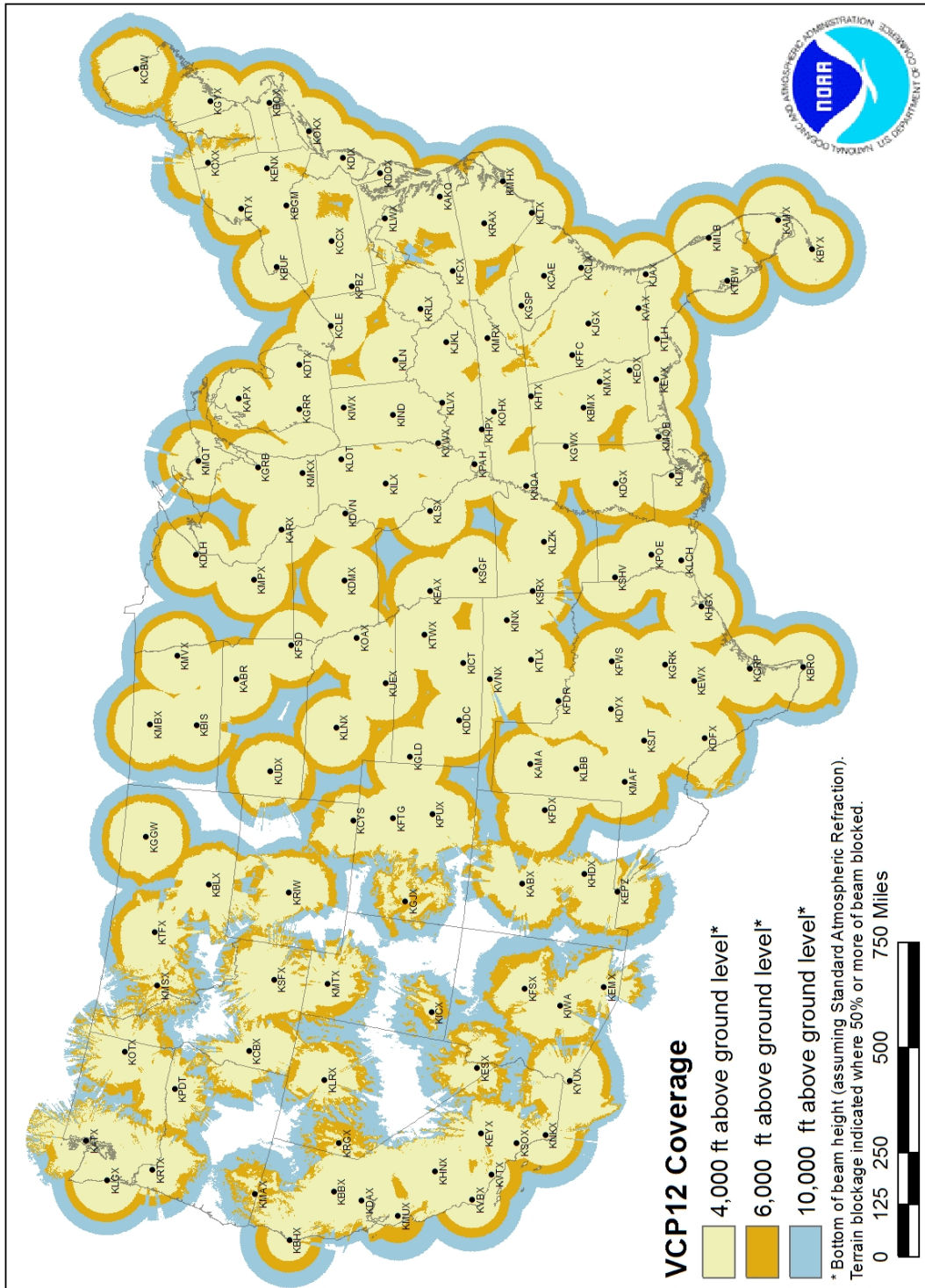


FIG 7-1-10  
NEXRAD Coverage

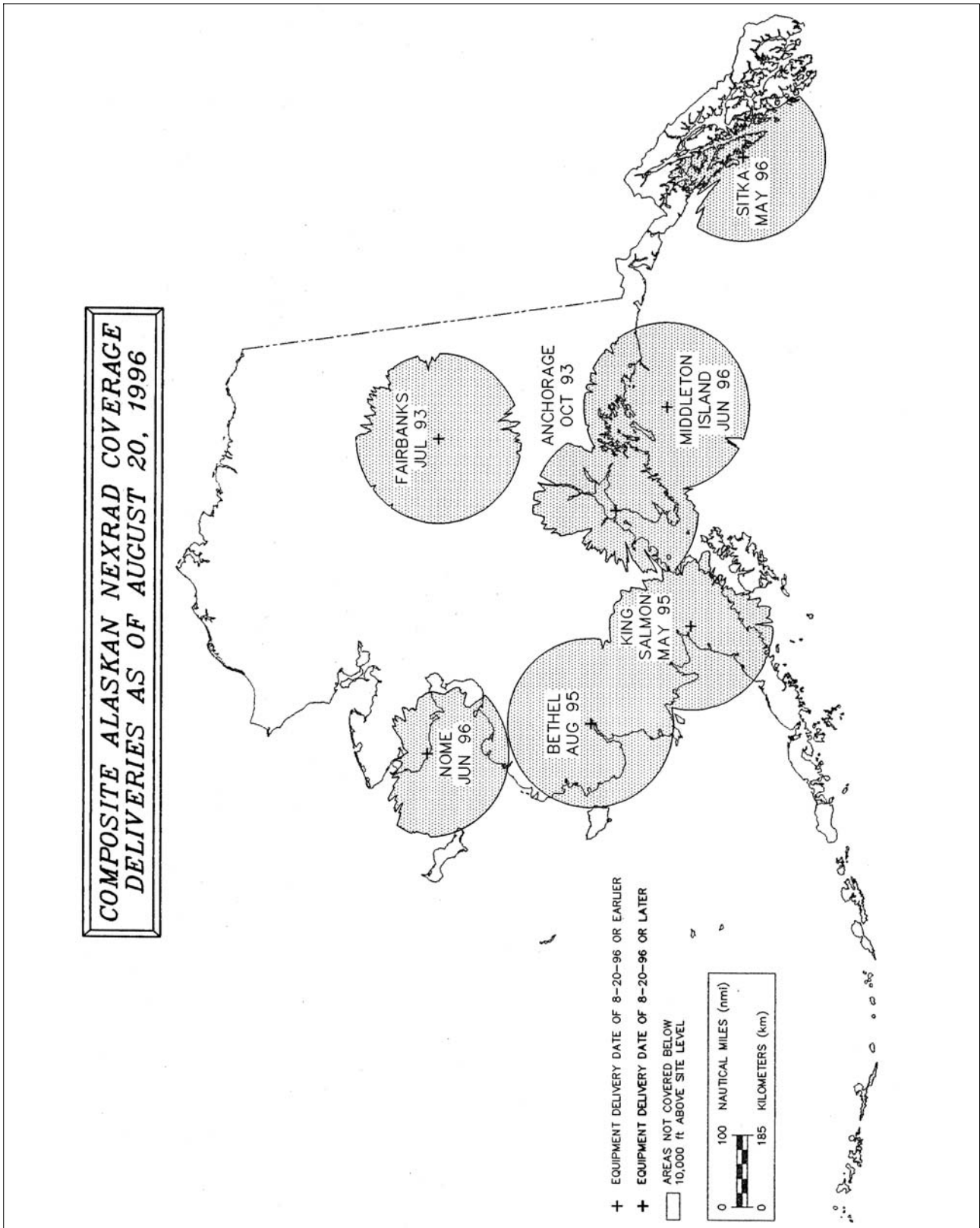
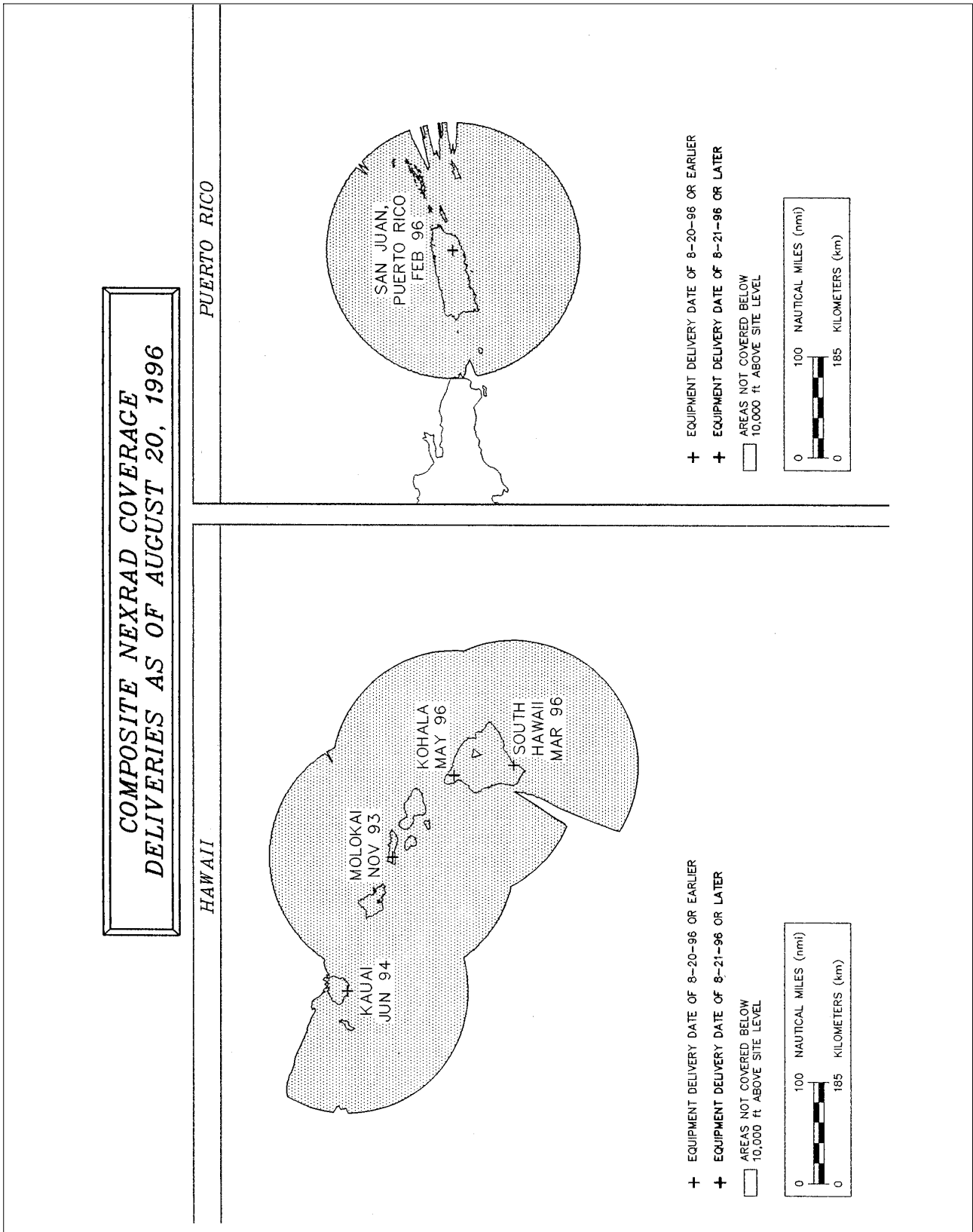


FIG 7-1-11  
NEXRAD Coverage





**d.** All En Route Flight Advisory Service facilities and FSSs have equipment to directly access the radar displays from the individual weather radar sites. Specialists at these locations are trained to interpret the display for pilot briefing and inflight advisory services. The Center Weather Service Units located in ARTCCs also have access to weather radar displays and provide support to all air traffic facilities within their center's area.

**e.** Additional information on weather radar products and services can be found in AC 00-45, Aviation Weather Services.

**REFERENCE-**

*Pilot/Controller Glossary Term- Precipitation Radar Weather Descriptions.*

*AIM, Paragraph 7-1-28, Thunderstorms*

*Chart Supplement U.S., Charts, NWS Upper Air Observing Stations and Weather Network for the location of specific radar sites.*

## **7-1-14. ATC Inflight Weather Avoidance Assistance**

### **a. ATC Radar Weather Display.**

**1.** ATC radars are able to display areas of precipitation by sending out a beam of radio energy that is reflected back to the radar antenna when it strikes an object or moisture which may be in the form of rain drops, hail, or snow. The larger the object is, or the more dense its reflective surface, the stronger the return will be presented. Radar weather processors indicate the intensity of reflective returns in terms of decibels (dBZ). ATC systems cannot detect the presence or absence of clouds. The ATC systems can often determine the intensity of a precipitation area, but the specific character of that area (snow, rain, hail, VIRGA, etc.) cannot be determined. For this reason, ATC refers to all weather areas displayed on ATC radar scopes as "precipitation."

**2.** All ATC facilities using radar weather processors with the ability to determine precipitation intensity, will describe the intensity to pilots as:

- (a)** "LIGHT" (< 26 dBZ)
- (b)** "MODERATE" (26 to 40 dBZ)
- (c)** "HEAVY" (> 40 to 50 dBZ)
- (d)** "EXTREME" (> 50 dBZ)

**NOTE-**

*En route ATC radar's Weather and Radar Processor (WARP) does not display light precipitation intensity.*

**3.** ATC facilities that, due to equipment limitations, cannot display the intensity levels of precipitation, will describe the location of the precipitation area by geographic position, or position relative to the aircraft. Since the intensity level is not available, the controller will state "INTENSITY UNKNOWN."

**4.** ARTCC facilities normally use a Weather and Radar Processor (WARP) to display a mosaic of data obtained from multiple NEXRAD sites. There is a time delay between actual conditions and those displayed to the controller. For example, the precipitation data on the ARTCC controller's display could be up to 6 minutes old. When the WARP is not available, a second system, the narrowband Air Route Surveillance Radar (ARSR) can display two distinct levels of precipitation intensity that will be described to pilots as "MODERATE" (30 to 40 dBZ) and "HEAVY TO EXTREME" (> 40 dBZ). The WARP processor is only used in ARTCC facilities.

**5.** *ATC radar is not able to detect turbulence.* Generally, turbulence can be expected to occur as the rate of rainfall or intensity of precipitation increases. Turbulence associated with greater rates of rainfall/precipitation will normally be more severe than any associated with lesser rates of rainfall/precipitation. Turbulence should be expected to occur near convective activity, even in clear air. Thunderstorms are a form of convective activity that imply severe or greater turbulence. Operation within 20 miles of thunderstorms should be approached with great caution, as the severity of turbulence can be markedly greater than the precipitation intensity might indicate.

### **b. Weather Avoidance Assistance.**

**1.** To the extent possible, controllers will issue pertinent information on weather or chaff areas and assist pilots in avoiding such areas when requested. Pilots should respond to a weather advisory by either acknowledging the advisory or by acknowledging the advisory and requesting an alternative course of action as follows:

**(a)** Request to deviate off course by stating a heading or degrees, direction of deviation, and approximate number of miles. In this case, when the requested deviation is approved, navigation is at the pilot's prerogative, but must maintain the altitude assigned, and remain within the lateral restrictions issued by ATC.

(b) An approval for lateral deviation authorizes the pilot to maneuver left or right within the limits specified in the clearance.

**NOTE—**

1. *It is often necessary for ATC to restrict the amount of lateral deviation (“twenty degrees right,” “up to fifteen degrees left,” “up to ten degrees left or right of course”).*

2. *The term “when able, proceed direct,” in an ATC weather deviation clearance, refers to the pilot’s ability to remain clear of the weather when returning to course/route.*

(c) Request a new route to avoid the affected area.

(d) Request a change of altitude.

(e) Request radar vectors around the affected areas.

2. For obvious reasons of safety, an IFR pilot must not deviate from the course or altitude or flight level without a proper ATC clearance. When weather conditions encountered are so severe that an immediate deviation is determined to be necessary and time will not permit approval by ATC, the pilot’s emergency authority may be exercised.

3. When the pilot requests clearance for a route deviation or for an ATC radar vector, the controller must evaluate the air traffic picture in the affected area, and coordinate with other controllers (if ATC jurisdictional boundaries may be crossed) before replying to the request.

4. It should be remembered that the controller’s primary function is to provide safe separation between aircraft. Any additional service, such as weather avoidance assistance, can only be provided to the extent that it does not derogate the primary function. It’s also worth noting that the separation workload is generally greater than normal when weather disrupts the usual flow of traffic. ATC radar limitations and frequency congestion may also be a factor in limiting the controller’s capability to provide additional service.

5. It is very important, therefore, that the request for deviation or radar vector be forwarded to ATC as far in advance as possible. Delay in submitting it may delay or even preclude ATC approval or require that additional restrictions be placed on the clearance. Insofar as possible the following information should

be furnished to ATC when requesting clearance to detour around weather activity:

(a) Proposed point where detour will commence.

(b) Proposed route and extent of detour (direction and distance).

(c) Point where original route will be resumed.

(d) Flight conditions (IFR or VFR).

(e) Any further deviation that may become necessary as the flight progresses.

(f) Advise if the aircraft is equipped with functioning airborne radar.

6. To a large degree, the assistance that might be rendered by ATC will depend upon the weather information available to controllers. Due to the extremely transitory nature of severe weather situations, the controller’s weather information may be of only limited value if based on weather observed on radar only. Frequent updates by pilots giving specific information as to the area affected, altitudes, intensity and nature of the severe weather can be of considerable value. Such reports are relayed by radio or phone to other pilots and controllers and also receive widespread teletypewriter dissemination.

7. Obtaining IFR clearance or an ATC radar vector to circumnavigate severe weather can often be accommodated more readily in the en route areas away from terminals because there is usually less congestion and, therefore, offer greater freedom of action. In terminal areas, the problem is more acute because of traffic density, ATC coordination requirements, complex departure and arrival routes, adjacent airports, etc. As a consequence, controllers are less likely to be able to accommodate all requests for weather detours in a terminal area or be in a position to volunteer such routing to the pilot. Nevertheless, pilots should not hesitate to advise controllers of any observed severe weather and should specifically advise controllers if they desire circumnavigation of observed weather.

**c. Procedures for Weather Deviations and Other Contingencies in Oceanic Controlled Airspace.**

1. When the pilot initiates communications with ATC, rapid response may be obtained by stating “WEATHER DEVIATION REQUIRED” to indicate

priority is desired on the frequency and for ATC response.

2. The pilot still retains the option of initiating the communications using the urgency call “PAN–PAN” 3 times to alert all listening parties of a special handling condition which will receive ATC priority for issuance of a clearance or assistance.

3. ATC will:

(a) Approve the deviation.

(b) Provide vertical separation and then approve the deviation; or

(c) If ATC is unable to establish vertical separation, ATC must advise the pilot that standard separation cannot be applied; provide essential traffic information for all affected aircraft, to the extent practicable; and if possible, suggest a course of action. ATC may suggest that the pilot climb or descend to a contingency altitude (1,000 feet above or below that assigned if operating above FL 290; 500 feet above or below that assigned if operating at or below FL 290).

**PHRASEOLOGY–**

*STANDARD SEPARATION NOT AVAILABLE, DEVIATE AT PILOT’S DISCRETION; SUGGEST CLIMB (or descent) TO (appropriate altitude); TRAFFIC (position and altitude); REPORT DEVIATION COMPLETE.*

4. The pilot will follow the ATC advisory altitude when approximately 10 NM from track as well as execute the procedures detailed in paragraph 7–1–14c5.

5. If contact cannot be established or revised ATC clearance or advisory is not available and deviation from track is required, the pilot must take the following actions:

(a) If possible, deviate away from an organized track or route system.

(b) Broadcast aircraft position and intentions on the frequency in use, as well as on frequency 121.5 MHz at suitable intervals stating: flight identification (operator call sign), flight level, track code or ATS route designator, and extent of deviation expected.

(c) Watch for conflicting traffic both visually and by reference to TCAS (if equipped).

(d) Turn on aircraft exterior lights.

(e) Deviations of less than 10 NM should REMAIN at ASSIGNED altitude. Otherwise, when the aircraft is approximately 10 NM from track, initiate an altitude change based on the following criteria:

*TBL 7-1-5*

Route Centerline/Track	Deviations >10 NM	Altitude Change
EAST (000°–179° magnetic)	LEFT	DESCEND 300 ft
	RIGHT	CLIMB 300 ft
WEST (180°–359° magnetic)	LEFT	CLIMB 300 ft
	RIGHT	DESCEND 300 ft
<i>Pilot Memory Slogan: “East right up, West right down.”</i>		

(f) When returning to track, be at assigned flight level when the aircraft is within approximately 10 NM of centerline.

(g) If contact was not established prior to deviating, continue to attempt to contact ATC to obtain a clearance. If contact was established, continue to keep ATC advised of intentions and obtain essential traffic information.

**7–1–15. Runway Visual Range (RVR)**

There are currently two configurations of RVR in the NAS commonly identified as Taskers and New Generation RVR. The Taskers are the existing configuration which uses transmissometer technology. The New Generation RVRs were deployed in November 1994 and use forward scatter technology. The New Generation RVRs are currently being deployed in the NAS to replace the existing Taskers.

a. RVR values are measured by transmissometers mounted on 14–foot towers along the runway. A full RVR system consists of:

1. Transmissometer projector and related items.
2. Transmissometer receiver (detector) and related items.
3. Analog
4. recorder.
5. Signal data converter and related items.
6. Remote digital or remote display programmer.

**b.** The transmissometer projector and receiver are mounted on towers 250 feet apart. A known intensity of light is emitted from the projector and is measured by the receiver. Any obscuring matter such as rain, snow, dust, fog, haze or smoke reduces the light intensity arriving at the receiver. The resultant intensity measurement is then converted to an RVR value by the signal data converter. These values are displayed by readout equipment in the associated air traffic facility and updated approximately once every minute for controller issuance to pilots.

**c.** The signal data converter receives information on the high intensity runway edge light setting in use (step 3, 4, or 5); transmission values from the transmissometer and the sensing of day or night conditions. From the three data sources, the system will compute appropriate RVR values.

**d.** An RVR transmissometer established on a 250 foot baseline provides digital readouts to a minimum of 600 feet, which are displayed in 200 foot increments to 3,000 feet and in 500 foot increments from 3,000 feet to a maximum value of 6,000 feet.

**e.** RVR values for Category IIIa operations extend down to 700 feet RVR; however, only 600 and 800 feet are reportable RVR increments. The 800 RVR reportable value covers a range of 701 feet to 900 feet and is therefore a valid minimum indication of Category IIIa operations.

**f.** Approach categories with the corresponding minimum RVR values. (See TBL 7-1-6.)

*TBL 7-1-6*

**Approach Category/Minimum RVR Table**

Category	Visibility (RVR)
Nonprecision	2,400 feet
Category I	1,800 feet*
Category II	1,000 feet
Category IIIa	700 feet
Category IIIb	150 feet
Category IIIc	0 feet

\* 1,400 feet with special equipment and authorization

**g.** Ten minute maximum and minimum RVR values for the designated RVR runway are reported in the body of the aviation weather report when the prevailing visibility is less than one mile and/or the RVR is 6,000 feet or less. ATCTs report RVR when

the prevailing visibility is 1 mile or less and/or the RVR is 6,000 feet or less.

**h.** Details on the requirements for the operational use of RVR are contained in FAA AC 97-1, Runway Visual Range (RVR). Pilots are responsible for compliance with minimums prescribed for their class of operations in the appropriate CFRs and/or operations specifications.

**i.** RVR values are also measured by forward scatter meters mounted on 14-foot frangible fiberglass poles. A full RVR system consists of:

1. Forward scatter meter with a transmitter, receiver and associated items.
2. A runway light intensity monitor (RLIM).
3. An ambient light sensor (ALS).
4. A data processor unit (DPU).
5. Controller display (CD).

**j.** The forward scatter meter is mounted on a 14-foot frangible pole. Infrared light is emitted from the transmitter and received by the receiver. Any obscuring matter such as rain, snow, dust, fog, haze or smoke increases the amount of scattered light reaching the receiver. The resulting measurement along with inputs from the runway light intensity monitor and the ambient light sensor are forwarded to the DPU which calculates the proper RVR value. The RVR values are displayed locally and remotely on controller displays.

**k.** The runway light intensity monitors both the runway edge and centerline light step settings (steps 1 through 5). Centerline light step settings are used for CAT IIIb operations. Edge Light step settings are used for CAT I, II, and IIIa operations.

**l.** New Generation RVRs can measure and display RVR values down to the lowest limits of Category IIIb operations (150 feet RVR). RVR values are displayed in 100 feet increments and are reported as follows:

1. 100-foot increments for products below 800 feet.
2. 200-foot increments for products between 800 feet and 3,000 feet.
3. 500-foot increments for products between 3,000 feet and 6,500 feet.
4. 25-meter increments for products below 150 meters.

5. 50-meter increments for products between 150 meters and 800 meters.

6. 100-meter increments for products between 800 meters and 1,200 meters.

7. 200-meter increments for products between 1,200 meters and 2,000 meters.

### 7-1-16. Reporting of Cloud Heights

a. Ceiling, by definition in the CFRs and as used in aviation weather reports and forecasts, is the height above ground (or water) level of the lowest layer of clouds or obscuring phenomenon that is reported as “broken,” “overcast,” or “obscuration,” e.g., an aerodrome forecast (TAF) which reads “BKN030” refers to height above ground level. An area forecast which reads “BKN030” indicates that the height is above mean sea level.

#### REFERENCE-

AIM, Paragraph 7-1-30, Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR), defines “broken,” “overcast,” and “obscuration.”

b. Pilots usually report height values above MSL, since they determine heights by the altimeter. This is taken in account when disseminating and otherwise applying information received from pilots. (“Ceiling” heights are always above ground level.) In reports disseminated as PIREPs, height references are given the same as received from pilots, that is, above MSL.

c. In area forecasts or inflight advisories, ceilings are denoted by the contraction “CIG” when used with sky cover symbols as in “LWRG TO CIG OVC005,” or the contraction “AGL” after, the forecast cloud height value. When the cloud base is given in height above MSL, it is so indicated by the contraction “MSL” or “ASL” following the height value. The heights of clouds tops, freezing level, icing, and turbulence are always given in heights above ASL or MSL.

### 7-1-17. Reporting Prevailing Visibility

a. Surface (horizontal) visibility is reported in METAR reports in terms of statute miles and increments thereof; e.g.,  $\frac{1}{16}$ ,  $\frac{1}{8}$ ,  $\frac{3}{16}$ ,  $\frac{1}{4}$ ,  $\frac{5}{16}$ ,  $\frac{3}{8}$ ,  $\frac{1}{2}$ ,  $\frac{5}{8}$ ,  $\frac{3}{4}$ ,  $\frac{7}{8}$ , 1,  $1\frac{1}{8}$ , etc. (Visibility reported by an unaugmented automated site is reported differently than in a manual report, i.e., ASOS/AWOS: 0,  $\frac{1}{16}$ ,  $\frac{1}{8}$ ,  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ ,  $1\frac{3}{4}$ , 2,  $2\frac{1}{2}$ , 3, 4, 5, etc., AWOS:

$M\frac{1}{4}$ ,  $\frac{1}{4}$ ,  $\frac{1}{2}$ ,  $\frac{3}{4}$ , 1,  $1\frac{1}{4}$ ,  $1\frac{1}{2}$ ,  $1\frac{3}{4}$ , 2,  $2\frac{1}{2}$ , 3, 4, 5, etc.) Visibility is determined through the ability to see and identify preselected and prominent objects at a known distance from the usual point of observation. Visibilities which are determined to be less than 7 miles, identify the obscuring atmospheric condition; e.g., fog, haze, smoke, etc., or combinations thereof.

b. Prevailing visibility is the greatest visibility equaled or exceeded throughout at least one half of the horizon circle, not necessarily contiguous. Segments of the horizon circle which may have a significantly different visibility may be reported in the remarks section of the weather report; i.e., the southeastern quadrant of the horizon circle may be determined to be 2 miles in mist while the remaining quadrants are determined to be 3 miles in mist.

c. When the prevailing visibility at the usual point of observation, or at the tower level, is less than 4 miles, certificated tower personnel will take visibility observations in addition to those taken at the usual point of observation. The lower of these two values will be used as the prevailing visibility for aircraft operations.

### 7-1-18. Estimating Intensity of Rain and Ice Pellets

#### a. Rain

1. **Light.** From scattered drops that, regardless of duration, do not completely wet an exposed surface up to a condition where individual drops are easily seen.

2. **Moderate.** Individual drops are not clearly identifiable; spray is observable just above pavements and other hard surfaces.

3. **Heavy.** Rain seemingly falls in sheets; individual drops are not identifiable; heavy spray to height of several inches is observed over hard surfaces.

#### b. Ice Pellets

1. **Light.** Scattered pellets that do not completely cover an exposed surface regardless of duration. Visibility is not affected.

2. **Moderate.** Slow accumulation on ground. Visibility reduced by ice pellets to less than 7 statute miles.

**3. Heavy.** Rapid accumulation on ground. Visibility reduced by ice pellets to less than 3 statute miles.

### 7-1-19. Estimating Intensity of Snow or Drizzle (Based on Visibility)

- a. **Light.** Visibility more than  $\frac{1}{2}$  statute mile.
- b. **Moderate.** Visibility from more than  $\frac{1}{4}$  statute mile to  $\frac{1}{2}$  statute mile.
- c. **Heavy.** Visibility  $\frac{1}{4}$  statute mile or less.

### 7-1-20. Pilot Weather Reports (PIREPs)

a. FAA air traffic facilities are required to solicit PIREPs when the following conditions are reported or forecast: ceilings at or below 5,000 feet; visibility at or below 5 miles (surface or aloft); thunderstorms and related phenomena; icing of light degree or greater; turbulence of moderate degree or greater; wind shear and reported or forecast volcanic ash clouds.

b. Pilots are urged to cooperate and promptly volunteer reports of these conditions and other atmospheric data such as: cloud bases, tops and layers; flight visibility; precipitation; visibility restrictions such as haze, smoke and dust; wind at altitude; and temperature aloft.

c. PIREPs should be given to the ground facility with which communications are established; i.e., FSS, ARTCC, or terminal ATC. One of the primary duties of the Inflight position is to serve as a collection point for the exchange of PIREPs with en route aircraft.

d. If pilots are not able to make PIREPs by radio, reporting upon landing of the inflight conditions encountered to the nearest FSS or Weather Forecast Office will be helpful. Some of the uses made of the reports are:

1. The ATCT uses the reports to expedite the flow of air traffic in the vicinity of the field and for hazardous weather avoidance procedures.
2. The FSS uses the reports to brief other pilots, to provide inflight advisories, and weather avoidance information to en route aircraft.
3. The ARTCC uses the reports to expedite the flow of en route traffic, to determine most favorable

altitudes, and to issue hazardous weather information within the center's area.

4. The NWS uses the reports to verify or amend conditions contained in aviation forecast and advisories. In some cases, pilot reports of hazardous conditions are the triggering mechanism for the issuance of advisories. They also use the reports for pilot weather briefings.

5. The NWS, other government organizations, the military, and private industry groups use PIREPs for research activities in the study of meteorological phenomena.

6. All air traffic facilities and the NWS forward the reports received from pilots into the weather distribution system to assure the information is made available to all pilots and other interested parties.

e. The FAA, NWS, and other organizations that enter PIREPs into the weather reporting system use the format listed in TBL 7-1-7. Items 1 through 6 are included in all transmitted PIREPs along with one or more of items 7 through 13. Although the PIREP should be as complete and concise as possible, pilots should not be overly concerned with strict format or phraseology. The important thing is that the information is relayed so other pilots may benefit from your observation. If a portion of the report needs clarification, the ground station will request the information. Completed PIREPs will be transmitted to weather circuits as in the following examples:

#### EXAMPLE-

1. *KCMH UA /OV APE 230010/TM 1516/FL085/TP BE20/SK BKN065/WX FV03SM HZ FU/TA 20/TB LGT*

#### NOTE-

1. *One zero miles southwest of Appleton VOR; time 1516 UTC; altitude eight thousand five hundred; aircraft type BE200; bases of the broken cloud layer is six thousand five hundred; flight visibility 3 miles with haze and smoke; air temperature 20 degrees Celsius; light turbulence.*

#### EXAMPLE-

2. *KCRW UV /OV KBKW 360015-KCRW/TM 1815/FL120//TP BE99/SK IMC/WX RA/TA M08 /WV 290030/TB LGT-MDT/IC LGT RIME/RM MDT MXD ICG DURC KROA NWBND FL080-100 1750Z*

#### NOTE-

2. *From 15 miles north of Beckley VOR to Charleston VOR; time 1815 UTC; altitude 12,000 feet; type aircraft, BE-99; in clouds; rain; temperature minus 8 Celsius; wind 290 degrees magnetic at 30 knots; light to moderate turbulence; light rime icing during climb*

northwestbound from Roanoke, VA, between 8,000 and 10,000 feet at 1750 UTC.

can refer to the current version of AC 00–45, Aviation Weather Services.

- f. For more detailed information on PIREPS, users

*TBL 7-1-7*  
**PIREP Element Code Chart**

	<b>PIREP ELEMENT</b>	<b>PIREP CODE</b>	<b>CONTENTS</b>
1.	3-letter station identifier	XXX	Nearest weather reporting location to the reported phenomenon
2.	Report type	UA or UUA	Routine or Urgent PIREP
3.	Location	/OV	In relation to a VOR
4.	Time	/TM	Coordinated Universal Time
5.	Altitude	/FL	Essential for turbulence and icing reports
6.	Type Aircraft	/TP	Essential for turbulence and icing reports
7.	Sky cover	/SK	Cloud height and coverage (sky clear, few, scattered, broken, or overcast)
8.	Weather	/WX	Flight visibility, precipitation, restrictions to visibility, etc.
9.	Temperature	/TA	Degrees Celsius
10.	Wind	/WV	Direction in degrees magnetic north and speed in knots
11.	Turbulence	/TB	See AIM paragraph 7-1-23
12.	Icing	/IC	See AIM paragraph 7-1-21
13.	Remarks	/RM	For reporting elements not included or to clarify previously reported items

### 7-1-21. PIREPs Relating to Airframe Icing

a. The effects of ice on aircraft are cumulative—thrust is reduced, drag increases, lift lessens, and weight increases. The results are an increase in stall speed and a deterioration of aircraft performance. In extreme cases, 2 to 3 inches of ice can form on the leading edge of the airfoil in less than 5 minutes. It takes but  $\frac{1}{2}$  inch of ice to reduce the lifting power of some aircraft by 50 percent and increases the frictional drag by an equal percentage.

b. A pilot can expect icing when flying in visible precipitation, such as rain or cloud droplets, and the temperature is between +02 and –10 degrees Celsius. When icing is detected, a pilot should do one of two things, particularly if the aircraft is not equipped with deicing equipment; get out of the area of precipitation; or go to an altitude where the temperature is above freezing. This “warmer” altitude may not always be a lower altitude. Proper preflight action includes obtaining information on the freezing level and the above freezing levels in precipitation areas. Report icing to ATC, and if operating IFR, request new routing or altitude if icing

will be a hazard. Be sure to give the type of aircraft to ATC when reporting icing. The following describes how to report icing conditions.

**1. Trace.** Ice becomes noticeable. The rate of accumulation is slightly greater than the rate of sublimation. A representative accretion rate for reference purposes is less than  $\frac{1}{4}$  inch (6 mm) per hour on the outer wing. The pilot should consider exiting the icing conditions before they become worse.

**2. Light.** The rate of ice accumulation requires occasional cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is  $\frac{1}{4}$  inch to 1 inch (0.6 to 2.5 cm) per hour on the unprotected part of the outer wing. The pilot should consider exiting the icing condition.

**3. Moderate.** The rate of ice accumulation requires frequent cycling of manual deicing systems to minimize ice accretions on the airframe. A representative accretion rate for reference purposes is 1 to 3 inches (2.5 to 7.5 cm) per hour on the unprotected part of the outer wing. The pilot should

consider exiting the icing condition as soon as possible.

**4. Severe.** The rate of ice accumulation is such that ice protection systems fail to remove the accumulation of ice and ice accumulates in locations not normally prone to icing, such as areas aft of protected surfaces and any other areas identified by the manufacturer. A representative accretion rate for reference purposes is more than 3 inches (7.5 cm) per hour on the unprotected part of the outer wing. By regulation, immediate exit is required.

**NOTE–**  
Severe icing is aircraft dependent, as are the other categories of icing intensity. Severe icing may occur at any ice accumulation rate when the icing rate or ice accumulations exceed the tolerance of the aircraft.

**EXAMPLE–**  
*Pilot report: give aircraft identification, location, time (UTC), intensity of type, altitude/FL, aircraft type, indicated air speed (IAS), and outside air temperature (OAT).*

- NOTE–**
1. *Rime ice. Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets.*
  2. *Clear ice. A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets.*
  3. *The OAT should be requested by the FSS or ATC if not included in the PIREP.*

**7–1–22. Definitions of Inflight Icing Terms**

See TBL 7–1–8, Icing Types, and TBL 7–1–9, Icing Conditions.

**TBL 7–1–8  
Icing Types**

<b>Clear Ice</b>	See Glaze Ice.
<b>Glaze Ice</b>	Ice, sometimes clear and smooth, but usually containing some air pockets, which results in a lumpy translucent appearance. Glaze ice results from supercooled drops/droplets striking a surface but not freezing rapidly on contact. Glaze ice is denser, harder, and sometimes more transparent than rime ice. Factors, which favor glaze formation, are those that favor slow dissipation of the heat of fusion (i.e., slight supercooling and rapid accretion). With larger accretions, the ice shape typically includes “horns” protruding from unprotected leading edge surfaces. It is the ice shape, rather than the clarity or color of the ice, which is most likely to be accurately assessed from the cockpit. The terms “clear” and “glaze” have been used for essentially the same type of ice accretion, although some reserve “clear” for thinner accretions which lack horns and conform to the airfoil.
<b>Intercycle Ice</b>	Ice which accumulates on a protected surface between actuation cycles of a deicing system.
<b>Known or Observed or Detected Ice Accretion</b>	Actual ice observed visually to be on the aircraft by the flight crew or identified by on-board sensors.
<b>Mixed Ice</b>	Simultaneous appearance or a combination of rime and glaze ice characteristics. Since the clarity, color, and shape of the ice will be a mixture of rime and glaze characteristics, accurate identification of mixed ice from the cockpit may be difficult.
<b>Residual Ice</b>	Ice which remains on a protected surface immediately after the actuation of a deicing system.
<b>Rime Ice</b>	A rough, milky, opaque ice formed by the rapid freezing of supercooled drops/droplets after they strike the aircraft. The rapid freezing results in air being trapped, giving the ice its opaque appearance and making it porous and brittle. Rime ice typically accretes along the stagnation line of an airfoil and is more regular in shape and conformal to the airfoil than glaze ice. It is the ice shape, rather than the clarity or color of the ice, which is most likely to be accurately assessed from the cockpit.
<b>Runback Ice</b>	Ice which forms from the freezing or refreezing of water leaving protected surfaces and running back to unprotected surfaces.

**Note–**  
*Ice types are difficult for the pilot to discern and have uncertain effects on an airplane in flight. Ice type definitions will be included in the AIM for use in the “Remarks” section of the PIREP and for use in forecasting.*



*TBL 7-1-9*  
**Icing Conditions**

<b>Appendix C Icing Conditions</b>	Appendix C (14 CFR, Part 25 and 29) is the certification icing condition standard for approving ice protection provisions on aircraft. The conditions are specified in terms of altitude, temperature, liquid water content (LWC), representative droplet size (mean effective drop diameter [MED]), and cloud horizontal extent.
<b>Forecast Icing Conditions</b>	Environmental conditions expected by a National Weather Service or an FAA-approved weather provider to be conducive to the formation of inflight icing on aircraft.
<b>Freezing Drizzle (FZDZ)</b>	Drizzle is precipitation at ground level or aloft in the form of liquid water drops which have diameters less than 0.5 mm and greater than 0.05 mm. Freezing drizzle is drizzle that exists at air temperatures less than 0°C (supercooled), remains in liquid form, and freezes upon contact with objects on the surface or airborne.
<b>Freezing Precipitation</b>	Freezing precipitation is freezing rain or freezing drizzle falling through or outside of visible cloud.
<b>Freezing Rain (FZRA)</b>	Rain is precipitation at ground level or aloft in the form of liquid water drops which have diameters greater than 0.5 mm. Freezing rain is rain that exists at air temperatures less than 0°C (supercooled), remains in liquid form, and freezes upon contact with objects on the ground or in the air.
<b>Icing in Cloud</b>	Icing occurring within visible cloud. Cloud droplets (diameter < 0.05 mm) will be present; freezing drizzle and/or freezing rain may or may not be present.
<b>Icing in Precipitation</b>	Icing occurring from an encounter with freezing precipitation, that is, supercooled drops with diameters exceeding 0.05 mm, within or outside of visible cloud.
<b>Known Icing Conditions</b>	Atmospheric conditions in which the formation of ice is observed or detected in flight. <i>Note—</i> <i>Because of the variability in space and time of atmospheric conditions, the existence of a report of observed icing does not assure the presence or intensity of icing conditions at a later time, nor can a report of no icing assure the absence of icing conditions at a later time.</i>
<b>Potential Icing Conditions</b>	Atmospheric icing conditions that are typically defined by airframe manufacturers relative to temperature and visible moisture that may result in aircraft ice accretion on the ground or in flight. The potential icing conditions are typically defined in the Airplane Flight Manual or in the Airplane Operation Manual.
<b>Supercooled Drizzle Drops (SCDD)</b>	Synonymous with freezing drizzle aloft.
<b>Supercooled Drops or /Droplets</b>	Water drops/droplets which remain unfrozen at temperatures below 0°C. Supercooled drops are found in clouds, freezing drizzle, and freezing rain in the atmosphere. These drops may impinge and freeze after contact on aircraft surfaces.
<b>Supercooled Large Drops (SLD)</b>	Liquid droplets with diameters greater than 0.05 mm at temperatures less than 0°C, i.e., freezing rain or freezing drizzle.

**7-1-23. PIREPs Relating to Turbulence**

a. When encountering turbulence, pilots are urgently requested to report such conditions to ATC as soon as practicable. PIREPs relating to turbulence should state:

1. Aircraft location.
2. Time of occurrence in UTC.
3. Turbulence intensity.
4. Whether the turbulence occurred in or near clouds.

5. Aircraft altitude or flight level.

6. Type of aircraft.

7. Duration of turbulence.

**EXAMPLE-**

1. *Over Omaha, 1232Z, moderate turbulence in clouds at Flight Level three one zero, Boeing 707.*

2. *From five zero miles south of Albuquerque to three zero miles north of Phoenix, 1250Z, occasional moderate chop at Flight Level three three zero, DC8.*

b. Duration and classification of intensity should be made using TBL 7-1-10.

*TBL 7-1-10*

**Turbulence Reporting Criteria Table**

Intensity	Aircraft Reaction	Reaction Inside Aircraft	Reporting Term-Definition
Light	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as <b>Light Turbulence</b> ; <sup>1</sup> or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as <b>Light Chop</b> .	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional-Less than 1/3 of the time.  Intermittent-1/3 to 2/3.  Continuous-More than 2/3.
Moderate	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as <b>Moderate Turbulence</b> ; <sup>1</sup> or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as <b>Moderate Chop</b> . <sup>1</sup>	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	<p style="text-align: center;"><b>NOTE</b></p> <p>1. Pilots should report location(s), time (UTC), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence.</p> <p>2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable.</p>
Severe	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as <b>Severe Turbulence</b> . <sup>1</sup>	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food Service and walking are impossible.	
Extreme	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as <b>Extreme Turbulence</b> . <sup>1</sup>		<p style="text-align: center;"><b>EXAMPLES:</b></p> <p>a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707.</p> <p>b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.</p>
<p><sup>1</sup> High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.</p>			

### 7-1-24. Wind Shear PIREPs

a. Because unexpected changes in wind speed and direction can be hazardous to aircraft operations at low altitudes on approach to and departing from airports, pilots are urged to promptly volunteer reports to controllers of wind shear conditions they encounter. An advance warning of this information will assist other pilots in avoiding or coping with a wind shear on approach or departure.

b. When describing conditions, use of the terms “negative” or “positive” wind shear should be avoided. PIREPs of “negative wind shear on final,” intended to describe loss of airspeed and lift, have been interpreted to mean that no wind shear was encountered. The recommended method for wind shear reporting is to state the loss or gain of airspeed and the altitudes at which it was encountered.

#### EXAMPLE-

1. *Denver Tower, Cessna 1234 encountered wind shear, loss of 20 knots at 400.*

2. *Tulsa Tower, American 721 encountered wind shear on final, gained 25 knots between 600 and 400 feet followed by loss of 40 knots between 400 feet and surface.*

1. Pilots who are not able to report wind shear in these specific terms are encouraged to make reports in terms of the effect upon their aircraft.

#### EXAMPLE-

*Miami Tower, Gulfstream 403 Charlie encountered an abrupt wind shear at 800 feet on final, max thrust required.*

2. Pilots using Inertial Navigation Systems (INSS) should report the wind and altitude both above and below the shear level.

### c. Wind Shear Escape

1. Pilots should report to ATC when they are performing a wind shear escape maneuver. This report should be made as soon as practicable, but not until aircraft safety and control is assured, which may not be satisfied until the aircraft is clear of the wind shear or microburst. ATC should provide safety alerts and traffic advisories, as appropriate.

#### EXAMPLE-

*“Denver Tower, United 1154, wind shear escape.”*

2. Once the pilot initiates a wind shear escape maneuver, ATC is not responsible for providing approved separation between the aircraft and any other aircraft, airspace, terrain, or obstacle until the

pilot reports that the escape procedure is complete and approved separation has been re-established. Pilots should advise ATC that they are resuming the previously assigned clearance or should request an alternate clearance.

#### EXAMPLE-

*“Denver Tower, United 1154, wind shear escape complete, resuming last assigned heading/(name) DP/clearance.”*

or

*“Denver Tower, United 1154, wind shear escape complete, request further instructions.”*

### 7-1-25. Clear Air Turbulence (CAT) PIREPs

CAT has become a very serious operational factor to flight operations at all levels and especially to jet traffic flying in excess of 15,000 feet. The best available information on this phenomenon must come from pilots via the PIREP reporting procedures. All pilots encountering CAT conditions are urgently requested to report time, location, and intensity (light, moderate, severe, or extreme) of the element to the FAA facility with which they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other PIREPs and position reports.

#### REFERENCE-

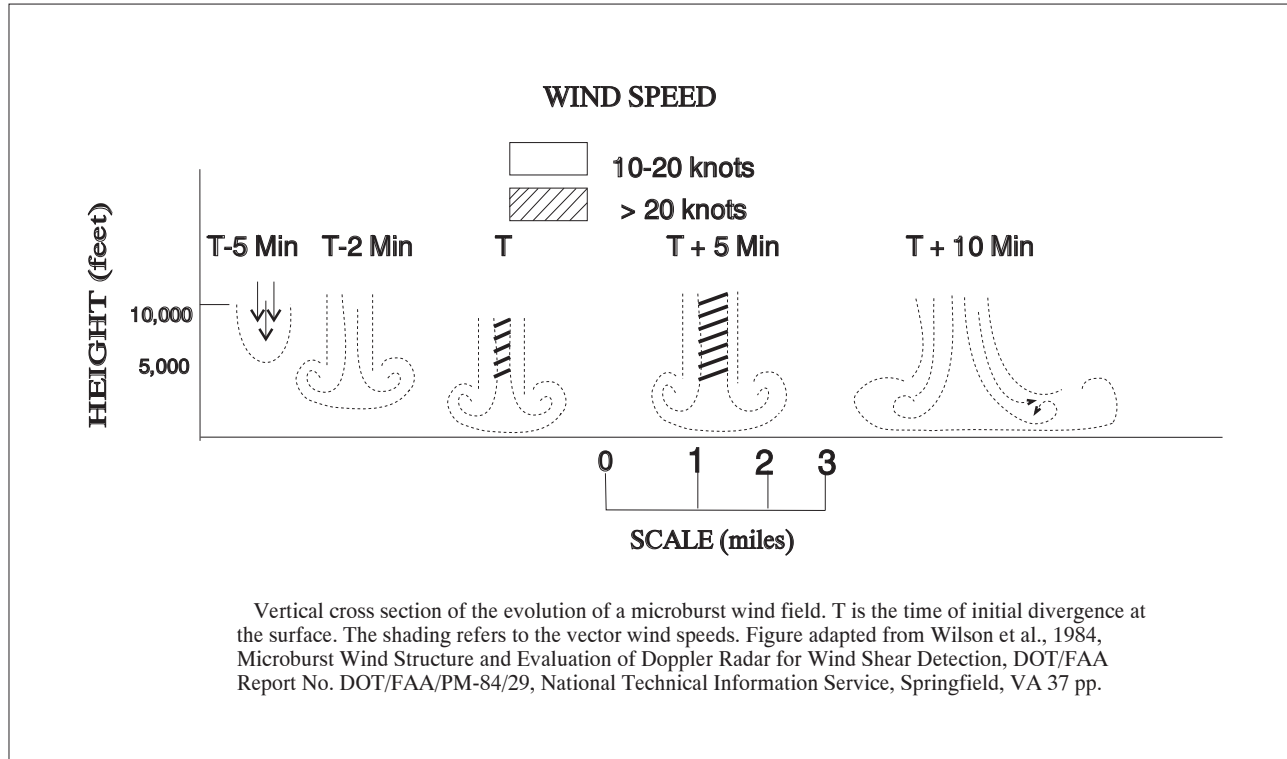
*AIM, Paragraph 7-1-23, PIREPs Relating to Turbulence*

### 7-1-26. Microbursts

a. Relatively recent meteorological studies have confirmed the existence of microburst phenomenon. Microbursts are small scale intense downdrafts which, on reaching the surface, spread outward in all directions from the downdraft center. This causes the presence of both vertical and horizontal wind shears that can be extremely hazardous to all types and categories of aircraft, especially at low altitudes. Due to their small size, short life span, and the fact that they can occur over areas without surface precipitation, microbursts are not easily detectable using conventional weather radar or wind shear alert systems.

b. Parent clouds producing microburst activity can be any of the low or middle layer convective cloud types. Note, however, that microbursts commonly occur within the heavy rain portion of thunderstorms, and in much weaker, benign appearing convective cells that have little or no precipitation reaching the ground.

FIG 7-1-12  
Evolution of a Microburst



c. The life cycle of a microburst as it descends in a convective rain shaft is seen in FIG 7-1-12. An important consideration for pilots is the fact that the microburst intensifies for about 5 minutes after it strikes the ground.

**d. Characteristics of microbursts include:**

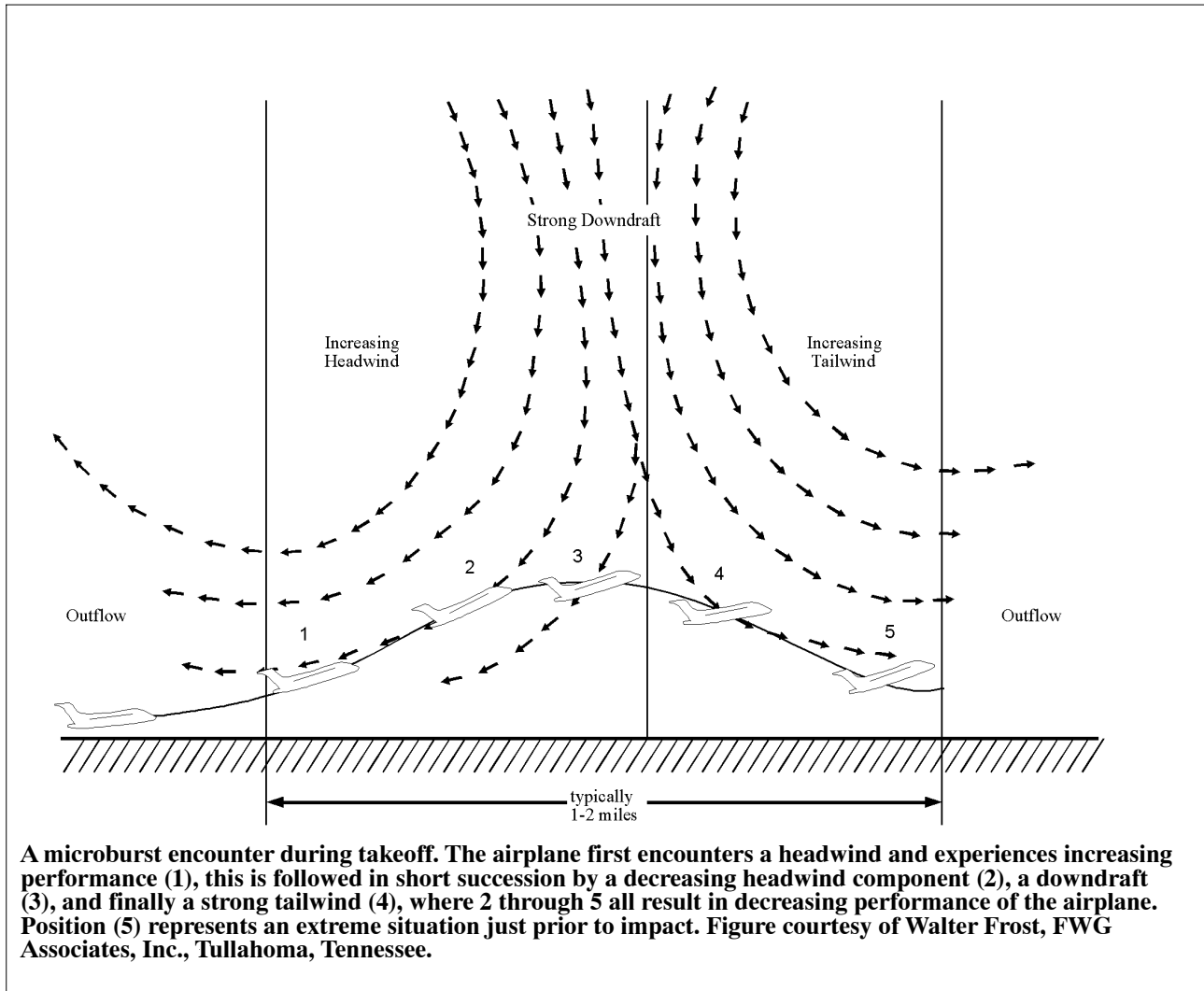
**1. Size.** The microburst downdraft is typically less than 1 mile in diameter as it descends from the cloud base to about 1,000–3,000 feet above the ground. In the transition zone near the ground, the downdraft changes to a horizontal outflow that can extend to approximately 2 1/2 miles in diameter.

**2. Intensity.** The downdrafts can be as strong as 6,000 feet per minute. Horizontal winds near the surface can be as strong as 45 knots resulting in a 90 knot shear (headwind to tailwind change for a traversing aircraft) across the microburst. These strong horizontal winds occur within a few hundred feet of the ground.

**3. Visual Signs.** Microbursts can be found almost anywhere that there is convective activity. They may be embedded in heavy rain associated with a thunderstorm or in light rain in benign appearing virga. When there is little or no precipitation at the surface accompanying the microburst, a ring of blowing dust may be the only visual clue of its existence.

**4. Duration.** An individual microburst will seldom last longer than 15 minutes from the time it strikes the ground until dissipation. The horizontal winds continue to increase during the first 5 minutes with the maximum intensity winds lasting approximately 2–4 minutes. Sometimes microbursts are concentrated into a line structure, and under these conditions, activity may continue for as long as an hour. Once microburst activity starts, multiple microbursts in the same general area are not uncommon and should be expected.

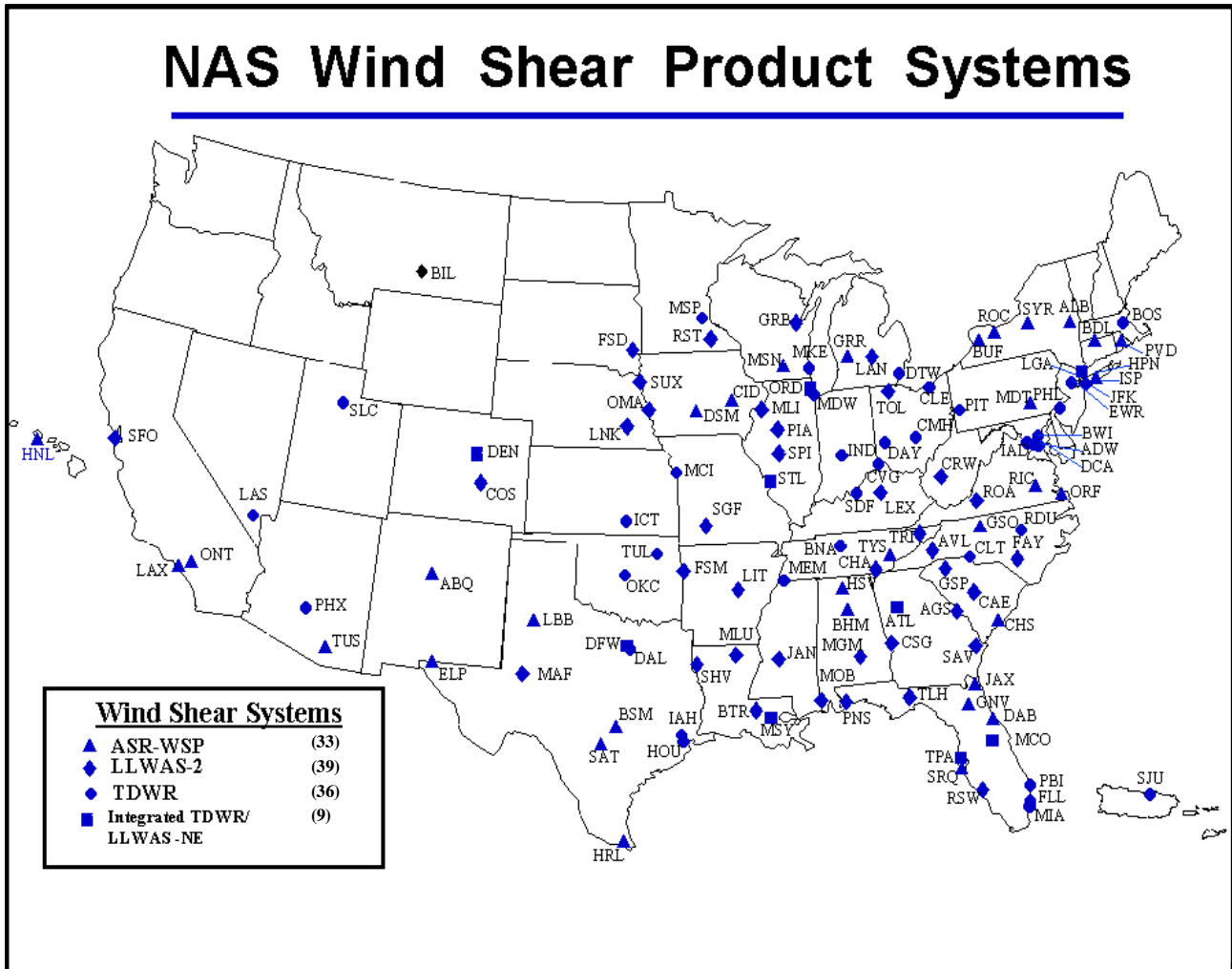
FIG 7-1-13  
Microburst Encounter During Takeoff



e. Microburst wind shear may create a severe hazard for aircraft within 1,000 feet of the ground, particularly during the approach to landing and landing and take-off phases. The impact of a microburst on aircraft which have the unfortunate

experience of penetrating one is characterized in FIG 7-1-13. The aircraft may encounter a headwind (performance increasing) followed by a downdraft and tailwind (both performance decreasing), possibly resulting in terrain impact.

FIG 7-1-14  
NAS Wind Shear Product Systems



**f. Detection of Microbursts, Wind Shear and Gust Fronts.**

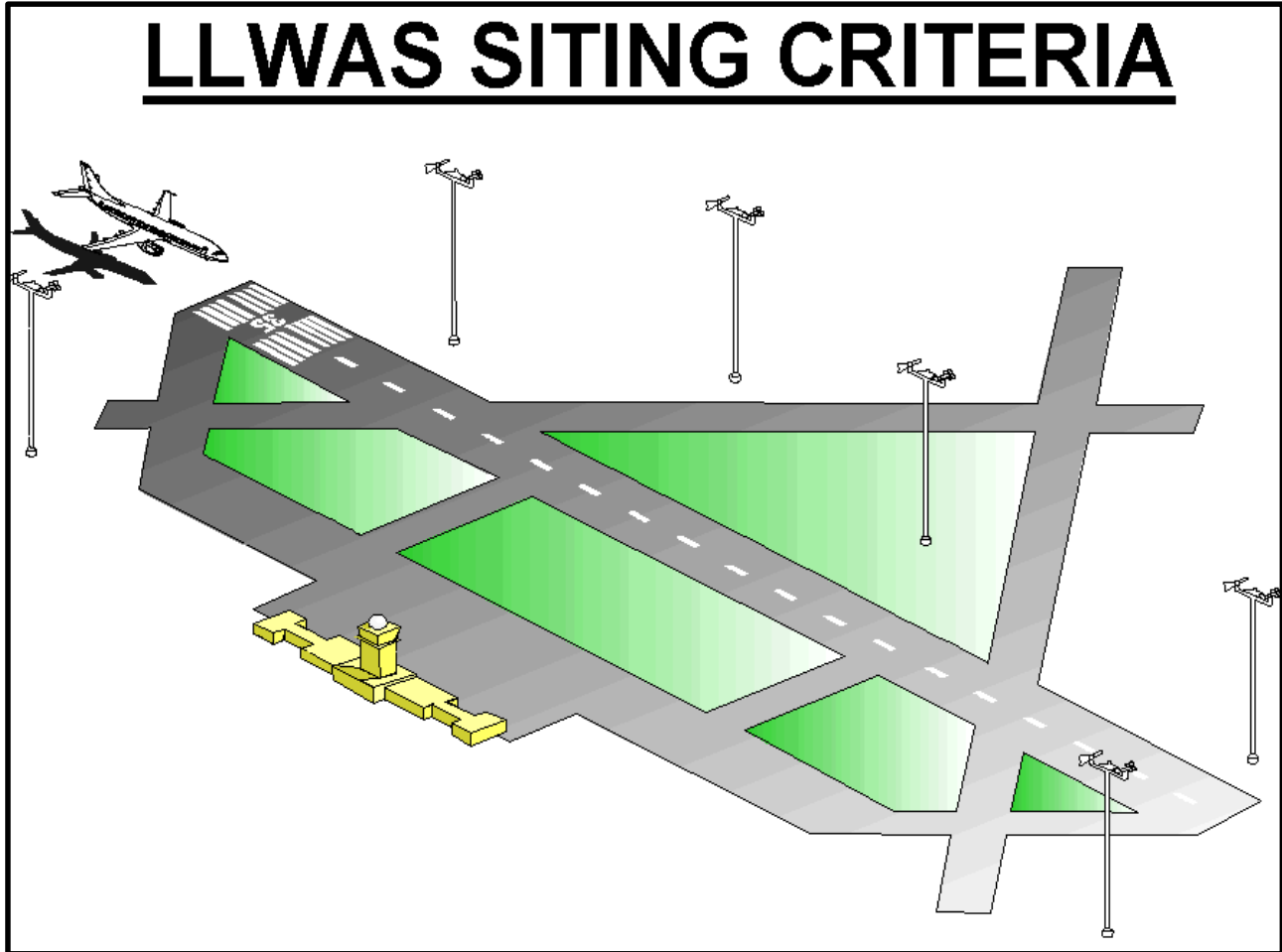
**1. FAA’s Integrated Wind Shear Detection Plan.**

(a) The FAA currently employs an integrated plan for wind shear detection that will significantly improve both the safety and capacity of the majority of the airports currently served by the air carriers. This plan integrates several programs, such as the Integrated Terminal Weather System (ITWS), Terminal Doppler Weather Radar (TDWR), Weather System Processor (WSP), and Low Level Wind Shear Alert Systems (LLWAS) into a single strategic

concept that significantly improves the aviation weather information in the terminal area. (See FIG 7-1-14.)

(b) The wind shear/microburst information and warnings are displayed on the ribbon display terminals (RBDT) located in the tower cabs. They are identical (and standardized) in the LLWAS, TDWR and WSP systems, and so designed that the controller does not need to interpret the data, but simply read the displayed information to the pilot. The RBDTs are constantly monitored by the controller to ensure the rapid and timely dissemination of any hazardous event(s) to the pilot.

FIG 7-1-15  
LLWAS Siting Criteria

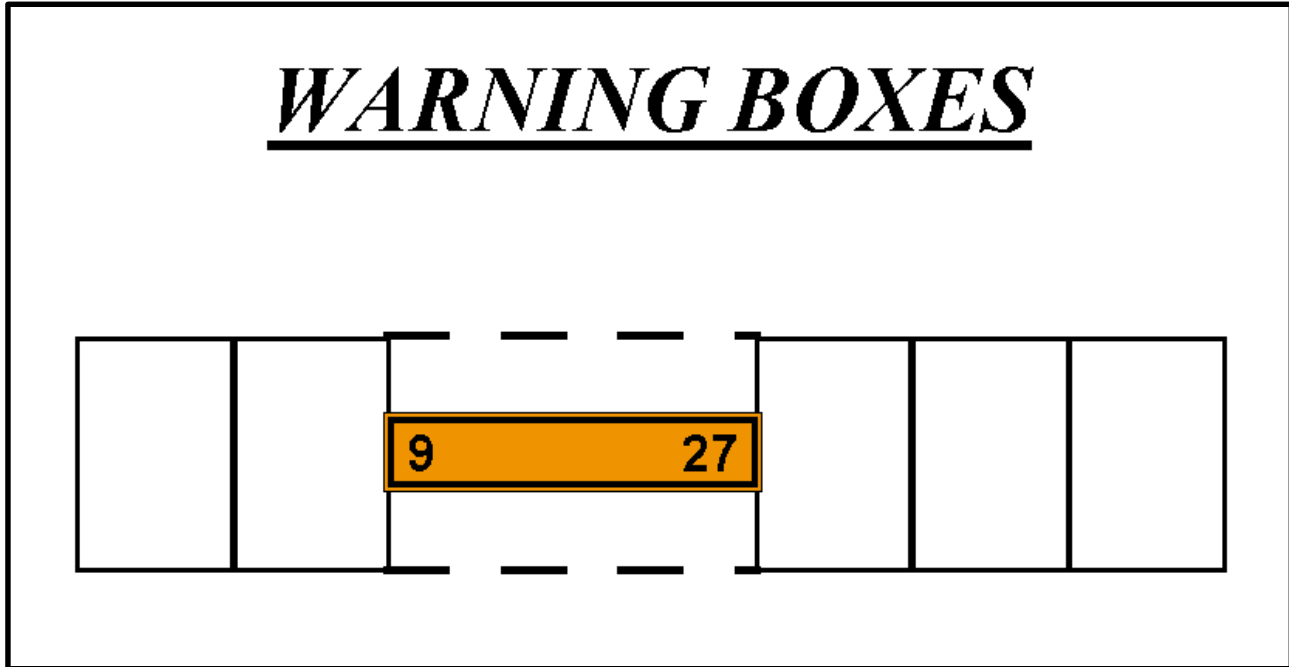


(c) The early detection of a wind shear/micro-burst event, and the subsequent warning(s) issued to an aircraft on approach or departure, will alert the pilot/crew to the potential of, and to be prepared for, a situation that could become very dangerous! Without these warnings, the aircraft may NOT be able to climb out of, or safely transition, the event, resulting in a catastrophe. The air carriers, working with the FAA, have developed specialized training programs using their simulators to train and prepare their pilots on the demanding aircraft procedures required to escape these very dangerous wind shear and/or microburst encounters.

## 2. Low Level Wind Shear Alert System (LLWAS).

(a) The LLWAS provides wind data and software processes to detect the presence of hazardous wind shear and microbursts in the vicinity of an airport. Wind sensors, mounted on poles sometimes as high as 150 feet, are (ideally) located 2,000 – 3,500 feet, but not more than 5,000 feet, from the centerline of the runway. (See FIG 7-1-15.)

FIG 7-1-16  
Warning Boxes



(b) LLWAS was fielded in 1988 at 110 airports across the nation. Many of these systems have been replaced by new TDWR and WSP technology. Eventually all LLWAS systems will be phased out; however, 39 airports will be upgraded to the LLWAS-NE (Network Expansion) system, which employs the very latest software and sensor technology. The new LLWAS-NE systems will not only provide the controller with wind shear warnings and alerts, including wind shear/microburst detection at the airport wind sensor location, but will also provide the location of the hazards relative to the airport runway(s). It will also have the flexibility and capability to grow with the airport as new runways are built. As many as 32 sensors, strategically located around the airport and in relationship to its runway configuration, can be accommodated by the LLWAS-NE network.

### 3. Terminal Doppler Weather Radar (TDWR).

(a) TDWRs are being deployed at 45 locations across the U.S. Optimum locations for TDWRs are 8 to 12 miles off of the airport proper, and designed to look at the airspace around and over the airport to detect microbursts, gust fronts, wind shifts

and precipitation intensities. TDWR products advise the controller of wind shear and microburst events impacting all runways and the areas  $\frac{1}{2}$  mile on either side of the extended centerline of the runways out to 3 miles on final approach and 2 miles out on departure.

(FIG 7-1-16 is a theoretical view of the warning boxes, including the runway, that the software uses in determining the location(s) of wind shear or microbursts). These warnings are displayed (as depicted in the examples in subparagraph 5) on the RBDT.

(b) It is very important to understand what TDWR does NOT DO:

- (1) It **DOES NOT** warn of wind shear outside of the alert boxes (on the arrival and departure ends of the runways);
- (2) It **DOES NOT** detect wind shear that is NOT a microburst or a gust front;
- (3) It **DOES NOT** detect gusty or cross wind conditions; and
- (4) It **DOES NOT** detect turbulence.

However, research and development is continuing on these systems. Future improvements may include such areas as storm motion (movement), improved



gust front detection, storm growth and decay, microburst prediction, and turbulence detection.

(c) TDWR also provides a geographical situation display (GSD) for supervisors and traffic management specialists for planning purposes. The GSD displays (in color) 6 levels of weather (precipitation), gust fronts and predicted storm movement(s). This data is used by the tower supervisor(s), traffic management specialists and controllers to plan for runway changes and arrival/departure route changes in order to both reduce aircraft delays and increase airport capacity.

#### 4. Weather System Processor (WSP).

(a) The WSP provides the controller, supervisor, traffic management specialist, and ultimately the pilot, with the same products as the terminal doppler weather radar (TDWR) at a fraction of the cost of a TDWR. This is accomplished by utilizing new technologies to access the weather channel capabilities of the existing ASR-9 radar located on or near the airport, thus eliminating the requirements for a separate radar location, land acquisition, support facilities and the associated communication landlines and expenses.

(b) The WSP utilizes the same RBDT display as the TDWR and LLWAS, and, just like TDWR, also has a GSD for planning purposes by supervisors, traffic management specialists and controllers. The WSP GSD emulates the TDWR display, i.e., it also depicts 6 levels of precipitation, gust fronts and predicted storm movement, and like the TDWR GSD, is used to plan for runway changes and arrival/departure route changes in order to reduce aircraft delays and to increase airport capacity.

(c) This system is currently under development and is operating in a developmental test status at the Albuquerque, New Mexico, airport. When fielded, the WSP is expected to be installed at

34 airports across the nation, substantially increasing the safety of the American flying public.

#### 5. Operational aspects of LLWAS, TDWR and WSP.

To demonstrate how this data is used by both the controller and the pilot, 3 ribbon display examples and their explanations are presented:

##### (a) MICROBURST ALERTS

###### **EXAMPLE-**

*This is what the controller sees on his/her ribbon display in the tower cab.*

27A MBA 35K- 2MF 250 20
-------------------------

###### **NOTE-**

*(See FIG 7-1-17 to see how the TDWR/WSP determines the microburst location).*

This is what the controller will say when issuing the alert.

###### **PHRASEOLOGY-**

*RUNWAY 27 ARRIVAL, MICROBURST ALERT, 35 KT LOSS 2 MILE FINAL, THRESHOLD WIND 250 AT 20.*

In plain language, the controller is telling the pilot that on approach to runway 27, there is a microburst alert on the approach lane to the runway, and to anticipate or expect a 35 knot loss of airspeed at approximately 2 miles out on final approach (where it will first encounter the phenomena). With that information, the aircrew is forewarned, and should be prepared to apply wind shear/microburst escape procedures should they decide to continue the approach. Additionally, the surface winds at the airport for landing runway 27 are reported as 250 degrees at 20 knots.

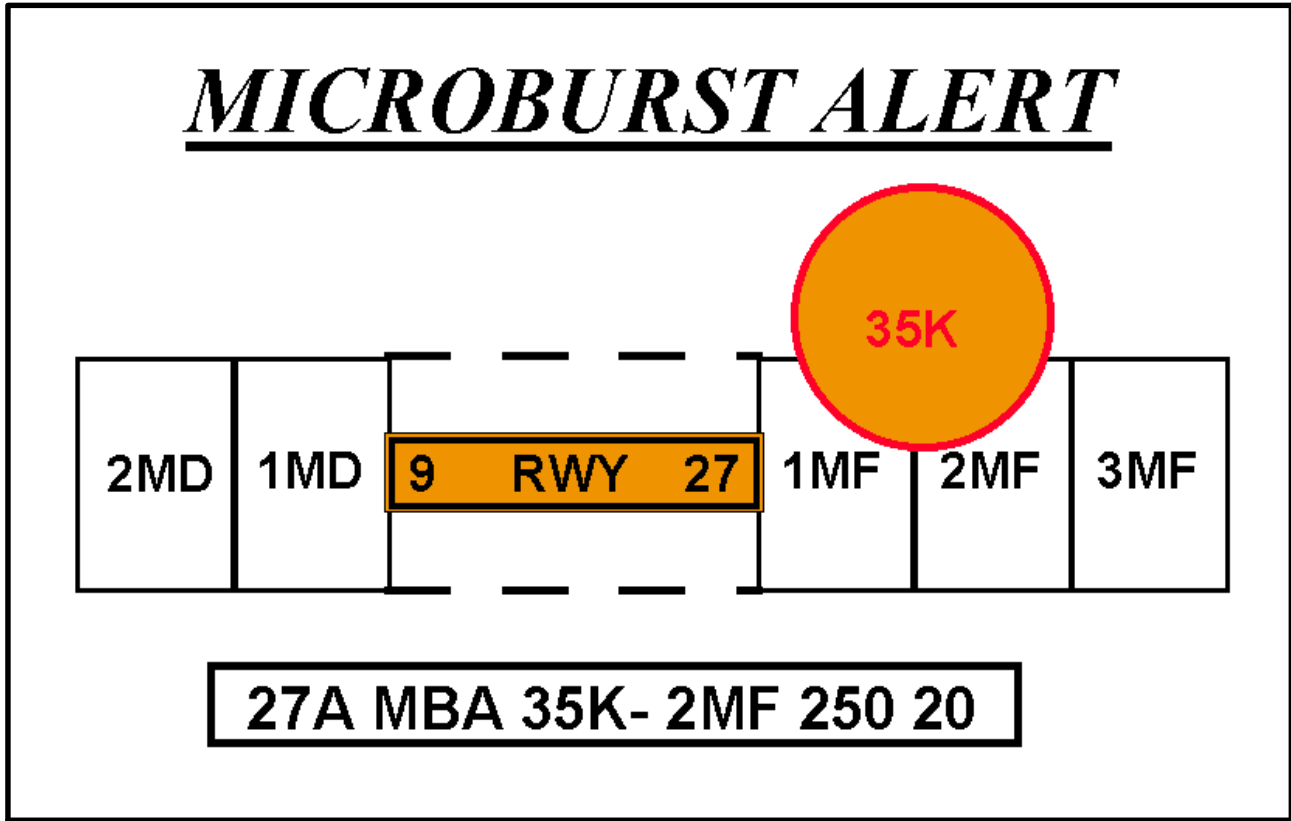
###### **NOTE-**

*Threshold wind is at pilot's request or as deemed appropriate by the controller.*

###### **REFERENCE-**

*FAA Order JO 7110.65, Paragraph 3-1-8b2(a), Air Traffic Control, Low Level Wind Shear/Microburst Advisories*

FIG 7-1-17  
Microburst Alert



**(b) WIND SHEAR ALERTS**

**EXAMPLE-**

*This is what the controller sees on his/her ribbon display in the tower cab.*

27A WSA 20K- 3MF 200 15

**NOTE-**

*(See FIG 7-1-18 to see how the TDWR/WSP determines the wind shear location).*

This is what the controller will say when issuing the alert.

**PHRASEOLOGY-**

**RUNWAY 27 ARRIVAL, WIND SHEAR ALERT, 20 KT LOSS 3 MILE FINAL, THRESHOLD WIND 200 AT 15.**

In plain language, the controller is advising the aircraft arriving on runway 27 that at about 3 miles out they can expect to encounter a wind shear condition that will decrease their airspeed by 20 knots and possibly encounter turbulence. Additionally, the airport surface winds for landing runway 27 are reported as 200 degrees at 15 knots.

**NOTE-**

*Threshold wind is at pilot's request or as deemed appropriate by the controller.*

**REFERENCE-**

*FAA Order JO 7110.65, Air Traffic Control, Low Level Wind Shear/Microburst Advisories, Paragraph 3-1-8b2(a).*

FIG 7-1-18  
Weak Microburst Alert

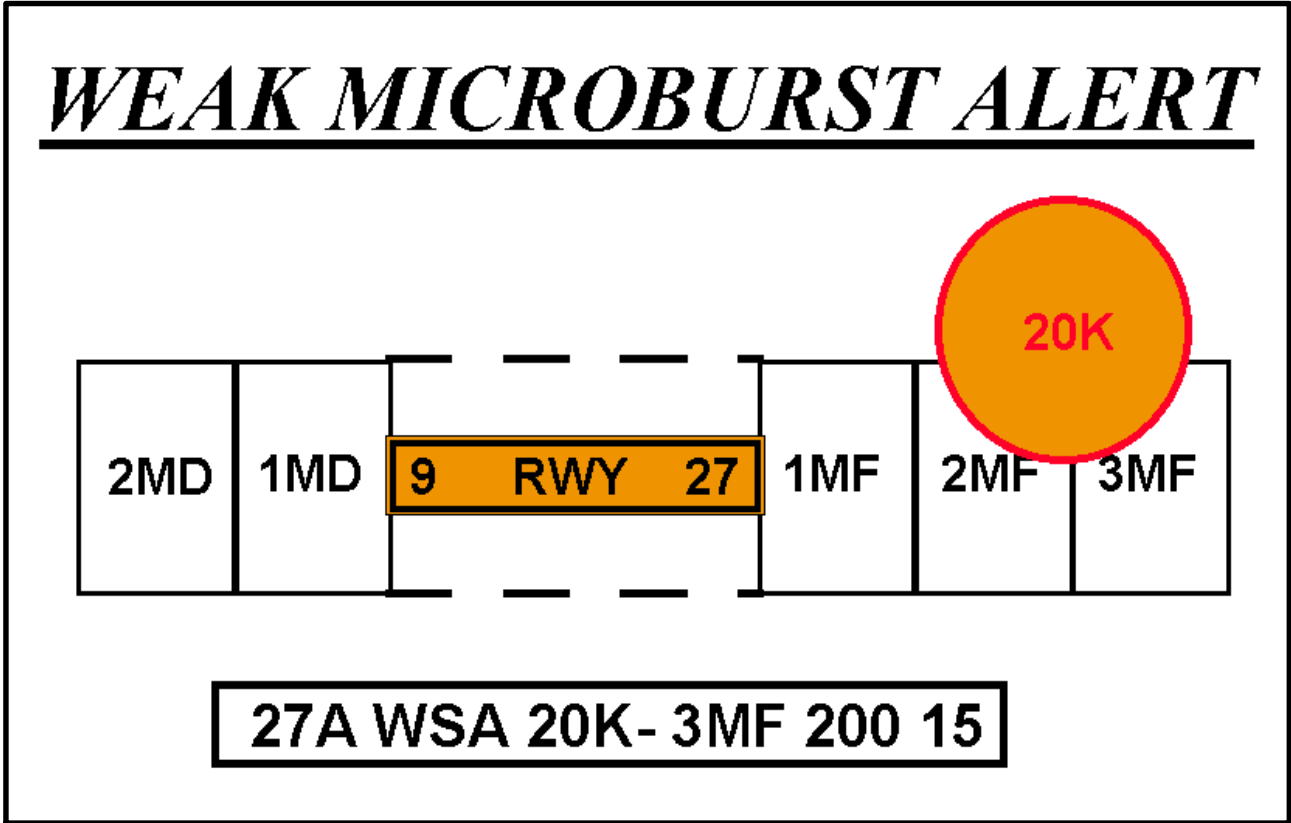
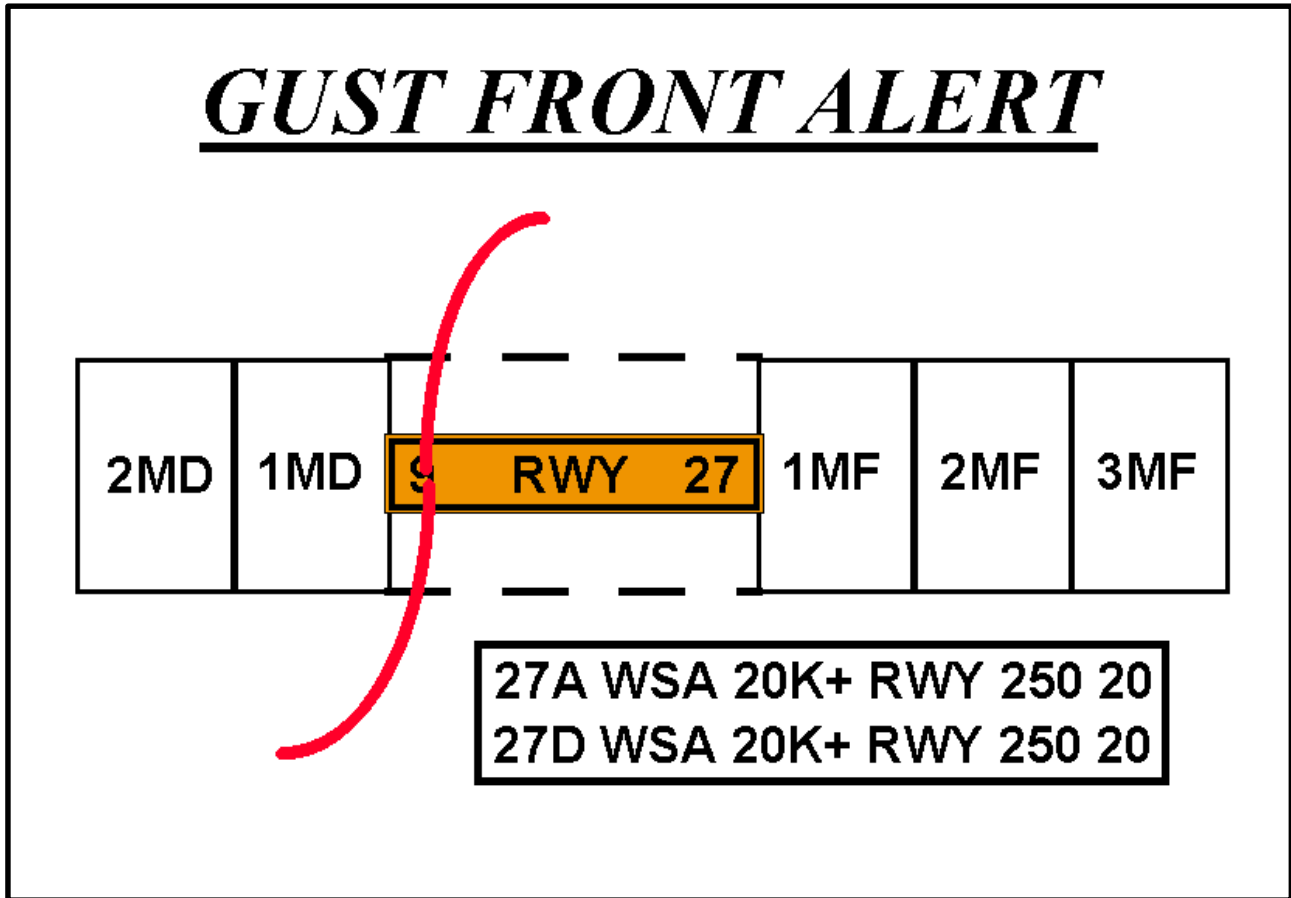


FIG 7-1-19  
Gust Front Alert



**(c) MULTIPLE WIND SHEAR ALERTS**

**EXAMPLE-**

*This is what the controller sees on his/her ribbon display in the tower cab.*

27A WSA 20K+ RWY 250 20
27D WSA 20K+ RWY 250 20

**NOTE-**

*(See FIG 7-1-19 to see how the TDWR/WSP determines the gust front/wind shear location.)*

This is what the controller will say when issuing the alert.

**PHRASEOLOGY-**

*MULTIPLE WIND SHEAR ALERTS. RUNWAY 27 ARRIVAL, WIND SHEAR ALERT, 20 KT GAIN ON RUNWAY; RUNWAY 27 DEPARTURE, WIND SHEAR ALERT, 20 KT GAIN ON RUNWAY, WIND 250 AT 20.*

**EXAMPLE-**

*In this example, the controller is advising arriving and departing aircraft that they could encounter a wind shear condition right on the runway due to a gust front (significant change of wind direction) with the possibility of a 20 knot gain in airspeed associated with the gust front. Additionally, the airport surface winds (for the runway in use) are reported as 250 degrees at 20 knots.*

**REFERENCE-**

*FAA Order 7110.65, Air Traffic Control, Low Level Wind Shear/Microburst Advisories, Paragraph 3-1-8b2(d).*

### 6. The Terminal Weather Information for Pilots System (TWIP).

(a) With the increase in the quantity and quality of terminal weather information available through TDWR, the next step is to provide this information directly to pilots rather than relying on voice communications from ATC. The National Airspace System has long been in need of a means of delivering terminal weather information to the cockpit more efficiently in terms of both speed and accuracy to enhance pilot awareness of weather hazards and reduce air traffic controller workload. With the TWIP capability, terminal weather information, both alphanumerically and graphically, is now available directly to the cockpit at 43 airports in the U.S. NAS. (See FIG 7-1-20.)

FIG 7-1-20

**TWIP Image of Convective Weather at MCO International**

WEATHER SITUATION	TWIP TEXT MESSAGE
	<p>MCO 1800                      TERMINAL WEATHER                      -STORM(S)                      3NM N-E MOD PRECIP                      4NM NE HVY PRECIP                      MOVG W AT 15KT                      .EXPECTED MOD PRECIP                      BEGIN 1805</p>
	<p>MCO 1810                      TERMINAL WEATHER                      *MODERATE PRECIP                      BEGAN 1805                      -STORM(S)                      ARPT ALQDS MOD PRECIP                      1NM N-E HVY PRECIP                      MOVG W AT 15KT                      .EXPECTED HVY PRECIP                      BEGIN 1815</p>

(b) TWIP products are generated using weather data from the TDWR or the Integrated Terminal Weather System (ITWS) testbed. TWIP products are generated and stored in the form of text and character graphic messages. Software has been developed to allow TDWR or ITWS to format the data and send the TWIP products to a database resident at Aeronautical Radio, Inc. (ARINC). These products can then be accessed by pilots using the ARINC Aircraft Communications Addressing and Reporting System (ACARS) data link services. Airline dispatchers can also access this database and send messages to specific aircraft whenever wind shear activity begins or ends at an airport.

(c) TWIP products include descriptions and character graphics of microburst alerts, wind shear alerts, significant precipitation, convective activity

within 30 NM surrounding the terminal area, and expected weather that will impact airport operations. During inclement weather, i.e., whenever a predetermined level of precipitation or wind shear is detected within 15 miles of the terminal area, TWIP products are updated once each minute for text messages and once every five minutes for character graphic messages. During good weather (below the predetermined precipitation or wind shear parameters) each message is updated every 10 minutes. These products are intended to improve the situational awareness of the pilot/flight crew, and to aid in flight planning prior to arriving or departing the terminal area. It is important to understand that, in the context of TWIP, the predetermined levels for inclement versus good weather has nothing to do with the criteria for VFR/MVFR/IFR/LIFR; it only deals with precipitation, wind shears and microbursts.

TBL 7-1-11

**TWIP-Equipped Airports**

Airport	Identifier
Andrews AFB, MD	KADW
Hartsfield-Jackson Atlanta Intl Airport	KATL
Nashville Intl Airport	KBNA
Logan Intl Airport	KBOS
Baltimore/Washington Intl Airport	KBWI
Hopkins Intl Airport	KCLE
Charlotte/Douglas Intl Airport	KCLT
Port Columbus Intl Airport	KCMH
Cincinnati/Northern Kentucky Intl Airport	KCVG
Dallas Love Field Airport	KDAL
James M. Cox Intl Airport	KDAY
Ronald Reagan Washington National Airport	KDCA
Denver Intl Airport	KDEN
Dallas-Fort Worth Intl Airport	KDFW
Detroit Metro Wayne County Airport	KDTW
Newark Liberty Intl Airport	KEWR
Fort Lauderdale-Hollywood Intl Airport	KFLL
William P. Hobby Airport	KHOU
Washington Dulles Intl Airport	KIAD
George Bush Intercontinental Airport	KIAH
Wichita Mid-Continent Airport	KICT
Indianapolis Intl Airport	KIND

<b>Airport</b>	<b>Identifier</b>
John F. Kennedy Intl Airport	KJFK
LaGuardia Airport	KLGA
Kansas City Intl Airport	KMCI
Orlando Intl Airport	KMCO
Midway Intl Airport	KMDW
Memphis Intl Airport	KMEM
Miami Intl Airport	KMIA
General Mitchell Intl Airport	KMKE
Minneapolis St. Paul Intl Airport	KMSP
Louis Armstrong New Orleans Intl Airport	KMSY
Will Rogers World Airport	KOKC
O'Hare Intl Airport	KORD
Palm Beach Intl Airport	KPBI
Philadelphia Intl Airport	KPHL
Pittsburgh Intl Airport	KPIT
Raleigh-Durham Intl Airport	KRDU
Louisville Intl Airport	KSDF
Salt Lake City Intl Airport	KSLC
Lambert-St. Louis Intl Airport	KSTL
Tampa Intl Airport	KTPA
Tulsa Intl Airport	KTUL

### 7-1-27. PIREPs Relating to Volcanic Ash Activity

a. Volcanic eruptions which send ash into the upper atmosphere occur somewhere around the world several times each year. Flying into a volcanic ash cloud can be extremely dangerous. At least two B747s have lost all power in all four engines after such an encounter. Regardless of the type aircraft, some damage is almost certain to ensue after an encounter with a volcanic ash cloud. Additionally, studies have shown that volcanic eruptions are the only significant source of large quantities of sulphur dioxide (SO<sub>2</sub>) gas at jet-cruising altitudes. Therefore, the detection and subsequent reporting of SO<sub>2</sub> is of significant importance. Although SO<sub>2</sub> is colorless, its presence in the atmosphere should be suspected when a sulphur-like or rotten egg odor is present throughout the cabin.

b. While some volcanoes in the U.S. are monitored, many in remote areas are not. These unmonitored volcanoes may erupt without prior warning to the aviation community. A pilot observing a volcanic eruption who has not had previous notification of it may be the only witness to the eruption. Pilots are strongly encouraged to transmit a PIREP regarding volcanic eruptions and any observed volcanic ash clouds or detection of sulphur dioxide (SO<sub>2</sub>) gas associated with volcanic activity.

c. Pilots should submit PIREPs regarding volcanic activity using the Volcanic Activity Reporting (VAR) form as illustrated in Appendix 2. If a VAR form is not immediately available, relay enough information to identify the position and type of volcanic activity.

d. Pilots should verbally transmit the data required in items 1 through 8 of the VAR as soon as possible. The data required in items 9 through 16 of the VAR should be relayed after landing if possible.

### 7-1-28. Thunderstorms

a. Turbulence, hail, rain, snow, lightning, sustained updrafts and downdrafts, icing conditions—are present in thunderstorms. While there is some evidence that maximum turbulence exists at the middle level of a thunderstorm, recent studies show little variation of turbulence intensity with altitude.

b. There is no useful correlation between the external visual appearance of thunderstorms and the severity or amount of turbulence or hail within them. The visible thunderstorm cloud is only a portion of a turbulent system whose updrafts and downdrafts often extend far beyond the visible storm cloud. Severe turbulence can be expected up to 20 miles from severe thunderstorms. This distance decreases to about 10 miles in less severe storms.

c. Weather radar, airborne or ground based, will normally reflect the areas of moderate to heavy precipitation (radar does not detect turbulence). The frequency and severity of turbulence generally increases with the radar reflectivity which is closely associated with the areas of highest liquid water content of the storm. NO FLIGHT PATH THROUGH AN AREA OF STRONG OR VERY STRONG RADAR ECHOES SEPARATED BY 20-30 MILES OR LESS MAY BE CONSIDERED FREE OF SEVERE TURBULENCE.

d. Turbulence beneath a thunderstorm should not be minimized. This is especially true when the

relative humidity is low in any layer between the surface and 15,000 feet. Then the lower altitudes may be characterized by strong out flowing winds and severe turbulence.

**e.** The probability of lightning strikes occurring to aircraft is greatest when operating at altitudes where temperatures are between minus 5 degrees Celsius and plus 5 degrees Celsius. Lightning can strike aircraft flying in the clear in the vicinity of a thunderstorm.

**f.** METAR reports do not include a descriptor for severe thunderstorms. However, by understanding severe thunderstorm criteria, i.e., 50 knot winds or  $\frac{3}{4}$  inch hail, the information is available in the report to know that one is occurring.

**g.** Current weather radar systems are able to objectively determine precipitation intensity. These precipitation intensity areas are described as “light,” “moderate,” “heavy,” and “extreme.”

**REFERENCE–**

*Pilot/Controller Glossary– Precipitation Radar Weather Descriptions*

**EXAMPLE–**

**1.** Alert provided by an ATC facility to an aircraft: (aircraft identification) **EXTREME** precipitation between ten o'clock and two o'clock, one five miles. Precipitation area is two five miles in diameter.

**2.** Alert provided by an FSS: (aircraft identification) **EXTREME** precipitation two zero miles west of Atlanta V-O-R, two five miles wide, moving east at two zero knots, tops flight level three niner zero.

## 7-1-29. Thunderstorm Flying

**a.** Thunderstorm Avoidance. Never regard any thunderstorm lightly, even when radar echoes are of light intensity. Avoiding thunderstorms is the best policy. Following are some Do's and Don'ts of thunderstorm avoidance:

**1.** Don't land or takeoff in the face of an approaching thunderstorm. A sudden gust front of low level turbulence could cause loss of control.

**2.** Don't attempt to fly under a thunderstorm even if you can see through to the other side. Turbulence and wind shear under the storm could be hazardous.

**3.** Don't attempt to fly under the anvil of a thunderstorm. There is a potential for severe and extreme clear air turbulence.

**4.** Don't fly without airborne radar into a cloud mass containing scattered embedded thunderstorms. Scattered thunderstorms not embedded usually can be visually circumnavigated.

**5.** Don't trust the visual appearance to be a reliable indicator of the turbulence inside a thunderstorm.

**6.** Don't assume that ATC will offer radar navigation guidance or deviations around thunderstorms.

**7.** Don't use data-linked weather next generation weather radar (NEXRAD) mosaic imagery as the sole means for negotiating a path through a thunderstorm area (tactical maneuvering).

**8.** Do remember that the data-linked NEXRAD mosaic imagery shows where the weather was, not where the weather is. The weather conditions may be 15 to 20 minutes older than the age indicated on the display.

**9.** Do listen to chatter on the ATC frequency for Pilot Weather Reports (PIREP) and other aircraft requesting to deviate or divert.

**10.** Do ask ATC for radar navigation guidance or to approve deviations around thunderstorms, if needed.

**11.** Do use data-linked weather NEXRAD mosaic imagery (for example, Flight Information Service-Broadcast (FIS-B)) for route selection to avoid thunderstorms entirely (strategic maneuvering).

**12.** Do advise ATC, when switched to another controller, that you are deviating for thunderstorms before accepting to rejoin the original route.

**13.** Do ensure that after an authorized weather deviation, before accepting to rejoin the original route, that the route of flight is clear of thunderstorms.

**14.** Do avoid by at least 20 miles any thunderstorm identified as severe or giving an intense radar echo. This is especially true under the anvil of a large cumulonimbus.

**15.** Do circumnavigate the entire area if the area has 6/10 thunderstorm coverage.

**16.** Do remember that vivid and frequent lightning indicates the probability of a severe thunderstorm.

**17.** Do regard as extremely hazardous any thunderstorm with tops 35,000 feet or higher whether the top is visually sighted or determined by radar.

**18.** Do give a PIREP for the flight conditions.

**19.** Do divert and wait out the thunderstorms on the ground if unable to navigate around an area of thunderstorms.

**20.** Do contact Flight Service for assistance in avoiding thunderstorms. Flight Service specialists have NEXRAD mosaic radar imagery and NEXRAD single site radar with unique features such as base and composite reflectivity, echo tops, and VAD wind profiles.

**b.** If you cannot avoid penetrating a thunderstorm, following are some Do's before entering the storm:

**1.** Tighten your safety belt, put on your shoulder harness (if installed), if and secure all loose objects.

**2.** Plan and hold the course to take the aircraft through the storm in a minimum time.

**3.** To avoid the most critical icing, establish a penetration altitude below the freezing level or above the level of -15°C.

**4.** Verify that pitot heat is on and turn on carburetor heat or jet engine anti-ice. Icing can be rapid at any altitude and cause almost instantaneous power failure and/or loss of airspeed indication.

**5.** Establish power settings for turbulence penetration airspeed recommended in the aircraft manual.

**6.** Turn up cockpit lights to highest intensity to lessen temporary blindness from lightning.

**7.** If using automatic pilot, disengage Altitude Hold Mode and Speed Hold Mode. The automatic altitude and speed controls will increase maneuvers of the aircraft thus increasing structural stress.

**8.** If using airborne radar, tilt the antenna up and down occasionally. This will permit the detection of other thunderstorm activity at altitudes other than the one being flown.

**c.** Following are some Do's and Don'ts during the thunderstorm penetration:

**1.** Do keep your eyes on your instruments. Looking outside the cockpit can increase danger of temporary blindness from lightning.

**2.** Don't change power settings; maintain settings for the recommended turbulence penetration airspeed.

**3.** Do maintain constant attitude. Allow the altitude and airspeed to fluctuate.

**4.** Don't turn back once you are in the thunderstorm. A straight course through the storm most likely will get the aircraft out of the hazards most quickly. In addition, turning maneuvers increase stress on the aircraft.



**7-1-30. Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR)**

FIG 7-1-21

**Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR) (Front)**



**Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR) (Front)**



<b>TAF</b>	KPIT 091730Z 0918/1024 15005KT 5SM HZ FEW020 WS010/31022KT FM091930 30015G25KT 3SM SHRA OVC015 TEMPO 0920/0922 1/2SM +TSRA OVC008CB FM100100 27008KT 5SM SHRA BKN020 OVC040 PROB30 1004/1007 1SM -RA BR FM101015 18005KT 6SM -SHRA OVC020 BECMG 1013/1015 P6SM NSW SKC
<b>NOTE:</b> Users are cautioned to confirm <i>DATE</i> and <i>TIME</i> of the TAF. For example FM100000 is 0000Z on the <b>10th</b> . Do not confuse with <b>1000Z!</b>	
<b>METAR</b>	KPIT 091955Z COR 22015G25KT 3/4SM R28L/2600FT TSRA OVC010CB 18/16 A2992 RMK SLP045 T01820159

Forecast	Explanation	Report
<b>TAF</b>	Message type: <u>TAF</u> -routine or <u>TAF AMD</u> -amended forecast, <u>METAR</u> -hourly, <u>SPECI</u> -special or <u>TESTM</u> -non-commissioned ASOS report	<b>METAR</b>
<b>KPIT</b>	ICAO location indicator	<b>KPIT</b>
<b>091730Z</b>	Issuance time: ALL times in UTC “Z”, 2-digit date, 4-digit time	<b>091955Z</b>
<b>0918/1024</b>	Valid period, either 24 hours or 30 hours. The first two digits of EACH four digit number indicate the date of the valid period, the final two digits indicate the time (valid from 18Z on the 9 <sup>th</sup> to 24Z on the 10 <sup>th</sup> ). In U.S. METAR: <u>COR</u> rected ob; or <u>AUTOM</u> ated ob for automated report with no human intervention; omitted when observer logs on.	<b>COR</b>
<b>15005KT</b>	Wind: 3 digit true-north direction, nearest 10 degrees (or <u>VaRiA</u> ble); next 2-3 digits for speed and unit, <u>KT</u> (KMH or MPS); as needed, <u>G</u> ust and maximum speed; 00000KT for calm; for METAR, if direction varies 60 degrees or more, <u>V</u> ariability appended, e.g., 180 <u>V</u> 260	<b>22015G25KT</b>
<b>5SM</b>	Prevailing visibility; in U.S., Statute <u>M</u> iles & fractions; above 6 miles in TAF Plus <u>6SM</u> . (Or, 4-digit minimum visibility in meters and as required, lowest value with direction)	<b>3/4SM</b>
	Runway Visual Range: <u>R</u> ; 2-digit runway designator <u>L</u> eft, <u>C</u> enter, or <u>R</u> ight as needed; “ <u>L</u> ”, Minus or Plus in U.S., 4-digit value, <u>F</u> ee <u>T</u> in U.S., (usually meters elsewhere); 4-digit value <u>V</u> ariability 4-digit value (and tendency <u>D</u> own, <u>U</u> p or <u>N</u> o change)	<b>R28L/2600FT</b>
<b>HZ</b>	Significant present, forecast and recent weather: see table (on back)	<b>TSRA</b>
<b>FEW020</b>	Cloud amount, height and type: <u>S</u> ky <u>C</u> lear 0/8, <u>F</u> EW >0/8-2/8, <u>S</u> ca <u>T</u> tered 3/8-4/8, <u>B</u> ro <u>K</u> e <u>N</u> 5/8-7/8, <u>O</u> ver <u>C</u> ast 8/8; 3-digit height in hundreds of ft; <u>T</u> owering <u>C</u> umulus or <u>C</u> umulonim <u>B</u> us in <b>METAR</b> ; in <b>TAF</b> , only <u>C</u> B. <u>V</u> ertical <u>V</u> isibility for obscured sky and height “VV004”. More than 1 layer may be reported or forecast. In automated <b>METAR</b> reports only, <u>C</u> lea <u>R</u> for “clear below 12,000 feet”	<b>OVC 010CB</b>
	Temperature: degrees Celsius; first 2 digits, temperature “ <u>L</u> ” last 2 digits, dew-point temperature; <u>M</u> inus for below zero, e.g., M06	<b>18/16</b>
	Altimeter setting: indicator and 4 digits; in U.S., <u>A</u> -inches and hundredths; ( <u>Q</u> -hectoPascals, e.g., Q1013)	<b>A2992</b>
<b>WS010/31022KT</b>	In U.S. <b>TAF</b> , non-convective low-level (<u>2,000 ft) <u>W</u> ind <u>S</u> hear; 3-digit height (hundreds of ft); “ <u>L</u> ”; 3-digit wind direction and 2-3 digit wind speed above the indicated height, and unit, <u>KT</u>	

FIG 7-1-22

**Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR) (Back)**



**Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR) (Back)**



	In <b>METAR</b> , <u>ReMarK</u> indicator & remarks. For example: <u>Sea- Level Pressure</u> in hectoPascals & tenths, as shown: 1004.5 hPa; <u>Temp/dew-point</u> in tenths °C, as shown: temp. 18.2°C, dew-point 15.9°C	<b>RMK SLP045 T01820159</b>
<b>FM091930</b>	<u>From</u> : changes are expected at: 2-digit date, 2-digit hour, and 2-digit minute beginning time: indicates significant change. Each FM starts on a new line, indented 5 spaces	
<b>TEMPO 0920/0922</b>	<u>TEMPO</u> rary: changes expected for <1 hour and in total, < half of the period between the 2-digit date and 2-digit hour beginning, and 2-digit date and 2-digit hour ending time	
<b>PROB30 1004/1007</b>	<u>PROB</u> ability and 2-digit percent (30 or 40): probable condition in the period between the 2-digit date & 2-digit hour beginning time, and the 2-digit date and 2-digit hour ending time	
<b>BECMG 1013/1015</b>	<u>BECO</u> minG: change expected in the period between the 2-digit date and 2-digit hour beginning time, and the 2-digit date and 2-digit hour ending time	

<b>Table of Significant Present, Forecast and Recent Weather - Grouped in categories and used in the order listed below; or as needed in TAF, <u>No Significant Weather</u>.</b>			
<b>Qualifiers</b>			
<b>Intensity or Proximity</b>			
“-” = Light		No sign = Moderate	“+” = Heavy
“VC” = Vicinity, but not at aerodrome. In the US METAR, 5 to 10 SM from the point of observation. In the US TAF, 5 to 10 SM from the center of the runway complex. Elsewhere, within 8000m.			
<b>Descriptor</b>			
<b>BC</b> – Patches	<b>BL</b> – Blowing	<b>DR</b> – Drifting	<b>FZ</b> – Freezing
<b>MI</b> – Shallow	<b>PR</b> – Partial	<b>SH</b> – Showers	<b>TS</b> – Thunderstorm
<b>Weather Phenomena</b>			
<b>Precipitation</b>			
<b>DZ</b> – Drizzle	<b>GR</b> – Hail	<b>GS</b> – Small Hail/Snow Pellets	
<b>IC</b> – Ice Crystals	<b>PL</b> – Ice Pellets	<b>RA</b> – Rain	<b>SG</b> – Snow Grains
<b>SN</b> – Snow	<b>UP</b> – Unknown Precipitation in automated observations		
<b>Obscuration</b>			
<b>BR</b> – Mist (≥5/8SM)	<b>DU</b> – Widespread Dust	<b>FG</b> – Fog (<5/8SM)	<b>FU</b> – Smoke
<b>HZ</b> – Haze	<b>PY</b> – Spray	<b>SA</b> – Sand	<b>VA</b> – Volcanic Ash
<b>Other</b>			
<b>DS</b> – Dust Storm	<b>FC</b> – Funnel Cloud	<b>+FC</b> – Tornado or Waterspout	
<b>PO</b> – Well developed dust or sand whirls		<b>SQ</b> – Squall	<b>SS</b> – Sandstorm
<ul style="list-style-type: none"> <li>- Explanations in parentheses “( )” indicate different worldwide practices.</li> <li>- Ceiling is not specified; defined as the lowest broken or overcast layer, or the vertical visibility.</li> <li>- NWS TAFs exclude BECMG groups and temperature forecasts, NWS TAFS do not use PROB in the first 9 hours of a TAF; NWS METARs exclude trend forecasts. US Military TAFs include Turbulence and Icing groups.</li> </ul>			

## 7-1-31. International Civil Aviation Organization (ICAO) Weather Formats

The U.S. uses the ICAO world standard for aviation weather reporting and forecasting. The World Meteorological Organization's (WMO) publication No. 782 "Aerodrome Reports and Forecasts" contains the base METAR and TAF code as adopted by the WMO member countries.

a. Although the METAR code is adopted worldwide, each country is allowed to make modifications or exceptions to the code for use in their particular country, e.g., the U.S. will continue to use statute miles for visibility, feet for RVR values, knots for wind speed, and inches of mercury for altimetry. However, temperature and dew point will be reported in degrees Celsius. The U.S. reports prevailing visibility rather than lowest sector visibility. The elements in the body of a METAR report are separated with a space. The only exceptions are RVR, temperature, and dew point which are separated with a solidus (/). When an element does not occur, or cannot be observed, the preceding space and that element are omitted from that particular report. A METAR report contains the following sequence of elements in the following order:

1. Type of report.
2. ICAO Station Identifier.
3. Date and time of report.
4. Modifier (as required).
5. Wind.
6. Visibility.
7. Runway Visual Range (RVR).
8. Weather phenomena.
9. Sky conditions.
10. Temperature/dew point group.
11. Altimeter.
12. Remarks (RMK).

b. The following paragraphs describe the elements in a METAR report.

1. **Type of report.** There are two types of report:

(a) Aviation Routine Weather Report (METAR); and

(b) Nonroutine (Special) Aviation Weather Report (SPECI).

The type of report (METAR or SPECI) will always appear as the lead element of the report.

2. **ICAO Station Identifier.** The METAR code uses ICAO 4-letter station identifiers. In the contiguous 48 States, the 3-letter domestic station identifier is prefixed with a "K;" i.e., the domestic identifier for Seattle is SEA while the ICAO identifier is KSEA. Elsewhere, the first two letters of the ICAO identifier indicate what region of the world and country (or state) the station is in. For Alaska, all station identifiers start with "PA;" for Hawaii, all station identifiers start with "PH." Canadian station identifiers start with "CU," "CW," "CY," and "CZ." Mexican station identifiers start with "MM." The identifier for the western Caribbean is "M" followed by the individual country's letter; i.e., Cuba is "MU;" Dominican Republic "MD;" the Bahamas "MY." The identifier for the eastern Caribbean is "T" followed by the individual country's letter; i.e., Puerto Rico is "TJ." For a complete worldwide listing see ICAO Document 7910, Location Indicators.

3. **Date and Time of Report.** The date and time the observation is taken are transmitted as a six-digit date/time group appended with Z to denote Coordinated Universal Time (UTC). The first two digits are the date followed with two digits for hour and two digits for minutes.

### EXAMPLE-

172345Z (the 17<sup>th</sup> day of the month at 2345Z)

4. **Modifier (As Required).** "AUTO" identifies a METAR/SPECI report as an automated weather report with no human intervention. If "AUTO" is shown in the body of the report, the type of sensor equipment used at the station will be encoded in the remarks section of the report. The absence of "AUTO" indicates that a report was made manually by an observer or that an automated report had human augmentation/backup. The modifier "COR" indicates a corrected report that is sent out to replace an earlier report with an error.

### NOTE-

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. (A precipitation discriminator can determine the difference between liquid and frozen/freezing precipitation). This information appears in the remarks section of an automated report.

**5. Wind.** The wind is reported as a five digit group (six digits if speed is over 99 knots). The first three digits are the direction the wind is blowing from, in tens of degrees referenced to true north, or “VRB” if the direction is variable. The next two digits is the wind speed in knots, or if over 99 knots, the next three digits. If the wind is gusty, it is reported as a “G” after the speed followed by the highest gust reported. The abbreviation “KT” is appended to denote the use of knots for wind speed.

**EXAMPLE–**

*13008KT – wind from 130 degrees at 8 knots*

*08032G45KT – wind from 080 degrees at 32 knots with gusts to 45 knots*

*VRB04KT – wind variable in direction at 4 knots*

*00000KT – wind calm*

*210103G130KT – wind from 210 degrees at 103 knots with gusts to 130 knots*

*If the wind direction is variable by 60 degrees or more and the speed is greater than 6 knots, a variable group consisting of the extremes of the wind direction separated by a “v” will follow the prevailing wind group.*

*32012G22KT 280V350*

**(a) Peak Wind.** Whenever the peak wind exceeds 25 knots “PK WND” will be included in Remarks, e.g., PK WND 28045/1955 “Peak wind two eight zero at four five occurred at one niner five five.” If the hour can be inferred from the report time, only the minutes will be appended, e.g., PK WND 34050/38 “Peak wind three four zero at five zero occurred at three eight past the hour.”

**(b) Wind shift.** Whenever a wind shift occurs, “WSHFT” will be included in remarks followed by the time the wind shift began, e.g., WSHFT 30 FROPA “Wind shift at three zero due to frontal passage.”

**6. Visibility.** Prevailing visibility is reported in statute miles with “SM” appended to it.

**EXAMPLE–**

*7SM – seven statute miles*

*15SM – fifteen statute miles*

*1/2SM – one-half statute mile*

**(a) Tower/surface visibility.** If either visibility (tower or surface) is below four statute miles,

the lesser of the two will be reported in the body of the report; the greater will be reported in remarks.

**(b) Automated visibility.** ASOS/AWOS visibility stations will show visibility 10 or greater than 10 miles as “10SM.” AWOS visibility stations will show visibility less than 1/4 statute mile as “M<sup>1/4</sup>SM” and visibility 10 or greater than 10 miles as “10SM.”

**NOTE–**

*Automated sites that are augmented by human observer to meet service level requirements can report 0, 1/16 SM, and 1/8 SM visibility increments.*

**(c) Variable visibility.** Variable visibility is shown in remarks (when rapid increase or decrease by 1/2 statute mile or more and the average prevailing visibility is less than three miles) e.g., VIS 1V2 “visibility variable between one and two.”

**(d) Sector visibility.** Sector visibility is shown in remarks when it differs from the prevailing visibility, and either the prevailing or sector visibility is less than three miles.

**EXAMPLE–**

*VIS N2 – visibility north two*

**7. Runway Visual Range (When Reported).** “R” identifies the group followed by the runway heading (and parallel runway designator, if needed) “/” and the visual range in feet (meters in other countries) followed with “FT” (feet is not spoken).

**(a) Variability Values.** When RVR varies (by more than on reportable value), the lowest and highest values are shown with “V” between them.

**(b) Maximum/Minimum Range.** “P” indicates an observed RVR is above the maximum value for this system (spoken as “more than”). “M” indicates an observed RVR is below the minimum value which can be determined by the system (spoken as “less than”).

**EXAMPLE–**

*R32L/1200FT – runway three two left R–V–R one thousand two hundred.*

*R27R/M1000V4000FT – runway two seven right R–V–R variable from less than one thousand to four thousand.*

**8. Weather Phenomena.** The weather as reported in the METAR code represents a significant change in the way weather is currently reported. In METAR, weather is reported in the format:

Intensity/Proximity/Descriptor/Precipitation/Obstruction to visibility/Other

**NOTE-**

The “/” above and in the following descriptions (except as the separator between the temperature and dew point) are for separation purposes in this publication and do not appear in the actual METARs.

(a) **Intensity** applies only to the first type of precipitation reported. A “-” denotes light, no symbol denotes moderate, and a “+” denotes heavy.

(b) **Proximity** applies to and reported only for weather occurring in the vicinity of the airport (between 5 and 10 miles of the point(s) of observation). It is denoted by the letters “VC.” (Intensity and “VC” will not appear together in the weather group).

(c) **Descriptor.** These eight descriptors apply to the precipitation or obstructions to visibility:

**TS** ..... thunderstorm  
**DR** ..... low drifting  
**SH** ..... showers  
**MI** ..... shallow  
**FZ** ..... freezing  
**BC** ..... patches  
**BL** ..... blowing  
**PR** ..... partial

**NOTE-**

Although “TS” and “SH” are used with precipitation and may be preceded with an intensity symbol, the intensity still applies to the precipitation, **not** the descriptor.

(d) **Precipitation.** There are nine types of precipitation in the METAR code:

**RA** ..... rain  
**DZ** ..... drizzle  
**SN** ..... snow  
**GR** ..... hail (1/4” or greater)  
**GS** ..... small hail/snow pellets  
**PL** ..... ice pellets  
**SG** ..... snow grains  
**IC** ..... ice crystals (diamond dust)  
**UP** ..... unknown precipitation  
 (automated stations only)

(e) **Obstructions to visibility.** There are eight types of obscuration phenomena in the METAR code (obscurations are any phenomena in the atmosphere, other than precipitation, that reduce horizontal visibility):

**FG** ..... fog (vsby less than 5/8 mile)  
**HZ** ..... haze  
**FU** ..... smoke  
**PY** ..... spray  
**BR** ..... mist (vsby 5/8 – 6 miles)  
**SA** ..... sand  
**DU** ..... dust  
**VA** ..... volcanic ash

**NOTE-**

Fog (FG) is observed or forecast only when the visibility is less than five-eighths of mile, otherwise mist (BR) is observed or forecast.

(f) **Other.** There are five categories of other weather phenomena which are reported when they occur:

**SQ** ..... squall  
**SS** ..... sandstorm  
**DS** ..... duststorm  
**PO** ..... dust/sand whirls  
**FC** ..... funnel cloud  
**+FC** ..... tornado/waterspout

**Examples:**

**TSRA** ..... thunderstorm with moderate rain  
**+SN** ..... heavy snow  
**-RA FG** ..... light rain and fog  
**BRHZ** ..... mist and haze  
 (visibility 5/8 mile or greater)  
**FZDZ** ..... freezing drizzle  
**VCSH** ..... rain shower in the vicinity  
**+SHRASNPL** .. heavy rain showers, snow, ice pellets (intensity indicator refers to the predominant rain)

**9. Sky Condition.** The sky condition as reported in METAR represents a significant change from the way sky condition is currently reported. In METAR, sky condition is reported in the format:

Amount/Height/(Type) or Indefinite Ceiling/Height

(a) **Amount.** The amount of sky cover is reported in eighths of sky cover, using the contractions:

- SKC . . . . . clear (no clouds)
- FEW . . . . . >0 to 2/8
- SCT . . . . . scattered (3/8s to 4/8s of clouds)
- BKN . . . . . broken (5/8s to 7/8s of clouds)
- OVC . . . . . overcast (8/8s clouds)
- CB . . . . . Cumulonimbus when present
- TCU . . . . . Towering cumulus when present

**NOTE-**

1. "SKC" will be reported at manual stations. "CLR" will be used at automated stations when no clouds below 12,000 feet are reported.

2. A ceiling layer is not designated in the METAR code. For aviation purposes, the ceiling is the lowest broken or overcast layer, or vertical visibility into an obscuration. Also there is no provision for reporting thin layers in the METAR code. When clouds are thin, that layer must be reported as if it were opaque.

(b) **Height.** Cloud bases are reported with three digits in hundreds of feet above ground level (AGL). (Clouds above 12,000 feet cannot be reported by an automated station).

(c) **(Type).** If Towering Cumulus Clouds (TCU) or Cumulonimbus Clouds (CB) are present, they are reported after the height which represents their base.

**EXAMPLE-**

(Reported as) SCT025TCU BKN080 BKN250 (spoken as) "TWO THOUSAND FIVE HUNDRED SCATTERED TOWERING CUMULUS, CEILING EIGHT THOUSAND BROKEN, TWO FIVE THOUSAND BROKEN."  
 (Reported as) SCT008 OVC012CB (spoken as) "EIGHT HUNDRED SCATTERED CEILING ONE THOUSAND TWO HUNDRED OVERCAST CUMULONIMBUS CLOUDS."

(d) **Vertical Visibility (indefinite ceiling height).** The height into an indefinite ceiling is preceded by "VV" and followed by three digits indicating the vertical visibility in hundreds of feet. This layer indicates total obscuration.

**EXAMPLE-**

1/8 SM FG VV006 – visibility one eighth, fog, indefinite ceiling six hundred.

(e) **Obscurations** are reported when the sky is partially obscured by a ground-based phenomena by indicating the amount of obscuration as FEW, SCT, BKN followed by three zeros (000). In remarks, the obscuring phenomenon precedes the amount of obscuration and three zeros.

**EXAMPLE-**

BKN000 (in body) . . . . . "sky partially obscured"  
 FU BKN000 (in remarks) . . . "smoke obscuring five-to seven-eighths of the sky"

(f) When sky conditions include a layer aloft, other than clouds, such as smoke or haze the type of phenomena, sky cover and height are shown in remarks.

**EXAMPLE-**

BKN020 (in body) . . . . . "ceiling two thousand broken"  
 RMK FU BKN020 . . . . . "broken layer of smoke aloft, based at two thousand"

(g) **Variable ceiling.** When a ceiling is below three thousand and is variable, the remark "CIG" will be shown followed with the lowest and highest ceiling heights separated by a "V."

**EXAMPLE-**

CIG 005V010 . . . . . "ceiling variable between five hundred and one thousand"

(h) **Second site sensor.** When an automated station uses meteorological discontinuity sensors, remarks will be shown to identify site specific sky conditions which differ and are lower than conditions reported in the body.

**EXAMPLE-**

CIG 020 RY11 . . . . . "ceiling two thousand at runway one one"

(i) **Variable cloud layer.** When a layer is varying in sky cover, remarks will show the variability range. If there is more than one cloud layer, the variable layer will be identified by including the layer height.

**EXAMPLE-**

SCT V BKN . . . . . "scattered layer variable to broken"  
 BKN025 V OVC . . . . . "broken layer at two thousand five hundred variable to overcast"

**(j) Significant clouds.** When significant clouds are observed, they are shown in remarks, along with the specified information as shown below:

**(1) Cumulonimbus (CB), or Cumulonimbus Mammatus (CBMAM), distance (if known), direction from the station, and direction of movement, if known.** If the clouds are beyond 10 miles from the airport, DSNT will indicate distance.

**EXAMPLE-**

*CB W MOVE . . . . . “cumulonimbus west moving east”*  
*CBMAM DSNT S . . . . . “cumulonimbus mammatus distant south”*

**(2) Towering Cumulus (TCU), location, (if known), or direction from the station.**

**EXAMPLE-**

*TCU OHD . . . . . “towering cumulus overhead”*  
*TCU W . . . . . “towering cumulus west”*

**(3) Altocumulus Castellanus (ACC), Stratocumulus Standing Lenticular (SCSL), Altocumulus Standing Lenticular (ACSL), Cirrocumulus Standing Lenticular (CCSL) or rotor clouds, describing the clouds (if needed) and the direction from the station.**

**EXAMPLE-**

*ACC W . . . . . “altocumulus castellanus west”*  
*ACSL SW-S . . . . . “standing lenticular altocumulus southwest through south”*  
*APRNT ROTOR CLD S “apparent rotor cloud south”*  
*CCSL OVR MTE . . . . . “standing lenticular cirrocumulus over the mountains east”*

**10. Temperature/Dew Point.** Temperature and dew point are reported in two, two-digit groups in degrees Celsius, separated by a solidus (“/”). Temperatures below zero are prefixed with an “M.” If the temperature is available but the dew point is missing, the temperature is shown followed by a solidus. If the temperature is missing, the group is omitted from the report.

**EXAMPLE-**

*15/08 . . . . . “temperature one five, dew point 8”*  
*00/M02 . . . . . “temperature zero, dew point minus 2”*

*M05/ . . . . . “temperature minus five, dew point missing”*

**11. Altimeter.** Altimeter settings are reported in a four-digit format in inches of mercury prefixed with an “A” to denote the units of pressure.

**EXAMPLE-**

*A2995 – “Altimeter two niner niner five”*

**12. Remarks.** Remarks will be included in all observations, when appropriate. The contraction “RMK” denotes the start of the remarks section of a METAR report.

Except for precipitation, phenomena located within 5 statute miles of the point of observation will be reported as at the station. Phenomena between 5 and 10 statute miles will be reported in the vicinity, “VC.” Precipitation not occurring at the point of observation but within 10 statute miles is also reported as in the vicinity, “VC.” Phenomena beyond 10 statute miles will be shown as distant, “DSNT.” Distances are in statute miles except for automated lightning remarks which are in nautical miles. Movement of clouds or weather will be indicated by the direction toward which the phenomena is moving.

**(a)** There are two categories of remarks:

**(1)** Automated, manual, and plain language.

**(2)** Additive and automated maintenance data.

**(b) Automated, Manual, and Plain Language.** This group of remarks may be generated from either manual or automated weather reporting stations and generally elaborate on parameters reported in the body of the report. (Plain language remarks are only provided by manual stations).

**(1)** Volcanic eruptions.

**(2)** Tornado, Funnel Cloud, Waterspout.

**(3)** Station Type (AO1 or AO2).

**(4)** PK WND.

**(5)** WSHFT (FROPA).

**(6)** TWR VIS or SFC VIS.

**(7)** VRB VIS.

**(8)** Sector VIS.

**(9)** VIS @ 2<sup>nd</sup> Site.

(10) Lightning. When lightning is observed at a manual location, the frequency and location is reported.

When cloud-to-ground lightning is detected by an automated lightning detection system, such as ALDARS:

[a] Within 5 nautical miles (NM) of the Airport Reference Point (ARP), it will be reported as “TS” in the body of the report with no remark;

[b] Between 5 and 10 NM of the ARP, it will be reported as “VCTS” in the body of the report with no remark;

[c] Beyond 10 but less than 30 NM of the ARP, it will be reported in remarks as “DSNT” followed by the direction from the ARP.

**EXAMPLE-**  
*LTG DSNT W or LTG DSNT ALQDS*

- (11) Beginning/Ending of Precipitation/ TSTMS.
- (12) TSTM Location MVMT.
- (13) Hailstone Size (GR).
- (14) Virga.
- (15) VRB CIG (height).
- (16) Obscuration.
- (17) VRB Sky Condition.
- (18) Significant Cloud Types.
- (19) Ceiling Height 2nd Location.
- (20) PRESFR PRESRR.
- (21) Sea-Level Pressure.
- (22) ACFT Mishap (not transmitted).
- (23) NOSPECI.
- (24) SNINCR.
- (25) Other SIG Info.

**(c) Additive and Automated Maintenance Data.**

- (1) Hourly Precipitation.
- (2) 3- and 6-Hour Precipitation Amount.
- (3) 24-Hour Precipitation.
- (4) Snow Depth on Ground.

- (5) Water Equivalent of Snow.
- (6) Cloud Type.
- (7) Duration of Sunshine.
- (8) Hourly Temperature/Dew Point (Tenths).
- (9) 6-Hour Maximum Temperature.
- (10) 6-Hour Minimum Temperature.
- (11) 24-Hour Maximum/Minimum Temperature.
- (12) Pressure Tendency.
- (13) Sensor Status.  
 PWINO  
 FZRANO  
 TSNO  
 RVRNO  
 PNO  
 VISNO

**Examples of METAR reports and explanation:**

METAR KBNA 281250Z 33018KT 290V360 1/2SM R31/2700FT SN BLSN FG VV008 00/M03 A2991 RMK RAE42SNB42

**METAR** . . . . . aviation routine weather report  
**KBNA** . . . . . Nashville, TN  
**281250Z** . . . . . date 28<sup>th</sup>, time 1250 UTC  
**(no modifier)** . . This is a manually generated report, due to the absence of “AUTO” and “AO1 or AO2” in remarks  
**33018KT** . . . . . wind three three zero at one eight  
**290V360** . . . . . wind variable between two nine zero and three six zero  
**1/2SM** . . . . . visibility one half  
**R31/2700FT** . . . Runway three one RVR two thousand seven hundred  
**SN** . . . . . moderate snow  
**BLSN FG** . . . . . visibility obscured by blowing snow and fog  
**VV008** . . . . . indefinite ceiling eight hundred  
**00/M03** . . . . . temperature zero, dew point minus three  
**A2991** . . . . . altimeter two niner niner one  
**RMK** . . . . . remarks



**RAE42** . . . . . rain ended at four two  
**SNB42** . . . . . snow began at four two

**TS W MOV E** thunderstorm west moving  
 east

METAR KSFO 041453Z AUTO VRB02KT 3SM  
 BR CLR 15/12 A3012 RMK AO2

**METAR** . . . . . aviation routine weather  
 report  
**KSFO** . . . . . San Francisco, CA  
**041453Z** . . . . . date 4<sup>th</sup>, time 1453 UTC  
**AUTO** . . . . . fully automated; no human  
 intervention  
**VRB02KT** . . . . . wind variable at two  
**3SM** . . . . . visibility three  
**BR** . . . . . visibility obscured by mist  
**CLR** . . . . . no clouds below one two  
 thousand  
**15/12** . . . . . temperature one five, dew  
 point one two  
**A3012** . . . . . altimeter three zero one two  
**RMK** . . . . . remarks  
**AO2** . . . . . this automated station has a  
 weather discriminator (for  
 precipitation)

SPECI KCVG 152224Z 28024G36KT 3/4SM  
 +TSRA BKN008 OVC020CB 28/23 A3000 RMK  
 TSRAB24 TS W MOV E

**SPECI** . . . . . (nonroutine) aviation special  
 weather report  
**KCVG** . . . . . Cincinnati, OH  
**152228Z** . . . . . date 15<sup>th</sup>, time 2228 UTC  
**(no modifier)** . . This is a manually generated  
 report due to the absence of  
 "AUTO" and "AO1 or AO2"  
 in remarks  
**28024G36KT** . . wind two eight zero at  
 two four gusts three six  
**3/4SM** . . . . . visibility three fourths  
**+TSRA** . . . . . thunderstorms, heavy rain  
**BKN008** . . . . . ceiling eight hundred broken  
**OVC020CB** . . . two thousand overcast  
 cumulonimbus clouds  
**28/23** . . . . . temperature two eight,  
 dew point two three  
**A3000** . . . . . altimeter three zero zero zero  
**RMK** . . . . . remarks  
**TSRAB24** . . . . . thunderstorm and rain began  
 at two four

**c. Aerodrome Forecast (TAF).** A concise state-  
 ment of the expected meteorological conditions at an  
 airport during a specified period. At most locations,  
 TAFs have a 24 hour forecast period. However, TAFs  
 for some locations have a 30 hour forecast period.  
 These forecast periods may be shorter in the case of  
 an amended TAF. TAFs use the same codes as  
 METAR weather reports. They are scheduled four  
 times daily for 24-hour periods beginning at 0000Z,  
 0600Z, 1200Z, and 1800Z.

Forecast times in the TAF are depicted in two ways.  
 The first is a 6-digit number to indicate a specific  
 point in time, consisting of a two-digit date,  
 two-digit hour, and two-digit minute (such as  
 issuance time or FM). The second is a pair of  
 four-digit numbers separated by a "/" to indicate a  
 beginning and end for a period of time. In this case,  
 each four-digit pair consists of a two-digit date and  
 a two-digit hour.

TAFs are issued in the following format:

TYPE OF REPORT/ICAO STATION IDENTIFIER/  
 DATE AND TIME OF ORIGIN/VALID PERIOD  
 DATE AND TIME/FORECAST METEOROLOGICAL  
 CONDITIONS

**NOTE-**

*The "/" above and in the following descriptions are for  
 separation purposes in this publication and do not appear  
 in the actual TAFs.*

TAF KORD 051130Z 0512/0618 14008KT 5SM BR  
 BKN030  
 TEMPO 0513/0516 1 1/2SM BR  
 FM051600 16010KT P6SM SKC  
 FM052300 20013G20KT 4SM SHRA OVC020  
 PROB40 0600/0606 2SM TSRA OVC008CB  
 BECMG 0606/0608 21015KT P6SM NSW  
 SCT040

TAF format observed in the above example:

TAF = type of report

KORD = ICAO station identifier

051130Z = date and time of origin (issuance time)

0512/0618 = valid period date and times

14008KT 5SM BR BKN030 = forecast meteorologi-  
 cal conditions

Explanation of TAF elements:

**1. Type of Report.** There are two types of TAF issuances, a routine forecast issuance (TAF) and an amended forecast (TAF AMD). An amended TAF is issued when the current TAF no longer adequately describes the on-going weather or the forecaster feels the TAF is not representative of the current or expected weather. Corrected (COR) or delayed (RTD) TAFs are identified only in the communications header which precedes the actual forecasts.

**2. ICAO Station Identifier.** The TAF code uses ICAO 4-letter location identifiers as described in the METAR section.

**3. Date and Time of Origin.** This element is the date and time the forecast is actually prepared. The format is a two-digit date and four-digit time followed, without a space, by the letter “Z.”

**4. Valid Period Date and Time.** The UTC valid period of the forecast consists of two four-digit sets, separated by a “/”. The first four-digit set is a two-digit date followed by the two-digit beginning hour, and the second four-digit set is a two-digit date followed by the two-digit ending hour. Although most airports have a 24-hour TAF, a select number of airports have a 30-hour TAF. In the case of an amended forecast, or a forecast which is corrected or delayed, the valid period may be for less than 24 hours. Where an airport or terminal operates on a part-time basis (less than 24 hours/day), the TAFs issued for those locations will have the abbreviated statement “AMD NOT SKED” added to the end of the forecasts. The time observations are scheduled to end and/or resume will be indicated by expanding the AMD NOT SKED statement. Expanded statements will include:

(a) Observation ending time (AFT DDHHmm; for example, AFT 120200)

(b) Scheduled observations resumption time (TIL DDHHmm; for example, TIL 171200Z) or

(c) Period of observation unavailability (DDHH/DDHH); for example, 2502/2512).

**5. Forecast Meteorological Conditions.** This is the body of the TAF. The basic format is:

WIND/VISIBILITY/WEATHER/SKY CONDITION/OPTIONAL DATA (WIND SHEAR)

The wind, visibility, and sky condition elements are always included in the initial time group of the forecast. Weather is included only if significant to

aviation. If a significant, lasting change in any of the elements is expected during the valid period, a new time period with the changes is included. It should be noted that with the exception of a “FM” group the new time period will include only those elements which are expected to change, i.e., if a lowering of the visibility is expected but the wind is expected to remain the same, the new time period reflecting the lower visibility would not include a forecast wind. The forecast wind would remain the same as in the previous time period. Any temporary conditions expected during a specific time period are included with that time period. The following describes the elements in the above format.

(a) **Wind.** This five (or six) digit group includes the expected wind direction (first 3 digits) and speed (last 2 digits or 3 digits if 100 knots or greater). The contraction “KT” follows to denote the units of wind speed. Wind gusts are noted by the letter “G” appended to the wind speed followed by the highest expected gust. A variable wind direction is noted by “VRB” where the three digit direction usually appears. A calm wind (3 knots or less) is forecast as “0000KT.”

**EXAMPLE–**

18010KT . . . . . wind one eight zero at one zero (wind is blowing from 180).

35012G20KT . . . . . wind three five zero at one two gust two zero.

(b) **Visibility.** The expected prevailing visibility up to and including 6 miles is forecast in statute miles, including fractions of miles, followed by “SM” to note the units of measure. Expected visibilities greater than 6 miles are forecast as P6SM (plus six statute miles).

**EXAMPLE–**

$\frac{1}{2}$ SM – visibility one-half

4SM – visibility four

P6SM – visibility more than six

(c) **Weather Phenomena.** The expected weather phenomena is coded in TAF reports using the same format, qualifiers, and phenomena contractions as METAR reports (except UP). Obscurations to vision will be forecast whenever the prevailing visibility is forecast to be 6 statute miles or less. If no significant weather is expected to occur during a specific time period in the forecast, the weather phenomena group is omitted for that time period. If, after a time period in which significant weather phenomena has been forecast, a change to a forecast

of no significant weather phenomena occurs, the contraction NSW (No Significant Weather) will appear as the weather group in the new time period. (NSW is included only in TEMPO groups).

**NOTE-**

*It is very important that pilots understand that NSW only refers to weather phenomena, i.e., rain, snow, drizzle, etc. Omitted conditions, such as sky conditions, visibility, winds, etc., are carried over from the previous time group.*

**(d) Sky Condition.** TAF sky condition forecasts use the METAR format described in the METAR section. Cumulonimbus clouds (CB) are the only cloud type forecast in TAFs. When clear skies are forecast, the contraction “SKC” will always be used. The contraction “CLR” is never used in the TAF. When the sky is obscured due to a surface-based phenomenon, vertical visibility (VV) into the obscuration is forecast. The format for vertical visibility is “VV” followed by a three-digit height in hundreds of feet.

**NOTE-**

*As in METAR, ceiling layers are not designated in the TAF code. For aviation purposes, the ceiling is the lowest broken or overcast layer or vertical visibility into a complete obscuration.*

- SKC ..... “sky clear”
- SCT005 BKN025CB . “five hundred scattered, ceiling two thousand five hundred broken cumulonimbus clouds”
- VV008 ..... “indefinite ceiling eight hundred”

**(e) Optional Data (Wind Shear).** Wind shear is the forecast of nonconvective low level winds (up to 2,000 feet). The forecast includes the letters “WS” followed by the height of the wind shear, the wind direction and wind speed at the indicated height and the ending letters “KT” (knots). Height is given in hundreds of feet (AGL) up to and including 2,000 feet. Wind shear is encoded with the contraction “WS,” followed by a three-digit height, slant character “/,” and winds at the height indicated in the same format as surface winds. The wind shear element is omitted if not expected to occur.

WS010/18040KT – “LOW LEVEL WIND SHEAR AT ONE THOUSAND, WIND ONE EIGHT ZERO AT FOUR ZERO”

**d. Probability Forecast.** The probability or chance of thunderstorms or other precipitation events

occurring, along with associated weather conditions (wind, visibility, and sky conditions). The PROB30 group is used when the occurrence of thunderstorms or precipitation is 30–39% and the PROB40 group is used when the occurrence of thunderstorms or precipitation is 40–49%. This is followed by two four-digit groups separated by a “/”, giving the beginning date and hour, and the ending date and hour of the time period during which the thunderstorms or precipitation are expected.

**NOTE-**

*NWS does not use PROB 40 in the TAF. However U.S. Military generated TAFS may include PROB40. PROB30 will not be shown during the first nine hours of a NWS forecast.*

**EXAMPLE-**

- PROB40 2221/2302 1/2SM +TSRA “chance between 2100Z and 0200Z of visibility one-half statute mile in thunderstorms and heavy rain.”
- PROB30 3010/3014 1SM RASN . “chance between 1000Z and 1400Z of visibility one statute mile in mixed rain and snow.”

**e. Forecast Change Indicators.** The following change indicators are used when either a rapid, gradual, or temporary change is expected in some or all of the forecast meteorological conditions. Each change indicator marks a time group within the TAF report.

**1. From (FM) group.** The FM group is used when a rapid change, usually occurring in less than one hour, in prevailing conditions is expected. Typically, a rapid change of prevailing conditions to more or less a completely new set of prevailing conditions is associated with a synoptic feature passing through the terminal area (cold or warm frontal passage). Appended to the “FM” indicator is the six-digit date, hour, and minute the change is expected to begin and continues until the next change group or until the end of the current forecast. A “FM” group will mark the beginning of a new line in a TAF report (indented 5 spaces). Each “FM” group contains all the required elements—wind, visibility, weather, and sky condition. Weather will be omitted in “FM” groups when it is not significant to aviation. FM groups will not include the contraction NSW.

**EXAMPLE–**

*FM210100 14010KT P6SM SKC – “after 0100Z on the 21st, wind one four zero at one zero, visibility more than six, sky clear.”*

**2. Becoming (BECMG) group.** The BECMG group is used when a gradual change in conditions is expected over a longer time period, usually two hours. The time period when the change is expected is two four–digit groups separated by a “/”, with the beginning date and hour, and ending date and hour of the change period which follows the BECMG indicator. The gradual change will occur at an unspecified time within this time period. Only the changing forecast meteorological conditions are included in BECMG groups. The omitted conditions are carried over from the previous time group.

**NOTE–**

*The NWS does not use BECMG in the TAF.*

**EXAMPLE–**

*OVC012 BECMG 0114/0116 BKN020 – “ceiling one thousand two hundred overcast. Then a gradual change to ceiling two thousand broken between 1400Z on the 1st and 1600Z on the 1st.”*

**3. Temporary (TEMPO) group.** The TEMPO group is used for any conditions in wind, visibility, weather, or sky condition which are expected to last for generally less than an hour at a time (occasional), and are expected to occur during less than half the time period. The TEMPO indicator is followed by two four–digit groups separated by a “/”. The first four digit group gives the beginning date and hour, and the second four digit group gives the ending date and hour of the time period during which the temporary conditions are expected. Only the changing forecast meteorological conditions are included in TEMPO groups. The omitted conditions are carried over from the previous time group.

**EXAMPLE–**

**1. SCT030 TEMPO 0519/0523 BKN030 – “three thousand scattered with occasional ceilings three thousand broken between 1900Z on the 5th and 2300Z on the 5th.”**

**2. 4SM HZ TEMPO 1900/1906 2SM BR HZ – “visibility four in haze with occasional visibility two in mist and haze between 0000Z on the 19th and 0600Z on the 19th.”**

# Chapter 9. Aeronautical Charts and Related Publications

## Section 1. Types of Charts Available

### 9-1-1. General

Civil aeronautical charts for the U.S. and its territories, and possessions are produced by Aeronautical Information Services (AIS), [http://www.faa.gov/air\\_traffic/flight\\_info/aeronav](http://www.faa.gov/air_traffic/flight_info/aeronav) which is part of FAA's Air Traffic Organization, Mission Support Services.

### 9-1-2. Obtaining Aeronautical Charts

Public sales of charts and publications are available through a network of FAA approved print providers. A listing of products, dates of latest editions and agents is available on the AIS website at: [http://www.faa.gov/air\\_traffic/flight\\_info/aeronav](http://www.faa.gov/air_traffic/flight_info/aeronav).

### 9-1-3. Selected Charts and Products Available

VFR Navigation Charts  
IFR Navigation Charts  
Planning Charts  
Supplementary Charts and Publications  
Digital Products

### 9-1-4. General Description of Each Chart Series

#### a. VFR Navigation Charts.

**1. Sectional Aeronautical Charts.** Sectional Charts are designed for visual navigation of slow to medium speed aircraft. The topographic information consists of contour lines, shaded relief, drainage patterns, and an extensive selection of visual checkpoints and landmarks used for flight under VFR. Cultural features include cities and towns, roads, railroads, and other distinct landmarks. The

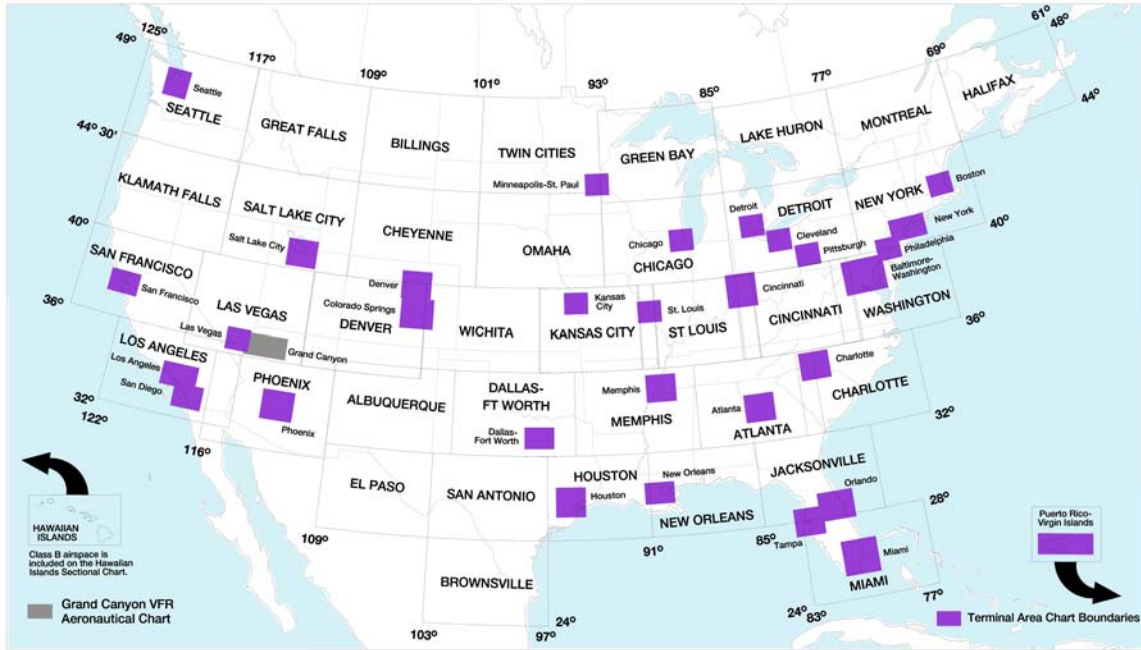
aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, special-use airspace, obstructions, and related data. Scale 1 inch = 6.86 nm/1:500,000. 60 x 20 inches folded to 5 x 10 inches. Revised biannually, except most Alaskan charts are revised annually. (See FIG 9-1-1 and FIG 9-1-2.)

**2. VFR Terminal Area Charts (TAC).** TACs depict the airspace designated as Class B airspace. While similar to sectional charts, TACs have more detail because the scale is larger. The TAC should be used by pilots intending to operate to or from airfields within or near Class B or Class C airspace. Areas with TAC coverage are indicated by a • on the Sectional Chart indexes. Scale 1 inch = 3.43 nm/1:250,000. Charts are revised biannually, except Puerto Rico-Virgin Islands which is revised annually. (See FIG 9-1-1 and FIG 9-1-2.)

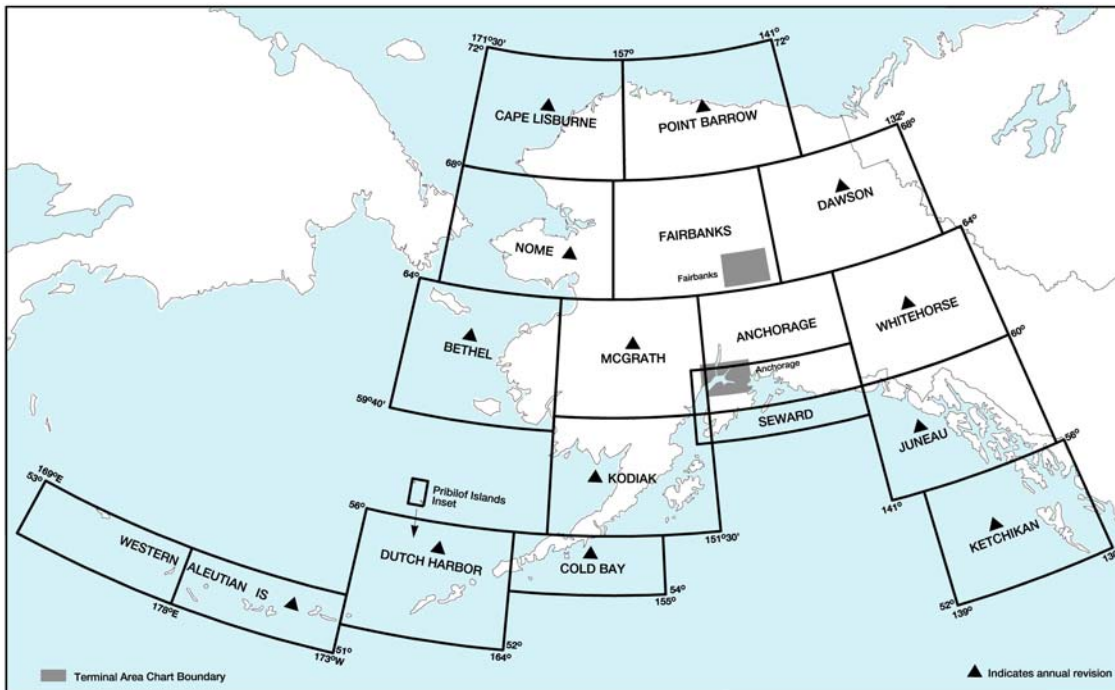
**3. U.S. Gulf Coast VFR Aeronautical Chart.** The Gulf Coast Chart is designed primarily for helicopter operation in the Gulf of Mexico area. Information depicted includes offshore mineral leasing areas and blocks, oil drilling platforms, and high density helicopter activity areas. Scale 1 inch = 13.7 nm/1:1,000,000. 55 x 27 inches folded to 5 x 10 inches. Revised annually.

**4. Grand Canyon VFR Aeronautical Chart.** Covers the Grand Canyon National Park area and is designed to promote aviation safety, flight free zones, and facilitate VFR navigation in this popular area. The chart contains aeronautical information for general aviation VFR pilots on one side and commercial VFR air tour operators on the other side. Revised biannually. ■

**FIG 9-1-1**  
**Sectional and VFR Terminal Area Charts for the Conterminous U.S., Hawaii, Puerto Rico, and Virgin Islands**



**FIG 9-1-2**  
**Sectional and VFR Terminal Area Charts for Alaska**

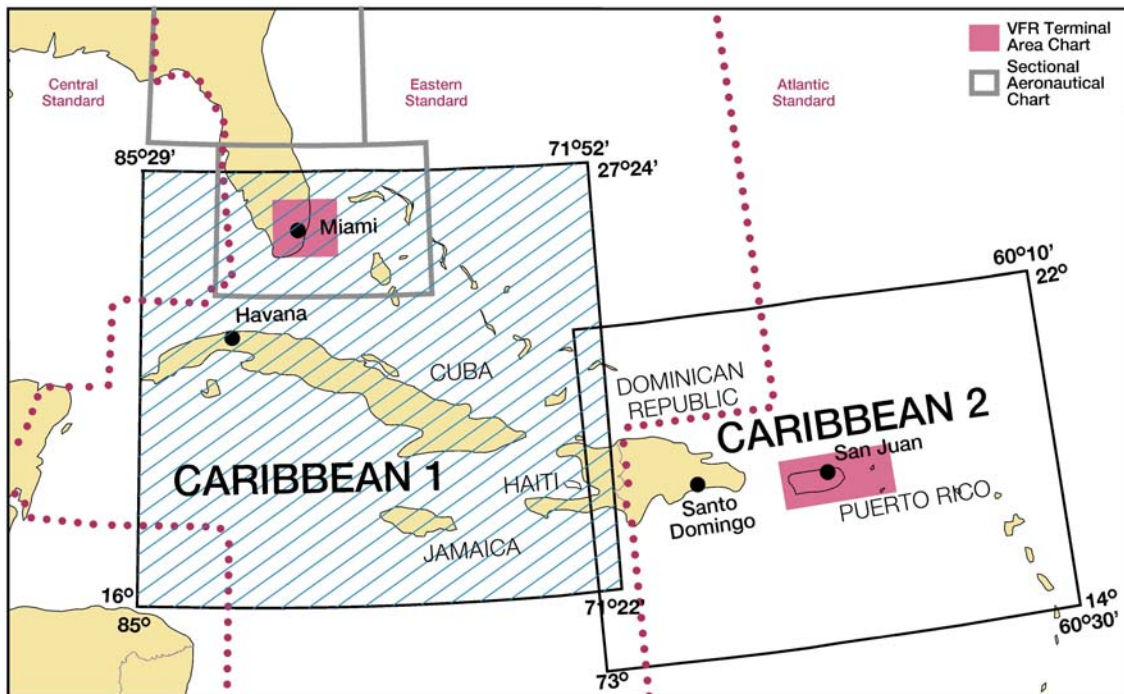


**5. Caribbean VFR Aeronautical Charts.**

Caribbean 1 and 2 (CAC-1 and CAC-2) are designed for visual navigation to assist familiarization of foreign aeronautical and topographic information. The aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, special-use airspace, obstructions, and related data. The topographic information consists of contour

lines, shaded relief, drainage patterns, and a selection of landmarks used for flight under VFR. Cultural features include cities and towns, roads, railroads, and other distinct landmarks. Scale 1 inch = 13.7 nm/1:1,000,000. CAC-1, revised annually, consists of two sides measuring 30" x 60" each. CAC-2, revised biennially, consists of two sides measuring 20" x 60" each. (See FIG 9-1-3.)

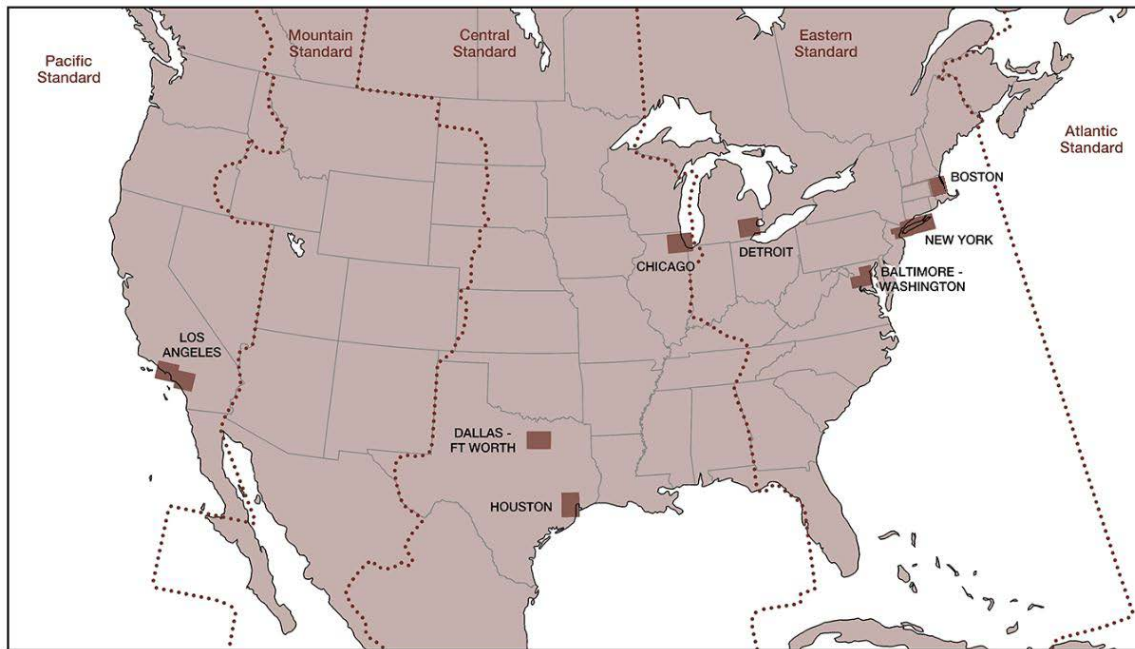
*FIG 9-1-3*  
**Caribbean VFR Aeronautical Charts**



**6. Helicopter Route Charts.** A three-color chart series which shows current aeronautical information useful to helicopter pilots navigating in areas with high concentrations of helicopter activity. Information depicted includes helicopter routes, four classes of heliports with associated frequency and lighting capabilities, NAVAIDs, and obstructions. In addition, pictorial symbols, roads, and easily

identified geographical features are portrayed. Helicopter charts have a longer life span than other chart products and may be current for several years. Helicopter Route Charts are updated as requested by the FAA. Scale 1 inch = 1.71 nm/1:125,000. 34 x 30 inches folded to 5 x 10 inches. Revised biannually. (See FIG 9-1-4.)

FIG 9-1-4  
Helicopter Route Charts



**b. IFR Navigation Charts.**

**1. IFR En Route Low Altitude Charts (Conterminous U.S. and Alaska).** En route low altitude charts provide aeronautical information for navigation under IFR conditions below 18,000 feet MSL. This four-color chart series includes airways; limits of controlled airspace; VHF NAVAIDs with frequency, identification, channel, geographic coordinates; airports with terminal air/ground

communications; minimum en route and obstruction clearance altitudes; airway distances; reporting points; special use airspace; and military training routes. Scales vary from 1 inch = 5nm to 1 inch = 20 nm. 50 x 20 inches folded to 5 x 10 inches. Charts revised every 56 days. *Area charts* show congested terminal areas at a large scale. They are included with subscriptions to any conterminous U.S. Set Low (Full set, East or West sets). (See FIG 9-1-5 and FIG 9-1-6.)



transmissions, including those from helicopters. The following practices are recommended.

## 2. Recommended Practices

**(a) Personnel Conducting Perforating Operations.** Whenever perforating operations are scheduled and operators are concerned that radio transmissions from helicopters in the vicinity may jeopardize the operation, personnel conducting perforating operations should take the following precautionary measures:

(1) Notify company aviation departments, helicopter operators or bases, and nearby manned platforms of the pending perforation operation so the Notice to Airmen (NOTAM) system can be activated for the perforation operation and the temporary helideck closure.

(2) Close the deck and make the radio warning clearly visible to passing pilots, install a temporary marking (described in subparagraph 10-2-1i1(b)) with the words “NO RADIO” stenciled in red on the legs of the diagonals. The letters should be 24 inches high and 12 inches wide. (See FIG 10-2-1.)

(3) The marker should be installed during the time that charges may be affected by radio transmissions.

### (b) Pilots

(1) When operating within 1,000 feet of a known perforation operation or observing the white X with red “NO RADIO” warning indicating perforation operations are underway, pilots will avoid radio transmissions from or near the helideck (within 1,000 feet) and will not land on the deck if the X is present. In addition to communications radios, radio transmissions are also emitted by aircraft radar,

transponders, ADS-B equipment, radar altimeters, and DME equipment, and ELTs.

(2) Whenever possible, make radio calls to the platform being approached or to the Flight Following Communications Center at least one mile out on approach. Ensure all communications are complete outside the 1,000 foot hazard distance. If no response is received, or if the platform is not radio equipped, further radio transmissions should not be made until visual contact with the deck indicates it is open for operation (no white “X”).

## g. Hydrogen Sulfide Gas Helideck/Heliport Operational Hazard Warning(s)/Procedures

**1. Background.** Hydrogen sulfide (H<sub>2</sub>S) gas: Hydrogen sulfide gas in higher concentrations (300–500 ppm) can cause loss of consciousness within a few seconds and presents a hazard to pilots on/near offshore helidecks. When operating in offshore areas that have been identified to have concentrations of hydrogen sulfide gas, the following practices are recommended.

## 2. Recommended Practices

### (a) Pilots

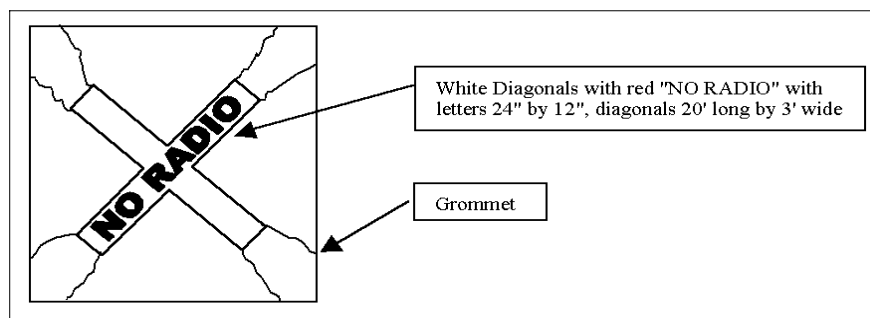
(1) Ensure approved protective air packs are available for emergency use by the crew on the helicopter.

(2) If shutdown on a helideck, request the supervisor in charge provide a briefing on location of protective equipment and safety procedures.

(3) If while flying near a helideck and the visual red beacon alarm is observed or an unusually strong odor of “rotten eggs” is detected, immediately don the protective air pack, exit to an area upwind, and notify the suspected source field of the hazard.

FIG 10-2-1

### Closed Helideck Marking – No Radio



### (b) Oil Field Supervisors

(1) If presence of hydrogen sulfide is detected, a red rotating beacon or red high intensity strobe light adjacent to the primary helideck stairwell or wind indicator on the structure should be turned on to provide visual warning of hazard. If the beacon is to be located near the stairwell, the State of Louisiana “Offshore Heliport Design Guide” and FAA Advisory Circular (AC) 150/5390–2A, Heliport Design Guide, should be reviewed to ensure proper clearance on the helideck.

(2) Notify nearby helicopter operators and bases of the hazard and advise when hazard is cleared.

(3) Provide a safety briefing to include location of protective equipment to all arriving personnel.

(4) Wind socks or indicator should be clearly visible to provide upwind indication for the pilot.

### h. Gas Venting Helideck/Heliport Operational Hazard Warning(s)/Procedures – Operations Near Gas Vent Booms

**1. Background.** Ignited flare booms can release a large volume of natural gas and create a hot fire and intense heat with little time for the pilot to react. Likewise, unignited gas vents can release reasonably large volumes of methane gas under certain conditions. Thus, operations conducted very near unignited gas vents require precautions to prevent inadvertent ingestion of combustible gases by the helicopter engine(s). The following practices are recommended.

#### 2. Pilots

(a) Gas will drift upwards and downwind of the vent. Plan the approach and takeoff to observe and avoid the area downwind of the vent, remaining as far away as practicable from the open end of the vent boom.

(b) Do not attempt to start or land on an offshore helideck when the deck is downwind of a gas vent unless properly trained personnel verify conditions are safe.

### 3. Oil Field Supervisors

(a) During venting of large amounts of unignited raw gas, a red rotating beacon or red high intensity strobe light adjacent to the primary helideck stairwell or wind indicator should be turned on to provide visible warning of hazard. If the beacon is to be located near the stairwell, the State of Louisiana “Offshore Heliport Design Guide” and FAA AC 150/5390–2A, Heliport Design Guide, should be reviewed to ensure proper clearance from the helideck.

(b) Notify nearby helicopter operators and bases of the hazard for planned operations.

(c) Wind socks or indicator should be clearly visible to provide upward indication for the pilot.

### i. Helideck/Heliport Operational Warning(s)/Procedure(s) – Closed Helidecks or Heliports

**1. Background.** A white “X” marked diagonally from corner to corner across a helideck or heliport touchdown area is the universally accepted visual indicator that the landing area is closed for safety of other reasons and that helicopter operations are not permitted. The following practices are recommended.

(a) **Permanent Closing.** If a helideck or heliport is to be permanently closed, X diagonals of the same size and location as indicated above should be used, but the markings should be painted on the landing area.

#### NOTE–

*White Decks: If a helideck is painted white, then international orange or yellow markings can be used for the temporary or permanent diagonals.*

(b) **Temporary Closing.** A temporary marker can be used for hazards of an interim nature. This marker could be made from vinyl or other durable material in the shape of a diagonal “X.” The marker should be white with legs at least 20 feet long and 3 feet in width. This marker is designed to be quickly secured and removed from the deck using grommets and rope ties. The duration, time, location, and nature of these temporary closings should be provided to and coordinated with company aviation departments, nearby helicopter bases, and helicopter operators supporting the area. These markers **MUST** be removed when the hazard no longer exists.

(See FIG 10–2–2.)

(2) No electrical storms (thunderstorms) are present within 10 nautical miles. Lightning can travel great distances beyond the actual thunderstorm.

(3) Passengers disembark the helicopter and move to a safe location prior to HRR operations. When the pilot-in-command deems it necessary for passenger safety that they remain onboard, passengers should be briefed on the evacuation route to follow to clear the area.

(4) Passengers not board or disembark during HRR operations nor should cargo be loaded or unloaded.

(5) Only designated personnel, trained in HRR operations should conduct HRR written authorization to include safe handling of the fuel and equipment. (See your Company Operations/Safety Manual for detailed instructions.)

(6) All doors, windows, and access points allowing entry to the interior of the helicopter that are adjacent to or in the immediate vicinity of the fuel inlet ports kept closed during HRR operations.

(7) Pilots ensure that appropriate electrical/electronic equipment is placed in standby-off position, to preclude the possibility of electrical discharge or other fire hazard, such as [i.e., weather radar is on standby and no radio transmissions are made (keying of the microphone/transmitter)]. Remember, in addition to communications radios, radio transmissions are also emitted by aircraft radar, transponders, ADS-B equipment, radar altimeters, DME equipment, and ELTs.

(8) Smoking be prohibited in and around the helicopter during all HRR operations.

The HRR procedures are critical and present associated hazards requiring attention to detail regarding quality control, weather conditions, static electricity, bonding, and spill/fires potential.

Any activity associated with rotors turning (i.e.; refueling embarking/disembarking, loading/unloading baggage/freight; etc.) personnel should only approach the aircraft when authorized to do so. Approach should be made via safe approach path/walkway or “arc” – **remain clear of all rotors.**

**NOTE–**

1. *Marine vessels, barges etc.: Vessel motion presents additional potential hazards to helicopter operations (blade flex, aircraft movement).*

2. *See National Fire Protection Association (NFPA) Document 407, “Standard for Aircraft Fuel Servicing” for specifics regarding non-HRR (routine refueling operations).*

## 10–2–2. Helicopter Night VFR Operations

### a. Effect of Lighting on Seeing Conditions in Night VFR Helicopter Operations

**NOTE–**

*This guidance was developed to support safe night VFR helicopter emergency medical services (HEMS) operations. The principles of lighting and seeing conditions are useful in any night VFR operation.*

While ceiling and visibility significantly affect safety in night VFR operations, lighting conditions also have a profound effect on safety. Even in conditions in which visibility and ceiling are determined to be visual meteorological conditions, the ability to discern unlighted or low contrast objects and terrain at night may be compromised. The ability to discern these objects and terrain is the seeing condition, and is related to the amount of natural and man made lighting available, and the contrast, reflectivity, and texture of surface terrain and obstruction features. In order to conduct operations safely, seeing conditions must be accounted for in the planning and execution of night VFR operations.

Night VFR seeing conditions can be described by identifying “high lighting conditions” and “low lighting conditions.”

1. High lighting conditions exist when one of two sets of conditions are present:

(a) The sky cover is less than broken (less than 5/8 cloud cover), the time is between the local Moon rise and Moon set, and the lunar disk is at least 50% illuminated; or

(b) The aircraft is operated over surface lighting which, at least, provides for the lighting of prominent obstacles, the identification of terrain features (shorelines, valleys, hills, mountains, slopes) and a horizontal reference by which the pilot may control the helicopter. For example, this surface lighting may be the result of:

(1) Extensive cultural lighting (man-made, such as a built-up area of a city),

(2) Significant reflected cultural lighting (such as the illumination caused by the reflection of a major metropolitan area's lighting reflecting off a cloud ceiling), or

(3) Limited cultural lighting combined with a high level of natural reflectivity of celestial illumination, such as that provided by a surface covered by snow or a desert surface.

2. Low lighting conditions are those that do not meet the high lighting conditions requirements.

3. Some areas may be considered a high lighting environment only in specific circumstances. For example, some surfaces, such as a forest with limited cultural lighting, normally have little reflectivity, requiring dependence on significant moonlight to achieve a high lighting condition. However, when that same forest is covered with snow, its reflectivity may support a high lighting condition based only on starlight. Similarly, a desolate area, with little cultural lighting, such as a desert, may have such inherent natural reflectivity that it may be considered a high lighting conditions area regardless of season, provided the cloud cover does not prevent starlight from being reflected from the surface. Other surfaces, such as areas of open water, may never have enough reflectivity or cultural lighting to ever be characterized as a high lighting area.

4. Through the accumulation of night flying experience in a particular area, the operator will develop the ability to determine, prior to departure, which areas can be considered supporting high or low lighting conditions. Without that operational experience, low lighting considerations should be applied by operators for both pre-flight planning and operations until high lighting conditions are observed or determined to be regularly available.

## **b. Astronomical Definitions and Background Information for Night Operations**

### **1. Definitions**

(a) **Horizon.** Wherever one is located on or near the Earth's surface, the Earth is perceived as essentially flat and, therefore, as a plane. If there are no visual obstructions, the apparent intersection of the sky with the Earth's (plane) surface is the horizon, which appears as a circle centered at the observer. For rise/set computations, the observer's eye is considered to be on the surface of the Earth, so that the

horizon is geometrically exactly 90 degrees from the local vertical direction.

(b) **Rise, Set.** During the course of a day the Earth rotates once on its axis causing the phenomena of rising and setting. All celestial bodies, the Sun, Moon, stars and planets, seem to appear in the sky at the horizon to the East of any particular place, then to cross the sky and again disappear at the horizon to the West. Because the Sun and Moon appear as circular disks and not as points of light, a definition of rise or set must be very specific, because not all of either body is seen to rise or set at once.

(c) **Sunrise and sunset** refer to the times when the upper edge of the disk of the Sun is on the horizon, considered unobstructed relative to the location of interest. Atmospheric conditions are assumed to be average, and the location is in a level region on the Earth's surface.

(d) **Moonrise and moonset** times are computed for exactly the same circumstances as for sunrise and sunset. However, moonrise and moonset may occur at any time during a 24 hour period and, consequently, it is often possible for the Moon to be seen during daylight, and to have moonless nights. It is also possible that a moonrise or moonset does not occur relative to a specific place on a given date.

(e) **Transit.** The transit time of a celestial body refers to the instant that its center crosses an imaginary line in the sky – the observer's meridian – running from north to south.

(f) **Twilight.** Before sunrise and again after sunset there are intervals of time, known as "twilight," during which there is natural light provided by the upper atmosphere, which does receive direct sunlight and reflects part of it toward the Earth's surface.

(g) **Civil twilight** is defined to begin in the morning, and to end in the evening when the center of the Sun is geometrically 6 degrees below the horizon. This is the limit at which twilight illumination is sufficient, under good weather conditions, for terrestrial objects to be clearly distinguished.

2. Title 14 of the Code of Federal Regulations applies these concepts and definitions in addressing the definition of night (Section 1.1), the requirement for aircraft lighting (Section 91.209) and pilot recency of night experience (Section 61.67).

## Appendix 3. Abbreviations/Acronyms

As used in this manual, the following abbreviations/acronyms have the meanings indicated.

Abbreviation/ Acronym	Meaning
AAWU . . . . .	Alaskan Aviation Weather Unit
AAS . . . . .	Airport Advisory Service
AC . . . . .	Advisory Circular
ACAR . . . . .	Aircraft Communications Addressing and Reporting System
ADCUS . . . . .	Advise Customs
ADDS . . . . .	Aviation Digital Data Service
ADF . . . . .	Automatic Direction Finder
ADIZ . . . . .	Air Defense Identification Zone
ADS-B . . . . .	Automatic Dependent Surveillance–Broadcast
AFB . . . . .	Air Force Base
AFCS . . . . .	Automatic Flight Control System
AFIS . . . . .	Automatic Flight Information Service
AFM . . . . .	Aircraft Flight Manual
AGL . . . . .	Above Ground Level
AHRS . . . . .	Attitude Heading Reference System
AIM . . . . .	Aeronautical Information Manual
AIRMET . . . . .	Airmen’s Meteorological Information
AIS . . . . .	Aeronautical Information Services
ALD . . . . .	Available Landing Distance
ALDARS . . . . .	Automated Lightning Detection and Reporting System
ALS . . . . .	Approach Light Systems
AMSL . . . . .	Above Mean Sea Level
ANP . . . . .	Actual Navigation Performance
AOCC . . . . .	Airline Operations Control Center
AP . . . . .	Autopilot System
APV . . . . .	Approach with Vertical Guidance
AR . . . . .	Authorization Required
ARENA . . . . .	Areas Noted for Attention
ARFF IC . . . . .	Aircraft Rescue and Fire Fighting Incident Commander
ARINC . . . . .	Aeronautical Radio Incorporated
ARO . . . . .	Airport Reservations Office
ARSA . . . . .	Airport Radar Service Area
ARSR . . . . .	Air Route Surveillance Radar
ARTCC . . . . .	Air Route Traffic Control Center
ARTS . . . . .	Automated Radar Terminal System
ASDE-X . . . . .	Airport Surface Detection Equipment – Model X
ASOS . . . . .	Automated Surface Observing System
ASR . . . . .	Airport Surveillance Radar

Abbreviation/ Acronym	Meaning
ASRS . . . . .	Aviation Safety Reporting System
ASSC . . . . .	Airport Surface Surveillance Capability
ATC . . . . .	Air Traffic Control
ATCRBS . . . . .	Air Traffic Control Radar Beacon System
ATCSCC . . . . .	Air Traffic Control System Command Center
ATCT . . . . .	Airport Traffic Control Tower
ATD . . . . .	Along–Track Distance
ATIS . . . . .	Automatic Terminal Information Service
ATT . . . . .	Attitude Retention System
AWC . . . . .	Aviation Weather Center
AWOS . . . . .	Automated Weather Observing System
AWTT . . . . .	Aviation Weather Technology Transfer
AWW . . . . .	Severe Weather Forecast Alert
BAASS . . . . .	Bigelow Aerospace Advanced Space Studies
BBS . . . . .	Bulletin Board System
BC . . . . .	Back Course
BECMG . . . . .	Becoming group
C/A . . . . .	Coarse Acquisition
CARTS . . . . .	Common Automated Radar Terminal System (ARTS) (to include ARTS IIIIE and ARTS IIE)
CAT . . . . .	Clear Air Turbulence
CD . . . . .	Controller Display
CDI . . . . .	Course Deviation Indicator
CDR . . . . .	Coded Departure Route
CERAP . . . . .	Combined Center/RAPCON
CFA . . . . .	Controlled Firing Area
CFIT . . . . .	Controlled Flight into Terrain
CFR . . . . .	Code of Federal Regulations
COA . . . . .	Certificate of Waiver or Authorization
CPDLC . . . . .	Controller Pilot Data Link Communications
CTAF . . . . .	Common Traffic Advisory Frequency
CVFP . . . . .	Chartered Visual Flight Procedure
CVRS . . . . .	Computerized Voice Reservation System
CWA . . . . .	Center Weather Advisory
CWSU . . . . .	Center Weather Service Unit
DA . . . . .	Decision Altitude
DCA . . . . .	Ronald Reagan Washington National Airport
DCP . . . . .	Data Collection Package
DER . . . . .	Departure End of Runway
DH . . . . .	Decision Height

Abbreviation/ Acronym	Meaning
DME . . . . .	Distance Measuring Equipment
DME/N . . . . .	Standard DME
DME/P . . . . .	Precision DME
DOD . . . . .	Department of Defense
DP . . . . .	Instrument Departure Procedure
DPU . . . . .	Data Processor Unit
DRT . . . . .	Diversion Recovery Tool
DRVSM . . . . .	Domestic Reduced Vertical Separation Minimum
DVA . . . . .	Diverse Vector Area
DVFR . . . . .	Defense Visual Flight Rules
DVRSN . . . . .	Diversion
EDCT . . . . .	Expect Departure Clearance Time
EFAS . . . . .	En Route Flight Advisory Service
EFV . . . . .	Enhanced Flight Visibility
EFVS . . . . .	Enhanced Flight Vision System
ELT . . . . .	Emergency Locator Transmitter
EMAS . . . . .	Engineered Materials Arresting System
EPE . . . . .	Estimate of Position Error
ESV . . . . .	Expanded Service Volume
ETA . . . . .	Estimated Time of Arrival
ETD . . . . .	Estimated Time of Departure
ETE . . . . .	Estimated Time En Route
EWINS . . . . .	Enhanced Weather Information System
EWR . . . . .	Newark International Airport
FA . . . . .	Area Forecast
FAA . . . . .	Federal Aviation Administration
FAF . . . . .	Final Approach Fix
FAROS . . . . .	Final Approach Runway Occupancy Signal
FAWP . . . . .	Final Approach Waypoint
FB . . . . .	Fly-by
FCC . . . . .	Federal Communications Commission
FD . . . . .	Flight Director System
FDC . . . . .	Flight Data Center
FDE . . . . .	Fault Detection and Exclusion
FIR . . . . .	Flight Information Region
FIS . . . . .	Flight Information Service
FISDL . . . . .	Flight Information Services Data Link
FLIP . . . . .	Flight Information Publication
FMS . . . . .	Flight Management System
FO . . . . .	Fly-over
FPA . . . . .	Flight Path Angle
FPV . . . . .	Flight Path Vector
FPNM . . . . .	Feet Per Nautical Mile
FSDO . . . . .	Flight Standards District Office
FSS . . . . .	Flight Service Station
GBAS . . . . .	Ground Based Augmentation System

Abbreviation/ Acronym	Meaning
GEO . . . . .	Geostationary Satellite
GLS . . . . .	GBAS Landing System
GNSS . . . . .	Global Navigation Satellite System
GNSSP . . . . .	Global Navigation Satellite System Panel
GPS . . . . .	Global Positioning System
GRI . . . . .	Group Repetition Interval
GSD . . . . .	Geographical Situation Display
GUS . . . . .	Ground Uplink Station
HAT . . . . .	Height Above Touchdown
HDTA . . . . .	High Density Traffic Airports
HEMS . . . . .	Helicopter Emergency Medical Services
HIRL . . . . .	High Intensity Runway Lights
HRR . . . . .	Helicopter Rapid Refueling Procedures
HUD . . . . .	Head-Up Display
Hz . . . . .	Hertz
IAF . . . . .	Initial Approach Fix
IAP . . . . .	Instrument Approach Procedure
IAS . . . . .	Indicated Air Speed
IAWP . . . . .	Initial Approach Waypoint
ICAO . . . . .	International Civil Aviation Organization
IF . . . . .	Intermediate Fix
IFR . . . . .	Instrument Flight Rules
ILS . . . . .	Instrument Landing System
ILS/PRM . . . . .	Instrument Landing System/Precision Runway Monitor
IM . . . . .	Inner Marker
IMC . . . . .	Instrument Meteorological Conditions
InFO . . . . .	Information For Operators
INS . . . . .	Inertial Navigation System
IOC . . . . .	Initial Operational Capability
IR . . . . .	IFR Military Training Route
IRU . . . . .	Inertial Reference Unit
ITWS . . . . .	Integrated Terminal Weather System
JFK . . . . .	John F. Kennedy International Airport
kHz . . . . .	Kilohertz
LAA . . . . .	Local Airport Advisory
LAAS . . . . .	Local Area Augmentation System
LAHSO . . . . .	Land and Hold Short Operations
LAWRS . . . . .	Limited Aviation Weather Reporting Station
LDA . . . . .	Localizer Type Directional Aid
LDA/PRM . . . . .	Localizer Type Directional Aid/Precision Runway Monitor
LGA . . . . .	LaGuardia Airport
LIRL . . . . .	Low Intensity Runway Lights
LLWAS . . . . .	Low Level Wind Shear Alert System

# PILOT/CONTROLLER GLOSSARY

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## PURPOSE

a. This Glossary was compiled to promote a common understanding of the terms used in the Air Traffic Control system. It includes those terms which are intended for pilot/controller communications. Those terms most frequently used in pilot/controller communications are printed in *bold italics*. The definitions are primarily defined in an operational sense applicable to both users and operators of the National Airspace System. Use of the Glossary will preclude any misunderstandings concerning the system's design, function, and purpose.

b. Because of the international nature of flying, terms used in the Lexicon, published by the International Civil Aviation Organization (ICAO), are included when they differ from FAA definitions. These terms are followed by "[ICAO]." For the reader's convenience, there are also cross references to related terms in other parts of the Glossary and to other documents, such as the Code of Federal Regulations (CFR) and the Aeronautical Information Manual (AIM).

c. This Glossary will be revised, as necessary, to maintain a common understanding of the system.

## EXPLANATION OF CHANGES

### d. Terms Added:

AIRCRAFT HAZARD AREA (AHA)  
 AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN (ADS–B In)  
 AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT (ADS–B Out)  
 CONTINGENCY HAZARD AREA (CHA)  
 COOPERATIVE SURVEILLANCE  
 NON–COOPERATIVE SURVEILLANCE  
 PRM APPROACH  
 REFINED HAZARD AREA (RHA)  
 ROUND–ROBIN FLIGHT PLAN  
 SPACE–BASED ADS–B (SBA)  
 SPOOFING  
 TRANSITIONAL HAZARD AREA (THA)  
 UNSERVICEABLE (U/S)

### e. Terms Deleted:

GROUND–BASED TRANSCEIVER (GBT)  
 HAZARDOUS INFLIGHT WEATHER ADVISORY SERVICE (HIWAS)  
 HIWAS BROADCAST AREA  
 HIWAS OUTLET AREA  
 ILS PRM APPROACH  
 RUNWAY VISIBILITY VALUE (RVV)

### f. Terms Modified:

AREA NAVIGATION (RNAV) GLOBAL POSITIONING SYSTEM (GPS) PRECISION RUNWAY  
 MONITORING (PRM) APPROACH  
 AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST (ADS–B)  
 FUSION [STARS/CARTS]  
 GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) [ICAO]

ICING  
JAMMING  
OUT OF SERVICE  
RADAR  
SQUAWK (Mode, Code, Function)  
STOP ALTITUDE SQUAWK  
STOP SQUAWK (Mode or Code)  
TARGET  
TARGET SYMBOL  
TRANSMISSOMETER  
VISIBILITY

**g.** Editorial/format changes were made where necessary. Revision bars were not used due to the insignificant nature of the changes.



navigation aids, navigation routes, designated airspace, and airports. Commonly used aeronautical charts are:

**a. Sectional Aeronautical Charts (1:500,000)**– Designed for visual navigation of slow or medium speed aircraft. Topographic information on these charts features the portrayal of relief and a judicious selection of visual check points for VFR flight. Aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, permanent special use airspace (SUA), obstructions, and related data.

**b. VFR Terminal Area Charts (1:250,000)**– Depict Class B airspace which provides for the control or segregation of all the aircraft within Class B airspace. The chart depicts topographic information and aeronautical information which includes visual and radio aids to navigation, airports, controlled airspace, permanent SUA, obstructions, and related data.

**c. En Route Low Altitude Charts**– Provide aeronautical information for en route instrument navigation (IFR) in the low altitude stratum. Information includes the portrayal of airways, limits of controlled airspace, position identification and frequencies of radio aids, selected airports, minimum en route and minimum obstruction clearance altitudes, airway distances, reporting points, permanent SUA, and related data. Area charts, which are a part of this series, furnish terminal data at a larger scale in congested areas.

**d. En Route High Altitude Charts**– Provide aeronautical information for en route instrument navigation (IFR) in the high altitude stratum. Information includes the portrayal of jet routes, identification and frequencies of radio aids, selected airports, distances, time zones, special use airspace, and related information.

**e. Instrument Approach Procedure (IAP) Charts**– Portray the aeronautical data which is required to execute an instrument approach to an airport. These charts depict the procedures, including all related data, and the airport diagram. Each procedure is designated for use with a specific type of electronic navigation system including NDB, TACAN, VOR, ILS RNAV and GLS. These charts are identified by the type of navigational aid(s)/equipment required to provide final approach guidance.

**f. Instrument Departure Procedure (DP) Charts**– Designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. Each DP is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.

**g. Standard Terminal Arrival (STAR) Charts**– Designed to expedite air traffic control arrival procedures and to facilitate transition between en route and instrument approach operations. Each STAR procedure is presented as a separate chart and may serve a single airport or more than one airport in a given geographical location.

**h. Airport Taxi Charts**– Designed to expedite the efficient and safe flow of ground traffic at an airport. These charts are identified by the official airport name; e.g., Ronald Reagan Washington National Airport.

(See ICAO term AERONAUTICAL CHART.)

**AERONAUTICAL CHART [ICAO]**– A representation of a portion of the earth, its culture and relief, specifically designated to meet the requirements of air navigation.

**AERONAUTICAL INFORMATION MANUAL (AIM)**– A primary FAA publication whose purpose is to instruct airmen about operating in the National Airspace System of the U.S. It provides basic flight information, ATC Procedures and general instructional information concerning health, medical facts, factors affecting flight safety, accident and hazard reporting, and types of aeronautical charts and their use.

**AERONAUTICAL INFORMATION PUBLICATION (AIP) [ICAO]**– A publication issued by or with the authority of a State and containing aeronautical information of a lasting character essential to air navigation.

(See CHART SUPPLEMENT U.S.)

**AFFIRMATIVE**– Yes.

**AFIS**–

(See AUTOMATIC FLIGHT INFORMATION SERVICE – ALASKA FSSs ONLY.)

**AFP**–

(See AIRSPACE FLOW PROGRAM.)

**AHA**–

(See AIRCRAFT HAZARD AREA.)

**AIM–**

(See AERONAUTICAL INFORMATION MANUAL.)

**AIP [ICAO]–**

(See ICAO term AERONAUTICAL INFORMATION PUBLICATION.)

**AIR CARRIER DISTRICT OFFICE–** An FAA field office serving an assigned geographical area, staffed with Flight Standards personnel serving the aviation industry and the general public on matters related to the certification and operation of scheduled air carriers and other large aircraft operations.

**AIR DEFENSE EMERGENCY–** A military emergency condition declared by a designated authority. This condition exists when an attack upon the continental U.S., Alaska, Canada, or U.S. installations in Greenland by hostile aircraft or missiles is considered probable, is imminent, or is taking place.

(Refer to AIM.)

**AIR DEFENSE IDENTIFICATION ZONE (ADIZ)–** An area of airspace over land or water in which the ready identification, location, and control of all aircraft (except for Department of Defense and law enforcement aircraft) is required in the interest of national security.

Note: ADIZ locations and operating and flight plan requirements for civil aircraft operations are specified in 14 CFR Part 99.

(Refer to AIM.)

**AIR NAVIGATION FACILITY–** Any facility used in, available for use in, or designed for use in, aid of air navigation, including landing areas, lights, any apparatus or equipment for disseminating weather information, for signaling, for radio-directional finding, or for radio or other electrical communication, and any other structure or mechanism having a similar purpose for guiding or controlling flight in the air or the landing and takeoff of aircraft.

(See NAVIGATIONAL AID.)

**AIR ROUTE SURVEILLANCE RADAR–** Air route traffic control center (ARTCC) radar used primarily to detect and display an aircraft's position while en route between terminal areas. The ARSR enables controllers to provide radar air traffic control service when aircraft are within the ARSR coverage. In some instances, ARSR may enable an ARTCC to provide terminal radar services similar to but usually more

limited than those provided by a radar approach control.

**AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC)–** A facility established to provide air traffic control service to aircraft operating on IFR flight plans within controlled airspace and principally during the en route phase of flight. When equipment capabilities and controller workload permit, certain advisory/assistance services may be provided to VFR aircraft.

(See EN ROUTE AIR TRAFFIC CONTROL SERVICES.)

(Refer to AIM.)

**AIR TAXI–** Used to describe a helicopter/VTOL aircraft movement conducted above the surface but normally not above 100 feet AGL. The aircraft may proceed either via hover taxi or flight at speeds more than 20 knots. The pilot is solely responsible for selecting a safe airspeed/altitude for the operation being conducted.

(See HOVER TAXI.)

(Refer to AIM.)

**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.)

**b.** Airport Reservation Office (ARO). Monitors the operation and allocation of reservations for unscheduled operations at airports designated by the Administrator as High Density Airports. These airports are generally known as slot controlled airports. The ARO allocates reservations on a first come, first served basis determined by the time the request is received at the ARO.

(Refer to 14 CFR Part 93.)

(See CHART SUPPLEMENT U.S.)

**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 Super, Heavy, Large, and Small as follows:

- a. Super. The Airbus A-380-800 (A388) and the Antonov An-225 (A225) are classified as super.
- b. Heavy– Aircraft capable of takeoff weights of 300,000 pounds or more whether or not they are operating at this weight during a particular phase of flight.
- c. Large– Aircraft of more than 41,000 pounds, maximum certificated takeoff weight, up to but not including 300,000 pounds.

- d. Small– Aircraft of 41,000 pounds or less maximum certificated takeoff weight.  
(Refer to AIM.)

**AIRCRAFT CONFLICT**– Predicted conflict, within EDST of two aircraft, or between aircraft and airspace. A Red alert is used for conflicts when the predicted minimum separation is 5 nautical miles or less. A Yellow alert is used when the predicted minimum separation is between 5 and approximately 12 nautical miles. A Blue alert is used for conflicts between an aircraft and predefined airspace.

(See **EN ROUTE DECISION SUPPORT TOOL**.)

**AIRCRAFT LIST (ACL)**– A view available with EDST that lists aircraft currently in or predicted to be in a particular sector's airspace. The view contains textual flight data information in line format and may be sorted into various orders based on the specific needs of the sector team.

(See **EN ROUTE DECISION SUPPORT TOOL**.)

**AIRCRAFT SURGE LAUNCH AND RECOVERY**– Procedures used at USAF bases to provide increased launch and recovery rates in instrument flight rules conditions. ASLAR is based on:

- a. Reduced separation between aircraft which is based on time or distance. Standard arrival separation applies between participants including multiple flights until the DRAG point. The DRAG point is a published location on an ASLAR approach where aircraft landing second in a formation slows to a predetermined airspeed. The DRAG point is the reference point at which MARSA applies as expanding elements effect separation within a flight or between subsequent participating flights.
- b. ASLAR procedures shall be covered in a Letter of Agreement between the responsible USAF military ATC facility and the concerned Federal Aviation Administration facility. Initial Approach Fix spacing requirements are normally addressed as a minimum.

**AIRCRAFT HAZARD AREA (AHA)**– Used by ATC to segregate air traffic from a launch vehicle, reentry vehicle, amateur rocket, jettisoned stages, hardware, or falling debris generated by failures associated with any of these activities. An AHA is

designated via NOTAM as either a TFR or stationary ALTRV. Unless otherwise specified, the vertical limits of an AHA are from the surface to unlimited.

(See CONTINGENCY HAZARD AREA.)

(See REFINED HAZARD AREA.)

(See TRANSITIONAL HAZARD AREA.)

**AIRCRAFT WAKE TURBULENCE CATEGORIES**– For the purpose of Wake Turbulence Recategorization (RECAT) Separation Minima, ATC groups aircraft into categories ranging from Category A through Category I, dependent upon the version of RECAT that is applied. Specific category assignments vary and are listed in the RECAT Orders.

**AIRMEN'S METEOROLOGICAL INFORMATION (AIRMET)**– In-flight weather advisories issued only to amend the Aviation Surface Forecast, Aviation Cloud Forecast, or area forecast concerning weather phenomena which are of operational interest to all aircraft and potentially hazardous to aircraft having limited capability because of lack of equipment, instrumentation, or pilot qualifications. AIRMETs concern weather of less severity than that covered by SIGMETs or Convective SIGMETs. AIRMETs cover moderate icing, moderate turbulence, sustained winds of 30 knots or more at the surface, widespread areas of ceilings less than 1,000 feet and/or visibility less than 3 miles, and extensive mountain obscurement.

(See AWW.)

(See CONVECTIVE SIGMET.)

(See CWA.)

(See SIGMET.)

(Refer to AIM.)

**AIRPORT**– An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

**AIRPORT ADVISORY AREA**– The area within ten miles of an airport without a control tower or where the tower is not in operation, and on which a Flight Service Station is located.

(See LOCAL AIRPORT ADVISORY.)

(Refer to AIM.)

**AIRPORT ARRIVAL RATE (AAR)**– A dynamic input parameter specifying the number of arriving aircraft which an airport or airspace can accept from the ARTCC per hour. The AAR is used to calculate

the desired interval between successive arrival aircraft.

**AIRPORT DEPARTURE RATE (ADR)**– A dynamic parameter specifying the number of aircraft which can depart an airport and the airspace can accept per hour.

**AIRPORT ELEVATION**– The highest point of an airport's usable runways measured in feet from mean sea level.

(See TOUCHDOWN ZONE ELEVATION.)

(See ICAO term AERODROME ELEVATION.)

**AIRPORT LIGHTING**– Various lighting aids that may be installed on an airport. Types of airport lighting include:

**a. Approach Light System (ALS)**– An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his/her final approach for landing. Condenser-Discharge Sequential Flashing Lights/Sequenced Flashing Lights may be installed in conjunction with the ALS at some airports. Types of Approach Light Systems are:

**1. ALSF-1**– Approach Light System with Sequenced Flashing Lights in ILS Cat-I configuration.

**2. ALSF-2**– Approach Light System with Sequenced Flashing Lights in ILS Cat-II configuration. The ALSF-2 may operate as an SSALR when weather conditions permit.

**3. SSALF**– Simplified Short Approach Light System with Sequenced Flashing Lights.

**4. SSALR**– Simplified Short Approach Light System with Runway Alignment Indicator Lights.

**5. MALSF**– Medium Intensity Approach Light System with Sequenced Flashing Lights.

**6. MALSR**– Medium Intensity Approach Light System with Runway Alignment Indicator Lights.

**7. RLLS**– Runway Lead-in Light System Consists of one or more series of flashing lights installed at or near ground level that provides positive visual guidance along an approach path, either curving or straight, where special problems exist with hazardous terrain, obstructions, or noise abatement procedures.

**8. RAIL**– Runway Alignment Indicator Lights– Sequenced Flashing Lights which are installed only in combination with other light systems.

**9. ODALS– Omnidirectional Approach Lighting System** consists of seven omnidirectional flashing lights located in the approach area of a nonprecision runway. Five lights are located on the runway centerline extended with the first light located 300 feet from the threshold and extending at equal intervals up to 1,500 feet from the threshold. The other two lights are located, one on each side of the runway threshold, at a lateral distance of 40 feet from the runway edge, or 75 feet from the runway edge when installed on a runway equipped with a VASI.

(Refer to FAA Order JO 6850.2, VISUAL GUIDANCE LIGHTING SYSTEMS.)

**b. Runway Lights/Runway Edge Lights–** Lights having a prescribed angle of emission used to define the lateral limits of a runway. Runway lights are uniformly spaced at intervals of approximately 200 feet, and the intensity may be controlled or preset.

**c. Touchdown Zone Lighting–** Two rows of transverse light bars located symmetrically about the runway centerline normally at 100 foot intervals. The basic system extends 3,000 feet along the runway.

**d. Runway Centerline Lighting–** Flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of the opposite end of the runway.

**e. Threshold Lights–** Fixed green lights arranged symmetrically left and right of the runway centerline, identifying the runway threshold.

**f. Runway End Identifier Lights (REIL)–** Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.

**g. Visual Approach Slope Indicator (VASI)–** An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he/she is “on path” if he/she sees red/white, “above path” if white/white, and “below path” if red/red. Some airports serving large aircraft have three-bar VASIs which provide two visual glide paths to the same runway.

**h. Precision Approach Path Indicator (PAPI)–** An airport lighting facility, similar to VASI, providing vertical approach slope guidance to aircraft during approach to landing. PAPIs consist of a single row of

either two or four lights, normally installed on the left side of the runway, and have an effective visual range of about 5 miles during the day and up to 20 miles at night. PAPIs radiate a directional pattern of high intensity red and white focused light beams which indicate that the pilot is “on path” if the pilot sees an equal number of white lights and red lights, with white to the left of the red; “above path” if the pilot sees more white than red lights; and “below path” if the pilot sees more red than white lights.

**i. Boundary Lights–** Lights defining the perimeter of an airport or landing area.

(Refer to AIM.)

**AIRPORT MARKING AIDS–** Markings used on runway and taxiway surfaces to identify a specific runway, a runway threshold, a centerline, a hold line, etc. A runway should be marked in accordance with its present usage such as:

- a. Visual.
- b. Nonprecision instrument.
- c. Precision instrument.

(Refer to AIM.)

**AIRPORT REFERENCE POINT (ARP)–** The approximate geometric center of all usable runway surfaces.

**AIRPORT RESERVATION OFFICE–** Office responsible for monitoring the operation of slot controlled airports. It receives and processes requests for unscheduled operations at slot controlled airports.

**AIRPORT ROTATING BEACON–** A visual NAVAID operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes.

(See INSTRUMENT FLIGHT RULES.)

(See SPECIAL VFR OPERATIONS.)

(See ICAO term AERODROME BEACON.)

(Refer to AIM.)

**AIRPORT STREAM FILTER (ASF)–** An on/off filter that allows the conflict notification function to be inhibited for arrival streams into single or multiple airports to prevent nuisance alerts.

**AIRPORT SURFACE DETECTION EQUIPMENT (ASDE)–** Surveillance equipment specifically designed to detect aircraft, vehicular traffic, and other objects, on the surface of an airport, and to present the

image on a tower display. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways. There are three ASDE systems deployed in the NAS:

- a. ASDE-3– a Surface Movement Radar.
- b. ASDE-X– a system that uses an X-band Surface Movement Radar, multilateration, and ADS-B.
- c. Airport Surface Surveillance Capability (ASSC)– A system that uses Surface Movement Radar, multilateration, and ADS-B.

**AIRPORT SURVEILLANCE RADAR**– Approach control radar used to detect and display an aircraft’s position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 miles.

**AIRPORT TAXI CHARTS**–

(See AERONAUTICAL CHART.)

**AIRPORT TRAFFIC CONTROL SERVICE**– A service provided by a control tower for aircraft operating on the movement area and in the vicinity of an airport.

(See MOVEMENT AREA.)

(See TOWER.)

(See ICAO term AERODROME CONTROL SERVICE.)

**AIRPORT TRAFFIC CONTROL TOWER**–

(See TOWER.)

**AIRSPACE CONFLICT**– Predicted conflict of an aircraft and active Special Activity Airspace (SAA).

**AIRSPACE FLOW PROGRAM (AFP)**– AFP is a Traffic Management (TM) process administered by the Air Traffic Control System Command Center (ATCSCC) where aircraft are assigned an Expect Departure Clearance Time (EDCT) in order to manage capacity and demand for a specific area of the National Airspace System (NAS). The purpose of the program is to mitigate the effects of en route constraints. It is a flexible program and may be implemented in various forms depending upon the needs of the air traffic system.

**AIRSPACE HIERARCHY**– Within the airspace classes, there is a hierarchy and, in the event of an overlap of airspace: Class A preempts Class B, Class B preempts Class C, Class C preempts Class D, Class D preempts Class E, and Class E preempts Class G.

**AIRSPEED**– The speed of an aircraft relative to its surrounding air mass. The unqualified term “airspeed” means one of the following:

a. Indicated Airspeed– The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term “airspeed.”

(Refer to 14 CFR Part 1.)

b. True Airspeed– The airspeed of an aircraft relative to undisturbed air. Used primarily in flight planning and en route portion of flight. When used in pilot/controller communications, it is referred to as “true airspeed” and not shortened to “airspeed.”

**AIRSTART**– The starting of an aircraft engine while the aircraft is airborne, preceded by engine shutdown during training flights or by actual engine failure.

**AIRWAY**– A Class E airspace area established in the form of a corridor, the centerline of which is defined by radio navigational aids.

(See FEDERAL AIRWAYS.)

(See ICAO term AIRWAY.)

(Refer to 14 CFR Part 71.)

(Refer to AIM.)

**AIRWAY [ICAO]**– A control area or portion thereof established in the form of corridor equipped with radio navigational aids.

**AIRWAY BEACON**– Used to mark airway segments in remote mountain areas. The light flashes Morse Code to identify the beacon site.

(Refer to AIM.)

**AIT**–

(See AUTOMATED INFORMATION TRANSFER.)

**ALERFA (Alert Phase) [ICAO]**– A situation wherein apprehension exists as to the safety of an aircraft and its occupants.

**ALERT**– A notification to a position that there is an aircraft-to-aircraft or aircraft-to-airspace conflict, as detected by Automated Problem Detection (APD).

**ALERT AREA**–

(See SPECIAL USE AIRSPACE.)

**ALERT NOTICE (ALNOT)**– A request originated by a flight service station (FSS) or an air route traffic control center (ARTCC) for an extensive communication search for overdue, unreported, or missing aircraft.

**ALERTING SERVICE**– A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and assist such organizations as required.

**ALNOT**–

(See ALERT NOTICE.)

**ALONG-TRACK DISTANCE (ATD)**– The horizontal distance between the aircraft's current position and a fix measured by an area navigation system that is not subject to slant range errors.

**ALPHANUMERIC DISPLAY**– Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a radar display.

(See AUTOMATED RADAR TERMINAL SYSTEMS.)

**ALTERNATE AERODROME [ICAO]**– An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing.

Note: The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for the flight.

**ALTERNATE AIRPORT**– An airport at which an aircraft may land if a landing at the intended airport becomes inadvisable.

(See ICAO term ALTERNATE AERODROME.)

**ALTIMETER SETTING**– The barometric pressure reading used to adjust a pressure altimeter for variations in existing atmospheric pressure or to the standard altimeter setting (29.92).

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**ALTITUDE**– The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL).

(See FLIGHT LEVEL.)

**a. MSL Altitude**– Altitude expressed in feet measured from mean sea level.

**b. AGL Altitude**– Altitude expressed in feet measured above ground level.

**c. Indicated Altitude**– The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error

and uncompensated for variation from standard atmospheric conditions.

(See ICAO term ALTITUDE.)

**ALTITUDE [ICAO]**– The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

**ALTITUDE READOUT**– An aircraft's altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments on a radar scope having readout capability.

(See ALPHANUMERIC DISPLAY.)

(See AUTOMATED RADAR TERMINAL SYSTEMS.)

(Refer to AIM.)

**ALTITUDE RESERVATION (ALTRV)**– Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility.

(See AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER.)

**ALTITUDE RESTRICTION**– An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

**ALTITUDE RESTRICTIONS ARE CANCELED**– Adherence to previously imposed altitude restrictions is no longer required during a climb or descent.

**ALTRV**–

(See ALTITUDE RESERVATION.)

**AMVER**–

(See AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM.)

**APB**–

(See AUTOMATED PROBLEM DETECTION BOUNDARY.)

**APD**–

(See AUTOMATED PROBLEM DETECTION.)

**APDIA**–

(See AUTOMATED PROBLEM DETECTION INHIBITED AREA.)

**APPROACH CLEARANCE**– Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a



clearance and other pertinent information is provided in the approach clearance when required.

(See CLEARED APPROACH.)

(See INSTRUMENT APPROACH PROCEDURE.)

(Refer to AIM.)

(Refer to 14 CFR Part 91.)

**APPROACH CONTROL FACILITY**– A terminal ATC facility that provides approach control service in a terminal area.

(See APPROACH CONTROL SERVICE.)

(See RADAR APPROACH CONTROL FACILITY.)

**APPROACH CONTROL SERVICE**– Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service.

(See ICAO term APPROACH CONTROL SERVICE.)

(Refer to AIM.)

**APPROACH CONTROL SERVICE [ICAO]**– Air traffic control service for arriving or departing controlled flights.

**APPROACH GATE**– An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course. The gate will be established along the final approach course 1 mile from the final approach fix on the side away from the airport and will be no closer than 5 miles from the landing threshold.

**APPROACH/DEPARTURE HOLD AREA**– The locations on taxiways in the approach or departure areas of a runway designated to protect landing or departing aircraft. These locations are identified by signs and markings.

**APPROACH LIGHT SYSTEM**–

(See AIRPORT LIGHTING.)

**APPROACH SEQUENCE**– The order in which aircraft are positioned while on approach or awaiting approach clearance.

(See LANDING SEQUENCE.)

(See ICAO term APPROACH SEQUENCE.)

**APPROACH SEQUENCE [ICAO]**– The order in which two or more aircraft are cleared to approach to land at the aerodrome.

**APPROACH SPEED**– The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

**APPROACH WITH VERTICAL GUIDANCE (APV)**– A term used to describe RNAV approach procedures that provide lateral and vertical guidance but do not meet the requirements to be considered a precision approach.

**APPROPRIATE ATS AUTHORITY [ICAO]**– The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned. In the United States, the “appropriate ATS authority” is the Program Director for Air Traffic Planning and Procedures, ATP-1.

**APPROPRIATE AUTHORITY**–

a. Regarding flight over the high seas: the relevant authority is the State of Registry.

b. Regarding flight over other than the high seas: the relevant authority is the State having sovereignty over the territory being overflown.

**APPROPRIATE OBSTACLE CLEARANCE MINIMUM ALTITUDE**– Any of the following:

(See MINIMUM EN ROUTE IFR ALTITUDE.)

(See MINIMUM IFR ALTITUDE.)

(See MINIMUM OBSTRUCTION CLEARANCE ALTITUDE.)

(See MINIMUM VECTORING ALTITUDE.)

**APPROPRIATE TERRAIN CLEARANCE MINIMUM ALTITUDE**– Any of the following:

(See MINIMUM EN ROUTE IFR ALTITUDE.)

(See MINIMUM IFR ALTITUDE.)

(See MINIMUM OBSTRUCTION CLEARANCE ALTITUDE.)

(See MINIMUM VECTORING ALTITUDE.)

**APRON**– A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

(See ICAO term APRON.)

**APRON [ICAO]**– A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, refueling, parking or maintenance.

**ARC**– The track over the ground of an aircraft flying at a constant distance from a navigational aid by reference to distance measuring equipment (DME).

**AREA CONTROL CENTER [ICAO]**– An air traffic control facility primarily responsible for ATC services being provided IFR aircraft during the en route phase of flight. The U.S. equivalent facility is an air route traffic control center (ARTCC).

**AREA NAVIGATION (RNAV)**– A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground- or space-based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

Note: Area navigation includes performance-based navigation as well as other operations that do not meet the definition of performance-based navigation.

**AREA NAVIGATION (RNAV) APPROACH CONFIGURATION:**

**a. STANDARD T**– An RNAV approach whose design allows direct flight to any one of three initial approach fixes (IAF) and eliminates the need for procedure turns. The standard design is to align the procedure on the extended centerline with the missed approach point (MAP) at the runway threshold, the final approach fix (FAF), and the initial approach/intermediate fix (IAF/IF). The other two IAFs will be established perpendicular to the IF.

**b. MODIFIED T**– An RNAV approach design for single or multiple runways where terrain or operational constraints do not allow for the standard T. The “T” may be modified by increasing or decreasing the angle from the corner IAF(s) to the IF or by eliminating one or both corner IAFs.

**c. STANDARD I**– An RNAV approach design for a single runway with both corner IAFs eliminated. Course reversal or radar vectoring may be required at busy terminals with multiple runways.

**d. TERMINAL ARRIVAL AREA (TAA)**– The TAA is controlled airspace established in conjunction with the Standard or Modified T and I RNAV approach configurations. In the standard TAA, there are three areas: straight-in, left base, and right base. The arc boundaries of the three areas of the TAA are published portions of the approach and allow aircraft to transition from the en route structure direct to the nearest IAF. TAAs will also eliminate or reduce feeder routes, departure extensions, and procedure turns or course reversal.

**1. STRAIGHT-IN AREA**– A 30NM arc centered on the IF bounded by a straight line extending through the IF perpendicular to the intermediate course.

**2. LEFT BASE AREA**– A 30NM arc centered on the right corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

**3. RIGHT BASE AREA**– A 30NM arc centered on the left corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

**AREA NAVIGATION (RNAV) GLOBAL POSITIONING SYSTEM (GPS) PRECISION RUNWAY MONITORING (PRM) APPROACH**–

A GPS approach, which requires vertical guidance, used in lieu of another type of PRM approach to conduct approaches to parallel runways whose extended centerlines are separated by less than 4,300 feet and at least 3,000 feet, where simultaneous close parallel approaches are permitted. Also used in lieu of an ILS PRM and/or LDA PRM approach to conduct Simultaneous Offset Instrument Approach (SOIA) operations.

**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**– EDST notification to the appropriate controller of the need to determine if an ATC preferred route needs to be applied, based on destination airport.

(See ROUTE ACTION NOTIFICATION.)

(See EN ROUTE DECISION SUPPORT TOOL.)

**ATC PREFERRED ROUTES**– Preferred routes that are not automatically applied by Host.

**ATC REQUESTS**– Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

**ATC SECURITY SERVICES**– Communications and security tracking provided by an ATC facility in support of the DHS, the DOD, or other Federal security elements in the interest of national security. Such security services are only applicable within designated areas. ATC security services do not include ATC basic radar services or flight following.

**ATC SECURITY SERVICES POSITION**– The position responsible for providing ATC security services as defined. This position does not provide ATC, IFR separation, or VFR flight following services, but is responsible for providing security services in an area comprising airspace assigned to one or more ATC operating sectors. This position may be combined with control positions.

**ATC SECURITY TRACKING**– The continuous tracking of aircraft movement by an ATC facility in support of the DHS, the DOD, or other security elements for national security using radar (i.e., radar tracking) or other means (e.g., manual tracking) without providing basic radar services (including traffic advisories) or other ATC services not defined in this section.

**ATS SURVEILLANCE SERVICE [ICAO]**– A term used to indicate a service provided directly by means of an ATS surveillance system.

**ATC SURVEILLANCE SOURCE**– Used by ATC for establishing identification, control and separation using a target depicted on an air traffic control facility’s video display that has met the relevant safety standards for operational use and received from one, or a combination, of the following surveillance sources:

- a. Radar (See RADAR.)
- b. ADS-B (See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST.)
- c. WAM (See WIDE AREA MULTILATERATION.)  
(See INTERROGATOR.)  
(See TRANSPONDER.)  
(See ICAO term RADAR.)  
(Refer to AIM.)

**ATS SURVEILLANCE SYSTEM [ICAO]**– A generic term meaning variously, ADS–B, PSR, SSR or any comparable ground–based system that enables the identification of aircraft.

**Note:** A comparable ground–based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level

of safety and performance equal to or better than monopulse SSR.

**ATCAA**–  
(See ATC ASSIGNED AIRSPACE.)

**ATCRBS**–  
(See RADAR.)

**ATCSCC**–  
(See AIR TRAFFIC CONTROL SYSTEM  
COMMAND CENTER.)

**ATCT**–  
(See TOWER.)

**ATD**–  
(See ALONG–TRACK DISTANCE.)

**ATIS**–  
(See AUTOMATIC TERMINAL INFORMATION  
SERVICE.)

**ATIS [ICAO]**–  
(See ICAO Term AUTOMATIC TERMINAL  
INFORMATION SERVICE.)

**ATS ROUTE [ICAO]**– A specified route designed for channeling the flow of traffic as necessary for the provision of air traffic services.

**Note:** The term “ATS Route” is used to mean variously, airway, advisory route, controlled or uncontrolled route, arrival or departure, etc.

**ATTENTION ALL USERS PAGE (AAUP)**– The AAUP provides the pilot with additional information relative to conducting a specific operation, for example, PRM approaches and RNAV departures.

**AUTOLAND APPROACH**–An autoland system aids by providing control of aircraft systems during a precision instrument approach to at least decision altitude and possibly all the way to touchdown, as well as in some cases, through the landing rollout. The autoland system is a sub-system of the autopilot system from which control surface management occurs. The aircraft autopilot sends instructions to the autoland system and monitors the autoland system performance and integrity during its execution.

**AUTOMATED INFORMATION TRANSFER (AIT)**– A precoordinated process, specifically defined in facility directives, during which a transfer of altitude control and/or radar identification is accomplished without verbal coordination between controllers using information communicated in a full data block.

**AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM**– A facility which can deliver, in

a matter of minutes, a surface picture (SURPIC) of vessels in the area of a potential or actual search and rescue incident, including their predicted positions and their characteristics.

(See FAA Order JO 7110.65, Para 10-6-4, INFLIGHT CONTINGENCIES.)

**AUTOMATED PROBLEM DETECTION (APD)**– An Automation Processing capability that compares trajectories in order to predict conflicts.

**AUTOMATED PROBLEM DETECTION BOUNDARY (APB)**– The adapted distance beyond a facilities boundary defining the airspace within which EDST performs conflict detection.

(See EN ROUTE DECISION SUPPORT TOOL.)

**AUTOMATED PROBLEM DETECTION INHIBITED AREA (APDIA)**– Airspace surrounding a terminal area within which APD is inhibited for all flights within that airspace.

**AUTOMATED 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, program-mable 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 IIIIE; and ARTS IIIIE with ACD (see DTAS) which combines functionalities of the previous ARTS systems.

**AUTOMATED WEATHER SYSTEM**– Any of the automated weather sensor platforms that collect weather data at airports and disseminate the weather information via radio and/or landline. The systems currently consist of the Automated Surface Observing System (ASOS) and Automated Weather Observation System (AWOS).

**AUTOMATED UNICOM**– Provides completely automated weather, radio check capability and airport

advisory information on an Automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the UNICOM frequency. Availability will be published in the Chart Supplement U.S. and approach charts.

**AUTOMATIC ALTITUDE REPORT**–  
(See ALTITUDE READOUT.)

**AUTOMATIC ALTITUDE REPORTING**– That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

**AUTOMATIC CARRIER LANDING SYSTEM**– U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

**AUTOMATIC DEPENDENT SURVEILLANCE (ADS) [ICAO]**– A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position fixing systems, including aircraft identification, four dimensional position and additional data as appropriate.

**AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST (ADS-B)**– A surveillance system in which an aircraft or vehicle to be detected is fitted with cooperative equipment in the form of a data link transmitter. The aircraft or vehicle periodically broadcasts its GNSS-derived position and other required information such as identity and velocity, which is then received by a ground-based or space-based receiver for processing and display at an air traffic control facility, as well as by suitably equipped aircraft.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT.)

(See COOPERATIVE SURVEILLANCE.)

(See GLOBAL POSITIONING SYSTEM.)

(See SPACE–BASED ADS–B.)

**AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN (ADS–B In)**– Aircraft avionics capable of receiving ADS–B Out transmissions directly from other aircraft, as well as traffic or

weather information transmitted from ground stations.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–REBROADCAST.)

(See FLIGHT INFORMATION SERVICE–BROADCAST.)

(See TRAFFIC INFORMATION SERVICE–BROADCAST.)

**AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT (ADS–B Out)**– The transmitter onboard an aircraft or ground vehicle that periodically broadcasts its GNSS–derived position along with other required information, such as identity, altitude, and velocity.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN.)

**AUTOMATIC DEPENDENT SURVEILLANCE–CONTRACT (ADS–C)**– A data link position reporting system, controlled by a ground station, that establishes contracts with an aircraft’s avionics that occur automatically whenever specific events occur, or specific time intervals are reached.

**AUTOMATIC DEPENDENT SURVEILLANCE–REBROADCAST (ADS–R)**– A datalink translation function of the ADS–B ground system required to accommodate the two separate operating frequencies (978 MHz and 1090 MHz). The ADS–B system receives the ADS–B messages transmitted on one frequency and ADS–R translates and reformats the information for rebroadcast and use on the other frequency. This allows ADS–B In equipped aircraft to see nearby ADS–B Out traffic regardless of the operating link of the other aircraft. Aircraft operating on the same ADS–B frequency exchange information directly and do not require the ADS–R translation function.

**AUTOMATIC DIRECTION FINDER**– An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may

be based on airborne and ground transmitters in the VHF/UHF frequency spectrum.

(See BEARING.)

(See NONDIRECTIONAL BEACON.)

**AUTOMATIC FLIGHT INFORMATION SERVICE (AFIS) – ALASKA FSSs ONLY**– The continuous broadcast of recorded non–control information at airports in Alaska where a FSS provides local airport advisory service. The AFIS broadcast automates the repetitive transmission of essential but routine information such as weather, wind, altimeter, favored runway, braking action, airport NOTAMs, and other applicable information. The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS/AWOS frequency).

**AUTOMATIC TERMINAL INFORMATION SERVICE**– The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g., “Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa.”

(See ICAO term AUTOMATIC TERMINAL INFORMATION SERVICE.)

(Refer to AIM.)

**AUTOMATIC TERMINAL INFORMATION SERVICE [ICAO]**– The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

**AUTOROTATION**– A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

**a. Autorotative Landing/Touchdown Autorotation.** Used by a pilot to indicate that the landing will be made without applying power to the rotor.

**b. Low Level Autorotation.** Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.

c. 180 degrees Autorotation. Initiated from a downwind heading and is commenced well inside the normal traffic pattern. "Go around" may not be possible during the latter part of this maneuver.

**AVAILABLE LANDING DISTANCE (ALD)**– The portion of a runway available for landing and roll-out for aircraft cleared for LAHSO. This distance is measured from the landing threshold to the hold-short point.

**AVIATION WEATHER SERVICE**– A service provided by the National Weather Service (NWS) and

FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS.

(See TRANSCRIBED WEATHER BROADCAST.)

(See WEATHER ADVISORY.)

(Refer to AIM.)

**AWW**–

(See SEVERE WEATHER FORECAST ALERTS.)





# C

**CALCULATED LANDING TIME**– A term that may be used in place of tentative or actual calculated landing time, whichever applies.

**CALL FOR RELEASE**– Wherein the overlying ARTCC requires a terminal facility to initiate verbal coordination to secure ARTCC approval for release of a departure into the en route environment.

**CALL UP**– Initial voice contact between a facility and an aircraft, using the identification of the unit being called and the unit initiating the call.

(Refer to AIM.)

**CANADIAN MINIMUM NAVIGATION PERFORMANCE SPECIFICATION AIRSPACE**– That portion of Canadian domestic airspace within which MNPS separation may be applied.

**CARDINAL ALTITUDES**– “Odd” or “Even” thousand-foot altitudes or flight levels; e.g., 5,000, 6,000, 7,000, FL 250, FL 260, FL 270.

(See ALTITUDE.)

(See FLIGHT LEVEL.)

**CARDINAL FLIGHT LEVELS**–

(See CARDINAL ALTITUDES.)

**CAT**–

(See CLEAR-AIR TURBULENCE.)

**CATCH POINT**– A fix/waypoint that serves as a transition point from the high altitude waypoint navigation structure to an arrival procedure (STAR) or the low altitude ground-based navigation structure.

**CEILING**– The heights above the earth’s surface of the lowest layer of clouds or obscuring phenomena that is reported as “broken,” “overcast,” or “obscuration,” and not classified as “thin” or “partial.”

(See ICAO term CEILING.)

**CEILING [ICAO]**– The height above the ground or water of the base of the lowest layer of cloud below 6,000 meters (20,000 feet) covering more than half the sky.

**CENRAP**–

(See CENTER RADAR ARTS PRESENTATION/PROCESSING.)

**CENRAP-PLUS**–

(See CENTER RADAR ARTS PRESENTATION/PROCESSING-PLUS.)

**CENTER**–

(See AIR ROUTE TRAFFIC CONTROL CENTER.)

**CENTER’S AREA**– The specified airspace within which an air route traffic control center (ARTCC) provides air traffic control and advisory service.

(See AIR ROUTE TRAFFIC CONTROL CENTER.)

(Refer to AIM.)

**CENTER RADAR ARTS PRESENTATION/PROCESSING**– A computer program developed to provide a back-up system for airport surveillance radar in the event of a failure or malfunction. The program uses air route traffic control center radar for the processing and presentation of data on the ARTS IIA or IIIA displays.

**CENTER RADAR ARTS PRESENTATION/PROCESSING-PLUS**– A computer program developed to provide a back-up system for airport surveillance radar in the event of a terminal secondary radar system failure. The program uses a combination of Air Route Traffic Control Center Radar and terminal airport surveillance radar primary targets displayed simultaneously for the processing and presentation of data on the ARTS IIA or IIIA displays.

**CENTER TRACON AUTOMATION SYSTEM (CTAS)**– A computerized set of programs designed to aid Air Route Traffic Control Centers and TRACONS in the management and control of air traffic.

**CENTER WEATHER ADVISORY**– An unscheduled weather advisory issued by Center Weather Service Unit meteorologists for ATC use to alert pilots of existing or anticipated adverse weather conditions within the next 2 hours. A CWA may modify or redefine a SIGMET.

(See AWW.)

(See AIRMET.)

(See CONVECTIVE SIGMET.)

(See SIGMET.)

(Refer to AIM.)

**CENTRAL EAST PACIFIC**– An organized route system between the U.S. West Coast and Hawaii.

**CEP**–

(See **CENTRAL EAST PACIFIC**.)

**CERAP**–

(See **COMBINED CENTER-RAPCON**.)

**CERTIFIED TOWER RADAR DISPLAY (CTRD)**– An FAA radar display certified for use in the NAS.

**CFR**–

(See **CALL FOR RELEASE**.)

**CHA**

(See **CONTINGENCY HAZARD AREA**)

**CHAFF**– Thin, narrow metallic reflectors of various lengths and frequency responses, used to reflect radar energy. These reflectors, when dropped from aircraft and allowed to drift downward, result in large targets on the radar display.

**CHART SUPPLEMENT U.S.**– A publication designed primarily as a pilot's operational manual containing all airports, seaplane bases, and heliports open to the public including communications data, navigational facilities, and certain special notices and procedures. This publication is issued in seven volumes according to geographical area.

**CHARTED VFR FLYWAYS**– Charted VFR Flyways are flight paths recommended for use to bypass areas heavily traversed by large turbine-powered aircraft. Pilot compliance with recommended flyways and associated altitudes is strictly voluntary. VFR Flyway Planning charts are published on the back of existing VFR Terminal Area charts.

**CHARTED VISUAL FLIGHT PROCEDURE APPROACH**– An approach conducted while operating on an instrument flight rules (IFR) flight plan which authorizes the pilot of an aircraft to proceed visually and clear of clouds to the airport via visual landmarks and other information depicted on a charted visual flight procedure. This approach must be authorized and under the control of the appropriate air traffic control facility. Weather minimums required are depicted on the chart.

**CHASE**– An aircraft flown in proximity to another aircraft normally to observe its performance during training or testing.

**CHASE AIRCRAFT**–

(See **CHASE**.)

**CHOP**– A form of turbulence.

**a. Light Chop**– Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude.

**b. Moderate Chop**– Turbulence similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude.

(See **TURBULENCE**.)

**CIRCLE-TO-LAND MANEUVER**– A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable. At tower controlled airports, this maneuver is made only after ATC authorization has been obtained and the pilot has established required visual reference to the airport.

(See **CIRCLE TO RUNWAY**.)

(See **LANDING MINIMUMS**.)

(Refer to **AIM**.)

***CIRCLE TO RUNWAY (RUNWAY NUMBER)***–

Used by ATC to inform the pilot that he/she must circle to land because the runway in use is other than the runway aligned with the instrument approach procedure. When the direction of the circling maneuver in relation to the airport/runway is required, the controller will state the direction (eight cardinal compass points) and specify a left or right downwind or base leg as appropriate; e.g., “Cleared VOR Runway Three Six Approach circle to Runway Two Two,” or “Circle northwest of the airport for a right downwind to Runway Two Two.”

(See **CIRCLE-TO-LAND MANEUVER**.)

(See **LANDING MINIMUMS**.)

(Refer to **AIM**.)

**CIRCLING APPROACH**–

(See **CIRCLE-TO-LAND MANEUVER**.)

**CIRCLING MANEUVER**–

(See **CIRCLE-TO-LAND MANEUVER**.)

**CIRCLING MINIMA**–

(See **LANDING MINIMUMS**.)

**CLASS A AIRSPACE**–

(See **CONTROLLED AIRSPACE**.)

**CLASS B AIRSPACE**–

(See **CONTROLLED AIRSPACE**.)

**CLASS C AIRSPACE–**

(See CONTROLLED AIRSPACE.)

**CLASS D AIRSPACE–**

(See CONTROLLED AIRSPACE.)

**CLASS E AIRSPACE–**

(See CONTROLLED AIRSPACE.)

**CLASS G AIRSPACE–** Airspace that is not designated in 14 CFR Part 71 as Class A, Class B, Class C, Class D, or Class E controlled airspace is Class G (uncontrolled) airspace.

(See UNCONTROLLED AIRSPACE.)

**CLEAR AIR TURBULENCE (CAT)–** Turbulence encountered in air where no clouds are present. This term is commonly applied to high-level turbulence associated with wind shear. CAT is often encountered in the vicinity of the jet stream.

(See WIND SHEAR.)

(See JET STREAM.)

**CLEAR OF THE RUNWAY–**

**a.** Taxiing aircraft, which is approaching a runway, is clear of the runway when all parts of the aircraft are held short of the applicable runway holding position marking.

**b.** A pilot or controller may consider an aircraft, which is exiting or crossing a runway, to be clear of the runway when all parts of the aircraft are beyond the runway edge and there are no restrictions to its continued movement beyond the applicable runway holding position marking.

**c.** Pilots and controllers shall exercise good judgement to ensure that adequate separation exists between all aircraft on runways and taxiways at airports with inadequate runway edge lines or holding position markings.

**CLEARANCE–**

(See AIR TRAFFIC CLEARANCE.)

**CLEARANCE LIMIT–** The fix, point, or location to which an aircraft is cleared when issued an air traffic clearance.

(See ICAO term CLEARANCE LIMIT.)

**CLEARANCE LIMIT [ICAO]–** The point to which an aircraft is granted an air traffic control clearance.

**CLEARANCE VOID IF NOT OFF BY (TIME)–**

Used by ATC to advise an aircraft that the departure clearance is automatically canceled if takeoff is not made prior to a specified time. The pilot must obtain

a new clearance or cancel his/her IFR flight plan if not off by the specified time.

(See ICAO term CLEARANCE VOID TIME.)

**CLEARANCE VOID TIME [ICAO]–** A time specified by an air traffic control unit at which a clearance ceases to be valid unless the aircraft concerned has already taken action to comply therewith.

**CLEARED APPROACH–** ATC authorization for an aircraft to execute any standard or special instrument approach procedure for that airport. Normally, an aircraft will be cleared for a specific instrument approach procedure.

(See CLEARED (Type of) APPROACH.)

(See INSTRUMENT APPROACH PROCEDURE.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**CLEARED (Type of) APPROACH–** ATC authorization for an aircraft to execute a specific instrument approach procedure to an airport; e.g., “Cleared ILS Runway Three Six Approach.”

(See APPROACH CLEARANCE.)

(See INSTRUMENT APPROACH PROCEDURE.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**CLEARED AS FILED–** Means the aircraft is cleared to proceed in accordance with the route of flight filed in the flight plan. This clearance does not include the altitude, DP, or DP Transition.

(See REQUEST FULL ROUTE CLEARANCE.)

(Refer to AIM.)

**CLEARED FOR TAKEOFF–** ATC authorization for an aircraft to depart. It is predicated on known traffic and known physical airport conditions.

**CLEARED FOR THE OPTION–** ATC authorization for an aircraft to make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot. It is normally used in training so that an instructor can evaluate a student’s performance under changing situations. Pilots should advise ATC if they decide to remain on the runway, of any delay in their stop and go, delay clearing the runway, or are unable to comply with the instruction(s).

(See OPTION APPROACH.)

(Refer to AIM.)

**CLEARED THROUGH**– ATC authorization for an aircraft to make intermediate stops at specified airports without refiling a flight plan while en route to the clearance limit.

**CLEARED TO LAND**– ATC authorization for an aircraft to land. It is predicated on known traffic and known physical airport conditions.

**CLEARWAY**– An area beyond the takeoff runway under the control of airport authorities within which terrain or fixed obstacles may not extend above specified limits. These areas may be required for certain turbine-powered operations and the size and upward slope of the clearway will differ depending on when the aircraft was certificated.

(Refer to 14 CFR Part 1.)

**CLIMB TO VFR**– ATC authorization for an aircraft to climb to VFR conditions within Class B, C, D, and E surface areas when the only weather limitation is restricted visibility. The aircraft must remain clear of clouds while climbing to VFR.

(See SPECIAL VFR CONDITIONS.)

(Refer to AIM.)

**CLIMBOUT**– That portion of flight operation between takeoff and the initial cruising altitude.

**CLIMB VIA**– An abbreviated ATC clearance that requires compliance with the procedure lateral path, associated speed restrictions, and altitude restrictions along the cleared route or procedure.

**CLOSE PARALLEL RUNWAYS**– Two parallel runways whose extended centerlines are separated by less than 4,300 feet and at least 3000 feet (750 feet for SOIA operations) for which ATC is authorized to conduct simultaneous independent approach operations. PRM and simultaneous close parallel appear in approach title. Dual communications, special pilot training, an Attention All Users Page (AAUP), NTZ monitoring by displays that have aural and visual alerting algorithms are required. A high update rate surveillance sensor is required for certain runway or approach course spacing.

**CLOSED RUNWAY**– A runway that is unusable for aircraft operations. Only the airport management/military operations office can close a runway.

**CLOSED TRAFFIC**– Successive operations involving takeoffs and landings or low approaches where the aircraft does not exit the traffic pattern.

**CLOUD**– A cloud is a visible accumulation of minute water droplets and/or ice particles in the atmosphere above the Earth's surface. Cloud differs from ground fog, fog, or ice fog only in that the latter are, by definition, in contact with the Earth's surface.

**CLT**–

(See CALCULATED LANDING TIME.)

**CLUTTER**– In radar operations, clutter refers to the reception and visual display of radar returns caused by precipitation, chaff, terrain, numerous aircraft targets, or other phenomena. Such returns may limit or preclude ATC from providing services based on radar.

(See CHAFF.)

(See GROUND CLUTTER.)

(See PRECIPITATION.)

(See TARGET.)

(See ICAO term RADAR CLUTTER.)

**CMNPS**–

(See CANADIAN MINIMUM NAVIGATION PERFORMANCE SPECIFICATION AIRSPACE.)

**COASTAL FIX**– A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

**CODES**– The number assigned to a particular multiple pulse reply signal transmitted by a transponder.

(See DISCRETE CODE.)

**COLD TEMPERATURE COMPENSATION**– An action on the part of the pilot to adjust an aircraft's indicated altitude due to the effect of cold temperatures on true altitude above terrain versus aircraft indicated altitude. The amount of compensation required increases at a greater rate with a decrease in temperature and increase in height above the reporting station.

**COLLABORATIVE TRAJECTORY OPTIONS PROGRAM (CTOP)**– CTOP is a traffic management program administered by the Air Traffic Control System Command Center (ATCSCC) that manages demand through constrained airspace, while considering operator preference with regard to both route and delay as defined in a Trajectory Options Set (TOS).

**COMBINED CENTER-RAPCON**– An air traffic facility which combines the functions of an ARTCC and a radar approach control facility.

(See AIR ROUTE TRAFFIC CONTROL CENTER.)

(See RADAR APPROACH CONTROL FACILITY.)

**COMMON POINT**– A significant point over which two or more aircraft will report passing or have reported passing before proceeding on the same or diverging tracks. To establish/maintain longitudinal separation, a controller may determine a common point not originally in the aircraft's flight plan and then clear the aircraft to fly over the point.

(See SIGNIFICANT POINT.)

**COMMON PORTION**–

(See COMMON ROUTE.)

**COMMON ROUTE**– That segment of a North American Route between the inland navigation facility and the coastal fix.

## OR

**COMMON ROUTE**– Typically the portion of a RNAV STAR between the en route transition end point and the runway transition start point; however, the common route may only consist of a single point that joins the en route and runway transitions.

**COMMON TRAFFIC ADVISORY FREQUENCY (CTAF)**– A frequency designed for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, Multicom, FSS, or tower frequency and is identified in appropriate aeronautical publications.

(See DESIGNATED COMMON TRAFFIC ADVISORY FREQUENCY (CTAF) AREA.)

(Refer to AC 90-42, Traffic Advisory Practices at Airports Without Operating Control Towers.)

**COMPASS LOCATOR**– A low power, low or medium frequency (L/MF) radio beacon installed at the site of the outer or middle marker of an instrument landing system (ILS). It can be used for navigation at distances of approximately 15 miles or as authorized in the approach procedure.

**a. Outer Compass Locator (LOM)**– A compass locator installed at the site of the outer marker of an instrument landing system.

(See OUTER MARKER.)

**b. Middle Compass Locator (LMM)**– A compass locator installed at the site of the middle marker of an instrument landing system.

(See MIDDLE MARKER.)

(See ICAO term LOCATOR.)

**COMPASS ROSE**– A circle, graduated in degrees, printed on some charts or marked on the ground at an airport. It is used as a reference to either true or magnetic direction.

**COMPLY WITH RESTRICTIONS**– An ATC instruction that requires an aircraft being vectored back onto an arrival or departure procedure to comply with all altitude and/or speed restrictions depicted on the procedure. This term may be used in lieu of repeating each remaining restriction that appears on the procedure.

**COMPOSITE FLIGHT PLAN**– A flight plan which specifies VFR operation for one portion of flight and IFR for another portion. It is used primarily in military operations.

(Refer to AIM.)

**COMPULSORY REPORTING POINTS**– Reporting points which must be reported to ATC. They are designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes. These points are geographical locations which are defined by navigation aids/fixes. Pilots should discontinue position reporting over compulsory reporting points when informed by ATC that their aircraft is in “radar contact.”

**COMPUTER NAVIGATION FIX (CNF)**– A Computer Navigation Fix is a point defined by a latitude/longitude coordinate and is required to support Performance-Based Navigation (PBN) operations. A five-letter identifier denoting a CNF can be found next to an “x” on en route charts and on some approach charts. Eventually, all CNFs will be labeled and begin with the letters “CF” followed by three consonants (e.g., ‘CFWBG’). CNFs are not recognized by ATC, are not contained in ATC fix or automation databases, and are not used for ATC purposes. Pilots should not use CNFs for point-to-point navigation (e.g., proceed direct), filing a flight plan, or in aircraft/ATC communications. Use of CNFs has not been adopted or recognized by the International Civil Aviation Organization (ICAO).

(REFER to AIM 1-1-17b5(i)(2), Global Positioning System (GPS).)

**CONDITIONS NOT MONITORED**– When an airport operator cannot monitor the condition of the movement area or airfield surface area, this information is issued as a NOTAM. Usually necessitated due to staffing, operating hours or other mitigating factors associated with airport operations.

**CONFIDENCE MANEUVER**– A confidence maneuver consists of one or more turns, a climb or descent, or other maneuver to determine if the pilot in command (PIC) is able to receive and comply with ATC instructions.

**CONFLICT ALERT**– A function of certain air traffic control automated systems designed to alert radar controllers to existing or pending situations between tracked targets (known IFR or VFR aircraft) that require his/her immediate attention/action.

(See **MODE C INTRUDER ALERT**.)

**CONFLICT RESOLUTION**– The resolution of potential conflicts between aircraft that are radar identified and in communication with ATC by ensuring that radar targets do not touch. Pertinent traffic advisories shall be issued when this procedure is applied.

**Note:** This procedure shall not be provided utilizing mosaic radar systems.

**CONFORMANCE**– The condition established when an aircraft's actual position is within the conformance region constructed around that aircraft at its position, according to the trajectory associated with the aircraft's Current Plan.

**CONFORMANCE REGION**– A volume, bounded laterally, vertically, and longitudinally, within which an aircraft must be at a given time in order to be in conformance with the Current Plan Trajectory for that aircraft. At a given time, the conformance region is determined by the simultaneous application of the lateral, vertical, and longitudinal conformance bounds for the aircraft at the position defined by time and aircraft's trajectory.

**CONSOLAN**– A low frequency, long-distance NAVAID used principally for transoceanic navigations.

**CONTACT**–

**a.** Establish communication with (followed by the name of the facility and, if appropriate, the frequency to be used).

**b.** A flight condition wherein the pilot ascertains the attitude of his/her aircraft and navigates by visual reference to the surface.

(See **CONTACT APPROACH**.)

(See **RADAR CONTACT**.)

**CONTACT APPROACH**– An approach wherein an aircraft on an IFR flight plan, having an air traffic control authorization, operating clear of clouds with at least 1 mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, may deviate from the instrument approach procedure and proceed to the destination airport by visual reference to the surface. This approach will only be authorized when requested by the pilot and the reported ground visibility at the destination airport is at least 1 statute mile.

(Refer to **AIM**.)

**CONTAMINATED RUNWAY**– A runway is considered contaminated whenever standing water, ice, snow, slush, frost in any form, heavy rubber, or other substances are present. A runway is contaminated with respect to rubber deposits or other friction-degrading substances when the average friction value for any 500-foot segment of the runway within the ALD fails below the recommended minimum friction level and the average friction value in the adjacent 500-foot segments falls below the maintenance planning friction level.

**CONTERMINOUS U.S.**– The 48 adjoining States and the District of Columbia.

**CONTINENTAL UNITED STATES**– The 49 States located on the continent of North America and the District of Columbia.

**CONTINGENCY HAZARD AREA (CHA)**– Used by ATC. Areas of airspace that are defined and distributed in advance of a launch or reentry operation and are activated in response to a failure.

(See **AIRCRAFT HAZARD AREA**.)

(See **REFINED HAZARD AREA**.)

(See **TRANSITIONAL HAZARD AREA**.)

**CONTINUE**– When used as a control instruction should be followed by another word or words clarifying what is expected of the pilot. Example: “continue taxi,” “continue descent,” “continue inbound,” etc.

**CONTROL AREA [ICAO]**– A controlled airspace extending upwards from a specified limit above the earth.

**CONTROL SECTOR**– An airspace area of defined horizontal and vertical dimensions for which a controller or group of controllers has air traffic control responsibility, normally within an air route traffic control center or an approach control facility. Sectors are established based on predominant traffic flows, altitude strata, and controller workload. Pilot communications during operations within a sector are normally maintained on discrete frequencies assigned to the sector.

(See **DISCRETE FREQUENCY**.)

**CONTROL SLASH**– A radar beacon slash representing the actual position of the associated aircraft. Normally, the control slash is the one closest to the interrogating radar beacon site. When ARTCC radar is operating in narrowband (digitized) mode, the control slash is converted to a target symbol.

**CONTROLLED AIRSPACE**– An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

**a.** Controlled airspace is a generic term that covers Class A, Class B, Class C, Class D, and Class E airspace.

**b.** Controlled airspace is also that airspace within which all aircraft operators are subject to certain pilot qualifications, operating rules, and equipment requirements in 14 CFR Part 91 (for specific operating requirements, please refer to 14 CFR Part 91). For IFR operations in any class of controlled airspace, a pilot must file an IFR flight plan and receive an appropriate ATC clearance. Each Class B, Class C, and Class D airspace area designated for an airport contains at least one primary airport around which the airspace is designated (for specific designations and descriptions of the airspace classes, please refer to 14 CFR Part 71).

**c.** Controlled airspace in the United States is designated as follows:

**1. CLASS A**– Generally, that airspace from 18,000 feet MSL up to and including FL 600, including the airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska. Unless otherwise authorized, all persons must operate their aircraft under IFR.

**2. CLASS B**– Generally, that airspace from the surface to 10,000 feet MSL surrounding the nation's busiest airports in terms of airport operations or passenger enplanements. The configuration of each

Class B airspace area is individually tailored and consists of a surface area and two or more layers (some Class B airspace areas resemble upside-down wedding cakes), and is designed to contain all published instrument procedures once an aircraft enters the airspace. An ATC clearance is required for all aircraft to operate in the area, and all aircraft that are so cleared receive separation services within the airspace. The cloud clearance requirement for VFR operations is "clear of clouds."

**3. CLASS C**– Generally, that airspace from the surface to 4,000 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower, are serviced by a radar approach control, and that have a certain number of IFR operations or passenger enplanements. Although the configuration of each Class C area is individually tailored, the airspace usually consists of a surface area with a 5 nautical mile (NM) radius, a circle with a 10NM radius that extends no lower than 1,200 feet up to 4,000 feet above the airport elevation, and an outer area that is not charted. Each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while within the airspace. VFR aircraft are only separated from IFR aircraft within the airspace.

(See **OUTER AREA**.)

**4. CLASS D**– Generally, that airspace from the surface to 2,500 feet above the airport elevation (charted in MSL) surrounding those airports that have an operational control tower. The configuration of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures. Arrival extensions for instrument approach procedures may be Class D or Class E airspace. Unless otherwise authorized, each person must establish two-way radio communications with the ATC facility providing air traffic services prior to entering the airspace and thereafter maintain those communications while in the airspace. No separation services are provided to VFR aircraft.

**5. CLASS E**– Generally, if the airspace is not Class A, Class B, Class C, or Class D, and it is controlled airspace, it is Class E airspace. Class E airspace extends upward from either the surface or a designated altitude to the overlying or adjacent controlled airspace. When designated as a surface

area, the airspace will be configured to contain all instrument procedures. Also in this class are Federal airways, airspace beginning at either 700 or 1,200 feet AGL used to transition to/from the terminal or en route environment, en route domestic, and offshore airspace areas designated below 18,000 feet MSL. Unless designated at a lower altitude, Class E airspace begins at 14,500 MSL over the United States, including that airspace overlying the waters within 12 nautical miles of the coast of the 48 contiguous States and Alaska, up to, but not including 18,000 feet MSL, and the airspace above FL 600.

**CONTROLLED AIRSPACE [ICAO]**– An airspace of defined dimensions within which air traffic control service is provided to IFR flights and to VFR flights in accordance with the airspace classification.

Note: Controlled airspace is a generic term which covers ATS airspace Classes A, B, C, D, and E.

**CONTROLLED TIME OF ARRIVAL**– Arrival time assigned during a Traffic Management Program. This time may be modified due to adjustments or user options.

**CONTROLLER**–

(See AIR TRAFFIC CONTROL SPECIALIST.)

**CONTROLLER [ICAO]**– A person authorized to provide air traffic control services.

**CONTROLLER PILOT DATA LINK COMMUNICATIONS (CPDLC)**– A two-way digital communications system that conveys textual air traffic control messages between controllers and pilots using ground or satellite-based radio relay stations.

**CONVECTIVE SIGMET**– A weather advisory concerning convective weather significant to the safety of all aircraft. Convective SIGMETs are issued for tornadoes, lines of thunderstorms, embedded thunderstorms of any intensity level, areas of thunderstorms greater than or equal to VIP level 4 with an area coverage of  $\frac{4}{10}$  (40%) or more, and hail  $\frac{3}{4}$  inch or greater.

(See AIRMET.)

(See AWW.)

(See CWA.)

(See SIGMET.)

(Refer to AIM.)

**CONVECTIVE SIGNIFICANT METEOROLOGICAL INFORMATION**–

(See CONVECTIVE SIGMET.)

**COOPERATIVE SURVEILLANCE**– Any surveillance system, such as secondary surveillance radar (SSR), wide-area multilateration (WAM), or ADS-B, that is dependent upon the presence of certain equipment onboard the aircraft or vehicle to be detected.

(See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST.)

(See NON-COOPERATIVE SURVEILLANCE.)

(See RADAR.)

(See WIDE AREA MULTILATERATION.)

**COORDINATES**– The intersection of lines of reference, usually expressed in degrees/minutes/seconds of latitude and longitude, used to determine position or location.

**COORDINATION FIX**– The fix in relation to which facilities will handoff, transfer control of an aircraft, or coordinate flight progress data. For terminal facilities, it may also serve as a clearance for arriving aircraft.

**COPTER**–

(See HELICOPTER.)

**CORRECTION**– An error has been made in the transmission and the correct version follows.

**COUPLED APPROACH**– An instrument approach performed by the aircraft autopilot, and/or visually depicted on the flight director, which is receiving position information and/or steering commands from onboard navigational equipment. In general, coupled non-precision approaches must be flown manually (autopilot disengaged) at altitudes lower than 50 feet AGL below the minimum descent altitude, and coupled precision approaches must be flown manually (autopilot disengaged) below 50 feet AGL unless authorized to conduct autoland operations. Coupled instrument approaches are commonly flown to the allowable IFR weather minima established by the operator or PIC, or flown VFR for training and safety.

**COURSE**–

a. The intended direction of flight in the horizontal plane measured in degrees from north.



**b.** The ILS localizer signal pattern usually specified as the front course or the back course.

(See BEARING.)

(See INSTRUMENT LANDING SYSTEM.)

(See RADIAL.)

CPDLC–

(See CONTROLLER PILOT DATA LINK COMMUNICATIONS.)

CPL [ICAO]–

(See ICAO term CURRENT FLIGHT PLAN.)

**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.)

**CTOP**–

(See COLLABORATIVE TRAJECTORY OPTIONS PROGRAM)

**CTRD**–

(See CERTIFIED TOWER RADAR DISPLAY.)

**CURRENT FLIGHT PLAN [ICAO]**– The flight plan, including changes, if any, brought about by subsequent clearances.

**CURRENT PLAN**– The ATC clearance the aircraft has received and is expected to fly.

**CVFP APPROACH**–

(See CHARTED VISUAL FLIGHT PROCEDURE APPROACH.)

**CWA**–

(See CENTER WEATHER ADVISORY and WEATHER ADVISORY.)

and position reporting. Separation between aircraft within the formation is the responsibility of the flight leader and the pilots of the other aircraft in the flight. This includes transition periods when aircraft within the formation are maneuvering to attain separation from each other to effect individual control and during join-up and breakaway.

**a.** A standard formation is one in which a proximity of no more than 1 mile laterally or longitudinally and within 100 feet vertically from the flight leader is maintained by each wingman.

**b.** Nonstandard formations are those operating under any of the following conditions:

**1.** When the flight leader has requested and ATC has approved other than standard formation dimensions.

**2.** When operating within an authorized altitude reservation (ALTRV) or under the provisions of a letter of agreement.

**3.** When the operations are conducted in airspace specifically designed for a special activity.  
(See ALTITUDE RESERVATION.)  
(Refer to 14 CFR Part 91.)

***FRC***–

(See REQUEST FULL ROUTE CLEARANCE.)

**FREEZE/FROZEN**– Terms used in referring to arrivals which have been assigned ACLTs and to the lists in which they are displayed.

**FREEZE CALCULATED LANDING TIME**– A dynamic parameter number of minutes prior to the meter fix calculated time of arrival for each aircraft when the TCLT is frozen and becomes an ACLT (i.e., the VTA is updated and consequently the TCLT is modified as appropriate until FCLT minutes prior to meter fix calculated time of arrival, at which time updating is suspended and an ACLT and a frozen meter fix crossing time (MFT) is assigned).

**FREEZE HORIZON**– The time or point at which an aircraft's STA becomes fixed and no longer fluctuates with each radar update. This setting ensures a constant time for each aircraft, necessary for the metering controller to plan his/her delay technique. This setting can be either in distance from the meter fix or a prescribed flying time to the meter fix.

**FREEZE SPEED PARAMETER**– A speed adapted for each aircraft to determine fast and slow aircraft.

Fast aircraft freeze on parameter FCLT and slow aircraft freeze on parameter MLDI.

**FRICITION MEASUREMENT**– A measurement of the friction characteristics of the runway pavement surface using continuous self-watering friction measurement equipment in accordance with the specifications, procedures and schedules contained in AC 150/5320–12, Measurement, Construction, and Maintenance of Skid Resistant Airport Pavement Surfaces.

**FSDO**–

(See FLIGHT STANDARDS DISTRICT OFFICE.)

**FSPD**–

(See FREEZE SPEED PARAMETER.)

**FSS**–

(See FLIGHT SERVICE STATION.)

**FUEL DUMPING**– Airborne release of usable fuel. This does not include the dropping of fuel tanks.

(See JETTISONING OF EXTERNAL STORES.)

**FUEL REMAINING**– A phrase used by either pilots or controllers when relating to the fuel remaining on board until actual fuel exhaustion. When transmitting such information in response to either a controller question or pilot initiated cautionary advisory to air traffic control, pilots will state the APPROXIMATE NUMBER OF MINUTES the flight can continue with the fuel remaining. All reserve fuel SHOULD BE INCLUDED in the time stated, as should an allowance for established fuel gauge system error.

**FUEL SIPHONING**– Unintentional release of fuel caused by overflow, puncture, loose cap, etc.

**FUEL VENTING**–

(See FUEL SIPHONING.)

**FUSED TARGET**–

(See DIGITAL TARGET)

**FUSION [STARS]**– the combination of all available surveillance sources (airport surveillance radar [ASR], air route surveillance radar [ARSR], ADS-B, etc.) into the display of a single tracked target for air traffic control separation services. FUSION is the equivalent of the current single-sensor radar display. FUSION performance is characteristic of a single-sensor radar display system. Terminal areas use mono-pulse secondary surveillance radar (ASR 9, Mode S or ASR 11, MSSR).



# G

**GATE HOLD PROCEDURES**– Procedures at selected airports to hold aircraft at the gate or other ground location whenever departure delays exceed or are anticipated to exceed 15 minutes. The sequence for departure will be maintained in accordance with initial call-up unless modified by flow control restrictions. Pilots should monitor the ground control/clearance delivery frequency for engine start/taxi advisories or new proposed start/taxi time if the delay changes.

**GCA**–

(See **GROUND CONTROLLED APPROACH**.)

**GDP**–

(See **GROUND DELAY PROGRAM**.)

**GENERAL AVIATION**– That portion of civil aviation that does not include scheduled or unscheduled air carriers or commercial space operations.

(See ICAO term **GENERAL AVIATION**.)

**GENERAL AVIATION [ICAO]**– All civil aviation operations other than scheduled air services and nonscheduled air transport operations for remuneration or hire.

**GEO MAP**– The digitized map markings associated with the ASR-9 Radar System.

**GLIDEPATH**–

(See **GLIDESLOPE**.)

**GLIDEPATH [ICAO]**– A descent profile determined for vertical guidance during a final approach.

**GLIDEPATH INTERCEPT ALTITUDE**–

(See **GLIDESLOPE INTERCEPT ALTITUDE**.)

**GLIDESLOPE**– Provides vertical guidance for aircraft during approach and landing. The glideslope/glidepath is based on the following:

**a.** Electronic components emitting signals which provide vertical guidance by reference to airborne instruments during instrument approaches such as ILS; or,

**b.** Visual ground aids, such as VASI, which provide vertical guidance for a VFR approach or for

the visual portion of an instrument approach and landing.

**c. PAR.** Used by ATC to inform an aircraft making a PAR approach of its vertical position (elevation) relative to the descent profile.

(See ICAO term **GLIDEPATH**.)

**GLIDESLOPE INTERCEPT ALTITUDE**– The published minimum altitude to intercept the glideslope in the intermediate segment of an instrument approach. Government charts use the lightning bolt symbol to identify this intercept point. This intersection is called the Precise Final Approach fix (PFAF). ATC directs a higher altitude, the resultant intercept becomes the PFAF.

(See **FINAL APPROACH FIX**.)

(See **SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE**.)

**GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS)**– GNSS refers collectively to the worldwide positioning, navigation, and timing determination capability available from one or more satellite constellations. A GNSS constellation may be augmented by ground stations and/or geostationary satellites to improve integrity and position accuracy.

(See **GROUND-BASED AUGMENTATION SYSTEM**.)

(See **SATELLITE-BASED AUGMENTATION SYSTEM**.)

**GLOBAL NAVIGATION SATELLITE SYSTEM MINIMUM EN ROUTE IFR ALTITUDE (GNSS MEA)**– The minimum en route IFR altitude on a published ATS route or route segment which assures acceptable Global Navigation Satellite System reception and meets obstacle clearance requirements. (Refer to 14 CFR Part 91.) (Refer to 14 CFR Part 95.)

**GLOBAL POSITIONING SYSTEM (GPS)**– GPS refers to the worldwide positioning, navigation and timing determination capability available from the U.S. satellite constellation. The service provided by GPS for civil use is defined in the GPS Standard Positioning System Performance Standard. GPS is composed of space, control, and user elements.

**GNSS [ICAO]–**

(See GLOBAL NAVIGATION SATELLITE SYSTEM.)

**GNSS MEA–**

(See GLOBAL NAVIGATION SATELLITE SYSTEM MINIMUM EN ROUTE IFR ALTITUDE.)

**GO AHEAD–** Proceed with your message. Not to be used for any other purpose.

**GO AROUND–** Instructions for a pilot to abandon his/her approach to landing. Additional instructions may follow. Unless otherwise advised by ATC, a VFR aircraft or an aircraft conducting visual approach should overfly the runway while climbing to traffic pattern altitude and enter the traffic pattern via the crosswind leg. A pilot on an IFR flight plan making an instrument approach should execute the published missed approach procedure or proceed as instructed by ATC; e.g., “Go around” (additional instructions if required).

(See LOW APPROACH.)

(See MISSED APPROACH.)

**GPD–**

(See GRAPHIC PLAN DISPLAY.)

**GPS–**

(See GLOBAL POSITIONING SYSTEM.)

**GRAPHIC PLAN DISPLAY (GPD)–** A view available with EDST that provides a graphic display of aircraft, traffic, and notification of predicted conflicts. Graphic routes for Current Plans and Trial Plans are displayed upon controller request.

(See EN ROUTE DECISION SUPPORT TOOL.)

**GROSS NAVIGATION ERROR (GNE) –** A lateral deviation from a cleared track, normally in excess of 25 Nautical Miles (NM). More stringent standards (for example, 10NM in some parts of the North Atlantic region) may be used in certain regions to support reductions in lateral separation.

**GROUND BASED AUGMENTATION SYSTEM (GBAS)–** A ground based GNSS station which provides local differential corrections, integrity parameters and approach data via VHF data broadcast to GNSS users to meet real-time performance requirements for CAT I precision approaches. The aircraft applies the broadcast data to improve the accuracy and integrity of its GNSS signals and

computes the deviations to the selected approach. A single ground station can serve multiple runway ends up to an approximate radius of 23 NM.

**GROUND BASED AUGMENTATION SYSTEM (GBAS) LANDING SYSTEM (GLS)–** A type of precision IAP based on local augmentation of GNSS data using a single GBAS station to transmit locally corrected GNSS data, integrity parameters and approach information. This improves the accuracy of aircraft GNSS receivers’ signal in space, enabling the pilot to fly a precision approach with much greater flexibility, reliability and complexity. The GLS procedure is published on standard IAP charts, features the title GLS with the designated runway and minima as low as 200 feet DA. Future plans are expected to support Cat II and CAT III operations.

**GROUND CLUTTER–** A pattern produced on the radar scope by ground returns which may degrade other radar returns in the affected area. The effect of ground clutter is minimized by the use of moving target indicator (MTI) circuits in the radar equipment resulting in a radar presentation which displays only targets which are in motion.

(See CLUTTER.)

**GROUND COMMUNICATION OUTLET (GCO)–** An unstaffed, remotely controlled, ground/ground communications facility. Pilots at uncontrolled airports may contact ATC and FSS via VHF to a telephone connection to obtain an instrument clearance or close a VFR or IFR flight plan. They may also get an updated weather briefing prior to takeoff. Pilots will use four “key clicks” on the VHF radio to contact the appropriate ATC facility or six “key clicks” to contact the FSS. The GCO system is intended to be used only on the ground.

**GROUND CONTROLLED APPROACH–** A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR). Usage of the term “GCA” by pilots is discouraged except when referring to a GCA facility. Pilots should specifically request a “PAR” approach when a precision radar approach is desired or request an “ASR” or “surveillance” approach when a nonprecision radar approach is desired.

(See RADAR APPROACH.)

**GROUND DELAY PROGRAM (GDP)**– A traffic management process administered by the ATCSCC, when aircraft are held on the ground. The purpose of the program is to support the TM mission and limit airborne holding. It is a flexible program and may be implemented in various forms depending upon the needs of the AT system. Ground delay programs provide for equitable assignment of delays to all system users.

**GROUND SPEED**– The speed of an aircraft relative to the surface of the earth.

**GROUND STOP (GS)**– The GS is a process that

requires aircraft that meet a specific criteria to remain on the ground. The criteria may be airport specific, airspace specific, or equipment specific; for example, all departures to San Francisco, or all departures entering Yorktown sector, or all Category I and II aircraft going to Charlotte. GSs normally occur with little or no warning.

**GROUND VISIBILITY**–

(See VISIBILITY.)

**GS**–

(See GROUND STOP.)





# H

## HAA–

(See HEIGHT ABOVE AIRPORT.)

## HAL–

(See HEIGHT ABOVE LANDING.)

**HANDOFF**– An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller’s airspace and radio communications with the aircraft will be transferred.

## HAR–

(See HIGH ALTITUDE REDESIGN.)

## HAT–

(See HEIGHT ABOVE TOUCHDOWN.)

**HAVE NUMBERS**– Used by pilots to inform ATC that they have received runway, wind, and altimeter information only.

## HAZARDOUS WEATHER INFORMATION–

Summary of significant meteorological information (SIGMET/WS), convective significant meteorological information (convective SIGMET/WST), urgent pilot weather reports (urgent PIREP/UUA), center weather advisories (CWA), airmen’s meteorological information (AIRMET/WA) and any other weather such as isolated thunderstorms that are rapidly developing and increasing in intensity, or low ceilings and visibilities that are becoming widespread which is considered significant and are not included in a current hazardous weather advisory.

## HEAVY (AIRCRAFT)–

(See AIRCRAFT CLASSES.)

**HEIGHT ABOVE AIRPORT (HAA)**– The height of the Minimum Descent Altitude above the published airport elevation. This is published in conjunction with circling minimums.

(See MINIMUM DESCENT ALTITUDE.)

**HEIGHT ABOVE LANDING (HAL)**– The height above a designated helicopter landing area used for helicopter instrument approach procedures.

(Refer to 14 CFR Part 97.)

**HEIGHT ABOVE TOUCHDOWN (HAT)**– The height of the Decision Height or Minimum Descent Altitude above the highest runway elevation in the

touchdown zone (first 3,000 feet of the runway). HAT is published on instrument approach charts in conjunction with all straight-in minimums.

(See DECISION HEIGHT.)

(See MINIMUM DESCENT ALTITUDE.)

**HELICOPTER**– A heavier-than-air aircraft supported in flight chiefly by the reactions of the air on one or more power-driven rotors on substantially vertical axes.

**HELIPAD**– A small, designated area, usually with a prepared surface, on a heliport, airport, landing/take-off area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

**HELIPORT**– An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities if any.

**HELIPORT REFERENCE POINT (HRP)**– The geographic center of a heliport.

**HERTZ**– The standard radio equivalent of frequency in cycles per second of an electromagnetic wave. Kilohertz (kHz) is a frequency of one thousand cycles per second. Megahertz (MHz) is a frequency of one million cycles per second.

## HF–

(See HIGH FREQUENCY.)

## HF COMMUNICATIONS–

(See HIGH FREQUENCY COMMUNICATIONS.)

**HIGH ALTITUDE REDESIGN (HAR)**– A level of non-restrictive routing (NRR) service for aircraft that have all waypoints associated with the HAR program in their flight management systems or RNAV equipage.

**HIGH FREQUENCY**– The frequency band between 3 and 30 MHz.

(See HIGH FREQUENCY COMMUNICATIONS.)

**HIGH FREQUENCY COMMUNICATIONS**– High radio frequencies (HF) between 3 and 30 MHz used for air-to-ground voice communication in overseas operations.

## HIGH SPEED EXIT–

(See HIGH SPEED TAXIWAY.)

**HIGH SPEED TAXIWAY**– A long radius taxiway designed and provided with lighting or marking to define the path of aircraft, traveling at high speed (up to 60 knots), from the runway center to a point on the center of a taxiway. Also referred to as long radius exit or turn-off taxiway. The high speed taxiway is designed to expedite aircraft turning off the runway after landing, thus reducing runway occupancy time.

**HIGH SPEED TURNOFF**–

(See HIGH SPEED TAXIWAY.)

**HOLD FOR RELEASE**– Used by ATC to delay an aircraft for traffic management reasons; i.e., weather, traffic volume, etc. Hold for release instructions (including departure delay information) are used to inform a pilot or a controller (either directly or through an authorized relay) that an IFR departure clearance is not valid until a release time or additional instructions have been received.

(See ICAO term HOLDING POINT.)

**HOLD-IN-LIEU OF PROCEDURE TURN**– A hold-in-lieu of procedure turn shall be established over a final or intermediate fix when an approach can be made from a properly aligned holding pattern. The hold-in-lieu of procedure turn permits the pilot to align with the final or intermediate segment of the approach and/or descend in the holding pattern to an altitude that will permit a normal descent to the final approach fix altitude. The hold-in-lieu of procedure turn is a required maneuver (the same as a procedure turn) unless the aircraft is being radar vectored to the final approach course, when “NoPT” is shown on the approach chart, or when the pilot requests or the controller advises the pilot to make a “straight-in” approach.

**HOLD PROCEDURE**– A predetermined maneuver which keeps aircraft within a specified airspace while awaiting further clearance from air traffic control. Also used during ground operations to keep aircraft within a specified area or at a specified point while awaiting further clearance from air traffic control.

(See HOLDING FIX.)

(Refer to AIM.)

**HOLDING FIX**– A specified fix identifiable to a pilot by NAVAIDs or visual reference to the ground

used as a reference point in establishing and maintaining the position of an aircraft while holding.

(See FIX.)

(See VISUAL HOLDING.)

(Refer to AIM.)

**HOLDING POINT [ICAO]**– A specified location, identified by visual or other means, in the vicinity of which the position of an aircraft in flight is maintained in accordance with air traffic control clearances.

**HOLDING PROCEDURE**–

(See HOLD PROCEDURE.)

**HOLD-SHORT POINT**– A point on the runway beyond which a landing aircraft with a LAHSO clearance is not authorized to proceed. This point may be located prior to an intersecting runway, taxiway, predetermined point, or approach/departure flight path.

**HOLD-SHORT POSITION LIGHTS**– Flashing in-pavement white lights located at specified hold-short points.

**HOLD-SHORT POSITION MARKING**– The painted runway marking located at the hold-short point on all LAHSO runways.

**HOLD-SHORT POSITION SIGNS**– Red and white holding position signs located alongside the hold-short point.

**HOMING**– Flight toward a NAVAID, without correcting for wind, by adjusting the aircraft heading to maintain a relative bearing of zero degrees.

(See BEARING.)

(See ICAO term HOMING.)

**HOMING [ICAO]**– The procedure of using the direction-finding equipment of one radio station with the emission of another radio station, where at least one of the stations is mobile, and whereby the mobile station proceeds continuously towards the other station.

**HOVER CHECK**– Used to describe when a helicopter/VTOL aircraft requires a stabilized hover to conduct a performance/power check prior to hover taxi, air taxi, or takeoff. Altitude of the hover will vary based on the purpose of the check.

**HOVER TAXI**– Used to describe a helicopter/VTOL aircraft movement conducted above the surface and in ground effect at airspeeds less than approximately

20 knots. The actual height may vary, and some helicopters may require hover taxi above 25 feet AGL to reduce ground effect turbulence or provide clearance for cargo slingloads.

(See AIR TAXI.)

(See HOVER CHECK.)

(Refer to AIM.)

***HOW DO YOU HEAR ME?***– A question relating to the quality of the transmission or to determine how well the transmission is being received.

HZ–

(See HERTZ.)



# I

***I SAY AGAIN***– The message will be repeated.

**IAF**–

(See INITIAL APPROACH FIX.)

**IAP**–

(See INSTRUMENT APPROACH PROCEDURE.)

**IAWP**– Initial Approach Waypoint

**ICAO**–

(See ICAO Term INTERNATIONAL CIVIL AVIATION ORGANIZATION.)

**ICAO 3LD**–

(See ICAO Term ICAO Three–Letter Designator)

**ICAO Three–Letter Designator (3LD)**– An ICAO 3LD is an exclusive designator that, when used together with a flight number, becomes the aircraft call sign and provides distinct aircraft identification to air traffic control (ATC). ICAO approves 3LDs to enhance the safety and security of the air traffic system. An ICAO 3LD may be assigned to a company, agency, or organization and is used instead of the aircraft registration number for ATC operational and security purposes. An ICAO 3LD is also used for aircraft identification in the flight plan and associated messages and can be used for domestic and international flights. A telephony associated with an ICAO 3LD is used for radio communication.

**ICING**– The accumulation of airframe ice.

Types of icing are:

**a. Rime Ice**– Rough, milky, opaque ice formed by the instantaneous freezing of small supercooled water droplets.

**b. Clear Ice**– A glossy, clear, or translucent ice formed by the relatively slow freezing of large supercooled water droplets.

**c. Mixed**– A mixture of clear ice and rime ice.

Intensity of icing:

**a. Trace**– Ice becomes perceptible. Rate of accumulation is slightly greater than the rate of sublimation. Deicing/anti-icing equipment is not utilized unless encountered for an extended period of time (over 1 hour).

**b. Light**– The rate of accumulation may create a problem if flight is prolonged in this environment (over 1 hour). Occasional use of deicing/anti-icing equipment removes/prevents accumulation. It does not present a problem if the deicing/anti-icing equipment is used.

**c. Moderate**– The rate of accumulation is such that even short encounters become potentially hazardous and use of deicing/anti-icing equipment or flight diversion is necessary.

**d. Severe**– The rate of ice accumulation is such that ice protection systems fail to remove the accumulation of ice, or ice accumulates in locations not normally prone to icing, such as areas aft of protected surfaces and any other areas identified by the manufacturer. Immediate exit from the condition is necessary.

Note:

Severe icing is aircraft dependent, as are the other categories of icing intensity. Severe icing may occur at any ice accumulation rate when the icing rate or ice accumulations exceed the tolerance of the aircraft.

***IDENT***– A request for a pilot to activate the aircraft transponder identification feature. This will help the controller to confirm an aircraft identity or to identify an aircraft.

(Refer to AIM.)

**IDENT FEATURE**– The special feature in the Air Traffic Control Radar Beacon System (ATCRBS) equipment. It is used to immediately distinguish one displayed beacon target from other beacon targets.

(See IDENT.)

**IDENTIFICATION [ICAO]**– The situation which exists when the position indication of a particular aircraft is seen on a situation display and positively identified.

**IF**–

(See INTERMEDIATE FIX.)

***IF NO TRANSMISSION RECEIVED FOR (TIME)***– Used by ATC in radar approaches to prefix procedures which should be followed by the pilot in event of lost communications.

(See LOST COMMUNICATIONS.)

**IFR**–

(See INSTRUMENT FLIGHT RULES.)

**IFR AIRCRAFT**– An aircraft conducting flight in accordance with instrument flight rules.

**IFR CONDITIONS**– Weather conditions below the minimum for flight under visual flight rules.

(See **INSTRUMENT METEOROLOGICAL CONDITIONS**.)

**IFR DEPARTURE PROCEDURE**–

(See **IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES**.)

(Refer to AIM.)

**IFR FLIGHT**–

(See **IFR AIRCRAFT**.)

**IFR LANDING MINIMUMS**–

(See **LANDING MINIMUMS**.)

**IFR MILITARY TRAINING ROUTES (IR)**– Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training in both IFR and VFR weather conditions below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

**IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES**– Title 14 Code of Federal Regulations Part 91, prescribes standard takeoff rules for certain civil users. At some airports, obstructions or other factors require the establishment of nonstandard takeoff minimums, departure procedures, or both to assist pilots in avoiding obstacles during climb to the minimum en route altitude. Those airports are listed in FAA/DOD Instrument Approach Procedures (IAPs) Charts under a section entitled “IFR Takeoff Minimums and Departure Procedures.” The FAA/DOD IAP chart legend illustrates the symbol used to alert the pilot to nonstandard takeoff minimums and departure procedures. When departing IFR from such airports or from any airports where there are no departure procedures, DPs, or ATC facilities available, pilots should advise ATC of any departure limitations. Controllers may query a pilot to determine acceptable departure directions, turns, or headings after takeoff. Pilots should be familiar with the departure procedures and must assure that their aircraft can meet or exceed any specified climb gradients.

**IF/IAWP**– Intermediate Fix/Initial Approach Waypoint. The waypoint where the final approach course of a T approach meets the crossbar of the T. When

designated (in conjunction with a TAA) this waypoint will be used as an IAWP when approaching the airport from certain directions, and as an IFWP when beginning the approach from another IAWP.

**IFWP**– Intermediate Fix Waypoint

**ILS**–

(See **INSTRUMENT LANDING SYSTEM**.)

**ILS CATEGORIES**– 1. Category I. An ILS approach procedure which provides for approach to a height above touchdown of not less than 200 feet and with runway visual range of not less than 1,800 feet.– 2. Special Authorization Category I. An ILS approach procedure which provides for approach to a height above touchdown of not less than 150 feet and with runway visual range of not less than 1,400 feet, HUD to DH. 3. Category II. An ILS approach procedure which provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1,200 feet (with autoland or HUD to touchdown and noted on authorization, RVR 1,000 feet).– 4. Special Authorization Category II with Reduced Lighting. An ILS approach procedure which provides for approach to a height above touchdown of not less than 100 feet and with runway visual range of not less than 1,200 feet with autoland or HUD to touchdown and noted on authorization (no touchdown zone and centerline lighting are required).– 5. Category III:

**a. IIIA.**–An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 700 feet.

**b. IIIB.**–An ILS approach procedure which provides for approach without a decision height minimum and with runway visual range of not less than 150 feet.

**c. IIIC.**–An ILS approach procedure which provides for approach without a decision height minimum and without runway visual range minimum.

**IM**–

(See **INNER MARKER**.)

**IMC**–

(See **INSTRUMENT METEOROLOGICAL CONDITIONS**.)

**IMMEDIATELY**– Used by ATC or pilots when such action compliance is required to avoid an imminent situation.

**INCERFA (Uncertainty Phase) [ICAO]**– A situation wherein uncertainty exists as to the safety of an aircraft and its occupants.

**INCREASED SEPARATION REQUIRED (ISR)**– Indicates the confidence level of the track requires 5NM separation, 3NM separation, 1 1/2NM separation, and target resolution cannot be used.

***INCREASE SPEED TO (SPEED)***–  
(See **SPEED ADJUSTMENT**.)

**INERTIAL NAVIGATION SYSTEM (INS)**– An RNAV system which is a form of self-contained navigation.  
(See **Area Navigation/RNAV**.)

**INFLIGHT REFUELING**–  
(See **AERIAL REFUELING**.)

**INFLIGHT WEATHER ADVISORY**–  
(See **WEATHER ADVISORY**.)

**INFORMATION REQUEST (INREQ)**– A request originated by an FSS for information concerning an overdue VFR aircraft.

**INITIAL APPROACH FIX (IAF)**– The fixes depicted on instrument approach procedure charts that identify the beginning of the initial approach segment(s).  
(See **FIX**.)  
(See **SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE**.)

**INITIAL APPROACH SEGMENT**–  
(See **SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE**.)

**INITIAL APPROACH SEGMENT [ICAO]**– That segment of an instrument approach procedure between the initial approach fix and the intermediate approach fix or, where applicable, the final approach fix or point.

**INLAND NAVIGATION FACILITY**– A navigation aid on a North American Route at which the common route and/or the noncommon route begins or ends.

**INNER MARKER**– A marker beacon used with an ILS (CAT II) precision approach located between the middle marker and the end of the ILS runway, transmitting a radiation pattern keyed at six dots per second and indicating to the pilot, both aurally and visually, that he/she is at the designated decision height (DH), normally 100 feet above the touchdown

zone elevation, on the ILS CAT II approach. It also marks progress during a CAT III approach.  
(See **INSTRUMENT LANDING SYSTEM**.)  
(Refer to **AIM**.)

**INNER MARKER BEACON**–  
(See **INNER MARKER**.)

**INREQ**–  
(See **INFORMATION REQUEST**.)

**INS**–  
(See **INERTIAL NAVIGATION SYSTEM**.)

**INSTRUMENT APPROACH**–  
(See **INSTRUMENT APPROACH PROCEDURE**.)

**INSTRUMENT APPROACH OPERATIONS [ICAO]**– An approach and landing using instruments for navigation guidance based on an instrument approach procedure. There are two methods for executing instrument approach operations:

**a.** A two-dimensional (2D) instrument approach operation, using lateral navigation guidance only; and

**b.** A three-dimensional (3D) instrument approach operation, using both lateral and vertical navigation guidance.

Note: Lateral and vertical navigation guidance refers to the guidance provided either by:  
a) a ground-based radio navigation aid; or  
b) computer-generated navigation data from ground-based, space-based, self-contained navigation aids or a combination of these.

(See **ICAO term INSTRUMENT APPROACH PROCEDURE**.)

**INSTRUMENT APPROACH PROCEDURE**– A series of predetermined maneuvers for the orderly transfer of an aircraft under instrument flight conditions from the beginning of the initial approach to a landing or to a point from which a landing may be made visually. It is prescribed and approved for a specific airport by competent authority.

(See **SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE**.)

(Refer to **14 CFR Part 91**.)

(Refer to **AIM**.)

**a.** U.S. civil standard instrument approach procedures are approved by the FAA as prescribed under **14 CFR Part 97** and are available for public use.

**b.** U.S. military standard instrument approach procedures are approved and published by the Department of Defense.

**c.** Special instrument approach procedures are approved by the FAA for individual operators but are not published in 14 CFR Part 97 for public use.

(See ICAO term INSTRUMENT APPROACH PROCEDURE.)

**INSTRUMENT APPROACH PROCEDURE [ICAO]**– A series of predetermined maneuvers by reference to flight instruments with specified protection from obstacles from the initial approach fix, or where applicable, from the beginning of a defined arrival route to a point from which a landing can be completed and thereafter, if a landing is not completed, to a position at which holding or en route obstacle clearance criteria apply.

(See ICAO term INSTRUMENT APPROACH OPERATIONS)

**INSTRUMENT APPROACH PROCEDURE CHARTS**–

(See AERONAUTICAL CHART.)

**INSTRUMENT DEPARTURE PROCEDURE (DP)**– A preplanned instrument flight rule (IFR) departure procedure published for pilot use, in graphic or textual format, that provides obstruction clearance from the terminal area to the appropriate en route structure. There are two types of DP, Obstacle Departure Procedure (ODP), printed either textually or graphically, and, Standard Instrument Departure (SID), which is always printed graphically.

(See IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES.)

(See OBSTACLE DEPARTURE PROCEDURES.)

(See STANDARD INSTRUMENT DEPARTURES.)

(Refer to AIM.)

**INSTRUMENT DEPARTURE PROCEDURE (DP) CHARTS**–

(See AERONAUTICAL CHART.)

**INSTRUMENT FLIGHT RULES (IFR)**– Rules governing the procedures for conducting instrument

flight. Also a term used by pilots and controllers to indicate type of flight plan.

(See INSTRUMENT METEOROLOGICAL CONDITIONS.)

(See VISUAL FLIGHT RULES.)

(See VISUAL METEOROLOGICAL CONDITIONS.)

(See ICAO term INSTRUMENT FLIGHT RULES.)

(Refer to AIM.)

**INSTRUMENT FLIGHT RULES [ICAO]**– A set of rules governing the conduct of flight under instrument meteorological conditions.

**INSTRUMENT LANDING SYSTEM (ILS)**– A precision instrument approach system which normally consists of the following electronic components and visual aids:

**a.** Localizer.

(See LOCALIZER.)

**b.** Glideslope.

(See GLIDESLOPE.)

**c.** Outer Marker.

(See OUTER MARKER.)

**d.** Middle Marker.

(See MIDDLE MARKER.)

**e.** Approach Lights.

(See AIRPORT LIGHTING.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**INSTRUMENT METEOROLOGICAL CONDITIONS (IMC)**– Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual meteorological conditions.

(See INSTRUMENT FLIGHT RULES.)

(See VISUAL FLIGHT RULES.)

(See VISUAL METEOROLOGICAL CONDITIONS.)

**INSTRUMENT RUNWAY**– A runway equipped with electronic and visual navigation aids for which a precision or nonprecision approach procedure having straight-in landing minimums has been approved.

(See ICAO term INSTRUMENT RUNWAY.)

**INSTRUMENT RUNWAY [ICAO]**– One of the following types of runways intended for the operation of aircraft using instrument approach procedures:



**a. Nonprecision Approach Runway**– An instrument runway served by visual aids and a nonvisual aid providing at least directional guidance adequate for a straight-in approach.

**b. Precision Approach Runway, Category I**– An instrument runway served by ILS and visual aids intended for operations down to 60 m (200 feet) decision height and down to an RVR of the order of 800 m.

**c. Precision Approach Runway, Category II**– An instrument runway served by ILS and visual aids intended for operations down to 30 m (100 feet) decision height and down to an RVR of the order of 400 m.

**d. Precision Approach Runway, Category III**– An instrument runway served by ILS to and along the surface of the runway and:

**1.** Intended for operations down to an RVR of the order of 200 m (no decision height being applicable) using visual aids during the final phase of landing;

**2.** Intended for operations down to an RVR of the order of 50 m (no decision height being applicable) using visual aids for taxiing;

**3.** Intended for operations without reliance on visual reference for landing or taxiing.

Note 1: See Annex 10 Volume I, Part I, Chapter 3, for related ILS specifications.

Note 2: Visual aids need not necessarily be matched to the scale of nonvisual aids provided. The criterion for the selection of visual aids is the conditions in which operations are intended to be conducted.

**INTEGRITY**– The ability of a system to provide timely warnings to users when the system should not be used for navigation.

**INTERMEDIATE APPROACH SEGMENT**–  
(See SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE.)

**INTERMEDIATE APPROACH SEGMENT [ICAO]**– That segment of an instrument approach procedure between either the intermediate approach fix and the final approach fix or point, or between the end of a reversal, race track or dead reckoning track procedure and the final approach fix or point, as appropriate.

**INTERMEDIATE FIX**– The fix that identifies the beginning of the intermediate approach segment of an instrument approach procedure. The fix is not normally identified on the instrument approach chart as an intermediate fix (IF).

(See SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE.)

**INTERMEDIATE LANDING**– On the rare occasion that this option is requested, it should be approved. The departure center, however, must advise the ATCSCC so that the appropriate delay is carried over and assigned at the intermediate airport. An intermediate landing airport within the arrival center will not be accepted without coordination with and the approval of the ATCSCC.

**INTERNATIONAL AIRPORT**– Relating to international flight, it means:

**a.** An airport of entry which has been designated by the Secretary of Treasury or Commissioner of Customs as an international airport for customs service.

**b.** A landing rights airport at which specific permission to land must be obtained from customs authorities in advance of contemplated use.

**c.** Airports designated under the Convention on International Civil Aviation as an airport for use by international commercial air transport and/or international general aviation.

(See ICAO term INTERNATIONAL AIRPORT.)

(Refer to Chart Supplement U.S.)

**INTERNATIONAL AIRPORT [ICAO]**– Any airport designated by the Contracting State in whose territory it is situated as an airport of entry and departure for international air traffic, where the formalities incident to customs, immigration, public health, animal and plant quarantine and similar procedures are carried out.

**INTERNATIONAL CIVIL AVIATION ORGANIZATION [ICAO]**– A specialized agency of the United Nations whose objective is to develop the principles and techniques of international air navigation and to foster planning and development of international civil air transport.

**INTERROGATOR**– The ground-based surveillance radar beacon transmitter-receiver, which normally scans in synchronism with a primary radar, transmitting discrete radio signals which repetitiously request all transponders on the mode being used to

reply. The replies received are mixed with the primary radar returns and displayed on the same plan position indicator (radar scope). Also, applied to the airborne element of the TACAN/DME system.

(See TRANSPONDER.)

(Refer to AIM.)

**INTERSECTING RUNWAYS**– Two or more runways which cross or meet within their lengths.

(See INTERSECTION.)

**INTERSECTION**–

**a.** A point defined by any combination of courses, radials, or bearings of two or more navigational aids.

**b.** Used to describe the point where two runways, a runway and a taxiway, or two taxiways cross or meet.

**INTERSECTION DEPARTURE**– A departure from any runway intersection except the end of the runway.

(See INTERSECTION.)

**INTERSECTION TAKEOFF**–

(See INTERSECTION DEPARTURE.)

**IR**–

(See IFR MILITARY TRAINING ROUTES.)

**IRREGULAR SURFACE**– A surface that is open for use but not per regulations.

**ISR**–

(See INCREASED SEPARATION REQUIRED.)

# J

**JAMMING**– Denotes emissions that do not mimic Global Navigation Satellite System (GNSS) signals (e.g., GPS and WAAS), but rather interfere with the civil receiver’s ability to acquire and track GNSS signals. Jamming can result in denial of GNSS navigation, positioning, timing and aircraft dependent functions.

**JET BLAST**– The rapid air movement produced by exhaust from jet engines.

**JET ROUTE**– A route designed to serve aircraft operations from 18,000 feet MSL up to and including flight level 450. The routes are referred to as “J” routes with numbering to identify the designated route; e.g., J105.

(See Class A AIRSPACE.)

(Refer to 14 CFR Part 71.)

**JET STREAM**– A migrating stream of high-speed winds present at high altitudes.

**JETTISONING OF EXTERNAL STORES**– Airborne release of external stores; e.g., tiptanks, ordnance.

(See FUEL DUMPING.)

(Refer to 14 CFR Part 91.)

**JOINT USE RESTRICTED AREA**–

(See RESTRICTED AREA.)

**JUMP ZONE**– The airspace directly associated with a Drop Zone. Vertical and horizontal limits may be locally defined.



# N

## NAS–

(See NATIONAL AIRSPACE SYSTEM.)

## NAT HLA–

(See NORTH ATLANTIC HIGH LEVEL AIRSPACE.)

**NATIONAL AIRSPACE SYSTEM–** The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

**NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE (NBCAP)–** Airspace over United States territory located within the North American continent between Canada and Mexico, including adjacent territorial waters outward to about boundaries of oceanic control areas (CTA)/Flight Information Regions (FIR).

(See FLIGHT INFORMATION REGION.)

**NATIONAL FLIGHT DATA CENTER (NFDC)–** A facility in Washington D.C., established by FAA to operate a central aeronautical information service for the collection, validation, and dissemination of aeronautical data in support of the activities of government, industry, and the aviation community. The information is published in the National Flight Data Digest.

(See NATIONAL FLIGHT DATA DIGEST.)

**NATIONAL FLIGHT DATA DIGEST (NFDD)–** A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

**NATIONAL SEARCH AND RESCUE PLAN–** An interagency agreement which provides for the effective utilization of all available facilities in all types of search and rescue missions.

## NAVAID–

(See NAVIGATIONAL AID.)

**NAVAID CLASSES–** VOR, VORTAC, and TACAN aids are classed according to their operational use. The three classes of NAVAIDs are:

- a. T– Terminal.
- b. L– Low altitude.
- c. H– High altitude.

**Note:** The normal service range for T, L, and H class aids is found in the AIM. Certain operational requirements make it necessary to use some of these aids at greater service ranges than specified. Extended range is made possible through flight inspection determinations. Some aids also have lesser service range due to location, terrain, frequency protection, etc. Restrictions to service range are listed in Chart Supplement U.S.

**NAVIGABLE AIRSPACE–** Airspace at and above the minimum flight altitudes prescribed in the CFRs including airspace needed for safe takeoff and landing.

(Refer to 14 CFR Part 91.)

**NAVIGATION REFERENCE SYSTEM (NRS)–** The NRS is a system of waypoints developed for use within the United States for flight planning and navigation without reference to ground based navigational aids. The NRS waypoints are located in a grid pattern along defined latitude and longitude lines. The initial use of the NRS will be in the high altitude environment in conjunction with the High Altitude Redesign initiative. The NRS waypoints are intended for use by aircraft capable of point-to-point navigation.

**NAVIGATION SPECIFICATION [ICAO]–** A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications:

a. **RNP specification.** A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP; e.g., RNP 4, RNP APCH.

b. **RNAV specification.** A navigation specification based on area navigation that does not include the requirement for performance monitoring and alert-

ing, designated by the prefix RNAV; e.g., RNAV 5, RNAV 1.

**Note:** The Performance-based Navigation Manual (Doc 9613), Volume II contains detailed guidance on navigation specifications.

**NAVIGATIONAL AID**– Any visual or electronic device airborne or on the surface which provides point-to-point guidance information or position data to aircraft in flight.

(See AIR NAVIGATION FACILITY.)

**NAVSPEC**–

(See NAVIGATION SPECIFICATION [ICAO].)

**NBCAP AIRSPACE**–

(See NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE.)

**NDB**–

(See NONDIRECTIONAL BEACON.)

**NEGATIVE**– “No,” or “permission not granted,” or “that is not correct.”

**NEGATIVE CONTACT**– Used by pilots to inform ATC that:

**a.** Previously issued traffic is not in sight. It may be followed by the pilot’s request for the controller to provide assistance in avoiding the traffic.

**b.** They were unable to contact ATC on a particular frequency.

**NFDC**–

(See NATIONAL FLIGHT DATA CENTER.)

**NFDD**–

(See NATIONAL FLIGHT DATA DIGEST.)

**NIGHT**– The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.

(See ICAO term NIGHT.)

**NIGHT [ICAO]**– The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be specified by the appropriate authority.

**Note:** Civil twilight ends in the evening when the center of the sun’s disk is 6 degrees below the horizon and begins in the morning when the center of the sun’s disk is 6 degrees below the horizon.

**NO GYRO APPROACH**– A radar approach/vector provided in case of a malfunctioning gyro-compass or directional gyro. Instead of providing the pilot with headings to be flown, the controller observes the radar track and issues control instructions “turn right/left” or “stop turn” as appropriate.

(Refer to AIM.)

**NO GYRO VECTOR**–

(See NO GYRO APPROACH.)

**NO TRANSGRESSION ZONE (NTZ)**– The NTZ is a 2,000 foot wide zone, located equidistant between parallel runway or SOIA final approach courses, in which flight is normally not allowed.

**NONAPPROACH CONTROL TOWER**– Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the Class D airspace. The primary function of a nonapproach control tower is the sequencing of aircraft in the traffic pattern and on the landing area. Nonapproach control towers also separate aircraft operating under instrument flight rules clearances from approach controls and centers. They provide ground control services to aircraft, vehicles, personnel, and equipment on the airport movement area.

**NONCOMMON ROUTE/PORTION**– That segment of a North American Route between the inland navigation facility and a designated North American terminal.

**NON-COOPERATIVE SURVEILLANCE**– Any surveillance system, such as primary radar, that is not dependent upon the presence of any equipment on the aircraft or vehicle to be tracked.

(See COOPERATIVE SURVEILLANCE.)

(See RADAR.)

**NONDIRECTIONAL BEACON**– An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his/her bearing to or from the radio beacon and “home” on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

(See AUTOMATIC DIRECTION FINDER.)

(See COMPASS LOCATOR.)

**NONMOVEMENT AREAS**– Taxiways and apron (ramp) areas not under the control of air traffic.

**NONPRECISION APPROACH–**

(See **NONPRECISION APPROACH PROCEDURE**.)

**NONPRECISION APPROACH PROCEDURE–** A standard instrument approach procedure in which no electronic glideslope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDA, or SDF approaches.

**NONRADAR–** Precedes other terms and generally means without the use of radar, such as:

**a. Nonradar Approach.** Used to describe instrument approaches for which course guidance on final approach is not provided by ground-based precision or surveillance radar. Radar vectors to the final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, ILS, RNAV, and GLS approaches.

(See **FINAL APPROACH COURSE**.)

(See **FINAL APPROACH-IFR**.)

(See **INSTRUMENT APPROACH PROCEDURE**.)

(See **RADAR APPROACH**.)

**b. Nonradar Approach Control.** An ATC facility providing approach control service without the use of radar.

(See **APPROACH CONTROL FACILITY**.)

(See **APPROACH CONTROL SERVICE**.)

**c. Nonradar Arrival.** An aircraft arriving at an airport without radar service or at an airport served by a radar facility and radar contact has not been established or has been terminated due to a lack of radar service to the airport.

(See **RADAR ARRIVAL**.)

(See **RADAR SERVICE**.)

**d. Nonradar Route.** A flight path or route over which the pilot is performing his/her own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route.

(See **RADAR ROUTE**.)

**e. Nonradar Separation.** The spacing of aircraft in accordance with established minima without the use of radar; e.g., vertical, lateral, or longitudinal separation.

(See **RADAR SEPARATION**.)

**NON-RESTRICTIVE ROUTING (NRR)–** Portions of a proposed route of flight where a user can flight

plan the most advantageous flight path with no requirement to make reference to ground-based NAVAIDs.

**NOPAC–**

(See **NORTH PACIFIC**.)

**NORDO (No Radio)–** Aircraft that cannot or do not communicate by radio when radio communication is required are referred to as “NORDO.”

(See **LOST COMMUNICATIONS**.)

**NORMAL OPERATING ZONE (NOZ)–** The NOZ is the operating zone within which aircraft flight remains during normal independent simultaneous parallel ILS approaches.

**NORTH AMERICAN ROUTE–** A numerically coded route preplanned over existing airway and route systems to and from specific coastal fixes serving the North Atlantic. North American Routes consist of the following:

**a. Common Route/Portion.** That segment of a North American Route between the inland navigation facility and the coastal fix.

**b. Noncommon Route/Portion.** That segment of a North American Route between the inland navigation facility and a designated North American terminal.

**c. Inland Navigation Facility.** A navigation aid on a North American Route at which the common route and/or the noncommon route begins or ends.

**d. Coastal Fix.** A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

**NORTH AMERICAN ROUTE PROGRAM (NRP)–** The NRP is a set of rules and procedures which are designed to increase the flexibility of user flight planning within published guidelines.

**NORTH ATLANTIC HIGH LEVEL AIRSPACE (NAT HLA)–** That volume of airspace (as defined in ICAO Document 7030) between FL 285 and FL 420 within the Oceanic Control Areas of Bodo Oceanic, Gander Oceanic, New York Oceanic East, Reykjavik, Santa Maria, and Shanwick, excluding the Shannon and Brest Ocean Transition Areas. ICAO Doc 007 *North Atlantic Operations and Airspace Manual* provides detailed information on related aircraft and operational requirements.

**NORTH 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.

**NOT STANDARD**– Varying from what is expected or published. For use in NOTAMs only.

**NOT STD**–

(See NOT STANDARD.)

**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.

**a. I Distribution**– Distribution by means of telecommunication.

**b. II Distribution**– Distribution by means other than telecommunications.

**NOTICE TO AIRMEN (NOTAM)**– A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely

knowledge of which is essential to personnel concerned with flight operations.

**NOTAM(D)**– A NOTAM given (in addition to local dissemination) distant dissemination beyond the area of responsibility of the Flight Service Station. These NOTAMs will be stored and available until canceled.

**c. FDC NOTAM**– A NOTAM regulatory in nature, transmitted by USNOF and given system wide dissemination.

(See ICAO term NOTAM.)

**NOTICES TO AIRMEN PUBLICATION**– A publication issued every 28 days, designed primarily for the pilot, which contains NOTAMs, graphic notices, and other 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.)



**OFF-ROUTE OBSTRUCTION CLEARANCE ALTITUDE (OROCA)**– An off-route altitude which provides obstruction clearance with a 1,000 foot buffer in non-mountainous terrain areas and a 2,000 foot buffer in designated mountainous areas within the United States. This altitude may not provide signal coverage from ground-based navigational aids, air traffic control radar, or communications coverage.

**OTR**–

(See OCEANIC TRANSITION ROUTE.)

**OTS**–

(See ORGANIZED TRACK SYSTEM.)

**OUT**– The conversation is ended and no response is expected.

**OUT OF SERVICE/UNSERVICEABLE (U/S)**– When a piece of equipment, a NAVAID, a facility or a service is not operational, certified (if required) and immediately “available” for Air Traffic or public use.

**OUTER AREA** (associated with Class C airspace)– Non-regulatory airspace surrounding designated Class C airspace airports wherein ATC provides radar vectoring and sequencing on a full-time basis for all IFR and participating VFR aircraft. The service provided in the outer area is called Class C service which includes: IFR/IFR-IFR separation; IFR/VFR-traffic advisories and conflict resolution; and VFR/VFR-traffic advisories and, as appropriate, safety alerts. The normal radius will be 20 nautical miles with some variations based on site-specific requirements. The outer area extends outward from the primary Class C airspace airport and extends from the lower limits of radar/radio coverage up to the ceiling of the approach control’s delegated airspace excluding the Class C charted area and other airspace as appropriate.

(See CONFLICT RESOLUTION.)

(See CONTROLLED AIRSPACE.)

**OUTER COMPASS LOCATOR**–

(See COMPASS LOCATOR.)

**OUTER FIX**– A general term used within ATC to describe fixes in the terminal area, other than the final approach fix. Aircraft are normally cleared to these fixes by an Air Route Traffic Control Center or an Approach Control Facility. Aircraft are normally cleared from these fixes to the final approach fix or final approach course.

## OR

**OUTER FIX**– An adapted fix along the converted route of flight, prior to the meter fix, for which crossing times are calculated and displayed in the metering position list.

**OUTER FIX ARC**– A semicircle, usually about a 50–70 mile radius from a meter fix, usually in high altitude, which is used by CTAS/ERAM to calculate outer fix times and determine appropriate sector meter list assignments for aircraft on an established arrival route that will traverse the arc.

**OUTER FIX TIME**– A calculated time to depart the outer fix in order to cross the vertex at the ACLT. The time reflects descent speed adjustments and any applicable delay time that must be absorbed prior to crossing the meter fix.

**OUTER MARKER**– A marker beacon at or near the glideslope intercept altitude of an ILS approach. It is keyed to transmit two dashes per second on a 400 Hz tone, which is received aurally and visually by compatible airborne equipment. The OM is normally located four to seven miles from the runway threshold on the extended centerline of the runway.

(See INSTRUMENT LANDING SYSTEM.)

(See MARKER BEACON.)

(Refer to AIM.)

**OVER**– My transmission is ended; I expect a response.

**OVERHEAD MANEUVER**– A series of predetermined maneuvers prescribed for aircraft (often in formation) for entry into the visual flight rules (VFR) traffic pattern and to proceed to a landing. An overhead maneuver is not an instrument flight rules (IFR) approach procedure. An aircraft executing an overhead maneuver is considered VFR and the IFR flight plan is canceled when the aircraft reaches the “initial point” on the initial approach portion of the maneuver. The pattern usually specifies the following:

- a. The radio contact required of the pilot.
- b. The speed to be maintained.
- c. An initial approach 3 to 5 miles in length.
- d. An elliptical pattern consisting of two 180 degree turns.
- e. A break point at which the first 180 degree turn is started.
- f. The direction of turns.

**g.** Altitude (at least 500 feet above the conventional pattern).

**h.** A “Roll-out” on final approach not less than 1/4 mile from the landing threshold and not less than 300 feet above the ground.

**OVERLYING CENTER**– The ARTCC facility that is responsible for arrival/departure operations at a specific terminal.

# 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 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 EDST that provides detailed flight plan and predicted conflict information in textual format for requested Current Plans and all Trial Plans.

(See EN ROUTE DECISION SUPPORT 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 approved separation between aircraft.

**PREARRANGED COORDINATION PROCEDURES–** A facility's standardized procedure that describes the process by which one controller shall allow an aircraft to penetrate or transit another controller's airspace in a manner that assures approved separation without individual coordination for each aircraft.

**PRECIPITATION–** Any or all forms of water particles (rain, sleet, hail, or snow) that fall from the atmosphere and reach the surface.

**PRECIPITATION RADAR WEATHER DESCRIPTIONS–** Existing radar systems cannot detect turbulence. However, there is a direct correlation between the degree of turbulence and other weather features associated with thunderstorms and the weather radar precipitation intensity. Controllers will issue (where capable) precipitation intensity as observed by radar when using weather and radar processor (WARP) or NAS ground-based digital radars with weather capabilities. When precipitation intensity information is not available, the intensity will be described as UNKNOWN. When intensity levels can be determined, they shall be described as:

- a. LIGHT (< 26 dBZ)
- b. MODERATE (26 to 40 dBZ)
- c. HEAVY (> 40 to 50 dBZ)
- d. EXTREME (> 50 dBZ)

(Refer to 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 or other type of glidepath is provided; e.g., ILS, PAR, and GLS.

(See INSTRUMENT LANDING SYSTEM.)

(See PRECISION APPROACH RADAR.)

**PRECISION APPROACH RADAR–** Radar equipment in some ATC facilities operated by the FAA and/or the military services at joint-use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain non-radar 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) SYSTEM**– Provides air traffic controllers monitoring the NTZ during simultaneous close parallel PRM approaches with precision, high update rate secondary surveillance data. The high update rate surveillance sensor component of the PRM system is only required for specific runway or approach course separation. The high resolution color monitoring display, Final Monitor Aid (FMA) of the PRM system, or other FMA with the same capability, presents NTZ surveillance track data to controllers along with detailed maps depicting approaches and no transgression zone and is required for all simultaneous close parallel PRM NTZ monitoring operations.

(Refer to AIM)

**PREDICTIVE WIND SHEAR ALERT SYSTEM (PWS)**– A self-contained system used on board some aircraft to alert the flight crew to the presence of a potential wind shear. PWS systems typically monitor 3 miles ahead and 25 degrees left and right of the

aircraft's heading at or below 1200' AGL. Departing flights may receive a wind shear alert after they start the takeoff roll and may elect to abort the takeoff. Aircraft on approach receiving an alert may elect to go around or perform a wind shear escape maneuver.

**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 Chart Supplement U.S. If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Chart Supplement U.S., pilots may use that part of a

Preferred IFR Route which is appropriate for the departure or arrival point that is listed. Preferred IFR Routes 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 CHART SUPPLEMENT U.S.)

(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 AREA NAVIGATION (RNAV) GLOBAL POSITIONING SYSTEM (GPS) PRECISION RUNWAY MONITORING (PRM) APPROACH.)

(See PRM APPROACH.)

(See PRECISION RUNWAY MONITOR SYSTEM.)

PRM APPROACH– An instrument approach procedure titled ILS PRM, RNAV PRM, LDA PRM, or GLS PRM conducted to parallel runways separated by less than 4,300 feet and at least 3,000 feet where independent closely spaced approaches are permitted. Use of an enhanced display with alerting, a No Transgression Zone (NTZ), secondary monitor frequency, pilot PRM training, and publication of an Attention All Users Page are required for all PRM approaches. Depending on the runway spacing, the approach courses may be parallel or one approach course must be offset. PRM procedures are also used to conduct Simultaneous Offset Instrument Approach (SOIA) operations. In SOIA, one straight-in ILS PRM, RNAV PRM, GLS PRM, and one offset LDA PRM, RNAV PRM or GLS PRM approach are utilized. PRM procedures are terminated and a visual segment begins at the offset approach missed approach point where the minimum distance between the approach courses is

3000 feet. Runway spacing can be as close as 750 feet.

(Refer to AIM.)

PROCEDURAL CONTROL [ICAO]– Term used to indicate that information derived from an ATS surveillance system is not required for the provision of air traffic control service.

PROCEDURAL SEPARATION [ICAO]– The separation used when providing procedural control.

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.)

**PROPELLER (PROP) WASH (PROP BLAST)–** The disturbed mass of air generated by the motion of a propeller.

**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.

**PROTECTED SEGMENT–** The protected segment is a segment on the amended TFM route that is to be inhibited from automatic adapted route alteration by ERAM.

**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.)





# R

**RADAR**– A device that provides information on range, azimuth, and/or elevation of objects by measuring the time interval between transmission and reception of directional radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation.

**a. Primary Radar**– A radar system in which a minute portion of a radio pulse transmitted from a site is reflected by an object and then received back at that site for processing and display at an air traffic control facility.

**b. Secondary Radar/Radar Beacon (ATCRBS)**– A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radar pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This reply transmission, rather than a reflected signal, is then received back at the transmitter/receiver site for processing and display at an air traffic control facility.

(See COOPERATIVE SURVEILLANCE.)

(See INTERROGATOR.)

(See NON-COOPERATIVE SURVEILLANCE.)

(See TRANSPONDER.)

(See ICAO term RADAR.)

(Refer to AIM.)

**RADAR [ICAO]**– A radio detection device which provides information on range, azimuth and/or elevation of objects.

**a. Primary Radar**– Radar system which uses reflected radio signals.

**b. Secondary Radar**– Radar system wherein a radio signal transmitted from a radar station initiates the transmission of a radio signal from another station.

**RADAR ADVISORY**– The provision of advice and information based on radar observations.

(See ADVISORY SERVICE.)

**RADAR ALTIMETER**–

(See RADIO ALTIMETER.)

**RADAR APPROACH**– An instrument approach procedure which utilizes Precision Approach Radar (PAR) or Airport Surveillance Radar (ASR).

(See AIRPORT SURVEILLANCE RADAR.)

(See INSTRUMENT APPROACH PROCEDURE.)

(See PRECISION APPROACH RADAR.)

(See SURVEILLANCE APPROACH.)

(See ICAO term RADAR APPROACH.)

(Refer to AIM.)

**RADAR APPROACH [ICAO]**– An approach, executed by an aircraft, under the direction of a radar controller.

**RADAR APPROACH CONTROL FACILITY**– A terminal ATC facility that uses radar and nonradar capabilities to provide approach control services to aircraft arriving, departing, or transiting airspace controlled by the facility.

(See APPROACH CONTROL SERVICE.)

**a. Provides radar ATC services to aircraft operating in the vicinity of one or more civil and/or military airports in a terminal area. The facility may provide services of a ground controlled approach (GCA); i.e., ASR and PAR approaches. A radar approach control facility may be operated by FAA, USAF, US Army, USN, USMC, or jointly by FAA and a military service. Specific facility nomenclatures are used for administrative purposes only and are related to the physical location of the facility and the operating service generally as follows:**

**1. Army Radar Approach Control (ARAC)** (US Army).

**2. Radar Air Traffic Control Facility (RATCF)** (USN/FAA and USMC/FAA).

**3. Radar Approach Control (RAPCON)** (USAF/FAA, USN/FAA, and USMC/FAA).

**4. Terminal Radar Approach Control (TRACON)** (FAA).

**5. Air Traffic Control Tower (ATCT)** (FAA). (Only those towers delegated approach control authority.)

**RADAR ARRIVAL**– An aircraft arriving at an airport served by a radar facility and in radar contact with the facility.

(See NONRADAR.)

**RADAR BEACON–**

(See RADAR.)

**RADAR CLUTTER [ICAO]–** The visual indication on a radar display of unwanted signals.

***RADAR CONTACT–***

**a.** Used by ATC to inform an aircraft that it is identified using an approved ATC surveillance source on an air traffic controller’s display and that radar flight following will be provided until radar service is terminated. Radar service may also be provided within the limits of necessity and capability. When a pilot is informed of “radar contact,” he/she automatically discontinues reporting over compulsory reporting points.

(See ATC SURVEILLANCE SOURCE.)

(See RADAR CONTACT LOST.)

(See RADAR FLIGHT FOLLOWING.)

(See RADAR SERVICE.)

(See RADAR SERVICE TERMINATED.)

(Refer to AIM.)

**b.** The term used to inform the controller that the aircraft is identified and approval is granted for the aircraft to enter the receiving controllers airspace.

(See ICAO term RADAR CONTACT.)

**RADAR CONTACT [ICAO]–** The situation which exists when the radar blip or radar position symbol of a particular aircraft is seen and identified on a radar display.

***RADAR CONTACT LOST–*** Used by ATC to inform a pilot that the surveillance data used to determine the aircraft’s position is no longer being received, or is no longer reliable and radar service is no longer being provided. The loss may be attributed to several factors including the aircraft merging with weather or ground clutter, the aircraft operating below radar line of sight coverage, the aircraft entering an area of poor radar return, failure of the aircraft’s equipment, or failure of the surveillance equipment.

(See CLUTTER.)

(See RADAR CONTACT.)

**RADAR ENVIRONMENT–** An area in which radar service may be provided.

(See ADDITIONAL SERVICES.)

(See RADAR CONTACT.)

(See RADAR SERVICE.)

(See TRAFFIC ADVISORIES.)

**RADAR FLIGHT FOLLOWING–** The observation of the progress of radar-identified aircraft, whose primary navigation is being provided by the pilot, wherein the controller retains and correlates the aircraft identity with the appropriate target or target symbol displayed on the radar scope.

(See RADAR CONTACT.)

(See RADAR SERVICE.)

(Refer to AIM.)

**RADAR IDENTIFICATION–** The process of ascertaining that an observed radar target is the radar return from a particular aircraft.

(See RADAR CONTACT.)

(See RADAR SERVICE.)

**RADAR IDENTIFIED AIRCRAFT–** An aircraft, the position of which has been correlated with an observed target or symbol on the radar display.

(See RADAR CONTACT.)

(See RADAR CONTACT LOST.)

**RADAR MONITORING–**

(See RADAR SERVICE.)

**RADAR NAVIGATIONAL GUIDANCE–**

(See RADAR SERVICE.)

**RADAR POINT OUT–** An action taken by a controller to transfer the radar identification of an aircraft to another controller if the aircraft will or may enter the airspace or protected airspace of another controller and radio communications will not be transferred.

**RADAR REQUIRED–** A term displayed on charts and approach plates and included in FDC NOTAMS to alert pilots that segments of either an instrument approach procedure or a route are not navigable because of either the absence or unusability of a NAVAID. The pilot can expect to be provided radar navigational guidance while transiting segments labeled with this term.

(See RADAR ROUTE.)

(See RADAR SERVICE.)

**RADAR ROUTE–** A flight path or route over which an aircraft is vectored. Navigational guidance and altitude assignments are provided by ATC.

(See FLIGHT PATH.)

(See ROUTE.)

**RADAR SEPARATION–**

(See RADAR SERVICE.)

**RADAR SERVICE–** A term which encompasses one or more of the following services based on the use of

radar which can be provided by a controller to a pilot of a radar identified aircraft.

**a. Radar Monitoring**– The radar flight-following of aircraft, whose primary navigation is being performed by the pilot, to observe and note deviations from its authorized flight path, airway, or route. When being applied specifically to radar monitoring of instrument approaches; i.e., with precision approach radar (PAR) or radar monitoring of simultaneous ILS, RNAV and GLS approaches, it includes advice and instructions whenever an aircraft nears or exceeds the prescribed PAR safety limit or simultaneous ILS RNAV and GLS no transgression zone.

(See ADDITIONAL SERVICES.)

(See TRAFFIC ADVISORIES.)

**b. Radar Navigational Guidance**– Vectoring aircraft to provide course guidance.

**c. Radar Separation**– Radar spacing of aircraft in accordance with established minima.

(See ICAO term RADAR SERVICE.)

**RADAR SERVICE [ICAO]**– Term used to indicate a service provided directly by means of radar.

**a. Monitoring**– The use of radar for the purpose of providing aircraft with information and advice relative to significant deviations from nominal flight path.

**b. Separation**– The separation used when aircraft position information is derived from radar sources.

***RADAR SERVICE TERMINATED***– Used by ATC to inform a pilot that he/she will no longer be provided any of the services that could be received while in radar contact. Radar service is automatically terminated, and the pilot is not advised in the following cases:

**a.** An aircraft cancels its IFR flight plan, except within Class B airspace, Class C airspace, a TRSA, or where Basic Radar service is provided.

**b.** An aircraft conducting an instrument, visual, or contact approach has landed or has been instructed to change to advisory frequency.

**c.** An arriving VFR aircraft, receiving radar service to a tower-controlled airport within Class B airspace, Class C airspace, a TRSA, or where sequencing service is provided, has landed; or to all other airports, is instructed to change to tower or advisory frequency.

**d.** An aircraft completes a radar approach.

**RADAR SURVEILLANCE**– The radar observation of a given geographical area for the purpose of performing some radar function.

**RADAR TRAFFIC ADVISORIES**– Advisories issued to alert pilots to known or observed radar traffic which may affect the intended route of flight of their aircraft.

(See TRAFFIC ADVISORIES.)

**RADAR TRAFFIC INFORMATION SERVICE**–

(See TRAFFIC ADVISORIES.)

**RADAR VECTORING [ICAO]**– Provision of navigational guidance to aircraft in the form of specific headings, based on the use of radar.

**RADIAL**– A magnetic bearing extending from a VOR/VORTAC/TACAN navigation facility.

**RADIO**–

**a.** A device used for communication.

**b.** Used to refer to a flight service station; e.g., “Seattle Radio” is used to call Seattle FSS.

**RADIO ALTIMETER**– Aircraft equipment which makes use of the reflection of radio waves from the ground to determine the height of the aircraft above the surface.

**RADIO BEACON**–

(See NONDIRECTIONAL BEACON.)

**RADIO DETECTION AND RANGING**–

(See RADAR.)

**RADIO MAGNETIC INDICATOR**– An aircraft navigational instrument coupled with a gyro compass or similar compass that indicates the direction of a selected NAVAID and indicates bearing with respect to the heading of the aircraft.

**RAIS**–

(See REMOTE AIRPORT INFORMATION SERVICE.)

**RAMP**–

(See APRON.)

**RANDOM ALTITUDE**– An altitude inappropriate for direction of flight and/or not in accordance with FAA Order JO 7110.65, Paragraph 4–5–1, VERTICAL SEPARATION MINIMA.

**RANDOM ROUTE**– Any route not established or charted/published or not otherwise available to all users.

**RC**–

(See ROAD RECONNAISSANCE.)

**RCAG–**

(See REMOTE COMMUNICATIONS AIR/GROUND FACILITY.)

**RCC–**

(See RESCUE COORDINATION CENTER.)

**RCO–**

(See REMOTE COMMUNICATIONS OUTLET.)

**RCR–**

(See RUNWAY CONDITION READING.)

**READ BACK–** Repeat my message back to me.

**RECEIVER AUTONOMOUS INTEGRITY MONITORING (RAIM)–** A technique whereby a civil GNSS receiver/processor determines the integrity of the GNSS navigation signals without reference to sensors or non-DoD integrity systems other than the receiver itself. This determination is achieved by a consistency check among redundant pseudorange measurements.

**RECEIVING CONTROLLER–** A controller/facility receiving control of an aircraft from another controller/facility.

**RECEIVING FACILITY–**

(See RECEIVING CONTROLLER.)

**RECONFORMANCE–** The automated process of bringing an aircraft's Current Plan Trajectory into conformance with its track.

**REDUCE SPEED TO (SPEED)–**

(See SPEED ADJUSTMENT.)

**REFINED HAZARD AREA (RHA)–** Used by ATC. Airspace that is defined and distributed after a failure of a launch or reentry operation to provide a more concise depiction of the hazard location than a Contingency Hazard Area.

(See AIRCRAFT HAZARD AREA.)

(See CONTINGENCY HAZARD AREA.)

(See TRANSITIONAL HAZARD AREA.)

**REIL–**

(See RUNWAY END IDENTIFIER LIGHTS.)

**RELEASE TIME–** A departure time restriction issued to a pilot by ATC (either directly or through an authorized relay) when necessary to separate a departing aircraft from other traffic.

(See ICAO term RELEASE TIME.)

**RELEASE TIME [ICAO]–** Time prior to which an aircraft should be given further clearance or prior to which it should not proceed in case of radio failure.

**REMOTE AIRPORT INFORMATION SERVICE (RAIS)–** A temporary service provided by facilities, which are not located on the landing airport, but have communication capability and automated weather reporting available to the pilot at the landing airport.

**REMOTE COMMUNICATIONS AIR/GROUND FACILITY–** An unmanned VHF/UHF transmitter/receiver facility which is used to expand ARTCC air/ground communications coverage and to facilitate direct contact between pilots and controllers. RCAG facilities are sometimes not equipped with emergency frequencies 121.5 MHz and 243.0 MHz.

(Refer to AIM.)

**REMOTE COMMUNICATIONS OUTLET (RCO)–** An unmanned communications facility remotely controlled by air traffic personnel. RCOs serve FSSs. Remote Transmitter/Receivers (RTR) serve terminal ATC facilities. An RCO or RTR may be UHF or VHF and will extend the communication range of the air traffic facility. There are several classes of RCOs and RTRs. The class is determined by the number of transmitters or receivers. Classes A through G are used primarily for air/ground purposes. RCO and RTR class O facilities are nonprotected outlets subject to undetected and prolonged outages. RCO (O's) and RTR (O's) were established for the express purpose of providing ground-to-ground communications between air traffic control specialists and pilots located at a satellite airport for delivering en route clearances, issuing departure authorizations, and acknowledging instrument flight rules cancellations or departure/landing times. As a secondary function, they may be used for advisory purposes whenever the aircraft is below the coverage of the primary air/ground frequency.

**REMOTE TRANSMITTER/RECEIVER (RTR)–**

(See REMOTE COMMUNICATIONS OUTLET.)

**REPORT–** Used to instruct pilots to advise ATC of specified information; e.g., "Report passing Hamilton VOR."

**REPORTING POINT–** A geographical location in relation to which the position of an aircraft is reported.

(See COMPULSORY REPORTING POINTS.)

(See ICAO term REPORTING POINT.)

(Refer to AIM.)

**REPORTING POINT [ICAO]**– A specified geographical location in relation to which the position of an aircraft can be reported.

**REQUEST FULL ROUTE CLEARANCE**– Used by pilots to request that the entire route of flight be read verbatim in an ATC clearance. Such request should be made to preclude receiving an ATC clearance based on the original filed flight plan when a filed IFR flight plan has been revised by the pilot, company, or operations prior to departure.

**REQUIRED NAVIGATION PERFORMANCE (RNP)**– A statement of the navigational performance necessary for operation within a defined airspace. The following terms are commonly associated with RNP:

**a.** Required Navigation Performance Level or Type (RNP-X). A value, in nautical miles (NM), from the intended horizontal position within which an aircraft would be at least 95-percent of the total flying time.

**b.** Advanced – Required Navigation Performance (A-RNP). A navigation specification based on RNP that requires advanced functions such as scalable RNP, radius-to-fix (RF) legs, and tactical parallel offsets. This sophisticated Navigation Specification (NavSpec) is designated by the abbreviation “A-RNP”.

**c.** Required Navigation Performance (RNP) Airspace. A generic term designating airspace, route(s), leg(s), operation(s), or procedure(s) where minimum required navigational performance (RNP) have been established.

**d.** Actual Navigation Performance (ANP). A measure of the current estimated navigational performance. Also referred to as Estimated Position Error (EPE).

**e.** Estimated Position Error (EPE). A measure of the current estimated navigational performance. Also referred to as Actual Navigation Performance (ANP).

**f.** Lateral Navigation (LNAV). A function of area navigation (RNAV) equipment which calculates, displays, and provides lateral guidance to a profile or path.

**g.** Vertical Navigation (VNAV). A function of area navigation (RNAV) equipment which calculates, displays, and provides vertical guidance to a profile or path.

**RESCUE COORDINATION CENTER (RCC)**– A search and rescue (SAR) facility equipped and manned to coordinate and control SAR operations in an area designated by the SAR plan. The U.S. Coast Guard and the U.S. Air Force have responsibility for the operation of RCCs.

(See ICAO term RESCUE CO-ORDINATION CENTRE.)

**RESCUE CO-ORDINATION CENTRE [ICAO]**– A unit responsible for promoting efficient organization of search and rescue service and for coordinating the conduct of search and rescue operations within a search and rescue region.

**RESOLUTION ADVISORY**– A display indication given to the pilot by the Traffic alert and Collision Avoidance System (TCAS II) recommending a maneuver to increase vertical separation relative to an intruding aircraft. Positive, negative, and vertical speed limit (VSL) advisories constitute the resolution advisories. A resolution advisory is also classified as corrective or preventive.

**RESTRICTED AREA**–

(See SPECIAL USE AIRSPACE.)

(See ICAO term RESTRICTED AREA.)

**RESTRICTED AREA [ICAO]**– An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

**RESUME NORMAL SPEED**– Used by ATC to advise a pilot to resume an aircraft’s normal operating speed. It is issued to terminate a speed adjustment where no published speed restrictions apply. It does not delete speed restrictions in published procedures of upcoming segments of flight. This does not relieve the pilot of those speed restrictions that are applicable to 14 CFR Section 91.117.

**RESUME OWN NAVIGATION**– Used by ATC to advise a pilot to resume his/her own navigational responsibility. It is issued after completion of a radar vector or when radar contact is lost while the aircraft is being radar vectored.

(See RADAR CONTACT LOST.)

(See RADAR SERVICE TERMINATED.)

**RESUME PUBLISHED SPEED**– Used by ATC to advise a pilot to resume published speed restrictions that are applicable to a SID, STAR, or other instrument procedure. It is issued to terminate a speed

adjustment where speed restrictions are published on a charted procedure.

**RHA**–

(See REFINED HAZARD AREA.)

**RMI**–

(See RADIO MAGNETIC INDICATOR.)

**RNAV**–

(See AREA NAVIGATION (RNAV).)

**RNAV APPROACH**– An instrument approach procedure which relies on aircraft area navigation equipment for navigational guidance.

(See AREA NAVIGATION (RNAV).)

(See INSTRUMENT APPROACH PROCEDURE.)

**ROAD RECONNAISSANCE (RC)**– Military activity requiring navigation along roads, railroads, and rivers. Reconnaissance route/route segments are seldom along a straight line and normally require a lateral route width of 10 NM to 30 NM and an altitude range of 500 feet to 10,000 feet AGL.

**ROGER**– I have received all of your last transmission. It should not be used to answer a question requiring a yes or a no answer.

(See AFFIRMATIVE.)

(See NEGATIVE.)

**ROLLOUT RVR**–

(See VISIBILITY.)

**ROTOR WASH**– A phenomenon resulting from the vertical down wash of air generated by the main rotor(s) of a helicopter.

**ROUND-ROBIN FLIGHT PLAN**– A single flight plan filed from the departure airport to an intermediary destination(s) and then returning to the original departure airport.

**ROUTE**– A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth.

(See AIRWAY.)

(See JET ROUTE.)

(See PUBLISHED ROUTE.)

(See UNPUBLISHED ROUTE.)

**ROUTE ACTION NOTIFICATION**– EDST notification that a PAR/PDR/PDAR has been applied to the flight plan.

(See ATC PREFERRED ROUTE NOTIFICATION.)

(See EN ROUTE DECISION SUPPORT TOOL.)

**ROUTE 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 takeoff of aircraft.

**RUNWAY CENTERLINE LIGHTING**–

(See AIRPORT LIGHTING.)

**RUNWAY CONDITION CODES (RwyCC)**– Numerical readings, provided by airport operators, that indicate runway surface contamination (for example, slush, ice, rain, etc.). These values range from “1” (poor) to “6” (dry) and must be included on the ATIS when the reportable condition is less than 6 in any one or more of the three runway zones (touchdown, midpoint, rollout).

**RUNWAY CONDITION READING**– Numerical decelerometer readings relayed by air traffic controllers at USAF and certain civil bases for use by the pilot in determining runway braking action. These readings are routinely relayed only to USAF and Air National Guard Aircraft.

(See BRAKING ACTION.)

**RUNWAY CONDITION REPORT (RwyCR)**– A data collection worksheet used by airport operators that correlates the runway percentage of coverage along with the depth and type of contaminant for the purpose of creating a FICON NOTAM.

(See **RUNWAY CONDITION CODES**.)

**RUNWAY END IDENTIFIER LIGHTS (REIL)**–

(See **AIRPORT LIGHTING**.)

**RUNWAY ENTRANCE LIGHTS (REL)**–An array of red lights which include the first light at the hold line followed by a series of evenly spaced lights to the runway edge aligned with the taxiway centerline, and one additional light at the runway centerline in line with the last two lights before the runway edge.

**RUNWAY GRADIENT**– The average slope, measured in percent, between two ends or points on a runway. Runway gradient is depicted on Government aerodrome sketches when total runway gradient exceeds 0.3%.

***RUNWAY HEADING***– The magnetic direction that corresponds with the runway centerline extended, not the painted runway number. When cleared to “fly or maintain runway heading,” pilots are expected to fly or maintain the heading that corresponds with the extended centerline of the departure runway. Drift correction shall not be applied; e.g., Runway 4, actual magnetic heading of the runway centerline 044, fly 044.

**RUNWAY IN USE/ACTIVE RUNWAY/DUTY RUNWAY**– Any runway or runways currently being used for takeoff or landing. When multiple runways are used, they are all considered active runways. In the metering sense, a selectable adapted item which specifies the landing runway configuration or direction of traffic flow. The adapted optimum flight plan from each transition fix to the vertex is determined by the runway configuration for arrival metering processing purposes.

**RUNWAY LIGHTS**–

(See **AIRPORT LIGHTING**.)

**RUNWAY MARKINGS**–

(See **AIRPORT MARKING AIDS**.)

**RUNWAY OVERRUN**– In military aviation exclusively, a stabilized or paved area beyond the end of a runway, of the same width as the runway plus

shoulders, centered on the extended runway centerline.

**RUNWAY PROFILE DESCENT**– An instrument flight rules (IFR) air traffic control arrival procedure to a runway published for pilot use in graphic and/or textual form and may be associated with a STAR. Runway Profile Descents provide routing and may depict crossing altitudes, speed restrictions, and headings to be flown from the en route structure to the point where the pilot will receive clearance for and execute an instrument approach procedure. A Runway Profile Descent may apply to more than one runway if so stated on the chart.

(Refer to **AIM**.)

**RUNWAY SAFETY AREA**– A defined surface surrounding the runway prepared, or suitable, for reducing the risk of damage to airplanes in the event of an undershoot, overshoot, or excursion from the runway. The dimensions of the RSA vary and can be determined by using the criteria contained within AC 150/5300-13, Airport Design, Chapter 3. Figure 3–1 in AC 150/5300-13 depicts the RSA. The design standards dictate that the RSA shall be:

**a.** Cleared, graded, and have no potentially hazardous ruts, humps, depressions, or other surface variations;

**b.** Drained by grading or storm sewers to prevent water accumulation;

**c.** Capable, under dry conditions, of supporting snow removal equipment, aircraft rescue and firefighting equipment, and the occasional passage of aircraft without causing structural damage to the aircraft; and,

**d.** Free of objects, except for objects that need to be located in the runway safety area because of their function. These objects shall be constructed on low impact resistant supports (frangible mounted structures) to the lowest practical height with the frangible point no higher than 3 inches above grade.

(Refer to AC 150/5300-13, Airport Design, Chapter 3.)

**RUNWAY STATUS LIGHTS (RWSL) SYSTEM**– The RWSL is a system of runway and taxiway lighting to provide pilots increased situational awareness by illuminating runway entry lights (REL) when the runway is unsafe for entry or crossing, and take-off hold lights (THL) when the runway is unsafe for departure.

**RUNWAY TRANSITION–**

**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 VISUAL RANGE (RVR)–**

(See VISIBILITY.)

**RwyCC–**

(See RUNWAY CONDITION CODES.)

**RwyCR–**

(See RUNWAY CONDITION REPORT.)



to the runway threshold, visual separation by the aircraft conducting the offset approach is utilized.

(Refer to AIM)

**SIMULTANEOUS (PARALLEL) DEPENDENT APPROACHES-** An approach operation permitting ILS/RNAV/GLS approaches to adjacent parallel runways where prescribed diagonal spacing must be maintained. Aircraft are not permitted to pass each other during simultaneous dependent operations. Integral parts of a total system ATC procedures, and appropriate airborne and ground based equipment.

**SINGLE DIRECTION ROUTES-** Preferred IFR Routes which are sometimes depicted on high altitude en route charts and which are normally flown in one direction only.

(See PREFERRED IFR ROUTES.)

(Refer to CHART SUPPLEMENT U.S.)

**SINGLE FREQUENCY APPROACH-** A service provided under a letter of agreement to military single-piloted turbojet aircraft which permits use of a single UHF frequency during approach for landing. Pilots will not normally be required to change frequency from the beginning of the approach to touchdown except that pilots conducting an en route descent are required to change frequency when control is transferred from the air route traffic control center to the terminal facility. The abbreviation "SFA" in the DOD FLIP IFR Supplement under "Communications" indicates this service is available at an aerodrome.

**SINGLE-PILOTED AIRCRAFT-** A military turbojet aircraft possessing one set of flight controls, tandem cockpits, or two sets of flight controls but operated by one pilot is considered single-piloted by ATC when determining the appropriate air traffic service to be applied.

(See SINGLE FREQUENCY APPROACH.)

**SKYSPOTTER-** A pilot who has received specialized training in observing and reporting inflight weather phenomena.

**SLASH-** A radar beacon reply displayed as an elongated target.

**SLDI-**

(See SECTOR LIST DROP INTERVAL.)

**SLOT TIME-**

(See METER FIX TIME/SLOT TIME.)

**SLOW TAXI-** To taxi a float plane at low power or low RPM.

**SN-**

(See SYSTEM STRATEGIC NAVIGATION.)

**SPACE-BASED ADS-B (SBA)-** A constellation of satellites that receives ADS-B Out broadcasts and relays that information to the appropriate surveillance facility. The currently deployed SBA system is only capable of receiving broadcasts from 1090ES-equipped aircraft, and not from those equipped with only a universal access transceiver (UAT). Also, aircraft with a top-of-fuselage-mounted transponder antenna (required for TCAS II installations) will be better received by SBA, especially at latitudes below 45 degrees.

(See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST.)

(See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST OUT.)

**SPEAK SLOWER-** Used in verbal communications as a request to reduce speech rate.

**SPECIAL ACTIVITY AIRSPACE (SAA)-** Any airspace with defined dimensions within the National Airspace System wherein limitations may be imposed upon aircraft operations. This airspace may be restricted areas, prohibited areas, military operations areas, air ATC assigned airspace, and any other designated airspace areas. The dimensions of this airspace are programmed into EDST and can be designated as either active or inactive by screen entry. Aircraft trajectories are constantly tested against the dimensions of active areas and alerts issued to the applicable sectors when violations are predicted.

(See EN ROUTE DECISION SUPPORT TOOL.)

**SPECIAL AIR TRAFFIC RULES (SATR)-** Rules that govern procedures for conducting flights in certain areas listed in 14 CFR Part 93. The term "SATR" is used in the United States to describe the rules for operations in specific areas designated in the Code of Federal Regulations.

(Refer to 14 CFR Part 93.)

**SPECIAL EMERGENCY-** A condition of air piracy or other hostile act by a person(s) aboard an aircraft which threatens the safety of the aircraft or its passengers.

**SPECIAL FLIGHT RULES AREA (SFRA)-** An area in the NAS, described in 14 CFR Part 93, wherein the flight of aircraft is subject to special

traffic rules, unless otherwise authorized by air traffic control. Not all areas listed in 14 CFR Part 93 are designated SFRA, but special air traffic rules apply to all areas described in 14 CFR Part 93.

**SPECIAL INSTRUMENT APPROACH PROCEDURE–**

(See INSTRUMENT APPROACH PROCEDURE.)

**SPECIAL USE AIRSPACE–** Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Types of special use airspace are:

**a. Alert Area–** Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of nonparticipating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations, and pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.

**b. Controlled Firing Area–** Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.

**c. Military Operations Area (MOA)–** Permanent and temporary MOAs are airspace established outside of Class A airspace area to separate or segregate certain nonhazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. Permanent MOAs are depicted on Sectional Aeronautical, VFR Terminal Area, and applicable En Route Low Altitude Charts.

Note: Temporary MOAs are not charted.

(Refer to AIM.)

**d. Prohibited Area–** Airspace designated under 14 CFR Part 73 within which no person may operate an aircraft without the permission of the using agency.

(Refer to AIM.)

(Refer to En Route Charts.)

**e. Restricted Area–** Permanent and temporary restricted areas are airspace designated under 14 CFR Part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most

restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Permanent restricted areas are depicted on Sectional Aeronautical, VFR Terminal Area, and applicable En Route charts. Where joint use is authorized, the name of the ATC controlling facility is also shown.

Note: Temporary restricted areas are not charted.

(Refer to 14 CFR Part 73.)

(Refer to AIM.)

**f. Warning Area–** A warning area is airspace of defined dimensions extending from 3 nautical miles outward from the coast of the United States, that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning area is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both.

**SPECIAL VFR CONDITIONS–** Meteorological conditions that are less than those required for basic VFR flight in Class B, C, D, or E surface areas and in which some aircraft are permitted flight under visual flight rules.

(See SPECIAL VFR OPERATIONS.)

(Refer to 14 CFR Part 91.)

**SPECIAL VFR FLIGHT [ICAO]–** A VFR flight cleared by air traffic control to operate within Class B, C, D, and E surface areas in metrological conditions below VMC.

**SPECIAL VFR OPERATIONS–** Aircraft operating in accordance with clearances within Class B, C, D, and E surface areas in weather conditions less than the basic VFR weather minima. Such operations must be requested by the pilot and approved by ATC.

(See SPECIAL VFR CONDITIONS.)

(See ICAO term SPECIAL VFR FLIGHT.)

**SPEED–**

(See AIRSPEED.)

(See GROUND SPEED.)

**SPEED ADJUSTMENT–** An ATC procedure used to request pilots to adjust aircraft speed to a specific value for the purpose of providing desired spacing. Pilots are expected to maintain a speed of plus or minus 10 knots or 0.02 Mach number of the specified speed. Examples of speed adjustments are:

**a. “Increase/reduce speed to Mach point (number).”**

b. “Increase/reduce speed to (speed in knots)” or “Increase/reduce speed (number of knots) knots.”

**SPEED BRAKES**– Moveable aerodynamic devices on aircraft that reduce airspeed during descent and landing.

**SPEED SEGMENTS**– Portions of the arrival route between the transition point and the vertex along the optimum flight path for which speeds and altitudes are specified. There is one set of arrival speed segments adapted from each transition point to each vertex. Each set may contain up to six segments.

**SPOOFING**– Denotes emissions of GNSS-like signals that may be acquired and tracked in combination with or instead of the intended signals by civil receivers. The onset of spoofing effects can be instantaneous or delayed, and effects can persist after the spoofing has ended. Spoofing can result in false and potentially confusing, or hazardously misleading, position, navigation, and/or date/time information in addition to loss of GNSS use.

**SQUAWK (Mode, Code, Function)**– Used by ATC to instruct a pilot to activate the aircraft transponder and ADS-B Out with altitude reporting enabled, or (military) to activate only specific modes, codes, or functions. Examples: “Squawk five seven zero seven;” “Squawk three/alpha, two one zero five.”

(See TRANSPONDER.)

**STA**–

(See SCHEDULED TIME OF ARRIVAL.)

**STAGING/QUEUING**– The placement, integration, and segregation of departure aircraft in designated movement areas of an airport by departure fix, EDCT, and/or restriction.

**STAND BY**– Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait as in “stand by for clearance.” The caller should reestablish contact if a delay is lengthy. “Stand by” is not an approval or denial.

**STANDARD INSTRUMENT APPROACH PROCEDURE (SIAP)**–

(See INSTRUMENT APPROACH PROCEDURE.)

**STANDARD INSTRUMENT DEPARTURE (SID)**– A preplanned instrument flight rule (IFR) air traffic control (ATC) departure procedure printed for pilot/controller use in graphic form to provide

obstacle clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement to expedite traffic flow and to reduce pilot/controller workload. ATC clearance must always be received prior to flying a SID.

(See IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES.)

(See OBSTACLE DEPARTURE PROCEDURE.)

(Refer to AIM.)

**STANDARD RATE TURN**– A turn of three degrees per second.

**STANDARD TERMINAL ARRIVAL (STAR)**– A preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STARs provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

**STANDARD TERMINAL ARRIVAL CHARTS**–

(See AERONAUTICAL CHART.)

**STANDARD TERMINAL AUTOMATION REPLACEMENT SYSTEM (STARS)**–

(See DTAS.)

**STAR**–

(See STANDARD TERMINAL ARRIVAL.)

**STATE AIRCRAFT**– Aircraft used in military, customs and police service, in the exclusive service of any government or of any political subdivision thereof, including the government of any state, territory, or possession of the United States or the District of Columbia, but not including any government-owned aircraft engaged in carrying persons or property for commercial purposes.

**STATIC RESTRICTIONS**– Those restrictions that are usually not subject to change, fixed, in place, and/or published.

**STATIONARY RESERVATIONS**– Altitude reservations which encompass activities in a fixed area. Stationary reservations may include activities, such as special tests of weapons systems or equipment, certain U.S. Navy carrier, fleet, and anti-submarine operations, rocket, missile and drone operations, and certain aerial refueling or similar operations.

**STEP TAXI**– To taxi a float plane at full power or high RPM.

**STEP TURN**– A maneuver used to put a float plane in a planing configuration prior to entering an active sea lane for takeoff. The STEP TURN maneuver should only be used upon pilot request.

**STEPDOWN FIX**– A fix permitting additional descent within a segment of an instrument approach procedure by identifying a point at which a controlling obstacle has been safely overflown.

**STEREO ROUTE**– A routinely used route of flight established by users and ARTCCs identified by a coded name; e.g., ALPHA 2. These routes minimize flight plan handling and communications.

**STOL AIRCRAFT**–

(See SHORT TAKEOFF AND LANDING AIRCRAFT.)

**STOP ALTITUDE SQUAWK**– Used by ATC to instruct a pilot to turn off the automatic altitude reporting feature of the aircraft transponder and ADS–B Out. It is issued when a verbally reported altitude varies by 300 feet or more from the automatic altitude report.

(See ALTITUDE READOUT.)

(See TRANSPONDER.)

**STOP AND GO**– A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point.

(See LOW APPROACH.)

(See OPTION APPROACH.)

**STOP BURST**–

(See STOP STREAM.)

**STOP BUZZER**–

(See STOP STREAM.)

**STOP SQUAWK (Mode or Code)**– Used by ATC to instruct a pilot to stop transponder and ADS–B transmissions, or to turn off only specified functions of the aircraft transponder (military).

(See STOP ALTITUDE SQUAWK.)

(See TRANSPONDER.)

**STOP STREAM**– Used by ATC to request a pilot to suspend electronic attack activity.

(See JAMMING.)

**STOPOVER FLIGHT PLAN**– A flight plan format which permits in a single submission the filing of a sequence of flight plans through interim full-stop destinations to a final destination.

**STOPWAY**– An area beyond the takeoff runway no less wide than the runway and centered upon the extended centerline of the runway, able to support the airplane during an aborted takeoff, without causing structural damage to the airplane, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff.

**STRAIGHT-IN APPROACH IFR**– An instrument approach wherein final approach is begun without first having executed a procedure turn, not necessarily completed with a straight-in landing or made to straight-in landing minimums.

(See LANDING MINIMUMS.)

(See STRAIGHT-IN APPROACH VFR.)

(See STRAIGHT-IN LANDING.)

**STRAIGHT-IN APPROACH VFR**– Entry into the traffic pattern by interception of the extended runway centerline (final approach course) without executing any other portion of the traffic pattern.

(See TRAFFIC PATTERN.)

**STRAIGHT-IN LANDING**– A landing made on a runway aligned within 30° of the final approach course following completion of an instrument approach.

(See STRAIGHT-IN APPROACH IFR.)

**STRAIGHT-IN LANDING MINIMUMS**–

(See LANDING MINIMUMS.)

**STRAIGHT-IN MINIMUMS**–

(See STRAIGHT-IN LANDING MINIMUMS.)

**STRATEGIC PLANNING**– Planning whereby solutions are sought to resolve potential conflicts.

**SUBSTITUTE ROUTE**– A route assigned to pilots when any part of an airway or route is unusable because of NAVAID status. These routes consist of:

a. Substitute routes which are shown on U.S. Government charts.

b. Routes defined by ATC as specific NAVAID radials or courses.

c. Routes defined by ATC as direct to or between NAVAIDs.

**SUNSET AND SUNRISE**– The mean solar times of sunset and sunrise as published in the Nautical Almanac, converted to local standard time for the locality concerned. Within Alaska, the end of evening civil twilight and the beginning of morning civil twilight, as defined for each locality.

**SUPPLEMENTAL WEATHER SERVICE LOCATION**– Airport facilities staffed with contract

personnel who take weather observations and provide current local weather to pilots via telephone or radio. (All other services are provided by the parent FSS.)

**SUPPS**– Refers to ICAO Document 7030 Regional Supplementary Procedures. SUPPS contain procedures for each ICAO Region which are unique to that Region and are not covered in the worldwide provisions identified in the ICAO Air Navigation Plan. Procedures contained in Chapter 8 are based in part on those published in SUPPS.

**SURFACE AREA**– The airspace contained by the lateral boundary of the Class B, C, D, or E airspace designated for an airport that begins at the surface and extends upward.

**SURPIC**– A description of surface vessels in the area of a Search and Rescue incident including their predicted positions and their characteristics.

(Refer to FAA Order JO 7110.65, Para 10–6–4, INFLIGHT CONTINGENCIES.)

**SURVEILLANCE APPROACH**– An instrument approach wherein the air traffic controller issues instructions, for pilot compliance, based on aircraft position in relation to the final approach course (azimuth), and the distance (range) from the end of the runway as displayed on the controller’s radar scope. The controller will provide recommended altitudes on final approach if requested by the pilot.

(Refer to AIM.)

**SWAP**–

(See SEVERE WEATHER AVOIDANCE PLAN.)

**SWSL**–

(See SUPPLEMENTAL WEATHER SERVICE LOCATION.)

**SYSTEM STRATEGIC NAVIGATION**– Military activity accomplished by navigating along a preplanned route using internal aircraft systems to maintain a desired track. This activity normally requires a lateral route width of 10 NM and altitude range of 1,000 feet to 6,000 feet AGL with some route segments that permit terrain following.



# T

## 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 (TCAN)**– 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 HOLD LIGHTS (THL)**– The THL system is composed of in-pavement lighting in a double, longitudinal row of lights aligned either side of the runway centerline. The lights 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. Illuminated red lights indicate 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 an aircraft or vehicle.

**TAKEOFF ROLL** – The process whereby an aircraft is aligned with the runway centerline and the aircraft is moving with the intent to take off. For helicopters,

this pertains to the act of becoming airborne after departing a takeoff area.

**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 a display resulting from a primary radar return, a radar beacon reply, or an ADS–B report. The specific target symbol presented to ATC may vary based on the surveillance source and automation platform.

(See ASSOCIATED.)

(See DIGITAL TARGET.)

(See DIGITIZED RADAR TARGET.)

(See FUSED TARGET.)

(See PRIMARY RADAR TARGET.)

(See RADAR.)

(See SECONDARY RADAR TARGET.)

(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–

(See TARGET.)

(See ICAO term TARGET.)

**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**.)

**TEMPORARY FLIGHT RESTRICTION (TFR)**– A TFR is a regulatory action issued by the FAA via the U.S. NOTAM System, under the authority of United States Code, Title 49. TFRs are issued within the sovereign airspace of the United States and its territories to restrict certain aircraft from operating within a defined area on a temporary basis to protect persons or property in the air or on the ground. While not all inclusive, TFRs may be issued for disaster or hazard situations such as: toxic gas leaks or spills, fumes from flammable agents, aircraft accident/incident sites, aviation or ground resources engaged in wildfire suppression, or aircraft relief activities following a disaster. TFRs may also be issued in support of VIP movements, for reasons of national security; or when determined necessary for the management of air traffic in the vicinity of aerial demonstrations or major sporting events. NAS users or other interested parties should contact a FSS for TFR information. Additionally, TFR information can be found in automated briefings, NOTAM publications, and on the internet at <http://www.faa.gov>. The FAA also distributes TFR information to aviation user groups for further dissemination.

**TENTATIVE CALCULATED LANDING TIME (TCLT)**– 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 Chart Supplement U.S.

**a. Basic Radar Service**– These services are provided for VFR aircraft by all commissioned terminal radar facilities. Basic radar service includes safety alerts, traffic advisories, limited radar vectoring when requested by the pilot, and sequencing at locations where procedures have been established for this purpose and/or when covered by a letter of agreement. The purpose of this service is to adjust the flow of arriving IFR and VFR aircraft into the traffic pattern in a safe and orderly manner and to provide traffic advisories to departing VFR aircraft.

**b. TRSA Service**– This service provides, in addition to basic radar service, sequencing of all IFR and participating VFR aircraft to the primary airport and separation between all participating VFR aircraft. The purpose of this service is to provide separation between all participating VFR aircraft and all IFR aircraft operating within the area defined as a TRSA.

**c. Class C Service**– This service provides, in addition to basic radar service, approved separation between IFR and VFR aircraft, and sequencing of

VFR aircraft, and sequencing of VFR arrivals to the primary airport.

**d. Class B Service**– This service provides, in addition to basic radar service, approved separation of aircraft based on IFR, VFR, and/or weight, and sequencing of VFR arrivals to the primary airport(s).

(See CONTROLLED AIRSPACE.)

(See TERMINAL RADAR SERVICE AREA.)

(Refer to AIM.)

(Refer to CHART SUPPLEMENT U.S.)

**TERMINAL-VERY HIGH FREQUENCY OMNI-DIRECTIONAL RANGE STATION (TVOR)**– A very high frequency terminal omnirange station located on or near an airport and used as an approach aid.

(See NAVIGATIONAL AID.)

(See VOR.)

**TERRAIN AWARENESS WARNING SYSTEM (TAWS)**– An on-board, terrain proximity alerting system providing the aircrew ‘Low Altitude warnings’ to allow immediate pilot action.

**TERRAIN FOLLOWING**– The flight of a military aircraft maintaining a constant AGL altitude above the terrain or the highest obstruction. The altitude of the aircraft will constantly change with the varying terrain and/or obstruction.

**TETRAHEDRON**– A device normally located on uncontrolled airports and used as a landing direction indicator. The small end of a tetrahedron points in the direction of landing. At controlled airports, the tetrahedron, if installed, should be disregarded because tower instructions supersede the indicator.

(See SEGMENTED CIRCLE.)

(Refer to AIM.)

**TF**–

(See TERRAIN FOLLOWING.)

**THAT IS CORRECT**– The understanding you have is right.

**THA**–

(See TRANSITIONAL HAZARD AREA.)

**THREE-HOUR TARMAC RULE**– Rule that relates to Department of Transportation (DOT) requirements placed on airlines when tarmac delays are anticipated to reach 3 hours.

**360 OVERHEAD**–

(See OVERHEAD MANEUVER.)

**THRESHOLD**– The beginning of that portion of the runway usable for landing.

(See AIRPORT LIGHTING.)

(See DISPLACED THRESHOLD.)

**THRESHOLD CROSSING HEIGHT**– The theoretical height above the runway threshold at which the aircraft’s glideslope antenna would be if the aircraft maintains the trajectory established by the mean ILS glideslope or the altitude at which the calculated glidepath of an RNAV or GPS approaches.

(See GLIDESLOPE.)

(See THRESHOLD.)

**THRESHOLD LIGHTS**–

(See AIRPORT LIGHTING.)

**TIBS**–

(See TELEPHONE INFORMATION BRIEFING SERVICE.)

**TIE-IN FACILITY**– The FSS primarily responsible for providing FSS services, including telecommunication services for landing facilities or navigational aids located within the boundaries of a flight plan area (FPA). Three-letter identifiers are assigned to each FSS/FPA and are annotated as tie-in facilities in the Chart Supplement U.S., the Alaska Supplement, the Pacific Supplement, and FAA Order JO 7350.9, Location Identifiers. Large consolidated FSS facilities may have many tie-in facilities or FSS sectors within one facility.

(See FLIGHT PLAN AREA.)

(See FLIGHT SERVICE STATION.)

**TIME BASED FLOW MANAGEMENT (TBFM)**–

The hardware, software, methods, processes, and initiatives to manage air traffic flows based on time to balance air traffic demand with system capacity, and support the management of PBN. This includes, but not limited to, Adjacent Center Metering (ACM), En Route Departure Capability (EDC), Ground-based Interval Management-Spacing (GIM-S), Integrated Departure/Arrival Capability (IDAC), Single Center Metering (SCM), Time-Based Metering (TBM), Time-Based Scheduling (TBS), and Extended/Coupled Metering.

**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.)

**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.)

**TOP ALTITUDE**– In reference to SID published altitude restrictions, the charted “maintain” altitude contained in the procedure description or assigned by ATC.

**TORA**–

(See TAKEOFF RUN AVAILABLE.)

(See ICAO term TAKEOFF RUN AVAILABLE.)

**TORCHING**– The burning of fuel at the end of an exhaust pipe or stack of a reciprocating aircraft engine, the result of an excessive richness in the fuel air mixture.

**TOS**–

(See TRAJECTORY OPTIONS SET)

**TOTAL ESTIMATED ELAPSED TIME [ICAO]**–

For IFR flights, the estimated time required from takeoff to arrive over that designated point, defined by reference to navigation aids, from which it is intended that an instrument approach procedure will be commenced, or, if no navigation aid is associated with the destination aerodrome, to arrive over the destination aerodrome. For VFR flights, the estimated time required from takeoff to arrive over the destination aerodrome.

(See ICAO term ESTIMATED ELAPSED TIME.)

**TOUCH-AND-GO**– An operation by an aircraft that lands and departs on a runway without stopping or exiting the runway.

**TOUCH-AND-GO LANDING–**

(See TOUCH-AND-GO.)

**TOUCHDOWN–**

**a.** The point at which an aircraft first makes contact with the landing surface.

**b.** Concerning a precision radar approach (PAR), it is the point where the glide path intercepts the landing surface.

(See ICAO term TOUCHDOWN.)

**TOUCHDOWN [ICAO]–** The point where the nominal glide path intercepts the runway.

Note: Touchdown as defined above is only a datum and is not necessarily the actual point at which the aircraft will touch the runway.

**TOUCHDOWN RVR–**

(See VISIBILITY.)

**TOUCHDOWN ZONE–** The first 3,000 feet of the runway beginning at the threshold. The area is used for determination of Touchdown Zone Elevation in the development of straight-in landing minimums for instrument approaches.

(See ICAO term TOUCHDOWN ZONE.)

**TOUCHDOWN ZONE [ICAO]–** The portion of a runway, beyond the threshold, where it is intended landing aircraft first contact the runway.

**TOUCHDOWN ZONE ELEVATION–** The highest elevation in the first 3,000 feet of the landing surface. TDZE is indicated on the instrument approach procedure chart when straight-in landing minimums are authorized.

(See TOUCHDOWN ZONE.)

**TOUCHDOWN ZONE LIGHTING–**

(See AIRPORT LIGHTING.)

**TOWER–** A terminal facility that uses air/ground communications, visual signaling, and other devices to provide ATC services to aircraft operating in the vicinity of an airport or on the movement area. Authorizes aircraft to land or takeoff at the airport controlled by the tower or to transit the Class D airspace area regardless of flight plan or weather

conditions (IFR or VFR). A tower may also provide approach control services (radar or nonradar).

(See AIRPORT TRAFFIC CONTROL SERVICE.)

(See APPROACH CONTROL FACILITY.)

(See APPROACH CONTROL SERVICE.)

(See MOVEMENT AREA.)

(See TOWER EN ROUTE CONTROL SERVICE.)

(See ICAO term AERODROME CONTROL TOWER.)

(Refer to AIM.)

**TOWER EN ROUTE CONTROL SERVICE–** The control of IFR en route traffic within delegated airspace between two or more adjacent approach control facilities. This service is designed to expedite traffic and reduce control and pilot communication requirements.

**TOWER TO TOWER–**

(See TOWER EN ROUTE CONTROL SERVICE.)

**TRACEABLE PRESSURE STANDARD–** The facility station pressure instrument, with certification/calibration traceable to the National Institute of Standards and Technology. Traceable pressure standards may be mercurial barometers, commissioned ASOS or dual transducer AWOS, or portable pressure standards or DASI.

**TRACK–** The actual flight path of an aircraft over the surface of the earth.

(See COURSE.)

(See FLIGHT PATH.)

(See ROUTE.)

(See ICAO term TRACK.)

**TRACK [ICAO]–** The projection on the earth's surface of the path of an aircraft, the direction of which path at any point is usually expressed in degrees from North (True, Magnetic, or Grid).

**TRACK OF INTEREST (TOI)–** Displayed data representing an airborne object that threatens or has the potential to threaten North America or National Security. Indicators may include, but are not limited to: noncompliance with air traffic control instructions or aviation regulations; extended loss of communications; unusual transmissions or unusual flight behavior; unauthorized intrusion into controlled airspace or an ADIZ; noncompliance with issued flight restrictions/security procedures; or unlawful interference with airborne flight crews, up to and including hijack. In certain circumstances, an object

may become a TOI based on specific and credible intelligence pertaining to that particular aircraft/object, its passengers, or its cargo.

**TRACK OF INTEREST RESOLUTION**– A TOI will normally be considered resolved when: the aircraft/object is no longer airborne; the aircraft complies with air traffic control instructions, aviation regulations, and/or issued flight restrictions/security procedures; radio contact is re-established and authorized control of the aircraft is verified; the aircraft is intercepted and intent is verified to be nonthreatening/nonhostile; TOI was identified based on specific and credible intelligence that was later determined to be invalid or unreliable; or displayed data is identified and characterized as invalid.

**TRAFFIC**–

**a.** A term used by a controller to transfer radar identification of an aircraft to another controller for the purpose of coordinating separation action. Traffic is normally issued:

1. In response to a handoff or point out,
2. In anticipation of a handoff or point out, or
3. In conjunction with a request for control of an aircraft.

**b.** A term used by ATC to refer to one or more aircraft.

**TRAFFIC ADVISORIES**– Advisories issued to alert pilots to other known or observed air traffic which may be in such proximity to the position or intended route of flight of their aircraft to warrant their attention. Such advisories may be based on:

- a.** Visual observation.
- b.** Observation of radar identified and nonidentified aircraft targets on an ATC radar display, or
- c.** Verbal reports from pilots or other facilities.

Note 1: The word “traffic” followed by additional information, if known, is used to provide such advisories; e.g., “Traffic, 2 o’clock, one zero miles, southbound, eight thousand.”

Note 2: Traffic advisory service will be provided to the extent possible depending on higher priority duties of the controller or other limitations; e.g., radar limitations, volume of traffic, frequency congestion, or controller workload. Radar/nonradar traffic advisories do not relieve the pilot of his/her responsibility to see and avoid other aircraft. Pilots are cautioned that there are many times when the controller is not able to give traffic

advisories concerning all traffic in the aircraft’s proximity; in other words, when a pilot requests or is receiving traffic advisories, he/she should not assume that all traffic will be issued.

(Refer to AIM.)

**TRAFFIC ALERT (aircraft call sign), TURN (left/right) IMMEDIATELY, (climb/descend) AND MAINTAIN (altitude).**

(See SAFETY ALERT.)

**TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM (TCAS)**– An airborne collision avoidance system based on radar beacon signals which operates independent of ground-based equipment. TCAS-I generates traffic advisories only. TCAS-II generates traffic advisories, and resolution (collision avoidance) advisories in the vertical plane.

**TRAFFIC INFORMATION**–

(See TRAFFIC ADVISORIES.)

**TRAFFIC INFORMATION SERVICE–BROADCAST (TIS–B)**– The broadcast of ATC derived traffic information to ADS–B equipped (1090ES or UAT) aircraft. The source of this traffic information is derived from 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 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 EDST representation of the path an aircraft is predicted to fly based upon a Current Plan or Trial Plan.

(See **EN ROUTE DECISION SUPPORT TOOL**.)

**TRAJECTORY MODELING**– The automated process of calculating a trajectory.

**TRAJECTORY OPTIONS SET (TOS)**– A TOS is an electronic message, submitted by the operator, that is used by the Collaborative Trajectory Options Program (CTOP) to manage the airspace captured in the traffic management program. The TOS will allow the operator to express the route and delay trade-off options that they are willing to accept.

**TRANSCRIBED WEATHER BROADCAST (TWEB)**– 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.

**TRANSITIONAL HAZARD AREA (THA)–** Used by ATC. Airspace normally associated with an Aircraft Hazard Area within which the flight of aircraft is subject to restrictions.

(See AIRCRAFT HAZARD AREA.)

(See CONTINGENCY HAZARD AREA.)

(See REFINED HAZARD AREA.)

**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).

(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.

**TURBULENCE–** An atmospheric phenomenon that causes changes in aircraft altitude, attitude, and or airspeed with aircraft reaction depending on intensity. Pilots report turbulence intensity according to aircraft's reaction as follows:

**a. Light –** Causes slight, erratic changes in altitude and or attitude (pitch, roll, or yaw).

**b. Moderate–** Similar to Light but of greater intensity. Changes in altitude and or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed.

**c. Severe–** Causes large, abrupt changes in altitude and or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control.

**d. Extreme**– The aircraft is violently tossed about and is practically impossible to control. It may cause structural damage.

(See CHOP.)

(Refer to AIM.)

**TURN ANTICIPATION**– (maneuver anticipation).

**TVOR**–

(See **TERMINAL-VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION**.)

**TWEB**–

(See **TRANSCRIBED WEATHER BROADCAST**.)

**TWO-WAY RADIO COMMUNICATIONS FAILURE**–

(See **LOST COMMUNICATIONS**.)





# U

## UHF–

(See ULTRAHIGH FREQUENCY.)

**ULTRAHIGH FREQUENCY (UHF)**– The frequency band between 300 and 3,000 MHz. The bank of radio frequencies used for military air/ground voice communications. In some instances this may go as low as 225 MHz and still be referred to as UHF.

**ULTRALIGHT VEHICLE**– A single-occupant aeronautical vehicle operated for sport or recreational purposes which does not require FAA registration, an airworthiness certificate, or pilot certification. Operation of an ultralight vehicle in certain airspace requires authorization from ATC.

(Refer to 14 CFR Part 103.)

**UNABLE**– Indicates inability to comply with a specific instruction, request, or clearance.

**UNASSOCIATED**– A radar target that does not display a data block with flight identification and altitude information.

(See ASSOCIATED.)

**UNCONTROLLED AIRSPACE**– Airspace in which aircraft are not subject to controlled airspace (Class A, B, C, D, or E) separation criteria.

**UNDER THE HOOD**– Indicates that the pilot is using a hood to restrict visibility outside the cockpit while simulating instrument flight. An appropriately rated pilot is required in the other control seat while this operation is being conducted.

(Refer to 14 CFR Part 91.)

**UNFROZEN**– The Scheduled Time of Arrival (STA) tags, which are still being rescheduled by the time based flow management (TBFM) calculations. The aircraft will remain unfrozen until the time the corresponding estimated time of arrival (ETA) tag passes the preset freeze horizon for that aircraft's stream class. At this point the automatic rescheduling will stop, and the STA becomes "frozen."

**UNICOM**– A nongovernment communication facility which may provide airport information at certain airports. Locations and frequencies of UNICOMs are shown on aeronautical charts and publications.

(See CHART SUPPLEMENT U.S.)

(Refer to AIM.)

**UNMANNED AIRCRAFT (UA)**– A device used or intended to be used for flight that has no onboard pilot. This device can be any type of airplane, helicopter, airship, or powered-lift aircraft. Unmanned free balloons, moored balloons, tethered aircraft, gliders, and unmanned rockets are not considered to be a UA.

**UNMANNED AIRCRAFT SYSTEM (UAS)**– An unmanned aircraft and its associated elements related to safe operations, which may include control stations (ground, ship, or air based), control links, support equipment, payloads, flight termination systems, and launch/recovery equipment. It consists of three elements: unmanned aircraft, control station, and data link.

**UNPUBLISHED ROUTE**– A route for which no minimum altitude is published or charted for pilot use. It may include a direct route between NAVAIDs, a radial, a radar vector, or a final approach course beyond the segments of an instrument approach procedure.

(See PUBLISHED ROUTE.)

(See ROUTE.)

**UNRELIABLE (GPS/WAAS)**– An advisory to pilots indicating the expected level of service of the GPS and/or WAAS may not be available. Pilots must then determine the adequacy of the signal for desired use.

## UNSERVICEABLE (U/S)

(See OUT OF SERVICE/UNSERVICEABLE.)

## UPWIND LEG–

(See TRAFFIC PATTERN.)

**URGENCY**– A condition of being concerned about safety and of requiring timely but not immediate assistance; a potential distress condition.

(See ICAO term URGENCY.)

**URGENCY [ICAO]**– A condition concerning the safety of an aircraft or other vehicle, or of person on board or in sight, but which does not require immediate assistance.

## USAFIB–

(See ARMY AVIATION FLIGHT INFORMATION BULLETIN.)



# V

## VASI–

(See VISUAL APPROACH SLOPE INDICATOR.)

## VCOA–

(See VISUAL CLIMB OVER AIRPORT.)

## VDP–

(See VISUAL DESCENT POINT.)

**VECTOR**– A heading issued to an aircraft to provide navigational guidance by radar.

(See ICAO term RADAR VECTORING.)

**VERIFY**– Request confirmation of information; e.g., “verify assigned altitude.”

**VERIFY SPECIFIC DIRECTION OF TAKEOFF (OR TURNS AFTER TAKEOFF)**– Used by ATC to ascertain an aircraft’s direction of takeoff and/or direction of turn after takeoff. It is normally used for IFR departures from an airport not having a control tower. When direct communication with the pilot is not possible, the request and information may be relayed through an FSS, dispatcher, or by other means.

(See IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES.)

**VERTEX**– The last fix adapted on the arrival speed segments. Normally, it will be the outer marker of the runway in use. However, it may be the actual threshold or other suitable common point on the approach path for the particular runway configuration.

**VERTEX TIME OF ARRIVAL**– A calculated time of aircraft arrival over the adapted vertex for the runway configuration in use. The time is calculated via the optimum flight path using adapted speed segments.

**VERTICAL NAVIGATION (VNAV)**– A function of area navigation (RNAV) equipment which calculates, displays, and provides vertical guidance to a profile or path.

**VERTICAL SEPARATION**– Separation between aircraft expressed in units of vertical distance.

(See SEPARATION.)

**VERTICAL TAKEOFF AND LANDING AIRCRAFT (VTOL)**– Aircraft capable of vertical climbs

and/or descents and of using very short runways or small areas for takeoff and landings. These aircraft include, but are not limited to, helicopters.

(See SHORT TAKEOFF AND LANDING AIRCRAFT.)

**VERY HIGH FREQUENCY (VHF)**– The frequency band between 30 and 300 MHz. Portions of this band, 108 to 118 MHz, are used for certain NAVAIDs; 118 to 136 MHz are used for civil air/ground voice communications. Other frequencies in this band are used for purposes not related to air traffic control.

**VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION**–

(See VOR.)

**VERY LOW FREQUENCY (VLF)**– The frequency band between 3 and 30 kHz.

## VFR–

(See VISUAL FLIGHT RULES.)

**VFR AIRCRAFT**– An aircraft conducting flight in accordance with visual flight rules.

(See VISUAL FLIGHT RULES.)

**VFR CONDITIONS**– Weather conditions equal to or better than the minimum for flight under visual flight rules. The term may be used as an ATC clearance/instruction only when:

**a.** An IFR aircraft requests a climb/descent in VFR conditions.

**b.** The clearance will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

**c.** A pilot has requested a practice instrument approach and is not on an IFR flight plan.

Note: All pilots receiving this authorization must comply with the VFR visibility and distance from cloud criteria in 14 CFR Part 91. Use of the term does not relieve controllers of their responsibility to separate aircraft in Class B and Class C airspace or TRSAs as required by FAA Order JO 7110.65. When used as an ATC clearance/instruction, the term may be abbreviated “VFR;” e.g., “MAINTAIN VFR,” “CLIMB/DESCEND VFR,” etc.

## VFR FLIGHT–

(See VFR AIRCRAFT.)

**VFR MILITARY TRAINING ROUTES (VR)**– Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training under VFR below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

**VFR NOT RECOMMENDED**– An advisory provided by a flight service station to a pilot during a preflight or inflight weather briefing that flight under visual flight rules is not recommended. To be given when the current and/or forecast weather conditions are at or below VFR minimums. It does not abrogate the pilot’s authority to make his/her own decision.

**VFR-ON-TOP**– ATC authorization for an IFR aircraft to operate in VFR conditions at any appropriate VFR altitude (as specified in 14 CFR and as restricted by ATC). A pilot receiving this authorization must comply with the VFR visibility, distance from cloud criteria, and the minimum IFR altitudes specified in 14 CFR Part 91. The use of this term does not relieve controllers of their responsibility to separate aircraft in Class B and Class C airspace or TRSAs as required by FAA Order JO 7110.65.

**VFR TERMINAL AREA CHARTS**–  
(See AERONAUTICAL CHART.)

**VFR WAYPOINT**–  
(See WAYPOINT.)

**VHF**–  
(See VERY HIGH FREQUENCY.)

**VHF OMNIDIRECTIONAL RANGE/TACTICAL AIR NAVIGATION**–  
(See VORTAC.)

**VIDEO MAP**– An electronically displayed map on the radar display that may depict data such as airports, heliports, runway centerline extensions, hospital emergency landing areas, NAVAIDs and fixes, reporting points, airway/route centerlines, boundaries, handoff points, special use tracks, obstructions, prominent geographic features, map alignment indicators, range accuracy marks, and/or minimum vectoring altitudes.

**VISIBILITY**– The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by

night. Visibility is reported as statute miles, hundreds of feet or meters.

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**a. Flight Visibility**– The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

**b. Ground Visibility**– Prevailing horizontal visibility near the earth’s surface as reported by the United States National Weather Service or an accredited observer.

**c. Prevailing Visibility**– The greatest horizontal visibility equaled or exceeded throughout at least half the horizon circle which need not necessarily be continuous.

**d. Runway Visual Range (RVR)**– An instrumentally derived value, based on standard calibrations, that represents the horizontal distance a pilot will see down the runway from the approach end. It is based on the sighting of either high intensity runway lights or on the visual contrast of other targets whichever yields the greater visual range. RVR, in contrast to prevailing or runway visibility, is based on what a pilot in a moving aircraft should see looking down the runway. RVR is horizontal visual range, not slant visual range. It is based on the measurement of a transmissometer made near the touchdown point of the instrument runway and is reported in hundreds of feet. RVR, where available, is used in lieu of prevailing visibility in determining minimums for a particular runway.

**1. Touchdown RVR**– The RVR visibility readout values obtained from RVR equipment serving the runway touchdown zone.

**2. Mid-RVR**– The RVR readout values obtained from RVR equipment located midfield of the runway.

**3. Rollout RVR**– The RVR readout values obtained from RVR equipment located nearest the rollout end of the runway.

(See ICAO term FLIGHT VISIBILITY.)

(See ICAO term GROUND VISIBILITY.)

(See ICAO term RUNWAY VISUAL RANGE.)

(See ICAO term VISIBILITY.)

**VISIBILITY [ICAO]**– The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night.

**a. Flight Visibility**– The visibility forward from the cockpit of an aircraft in flight.

**b. Ground Visibility**– The visibility at an aerodrome as reported by an accredited observer.

**c. Runway Visual Range [RVR]**– The range over which the pilot of an aircraft on the centerline of a runway can see the runway surface markings or the lights delineating the runway or identifying its centerline.

**VISUAL APPROACH**– An approach conducted on an instrument flight rules (IFR) flight plan which authorizes the pilot to proceed visually and clear of clouds to the airport. The pilot must, at all times, have either the airport or the preceding aircraft in sight. This approach must be authorized and under the control of the appropriate air traffic control facility. Reported weather at the airport must be: ceiling at or above 1,000 feet, and visibility of 3 miles or greater.

(See ICAO term VISUAL APPROACH.)

**VISUAL APPROACH [ICAO]**– An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

**VISUAL APPROACH SLOPE INDICATOR (VASI)**–

(See AIRPORT LIGHTING.)

**VISUAL CLIMB OVER AIRPORT (VCOA)**– A departure option for an IFR aircraft, operating in visual meteorological conditions equal to or greater than the specified visibility and ceiling, to visually conduct climbing turns over the airport to the published “climb-to” altitude from which to proceed with the instrument portion of the departure. VCOA procedures are developed to avoid obstacles greater than 3 statute miles from the departure end of the runway as an alternative to complying with climb gradients greater than 200 feet per nautical mile. Pilots are responsible to advise ATC as early as possible of the intent to fly the VCOA option prior to departure. These textual procedures are published in the ‘Take-Off Minimums and (Obstacle) Departure Procedures’ section of the Terminal Procedures Publications and/or appear as an option on a Graphic ODP.

(See AIM.)

**VISUAL DESCENT POINT**– A defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided the approach threshold of that runway, or approach lights, or other markings identifiable with the approach end of that runway are clearly visible to the pilot.

**VISUAL FLIGHT RULES**– Rules that govern the procedures for conducting flight under visual conditions. The term “VFR” is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

(See INSTRUMENT FLIGHT RULES.)

(See INSTRUMENT METEOROLOGICAL CONDITIONS.)

(See VISUAL METEOROLOGICAL CONDITIONS.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**VISUAL HOLDING**– The holding of aircraft at selected, prominent geographical fixes which can be easily recognized from the air.

(See HOLDING FIX.)

**VISUAL METEOROLOGICAL CONDITIONS**– Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.

(See INSTRUMENT FLIGHT RULES.)

(See INSTRUMENT METEOROLOGICAL CONDITIONS.)

(See VISUAL FLIGHT RULES.)

**VISUAL SEGMENT**–

(See PUBLISHED INSTRUMENT APPROACH PROCEDURE VISUAL SEGMENT.)

**VISUAL SEPARATION**– A means employed by ATC to separate aircraft in terminal areas and en route airspace in the NAS. There are two ways to effect this separation:

**a.** The tower controller sees the aircraft involved and issues instructions, as necessary, to ensure that the aircraft avoid each other.

**b.** A pilot sees the other aircraft involved and upon instructions from the controller provides his/her own separation by maneuvering his/her aircraft as

necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor.

(See SEE AND AVOID.)

(Refer to 14 CFR Part 91.)

VLF–

(See VERY LOW FREQUENCY.)

VMC–

(See VISUAL METEOROLOGICAL CONDITIONS.)

**VOICE SWITCHING AND CONTROL SYSTEM (VSCS)**– A computer controlled switching system that provides air traffic controllers with all voice circuits (air to ground and ground to ground) necessary for air traffic control.

(Refer to AIM.)

**VOR**– A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Airspace System. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots.

(See NAVIGATIONAL AID.)

(Refer to AIM.)

**VOR TEST SIGNAL**–

(See VOT.)

**VORTAC**– A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site.

(See DISTANCE MEASURING EQUIPMENT.)

(See NAVIGATIONAL AID.)

(See TACAN.)

(See VOR.)

(Refer to AIM.)

**VORTICES**– Circular patterns of air created by the movement of an airfoil through the air when generating lift. As an airfoil moves through the atmosphere in sustained flight, an area of low pressure is created above it. The air flowing from the high pressure area to the low pressure area around and about the tips of the airfoil tends to roll up into two rapidly rotating vortices, cylindrical in shape. These vortices are the most predominant parts of aircraft wake turbulence and their rotational force is dependent upon the wing loading, gross weight, and speed of the generating aircraft. The vortices from medium to super aircraft can be of extremely high velocity and hazardous to smaller aircraft.

(See AIRCRAFT CLASSES.)

(See WAKE TURBULENCE.)

(Refer to AIM.)

**VOT**– A ground facility which emits a test signal to check VOR receiver accuracy. Some VOTs are available to the user while airborne, and others are limited to ground use only.

(See CHART SUPPLEMENT U.S.)

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**VR**–

(See VFR MILITARY TRAINING ROUTES.)

**VSCS**–

(See VOICE SWITCHING AND CONTROL SYSTEM.)

**VTA**–

(See VERTEX TIME OF ARRIVAL.)

**VTOL AIRCRAFT**–

(See VERTICAL TAKEOFF AND LANDING AIRCRAFT.)

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