



U.S. Department  
of Transportation

**Federal Aviation  
Administration**

# *AERONAUTICAL INFORMATION MANUAL*

---

*Change 3  
April 27, 2017*

---

**DO NOT DESTROY  
BASIC DATED  
DECEMBER 10, 2015**



# Aeronautical Information Manual

## Explanation of Changes

**Effective: April 27, 2017**

### **a. 1-1-3. VHF Omni-directional Range (VOF)**

This change is necessary to increase pilot and controller awareness regarding the VOR Minimum Operating Network.

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

This change is added to provide clarity regarding user reports requested on NAVAID or GNSS performance or interference.

### **c. 1-2-4. Pilots and Air Traffic Controllers Recognizing Interference or Spoofing**

The GNSS Intentional Interference and Spoofing Study Team (GIISST) recently received a briefing on GPS spoofing and interference. As a result of the discussions that followed that briefing, the GIIST recommended that the AIM and AIP be updated to include information to pilots regarding the dangers of GPS spoofing and interference. Therefore, this paragraph is now added.

### **d. 2-1-6. Runway Status Light (RWSL) System**

#### **4-5-5. Airport Surface Detection Equipment Model-X (ASDE-X)**

#### **Appendix 3. Abbreviations/Acronyms**

This change is added to reflect that the FAA Surveillance and Broadcast Services Program Office intends to implement the Airport Surface Surveillance Capability (ASSC) for situational awareness and surveillance of the surface movement area, as well as approach and departure routes, at select airports within the National Airspace System (NAS). ASSC will augment visual observation of landing or departing aircraft, and aircraft or vehicle traffic on the surface movement area.

### **e. 4-1-6. Pilot Visits to Air Traffic Facilities**

This paragraph provides realistic information about pilot visits to Air Traffic Service facilities, but

encourages pilots to participate in pilot/air traffic outreach activities.

### **f. 4-1-7. Operation Take-Off and Operation Rain Check**

The Flight Services Directorate rescinded FAA Order 7230.17, Pilot Education Program – Operation Take-off, which required the amendment of this paragraph to show that Operation Rain Check is still viable.

### **g. 4-1-14. Automatic Flight Information Service (AFIS) – Alaska FSS Only**

#### **4-3-8. Braking Action Reports and Advisories**

#### **4-3-9. Runway Friction Reports and Advisories**

This change realigns paragraph 4-1-14 for easier reading and corrects a grammatical error for the use of word “breaking” versus “braking.” In paragraph 4-3-8, the reference to “fair” was replaced with “medium.” In addition, new FICON NOTAM terminology was introduced as well as two new braking action classifications that include “Good to Medium” and “Medium to Poor.” Paragraph 4-3-9 (containing Mu reporting) has been removed and replaced with new content that references Runway Condition Assessment reporting procedures.

### **h. 4-4-12. Speed Adjustments**

#### **5-2-8. Instrument Departure Procedures – Obstacle Departure Procedures (ODP) and Standard Instrument Departures (SID)**

#### **5-5-9. Speed Adjustments**

Since the introduction “climb via” procedures in April 2014, confusion and frustration within the industry has been communicated. The premise of one size fits all in the use of climb via clearances when departures procedures do not contain published crossing restrictions has not been successful. As a result, action is being taken to restore direction for use of “Maintain” when formulating departure clearances containing SID procedures that do not

contain published crossing restrictions, radar vector SIDs, and those SIDs with a radar vector segment.

**i. 4-5-7. Automatic Dependent Surveillance Broadcast (ADS-B) Services**

This change provides pilots with background information concerning duplicate ICAO addresses and explains the importance of ensuring the correct entry of the address.

**j. 5-1-8. Flight Plan (FAA Form 7233-1) – Domestic IFR Flights**

This change removes legacy language no longer used.

**k. 5-1-12. Change in Flight Plan  
5-1-13. Change in Proposed Departure Time**

This change gives flight plan filers guidance on the time parameters for completing flight plan amendments prior to an aircraft's proposed departure time. Additionally, this change amends the time parameter established to delete the proposed departure times from Air Route Traffic Control Centers (ARTCC) from 1 hour to 2 hours.

**l. 5-2-4. Line Up and Wait (LUAW)**

This change expands the definition of LUAW to include the terms "within six flying miles."

**m. 5-2-7. Departure Control**

This change clarifies the requirement for controllers to assign an altitude to an aircraft when they issue an initial heading that takes the aircraft off of a procedure.

**n. 5-3-8. Holding**

This guidance is intended to ensure that aircraft remain within holding protected airspace when RNAV systems are used to fly a holding pattern defined by RNAV or ground-based NAVAIDs. This change also updates recommended helicopter holding speeds and air traffic procedures specific to holding.

**o. 5-5-14. Instrument Departures**

This change clarifies the requirement for controllers to assign an altitude to an aircraft when they issue an initial heading that takes the aircraft off of a procedure. It also adds language inadvertently left off this paragraph when a companion paragraph in FAA Order JO 7110.65, Air Traffic Control, was revised in December 2015.

**p. 5-6-1. National Security and Interception Procedures**

This change adds the consolidation of four FDC NOTAMs that contain special security requirements for aircraft (including civil, foreign, and state) to, from, within, or transiting U.S. territorial airspace; removes obsolete references; and reorganizes and renumbers multiple paragraphs.

**q. 9-1-1. General**

**9-1-2. Obtaining Aeronautical Charts**

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

**9-1-5. Where and How to Get Charts of Foreign Areas**

**10-1-4. The Gulf of Mexico Grid System**

**Appendix 3. Abbreviations/Acronyms**

This change replaces references to "Aeronautical Navigation Products (AeroNav)" with "Aeronautical Information Services (AIS)" to reflect the organizational name change. The information on how to obtain copies of charts and other publications is also updated.

**r. Appendix 3. Abbreviations/Acronyms**

This change removes legacy language no longer used.

**s. Pilot/Controller Glossary**

Terms have been added, deleted, or modified within this glossary. Please refer to page PCG-1 for more details.

**t. Entire publication.**

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

## AIM Change 3

### Page Control Chart

April 27, 2017

REMOVE PAGES	DATED	INSERT PAGES	DATED
Checklist of Pages CK-1 through CK-6 . . . .	11/10/16	Checklist of Pages CK-1 through CK-6 . . . .	4/27/17
Basic Flt Info & ATC Procedures . . . . .	5/26/16	Basic Flt Info & ATC Procedures . . . . .	4/27/17
Flight Info Publication Policy . . . . .	12/10/15	Flight Info Publication Policy . . . . .	12/10/15
Table of Contents i through xi . . . . .	11/10/16	Table of Contents i through xii . . . . .	4/27/17
1-1-1 . . . . .	5/26/16	1-1-1 . . . . .	5/26/16
1-1-2 through 1-1-4 . . . . .	5/26/16	1-1-2 through 1-1-4 . . . . .	4/27/17
1-1-5 . . . . .	12/10/15	1-1-5 . . . . .	4/27/17
1-1-6 . . . . .	5/26/16	1-1-6 . . . . .	4/27/17
1-1-7 through 1-1-13 . . . . .	12/10/15	1-1-7 through 1-1-13 . . . . .	4/27/17
1-1-14 . . . . .	5/26/16	1-1-14 . . . . .	4/27/17
1-1-15 and 1-1-16 . . . . .	12/10/15	1-1-15 and 1-1-16 . . . . .	4/27/17
1-1-17 and 1-1-18 . . . . .	5/26/16	1-1-17 and 1-1-18 . . . . .	4/27/17
1-1-19 through 1-1-31 . . . . .	12/10/15	1-1-19 through 1-1-31 . . . . .	4/27/17
1-1-32 . . . . .	11/10/16	1-1-32 . . . . .	4/27/17
1-1-33 through 1-1-34 . . . . .	12/10/15	1-1-33 through 1-1-35 . . . . .	4/27/17
1-2-7 . . . . .	11/10/16	1-2-7 . . . . .	11/10/16
1-2-8 . . . . .	5/26/16	1-2-8 . . . . .	4/27/17
2-1-9 . . . . .	12/10/15	2-1-9 . . . . .	4/27/17
2-1-10 . . . . .	12/10/15	2-1-10 . . . . .	12/10/15
4-1-1 and 4-1-2 . . . . .	5/26/16	4-1-1 and 4-1-2 . . . . .	4/27/17
4-1-7 . . . . .	11/10/16	4-1-7 . . . . .	11/10/16
4-1-8 . . . . .	11/10/16	4-1-8 . . . . .	4/27/17
4-3-11 . . . . .	12/10/15	4-3-11 . . . . .	12/10/15
4-3-12 through 4-3-14 . . . . .	5/26/16	4-3-12 through 4-3-14 . . . . .	4/27/17
4-3-15 and 4-3-16 . . . . .	11/10/16	4-3-15 and 4-3-16 . . . . .	4/27/17
4-3-17 through 4-3-25 . . . . .	5/26/16	4-3-17 through 4-3-25 . . . . .	4/27/17
4-3-26 through 4-3-28 . . . . .	12/10/15	4-3-26 through 4-3-28 . . . . .	4/27/17
4-3-29 . . . . .	5/26/16	4-3-29 through 4-3-31 . . . . .	4/27/17
4-4-7 . . . . .	11/10/16	4-4-7 . . . . .	4/27/17
4-4-8 through 4-4-11 . . . . .	12/10/15	4-4-8 through 4-4-12 . . . . .	4/27/17
4-5-7 through 4-5-9 . . . . .	12/10/15	4-5-7 through 4-5-9 . . . . .	4/27/17
4-5-10 . . . . .	12/10/15	4-5-10 . . . . .	12/10/15
4-5-17 through 4-5-20 . . . . .	12/10/15	4-5-17 through 4-5-20 . . . . .	4/27/17
5-1-13 . . . . .	5/26/16	5-1-13 . . . . .	4/27/17
5-1-14 . . . . .	12/10/15	5-1-14 . . . . .	4/27/17
5-1-29 . . . . .	12/10/15	5-1-29 . . . . .	12/10/15
5-1-30 through 5-1-32 . . . . .	12/10/15	5-1-30 through 5-1-32 . . . . .	4/27/17
5-2-1 . . . . .	5/26/16	5-2-1 . . . . .	5/26/16
5-2-2 . . . . .	5/26/16	5-2-2 . . . . .	4/27/17
5-2-3 through 5-2-9 . . . . .	12/10/15	5-2-3 through 5-2-9 . . . . .	4/27/17

<b>REMOVE PAGES</b>	<b>DATED</b>	<b>INSERT PAGES</b>	<b>DATED</b>
5-2-10 and 5-2-11 .....	5/26/16	5-2-10 and 5-2-11 .....	4/27/17
5-2-12 .....	11/10/16	5-2-12 .....	4/27/17
5-3-7 .....	12/10/15	5-3-7 .....	12/10/15
5-3-8 and 5-3-9 .....	5/26/16	5-3-8 and 5-3-9 .....	11/10/16
5-3-10 .....	12/10/15	5-3-10 .....	12/10/15
5-3-11 through 5-3-14 .....	12/10/15	5-3-11 through 5-3-18 .....	4/27/17
5-4-47 .....	12/10/15	5-4-47 .....	4/27/17
5-4-48 .....	12/10/15	5-4-48 .....	12/10/15
5-5-3 .....	12/10/15	5-5-3 .....	12/10/15
5-5-4 .....	11/10/16	5-5-4 .....	4/27/17
5-5-7 and 5-5-8 .....	12/10/15	5-5-7 and 5-5-8 .....	4/27/17
5-6-1 through 5-6-10 .....	12/10/15	5-6-1 through 5-6-14 .....	4/27/17
7-2-3 .....	12/10/15	7-2-3 .....	4/27/17
7-2-4 .....	12/10/15	7-2-4 .....	12/10/15
9-1-1 .....	12/10/15	9-1-1 .....	4/27/17
9-1-2 .....	5/26/16	9-1-2 .....	5/26/16
9-1-7 .....	11/10/16	9-1-7 .....	4/27/17
9-1-8 .....	11/10/16	9-1-8 .....	11/10/16
9-1-9 through 9-1-11 .....	11/10/16	9-1-9 through 9-1-11 .....	4/27/17
9-1-12 .....	11/10/16	9-1-12 .....	11/10/16
9-1-13 .....	11/10/16	9-1-13 .....	4/27/17
10-1-3 .....	12/10/15	10-1-3 .....	12/10/15
10-1-4 .....	12/10/15	10-1-4 .....	4/27/17
10-1-7 .....	12/10/15	10-1-7 .....	4/27/17
PCG-1 and PCG-2 .....	11/10/16	PCG-1 and PCG-2 .....	4/27/17
PCG A-5 and PCG A-6 .....	5/26/16	PCG A-5 and PCG A-6 .....	4/27/17
PCG A-7 .....	5/26/16	PCG A-7 .....	5/26/16
PCG A-8 through PCG A-10 .....	5/26/16	PCG A-8 through PCG A-10 .....	4/27/17
PCG A-13 .....	11/10/16	PCG A-13 .....	11/10/16
PCG A-14 through PCG A-16 .....	5/26/16	PCG A-14 through PCG A-16 .....	4/27/17
PCG B-1 .....	5/26/16	PCG B-1 .....	5/26/16
PCG B-2 .....	5/26/16	PCG B-2 .....	4/27/17
PCG F-3 .....	12/10/15	PCG F-3 .....	4/27/17
PCG F-4 and PCG F-5 .....	5/26/16	PCG F-4 and PCG F-5 .....	4/27/17
PCG I-1 through PCG I-5 .....	5/26/16	PCG I-1 through PCG I-5 .....	4/27/17
PCG I-6 .....	11/10/16	PCG I-6 .....	4/27/17
PCG L-3 .....	12/10/15	PCG L-3 .....	4/27/17
PCG N-3 and PCG N-4 .....	11/10/16	PCG N-3 and PCG N-4 .....	4/27/17
PCG P-3 .....	12/10/15	PCG P-3 .....	12/10/15
PCG P-4 .....	5/26/16	PCG P-4 .....	4/27/17
PCG P-5 .....	12/10/15	PCG P-5 .....	4/27/17
PCG R-1 .....	5/26/16	PCG R-1 .....	5/26/16
PCG R-2 through PCG R-4 .....	5/26/16	PCG R-2 through PCG R-4 .....	4/27/17

<b>REMOVE PAGES</b>	<b>DATED</b>	<b>INSERT PAGES</b>	<b>DATED</b>
PCG S-1 .....	12/10/15	PCG S-1 .....	4/27/17
PCG S-2 .....	5/26/16	PCG S-2 .....	5/26/16
PCG T-1 .....	12/10/15	PCG T-1 .....	12/10/15
PCG T-2 .....	12/10/15	PCG T-2 .....	4/27/17
Appendix 3-1 .....	5/26/16	Appendix 3-1 .....	4/27/17
Appendix 3-2 .....	12/10/15	Appendix 3-2 .....	4/27/17
Index I-1 through I-12 .....	11/10/16	Index I-1 through I-12 .....	4/27/17





## Checklist of Pages

PAGE	DATE
Cover	4/27/17
Record of Changes	N/A
Exp of Chg-1	4/27/17
Exp of Chg-2	4/27/17
<b>Checklist of Pages</b>	
CK-1	4/27/17
CK-2	4/27/17
CK-3	4/27/17
CK-4	4/27/17
CK-5	4/27/17
CK-6	4/27/17
Subscription Info	12/10/15
Comments/Corr	12/10/15
Comments/Corr	12/10/15
Basic Flight Info	4/27/17
Publication Policy	12/10/15
Reg & Advis Cir	12/10/15
<b>Table of Contents</b>	
i	4/27/17
ii	4/27/17
iii	4/27/17
iv	4/27/17
v	4/27/17
vi	4/27/17
vii	4/27/17
viii	4/27/17
ix	4/27/17
x	4/27/17
xi	4/27/17
<b>Chapter 1. Air Navigation</b>	
<b>Section 1. Navigation Aids</b>	
1-1-1	5/26/16
1-1-2	4/27/17
1-1-3	4/27/17
1-1-4	4/27/17
1-1-5	4/27/17
1-1-6	4/27/17
1-1-7	4/27/17
1-1-8	4/27/17
1-1-9	4/27/17
1-1-10	4/27/17
1-1-11	4/27/17

PAGE	DATE
1-1-12	4/27/17
1-1-13	4/27/17
1-1-14	4/27/17
1-1-15	4/27/17
1-1-16	4/27/17
1-1-17	4/27/17
1-1-18	4/27/17
1-1-19	4/27/17
1-1-20	4/27/17
1-1-21	4/27/17
1-1-22	4/27/17
1-1-23	4/27/17
1-1-24	4/27/17
1-1-25	4/27/17
1-1-26	4/27/17
1-1-27	4/27/17
1-1-28	4/27/17
1-1-29	4/27/17
1-1-30	4/27/17
1-1-31	4/27/17
1-1-32	4/27/17
1-1-33	4/27/17
1-1-34	4/27/17
1-1-35	4/27/17
<b>Section 2. Performance-Based Navigation (PBN) and Area Navigation (RNAV)</b>	
1-2-1	12/10/15
1-2-2	12/10/15
1-2-3	12/10/15
1-2-4	12/10/15
1-2-5	12/10/15
1-2-6	12/10/15
1-2-7	11/10/16
1-2-8	4/27/17

PAGE	DATE
<b>Chapter 2. Aeronautical Lighting and Other Airport Visual Aids</b>	
<b>Section 1. Airport Lighting Aids</b>	
2-1-1	5/26/16
2-1-2	12/10/15
2-1-3	12/10/15
2-1-4	11/10/16
2-1-5	12/10/15
2-1-6	12/10/15
2-1-7	12/10/15
2-1-8	12/10/15
2-1-9	4/27/17
2-1-10	12/10/15
2-1-11	12/10/15
2-1-12	12/10/15
2-1-13	12/10/15
2-1-14	5/26/16
2-1-15	12/10/15
<b>Section 2. Air Navigation and Obstruction Lighting</b>	
2-2-1	12/10/15
2-2-2	12/10/15
<b>Section 3. Airport Marking Aids and Signs</b>	
2-3-1	12/10/15
2-3-2	12/10/15
2-3-3	12/10/15
2-3-4	12/10/15
2-3-5	12/10/15
2-3-6	12/10/15
2-3-7	12/10/15
2-3-8	12/10/15
2-3-9	12/10/15
2-3-10	12/10/15
2-3-11	12/10/15
2-3-12	12/10/15
2-3-13	12/10/15
2-3-14	12/10/15
2-3-15	12/10/15
2-3-16	12/10/15
2-3-17	12/10/15
2-3-18	12/10/15
2-3-19	12/10/15
2-3-20	12/10/15
2-3-21	12/10/15

## Checklist of Pages

PAGE	DATE
2-3-22	12/10/15
2-3-23	12/10/15
2-3-24	12/10/15
2-3-25	12/10/15
2-3-26	12/10/15
2-3-27	12/10/15
2-3-28	12/10/15
2-3-29	12/10/15
2-3-30	12/10/15
2-3-31	12/10/15
<b>Chapter 3. Airspace</b>	
<b>Section 1. General</b>	
3-1-1	12/10/15
3-1-2	12/10/15
<b>Section 2. Controlled Airspace</b>	
3-2-1	12/10/15
3-2-2	12/10/15
3-2-3	5/26/16
3-2-4	12/10/15
3-2-5	12/10/15
3-2-6	12/10/15
3-2-7	12/10/15
3-2-8	5/26/16
3-2-9	5/26/16
3-2-10	5/26/16
<b>Section 3. Class G Airspace</b>	
3-3-1	12/10/15
<b>Section 4. Special Use Airspace</b>	
3-4-1	12/10/15
3-4-2	12/10/15
<b>Section 5. Other Airspace Areas</b>	
3-5-1	11/10/16
3-5-2	5/26/16
3-5-3	5/26/16
3-5-4	5/26/16
3-5-5	5/26/16
3-5-6	12/10/15
3-5-7	12/10/15
3-5-8	12/10/15
3-5-9	12/10/15

PAGE	DATE
<b>Chapter 4. Air Traffic Control</b>	
<b>Section 1. Services Available to Pilots</b>	
4-1-1	4/27/17
4-1-2	4/27/17
4-1-3	5/26/16
4-1-4	5/26/16
4-1-5	5/26/16
4-1-6	5/26/16
4-1-7	11/10/16
4-1-8	4/27/17
4-1-9	11/10/16
4-1-10	11/10/16
4-1-11	11/10/16
4-1-12	11/10/16
4-1-13	11/10/16
4-1-14	11/10/16
4-1-15	11/10/16
4-1-16	11/10/16
4-1-17	11/10/16
4-1-18	11/10/16
4-1-19	5/26/16
4-1-20	5/26/16
<b>Section 2. Radio Communications Phraseology and Techniques</b>	
4-2-1	12/10/15
4-2-2	12/10/15
4-2-3	12/10/15
4-2-4	12/10/15
4-2-5	5/26/16
4-2-6	12/10/15
4-2-7	12/10/15
4-2-8	5/26/16
<b>Section 3. Airport Operations</b>	
4-3-1	12/10/15
4-3-2	12/10/15
4-3-3	5/26/16
4-3-4	12/10/15
4-3-5	12/10/15
4-3-6	12/10/15
4-3-7	5/26/16
4-3-8	12/10/15
4-3-9	12/10/15
4-3-10	12/10/15
4-3-11	12/10/15

PAGE	DATE
4-3-12	4/27/17
4-3-13	4/27/17
4-3-14	4/27/17
4-3-15	4/27/17
4-3-16	4/27/17
4-3-17	4/27/17
4-3-18	4/27/17
4-3-19	4/27/17
4-3-20	4/27/17
4-3-21	4/27/17
4-3-22	4/27/17
4-3-23	4/27/17
4-3-24	4/27/17
4-3-25	4/27/17
4-3-26	4/27/17
4-3-27	4/27/17
4-3-28	4/27/17
4-3-29	4/27/17
4-3-30	4/27/17
4-3-31	4/27/17
<b>Section 4. ATC Clearances and Aircraft Separation</b>	
4-4-1	12/10/15
4-4-2	12/10/15
4-4-3	12/10/15
4-4-4	12/10/15
4-4-5	12/10/15
4-4-6	12/10/15
4-4-7	4/27/17
4-4-8	4/27/17
4-4-9	4/27/17
4-4-10	4/27/17
4-4-11	4/27/17
4-4-12	4/27/17
<b>Section 5. Surveillance Systems</b>	
4-5-1	12/10/15
4-5-2	5/26/16
4-5-3	12/10/15
4-5-4	12/10/15
4-5-5	12/10/15
4-5-6	12/10/15
4-5-7	4/27/17
4-5-8	4/27/17
4-5-9	4/27/17
4-5-10	12/10/15
4-5-11	12/10/15

## Checklist of Pages

PAGE	DATE
4-5-12	12/10/15
4-5-13	12/10/15
4-5-14	12/10/15
4-5-15	12/10/15
4-5-16	12/10/15
4-5-17	4/27/17
4-5-18	4/27/17
4-5-19	4/27/17
4-5-20	4/27/17
4-5-21	12/10/15
<b>Section 6. Operational Policy/ Procedures for Reduced Vertical Separation Minimum (RVSM) in the Domestic U.S., Alaska, Offshore Airspace and the San Juan FIR</b>	
4-6-1	11/10/16
4-6-2	11/10/16
4-6-3	11/10/16
4-6-4	11/10/16
4-6-5	11/10/16
4-6-6	11/10/16
4-6-7	11/10/16
4-6-8	11/10/16
4-6-9	11/10/16
4-6-10	11/10/16
<b>Section 7. Operational Policy/ Procedures for the Gulf of Mexico 50 NM Lateral Separation Initiative</b>	
4-7-1	5/26/16
4-7-2	11/10/16
4-7-3	5/26/16
4-7-4	5/26/16
<b>Chapter 5. Air Traffic Procedures</b>	
<b>Section 1. Preflight</b>	
5-1-1	12/10/15
5-1-2	5/26/16
5-1-3	5/26/16
5-1-4	12/10/15
5-1-5	12/10/15
5-1-6	12/10/15
5-1-7	12/10/15
5-1-8	12/10/15
5-1-9	12/10/15

PAGE	DATE
5-1-10	12/10/15
5-1-11	12/10/15
5-1-12	12/10/15
5-1-13	4/27/17
5-1-14	4/27/17
5-1-15	12/10/15
5-1-16	12/10/15
5-1-17	12/10/15
5-1-18	12/10/15
5-1-19	12/10/15
5-1-20	12/10/15
5-1-21	11/10/16
5-1-22	12/10/15
5-1-23	12/10/15
5-1-24	12/10/15
5-1-25	12/10/15
5-1-26	12/10/15
5-1-27	12/10/15
5-1-28	12/10/15
5-1-29	12/10/15
5-1-30	4/27/17
5-1-31	4/27/17
5-1-32	4/27/17
<b>Section 2. Departure Procedures</b>	
5-2-1	5/26/16
5-2-2	4/27/17
5-2-3	4/27/17
5-2-4	4/27/17
5-2-5	4/27/17
5-2-6	4/27/17
5-2-7	4/27/17
5-2-8	4/27/17
5-2-9	4/27/17
5-2-10	4/27/17
5-2-11	4/27/17
5-2-12	4/27/17
<b>Section 3. En Route Procedures</b>	
5-3-1	12/10/15
5-3-2	12/10/15
5-3-3	12/10/15
5-3-4	12/10/15
5-3-5	12/10/15
5-3-6	12/10/15
5-3-7	12/10/15

PAGE	DATE
5-3-8	4/27/17
5-3-9	4/27/17
5-3-10	12/10/15
5-3-11	4/27/17
5-3-12	4/27/17
5-3-13	4/27/17
5-3-14	4/27/17
5-3-15	4/27/17
5-3-16	4/27/17
5-3-17	4/27/17
5-3-18	4/27/17
<b>Section 4. Arrival Procedures</b>	
5-4-1	11/10/16
5-4-2	5/26/16
5-4-3	5/26/16
5-4-4	5/26/16
5-4-5	5/26/16
5-4-6	5/26/16
5-4-7	5/26/16
5-4-8	5/26/16
5-4-9	12/10/15
5-4-10	12/10/15
5-4-11	12/10/15
5-4-12	12/10/15
5-4-13	12/10/15
5-4-14	12/10/15
5-4-15	12/10/15
5-4-16	11/10/16
5-4-17	11/10/16
5-4-18	11/10/16
5-4-19	11/10/16
5-4-20	11/10/16
5-4-21	11/10/16
5-4-22	11/10/16
5-4-23	11/10/16
5-4-24	11/10/16
5-4-25	11/10/16
5-4-26	11/10/16
5-4-27	5/26/16
5-4-28	5/26/16
5-4-29	5/26/16
5-4-30	12/10/15
5-4-31	12/10/15
5-4-32	12/10/15
5-4-33	12/10/15
5-4-34	12/10/15
5-4-35	12/10/15
5-4-36	12/10/15

## Checklist of Pages

PAGE	DATE
5-4-37	12/10/15
5-4-38	11/10/16
5-4-39	12/10/15
5-4-40	12/10/15
5-4-41	12/10/15
5-4-42	12/10/15
5-4-43	12/10/15
5-4-44	12/10/15
5-4-45	12/10/15
5-4-46	12/10/15
5-4-47	4/27/17
5-4-48	12/10/15
5-4-49	12/10/15
5-4-50	12/10/15
5-4-51	12/10/15
5-4-52	12/10/15
5-4-53	12/10/15
5-4-54	12/10/15
5-4-55	12/10/15
5-4-56	12/10/15
5-4-57	12/10/15
5-4-58	12/10/15
5-4-59	12/10/15
5-4-60	12/10/15
5-4-61	12/10/15
5-4-62	12/10/15
5-4-63	12/10/15
<b>Section 5. Pilot/Controller Roles and Responsibilities</b>	
5-5-1	12/10/15
5-5-2	12/10/15
5-5-3	12/10/15
5-5-4	4/27/17
5-5-5	12/10/15
5-5-6	12/10/15
5-5-7	4/27/17
5-5-8	4/27/17
<b>Section 6. National Security and Interception Procedures</b>	
5-6-1	4/27/17
5-6-2	4/27/17
5-6-3	4/27/17
5-6-4	4/27/17
5-6-5	4/27/17
5-6-6	4/27/17
5-6-7	4/27/17
5-6-8	4/27/17
5-6-9	4/27/17

PAGE	DATE
5-6-10	4/27/17
5-6-11	4/27/17
5-6-12	4/27/17
5-6-13	4/27/17
5-6-14	4/27/17
<b>Chapter 6. Emergency Procedures</b>	
<b>Section 1. General</b>	
6-1-1	12/10/15
<b>Section 2. Emergency Services Available to Pilots</b>	
6-2-1	12/10/15
6-2-2	12/10/15
6-2-3	5/26/16
6-2-4	12/10/15
6-2-5	12/10/15
6-2-6	12/10/15
6-2-7	12/10/15
6-2-8	12/10/15
6-2-9	12/10/15
6-2-10	12/10/15
6-2-11	12/10/15
<b>Section 3. Distress and Urgency Procedures</b>	
6-3-1	5/26/16
6-3-2	5/26/16
6-3-3	12/10/15
6-3-4	12/10/15
6-3-5	12/10/15
6-3-6	12/10/15
6-3-7	12/10/15
<b>Section 4. Two-way Radio Communications Failure</b>	
6-4-1	12/10/15
6-4-2	12/10/15
<b>Section 5. Aircraft Rescue and Fire Fighting Communications</b>	
6-5-1	12/10/15
6-5-2	12/10/15

PAGE	DATE
<b>Chapter 7. Safety of Flight</b>	
<b>Section 1. Meteorology</b>	
7-1-1	5/26/16
7-1-2	5/26/16
7-1-3	12/10/15
7-1-4	5/26/16
7-1-5	5/26/16
7-1-6	5/26/16
7-1-7	5/26/16
7-1-8	5/26/16
7-1-9	5/26/16
7-1-10	5/26/16
7-1-11	11/10/16
7-1-12	5/26/16
7-1-13	5/26/16
7-1-14	5/26/16
7-1-15	5/26/16
7-1-16	11/10/16
7-1-17	5/26/16
7-1-18	5/26/16
7-1-19	5/26/16
7-1-20	5/26/16
7-1-21	5/26/16
7-1-22	5/26/16
7-1-23	5/26/16
7-1-24	5/26/16
7-1-25	5/26/16
7-1-26	5/26/16
7-1-27	5/26/16
7-1-28	5/26/16
7-1-29	5/26/16
7-1-30	5/26/16
7-1-31	5/26/16
7-1-32	5/26/16
7-1-33	5/26/16
7-1-34	5/26/16
7-1-35	5/26/16
7-1-36	5/26/16
7-1-37	5/26/16
7-1-38	5/26/16
7-1-39	5/26/16
7-1-40	5/26/16
7-1-41	5/26/16
7-1-42	5/26/16
7-1-43	5/26/16
7-1-44	5/26/16
7-1-45	5/26/16
7-1-46	5/26/16
7-1-47	5/26/16

## Checklist of Pages

PAGE	DATE
7-1-48	5/26/16
7-1-49	5/26/16
7-1-50	5/26/16
7-1-51	5/26/16
7-1-52	5/26/16
7-1-53	5/26/16
7-1-54	5/26/16
7-1-55	5/26/16
7-1-56	5/26/16
7-1-57	5/26/16
7-1-58	5/26/16
7-1-59	5/26/16
7-1-60	5/26/16
7-1-61	5/26/16
7-1-62	5/26/16
7-1-63	5/26/16
7-1-64	5/26/16
7-1-65	5/26/16
7-1-66	5/26/16
7-1-67	5/26/16
7-1-68	5/26/16
7-1-69	5/26/16
<b>Section 2. Altimeter Setting Procedures</b>	
7-2-1	12/10/15
7-2-2	12/10/15
7-2-3	4/27/17
7-2-4	12/10/15
<b>Section 3. Wake Turbulence</b>	
7-3-1	12/10/15
7-3-2	12/10/15
7-3-3	12/10/15
7-3-4	12/10/15
7-3-5	12/10/15
7-3-6	12/10/15
7-3-7	12/10/15
7-3-8	12/10/15
<b>Section 4. Bird Hazards and Flight Over National Refuges, Parks, and Forests</b>	
7-4-1	12/10/15
7-4-2	5/26/16

PAGE	DATE
<b>Section 5. Potential Flight Hazards</b>	
7-5-1	12/10/15
7-5-2	12/10/15
7-5-3	12/10/15
7-5-4	12/10/15
7-5-5	12/10/15
7-5-6	12/10/15
7-5-7	12/10/15
7-5-8	12/10/15
7-5-9	12/10/15
7-5-10	5/26/16
7-5-11	12/10/15
7-5-12	12/10/15
7-5-13	12/10/15
7-5-14	5/26/16
<b>Section 6. Safety, Accident, and Hazard Reports</b>	
7-6-1	12/10/15
7-6-2	12/10/15
7-6-3	12/10/15
<b>Chapter 8. Medical Facts for Pilots</b>	
<b>Section 1. Fitness for Flight</b>	
8-1-1	12/10/15
8-1-2	12/10/15
8-1-3	12/10/15
8-1-4	12/10/15
8-1-5	12/10/15
8-1-6	12/10/15
8-1-7	12/10/15
8-1-8	12/10/15
8-1-9	12/10/15
<b>Chapter 9. Aeronautical Charts and Related Publications</b>	
<b>Section 1. Types of Charts Available</b>	
9-1-1	4/27/17
9-1-2	5/26/16
9-1-3	11/10/16
9-1-4	11/10/16
9-1-5	11/10/16
9-1-6	11/10/16
9-1-7	4/27/17
9-1-8	11/10/16

PAGE	DATE
9-1-9	4/27/17
9-1-10	4/27/17
9-1-11	4/27/17
9-1-12	11/10/16
9-1-13	4/27/17
<b>Chapter 10. Helicopter Operations</b>	
<b>Section 1. Helicopter IFR Operations</b>	
10-1-1	12/10/15
10-1-2	12/10/15
10-1-3	12/10/15
10-1-4	4/27/17
10-1-5	12/10/15
10-1-6	12/10/15
10-1-7	4/27/17
<b>Section 2. Special Operations</b>	
10-2-1	12/10/15
10-2-2	12/10/15
10-2-3	12/10/15
10-2-4	12/10/15
10-2-5	12/10/15
10-2-6	12/10/15
10-2-7	12/10/15
10-2-8	12/10/15
10-2-9	12/10/15
10-2-10	12/10/15
10-2-11	12/10/15
10-2-12	12/10/15
10-2-13	12/10/15
10-2-14	12/10/15
10-2-15	12/10/15
10-2-16	12/10/15
10-2-17	12/10/15
<b>Appendices</b>	
Appendix 1-1	12/10/15
Env	N/A
Appendix 2-1	12/10/15
Appendix 3-1	4/27/17
Appendix 3-2	4/27/17
Appendix 3-3	12/10/15
Appendix 3-4	12/10/15
Appendix 3-5	12/10/15

### Checklist of Pages

PAGE	DATE
<b>Pilot/Controller Glossary</b>	
PCG-1	4/27/17
PCG-2	4/27/17
PCG A-1	12/10/15
PCG A-2	5/26/16
PCG A-3	5/26/16
PCG A-4	5/26/16
PCG A-5	4/27/17
PGC A-6	4/27/17
PCG A-7	5/26/16
PCG A-8	4/27/17
PCG A-9	4/27/17
PCG A-10	4/27/17
PCG A-11	5/26/16
PCG A-12	5/26/16
PCG A-13	11/10/16
PCG A-14	4/27/17
PCG A-15	4/27/17
PCG A-16	4/27/17
PCG B-1	5/26/16
PCG B-2	4/27/17
PCG C-1	12/10/15
PCG C-2	5/26/16
PCG C-3	11/10/16
PCG C-4	11/10/16
PCG C-5	11/10/16
PCG C-6	11/10/16
PCG C-7	11/10/16
PCG C-8	11/10/16
PCG C-9	11/10/16
PCG D-1	11/10/16
PCG D-2	11/10/16
PCG D-3	11/10/16
PCG D-4	11/10/16
PCG E-1	11/10/16
PCG E-2	11/10/16
PCG F-1	12/10/15
PCG F-2	12/10/15
PCG F-3	4/27/17
PCG F-4	4/27/17
PCG F-5	4/27/17
PCG G-1	12/10/15
PCG G-2	5/26/16
PCG G-3	5/26/16
PCG H-1	12/10/15
PCG H-2	12/10/15
PCG H-3	12/10/15
PCG I-1	4/27/17
PCG I-2	4/27/17

PAGE	DATE
PCG I-3	4/27/17
PCG I-4	4/27/17
PCG I-5	4/27/17
PCG I-6	4/27/17
PCG J-1	12/10/15
PCG K-1	12/10/15
PCG L-1	12/10/15
PCG L-2	5/26/16
PCG L-3	4/27/17
PCG M-1	12/10/15
PCG M-2	12/10/15
PCG M-3	12/10/15
PCG M-4	11/10/16
PCG M-5	11/10/16
PCG M-6	11/10/16
PCG N-1	11/10/16
PCG N-2	11/10/16
PCG N-3	4/27/17
PCG N-4	4/27/17
PCG O-1	12/10/15
PCG O-2	11/10/16
PCG O-3	11/10/16
PCG O-4	11/10/16
PCG P-1	12/10/15
PCG P-2	12/10/15
PCG P-3	12/10/15
PCG P-4	4/27/17
PCG P-5	4/27/17
PCG Q-1	12/10/15
PCG R-1	5/26/16
PCG R-2	4/27/17
PCG R-3	4/27/17
PCG R-4	4/27/17
PCG R-5	5/26/16
PCG R-6	5/26/16
PCG R-7	5/26/16
PCG R-8	5/26/16
PCG S-1	4/27/17
PCG S-2	5/26/16
PCG S-3	12/10/15
PCG S-4	12/10/15
PCG S-5	5/26/16
PCG S-6	12/10/15
PCG S-7	12/10/15
PCG S-8	5/26/16
PCG T-1	12/10/15
PCG T-2	4/27/17
PCG T-3	5/26/16
PCG T-4	5/26/16

PAGE	DATE
PCG T-5	5/26/16
PCG T-6	5/26/16
PCG T-7	5/26/16
PCG T-8	5/26/16
PCG U-1	5/26/16
PCG V-1	12/10/15
PCG V-2	12/10/15
PCG V-3	12/10/15
PCG V-4	5/26/16
PCG W-1	11/10/16
PCG W-2	5/26/16
<b>Index</b>	
I-1	4/27/17
I-2	4/27/17
I-3	4/27/17
I-4	4/27/17
I-5	4/27/17
I-6	4/27/17
I-7	4/27/17
I-8	4/27/17
I-9	4/27/17
I-10	4/27/17
I-11	4/27/17
I-12	4/27/17
Back Cover	N/A

## Federal Aviation Administration (FAA)

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

The activities required to carry out these responsibilities include: safety regulations; airspace management

and the establishment, operation, and maintenance of a civil–military common system of air traffic control (ATC) and navigation facilities; research and development in support of the fostering of a national system of airports, promulgation of standards and specifications for civil airports, and administration of Federal grants–in–aid for developing public airports; various joint and cooperative activities with the Department of Defense; and technical assistance (under State Department auspices) to other countries.

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

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

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

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

Notices to Airmen publication - A publication containing current Notices to Airmen (NOTAMs) which are considered essential to the safety of flight as well as supplemental data affecting the other

operational publications listed here. It also includes current Flight Data Center NOTAMs, which are regulatory in nature, issued to establish restrictions to flight or to amend charts or published Instrument Approach Procedures. This publication is issued every four weeks and is available through subscription from the Superintendent of Documents.

The Chart Supplement U.S., the Chart Supplement Alaska, and the Chart Supplement Pacific – These publications contain information on airports, communications, navigation aids, instrument landing systems, VOR receiver check points, preferred routes, Flight Service Station/Weather Service telephone numbers, Air Route Traffic Control Center (ARTCC) frequencies, part–time surface areas, and various other pertinent special notices essential to air navigation. These publications are available through a network of FAA approved print providers. A listing of products, dates of latest editions, and print providers is available on the Aeronautical Information Services (AIS) web site at: [http://www.faa.gov/air\\_traffic/flight\\_info/aeronav/print\\_providers/](http://www.faa.gov/air_traffic/flight_info/aeronav/print_providers/).

<b>Publication Schedule</b>		
<b>Basic or Change</b>	<b>Cutoff Date for Submission</b>	<b>Effective Date of Publication</b>
Basic Manual	6/25/15	12/10/15
Change 1	12/10/15	5/26/16
Change 2	5/26/16	11/10/16
Change 3	11/10/16	4/27/17
Basic Manual	4/27/17	10/12/17

## Flight Information Publication Policy

The following is in essence, the statement issued by the FAA Administrator and published in the December 10, 1964, issue of the Federal Register, concerning the FAA policy as pertaining to the type of information that will be published as NOTAMs and in the Aeronautical Information Manual.

**a.** It is a pilot's inherent responsibility to be alert at all times for and in anticipation of all circumstances, situations, and conditions affecting the safe operation of the aircraft. For example, a pilot should expect to find air traffic at any time or place. At or near both civil and military airports and in the vicinity of known training areas, a pilot should expect concentrated air traffic and realize concentrations of air traffic are not limited to these places.

**b.** It is the general practice of the agency to advertise by NOTAM or other flight information publications such information it may deem appropriate; information which the agency may from time to time make available to pilots is solely for the purpose of assisting them in executing their regulatory responsibilities. Such information serves the aviation community as a whole and not pilots individually.

**c.** The fact that the agency under one particular situation or another may or may not furnish information does not serve as a precedent of the agency's responsibility to the aviation community; neither does it give assurance that other information of the same or similar nature will be advertised, nor, does it guarantee that any and all information known to the agency will be advertised.

**d.** This publication, while not regulatory, provides information which reflects examples of operating techniques and procedures which may be requirements in other federal publications or regulations. It is made available solely to assist pilots in executing their responsibilities required by other publications.

Consistent with the foregoing, it is the policy of the Federal Aviation Administration to furnish information only when, in the opinion of the agency, a unique situation should be advertised and not to furnish routine information such as concentrations of air traffic, either civil or military. The Aeronautical Information Manual will not contain informative items concerning everyday circumstances that pilots should, either by good practices or regulation, expect to encounter or avoid.



# Table of Contents

## Chapter 1. Air Navigation

### Section 1. Navigation Aids

Paragraph	Page
1-1-1. General . . . . .	1-1-1
1-1-2. Nondirectional Radio Beacon (NDB) . . . . .	1-1-1
1-1-3. VHF Omni-directional Range (VOR) . . . . .	1-1-1
1-1-4. VOR Receiver Check . . . . .	1-1-3
1-1-5. Tactical Air Navigation (TACAN) . . . . .	1-1-4
1-1-6. VHF Omni-directional Range/Tactical Air Navigation (VORTAC) . . . . .	1-1-4
1-1-7. Distance Measuring Equipment (DME) . . . . .	1-1-5
1-1-8. Navigational Aid (NAVAID) Service Volumes . . . . .	1-1-5
1-1-9. Instrument Landing System (ILS) . . . . .	1-1-8
1-1-10. Simplified Directional Facility (SDF) . . . . .	1-1-13
1-1-11. NAVAID Identifier Removal During Maintenance . . . . .	1-1-15
1-1-12. NAVAIDs with Voice . . . . .	1-1-15
1-1-13. User Reports Requested on NAVAID or Global Navigation Satellite System (GNSS) Performance or Interference . . . . .	1-1-15
1-1-14. LORAN . . . . .	1-1-16
1-1-15. Inertial Reference Unit (IRU), Inertial Navigation System (INS), and Attitude Heading Reference System (AHRS) . . . . .	1-1-16
1-1-16. Doppler Radar . . . . .	1-1-16
1-1-17. Global Positioning System (GPS) . . . . .	1-1-16
1-1-18. Wide Area Augmentation System (WAAS) . . . . .	1-1-29
1-1-19. Ground Based Augmentation System (GBAS) Landing System (GLS) . . . . .	1-1-34
1-1-20. Precision Approach Systems other than ILS and GLS . . . . .	1-1-34

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

1-2-1. General . . . . .	1-2-1
1-2-2. Required Navigation Performance (RNP) . . . . .	1-2-4
1-2-3. Use of Suitable Area Navigation (RNAV) Systems on Conventional Procedures and Routes . . . . .	1-2-6
1-2-4. Pilots and Air Traffic Controllers Recognizing Interference or Spoofing . . . . .	1-2-8

## Chapter 2. Aeronautical Lighting and Other Airport Visual Aids

### Section 1. Airport Lighting Aids

2-1-1. Approach Light Systems (ALS) . . . . .	2-1-1
2-1-2. Visual Glideslope Indicators . . . . .	2-1-1
2-1-3. Runway End Identifier Lights (REIL) . . . . .	2-1-6
2-1-4. Runway Edge Light Systems . . . . .	2-1-6
2-1-5. In-runway Lighting . . . . .	2-1-6
2-1-6. Runway Status Light (RWSL) System . . . . .	2-1-7
2-1-7. Stand-Alone Final Approach Runway Occupancy Signal (FAROS) . . . . .	2-1-10
2-1-8. Control of Lighting Systems . . . . .	2-1-11

<b>Paragraph</b>	<b>Page</b>
2-1-9. Pilot Control of Airport Lighting .....	2-1-11
2-1-10. Airport/Heliport Beacons .....	2-1-14
2-1-11. Taxiway Lights .....	2-1-15

**Section 2. Air Navigation and Obstruction Lighting**

2-2-1. Aeronautical Light Beacons .....	2-2-1
2-2-2. Code Beacons and Course Lights .....	2-2-1
2-2-3. Obstruction Lights .....	2-2-1

**Section 3. Airport Marking Aids and Signs**

2-3-1. General .....	2-3-1
2-3-2. Airport Pavement Markings .....	2-3-1
2-3-3. Runway Markings .....	2-3-1
2-3-4. Taxiway Markings .....	2-3-7
2-3-5. Holding Position Markings .....	2-3-12
2-3-6. Other Markings .....	2-3-16
2-3-7. Airport Signs .....	2-3-19
2-3-8. Mandatory Instruction Signs .....	2-3-20
2-3-9. Location Signs .....	2-3-23
2-3-10. Direction Signs .....	2-3-25
2-3-11. Destination Signs .....	2-3-28
2-3-12. Information Signs .....	2-3-29
2-3-13. Runway Distance Remaining Signs .....	2-3-29
2-3-14. Aircraft Arresting Systems .....	2-3-30
2-3-15. Security Identifications Display Area (Airport Ramp Area) .....	2-3-31

**Chapter 3. Airspace**

**Section 1. General**

3-1-1. General .....	3-1-1
3-1-2. General Dimensions of Airspace Segments .....	3-1-1
3-1-3. Hierarchy of Overlapping Airspace Designations .....	3-1-1
3-1-4. Basic VFR Weather Minimums .....	3-1-1
3-1-5. VFR Cruising Altitudes and Flight Levels .....	3-1-2

**Section 2. Controlled Airspace**

3-2-1. General .....	3-2-1
3-2-2. Class A Airspace .....	3-2-2
3-2-3. Class B Airspace .....	3-2-2
3-2-4. Class C Airspace .....	3-2-4
3-2-5. Class D Airspace .....	3-2-8
3-2-6. Class E Airspace .....	3-2-9

**Section 3. Class G Airspace**

3-3-1. General .....	3-3-1
3-3-2. VFR Requirements .....	3-3-1
3-3-3. IFR Requirements .....	3-3-1

**Section 4. Special Use Airspace**

<b>Paragraph</b>	<b>Page</b>
3-4-1. General . . . . .	3-4-1
3-4-2. Prohibited Areas . . . . .	3-4-1
3-4-3. Restricted Areas . . . . .	3-4-1
3-4-4. Warning Areas . . . . .	3-4-1
3-4-5. Military Operations Areas . . . . .	3-4-2
3-4-6. Alert Areas . . . . .	3-4-2
3-4-7. Controlled Firing Areas . . . . .	3-4-2
3-4-8. National Security Areas . . . . .	3-4-2

**Section 5. Other Airspace Areas**

3-5-1. Airport Advisory/Information Services . . . . .	3-5-1
3-5-2. Military Training Routes . . . . .	3-5-1
3-5-3. Temporary Flight Restrictions . . . . .	3-5-2
3-5-4. Parachute Jump Aircraft Operations . . . . .	3-5-5
3-5-5. Published VFR Routes . . . . .	3-5-5
3-5-6. Terminal Radar Service Area (TRSA) . . . . .	3-5-9

**Chapter 4. Air Traffic Control**

**Section 1. Services Available to Pilots**

4-1-1. Air Route Traffic Control Centers . . . . .	4-1-1
4-1-2. Control Towers . . . . .	4-1-1
4-1-3. Flight Service Stations . . . . .	4-1-1
4-1-4. Recording and Monitoring . . . . .	4-1-1
4-1-5. Communications Release of IFR Aircraft Landing at an Airport Without an Operating Control Tower . . . . .	4-1-1
4-1-6. Pilot Visits to Air Traffic Facilities . . . . .	4-1-1
4-1-7. Operation Rain Check . . . . .	4-1-2
4-1-8. Approach Control Service for VFR Arriving Aircraft . . . . .	4-1-2
4-1-9. Traffic Advisory Practices at Airports Without Operating Control Towers . . . . .	4-1-2
4-1-10. IFR Approaches/Ground Vehicle Operations . . . . .	4-1-6
4-1-11. Designated UNICOM/MULTICOM Frequencies . . . . .	4-1-6
4-1-12. Use of UNICOM for ATC Purposes . . . . .	4-1-7
4-1-13. Automatic Terminal Information Service (ATIS) . . . . .	4-1-7
4-1-14. Automatic Flight Information Service (AFIS) – Alaska FSSs Only . . . . .	4-1-8
4-1-15. Radar Traffic Information Service . . . . .	4-1-9
4-1-16. Safety Alert . . . . .	4-1-10
4-1-17. Radar Assistance to VFR Aircraft . . . . .	4-1-11
4-1-18. Terminal Radar Services for VFR Aircraft . . . . .	4-1-12
4-1-19. Tower En Route Control (TEC) . . . . .	4-1-14
4-1-20. Transponder Operation . . . . .	4-1-15
4-1-21. Airport Reservation Operations and Special Traffic Management Programs . . . . .	4-1-18
4-1-22. Requests for Waivers and Authorizations from Title 14, Code of Federal Regulations (14 CFR) . . . . .	4-1-20
4-1-23. Weather System Processor . . . . .	4-1-20

**Section 2. Radio Communications Phraseology and Techniques**

<b>Paragraph</b>	<b>Page</b>
4-2-1. General .....	4-2-1
4-2-2. Radio Technique .....	4-2-1
4-2-3. Contact Procedures .....	4-2-1
4-2-4. Aircraft Call Signs .....	4-2-3
4-2-5. Description of Interchange or Leased Aircraft .....	4-2-4
4-2-6. Ground Station Call Signs .....	4-2-4
4-2-7. Phonetic Alphabet .....	4-2-5
4-2-8. Figures .....	4-2-6
4-2-9. Altitudes and Flight Levels .....	4-2-6
4-2-10. Directions .....	4-2-6
4-2-11. Speeds .....	4-2-6
4-2-12. Time .....	4-2-6
4-2-13. Communications with Tower when Aircraft Transmitter or Receiver or Both are Inoperative .....	4-2-7
4-2-14. Communications for VFR Flights .....	4-2-8

**Section 3. Airport Operations**

4-3-1. General .....	4-3-1
4-3-2. Airports with an Operating Control Tower .....	4-3-1
4-3-3. Traffic Patterns .....	4-3-2
4-3-4. Visual Indicators at Airports Without an Operating Control Tower .....	4-3-6
4-3-5. Unexpected Maneuvers in the Airport Traffic Pattern .....	4-3-6
4-3-6. Use of Runways/Declared Distances .....	4-3-7
4-3-7. Low Level Wind Shear/Microburst Detection Systems .....	4-3-12
4-3-8. Braking Action Reports and Advisories .....	4-3-12
4-3-9. Runway Condition Reports .....	4-3-13
4-3-10. Intersection Takeoffs .....	4-3-15
4-3-11. Pilot Responsibilities When Conducting Land and Hold Short Operations (LAHSO) .....	4-3-15
4-3-12. Low Approach .....	4-3-18
4-3-13. Traffic Control Light Signals .....	4-3-18
4-3-14. Communications .....	4-3-19
4-3-15. Gate Holding Due to Departure Delays .....	4-3-20
4-3-16. VFR Flights in Terminal Areas .....	4-3-20
4-3-17. VFR Helicopter Operations at Controlled Airports .....	4-3-20
4-3-18. Taxiing .....	4-3-22
4-3-19. Taxi During Low Visibility .....	4-3-23
4-3-20. Exiting the Runway After Landing .....	4-3-24
4-3-21. Practice Instrument Approaches .....	4-3-24
4-3-22. Option Approach .....	4-3-25
4-3-23. Use of Aircraft Lights .....	4-3-26
4-3-24. Flight Inspection/'Flight Check' Aircraft in Terminal Areas .....	4-3-26
4-3-25. Hand Signals .....	4-3-27
4-3-26. Operations at Uncontrolled Airports With Automated Surface Observing System (ASOS)/Automated Weather Sensor System(AWSS)/Automated Weather Observing System (AWOS) .....	4-3-31

**Section 4. ATC Clearances and Aircraft Separation**

<b>Paragraph</b>	<b>Page</b>
4-4-1. Clearance .....	4-4-1
4-4-2. Clearance Prefix .....	4-4-1
4-4-3. Clearance Items .....	4-4-1
4-4-4. Amended Clearances .....	4-4-2
4-4-5. Coded Departure Route (CDR) .....	4-4-3
4-4-6. Special VFR Clearances .....	4-4-3
4-4-7. Pilot Responsibility upon Clearance Issuance .....	4-4-4
4-4-8. IFR Clearance VFR-on-top .....	4-4-4
4-4-9. VFR/IFR Flights .....	4-4-5
4-4-10. Adherence to Clearance .....	4-4-5
4-4-11. IFR Separation Standards .....	4-4-7
4-4-12. Speed Adjustments .....	4-4-7
4-4-13. Runway Separation .....	4-4-10
4-4-14. Visual Separation .....	4-4-10
4-4-15. Use of Visual Clearing Procedures .....	4-4-11
4-4-16. Traffic Alert and Collision Avoidance System (TCAS I & II) .....	4-4-11
4-4-17. Traffic Information Service (TIS) .....	4-4-12

**Section 5. Surveillance Systems**

4-5-1. Radar .....	4-5-1
4-5-2. Air Traffic Control Radar Beacon System (ATCRBS) .....	4-5-2
4-5-3. Surveillance Radar .....	4-5-7
4-5-4. Precision Approach Radar (PAR) .....	4-5-7
4-5-5. Airport Surface Detection Equipment (ASDE-X)/Airport Surface Surveillance Capability (ASSC) .....	4-5-7
4-5-6. Traffic Information Service (TIS) .....	4-5-8
4-5-7. Automatic Dependent Surveillance-Broadcast (ADS-B) Services .....	4-5-14
4-5-8. Traffic Information Service- Broadcast (TIS-B) .....	4-5-18
4-5-9. Flight Information Service- Broadcast (FIS-B) .....	4-5-19
4-5-10. Automatic Dependent Surveillance-Rebroadcast (ADS-R) .....	4-5-21

**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) .....	4-6-1
4-6-2. Flight Level Orientation Scheme .....	4-6-1
4-6-3. Aircraft and Operator Approval Policy/Procedures, RVSM Monitoring and Databases for Aircraft and Operator Approval .....	4-6-2
4-6-4. Flight Planning into RVSM Airspace .....	4-6-2
4-6-5. Pilot RVSM Operating Practices and Procedures .....	4-6-3
4-6-6. Guidance on Severe Turbulence and Mountain Wave Activity (MWA) .....	4-6-3
4-6-7. Guidance on Wake Turbulence .....	4-6-5
4-6-8. Pilot/Controller Phraseology .....	4-6-5
4-6-9. Contingency Actions: Weather Encounters and Aircraft System Failures that Occur After Entry into RVSM Airspace .....	4-6-7
4-6-10. Procedures for Accommodation of Non-RVSM Aircraft .....	4-6-9
4-6-11. Non-RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off .....	4-6-10

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

<b>Paragraph</b>	<b>Page</b>
4-7-1. Introduction and Background .....	4-7-1
4-7-2. Lateral Separation Minima Applied .....	4-7-1
4-7-3. Operation on Routes on the Periphery of the Gulf of Mexico CTAs .....	4-7-1
4-7-4. Provisions for Non-RNP 10 Aircraft (Not Authorized RNP 10 or RNP 4) ...	4-7-1
4-7-5. Operator Action .....	4-7-2
4-7-6. RNP 10 or RNP 4 Authorization: Policy and Procedures for Aircraft and Operators .....	4-7-2
4-7-7. Flight Planning Requirements .....	4-7-3
4-7-8. Pilot and Dispatcher Procedures: Basic and In-flight Contingency Procedures .	4-7-3

## Chapter 5. Air Traffic Procedures

### Section 1. Preflight

5-1-1. Preflight Preparation .....	5-1-1
5-1-2. Follow IFR Procedures Even When Operating VFR .....	5-1-2
5-1-3. Notice to Airmen (NOTAM) System .....	5-1-2
5-1-4. Flight Plan – VFR Flights .....	5-1-7
5-1-5. Operational Information System (OIS) .....	5-1-10
5-1-6. Flight Plan– Defense VFR (DVFR) Flights .....	5-1-10
5-1-7. Composite Flight Plan (VFR/IFR Flights) .....	5-1-11
5-1-8. Flight Plan (FAA Form 7233-1)– Domestic IFR Flights .....	5-1-11
5-1-9. International Flight Plan (FAA Form 7233-4)– IFR Flights (For Domestic or International Flights) .....	5-1-17
5-1-10. IFR Operations to High Altitude Destinations .....	5-1-27
5-1-11. Flights Outside the U.S. and U.S. Territories .....	5-1-28
5-1-12. Change in Flight Plan .....	5-1-30
5-1-13. Change in Proposed Departure Time .....	5-1-30
5-1-14. Closing VFR/DVFR Flight Plans .....	5-1-30
5-1-15. Canceling IFR Flight Plan .....	5-1-30
5-1-16. RNAV and RNP Operations .....	5-1-31
5-1-17. Cold Temperature Operations .....	5-1-31

### Section 2. Departure Procedures

5-2-1. Pre-taxi Clearance Procedures .....	5-2-1
5-2-2. Automated Pre-Departure Clearance Procedures .....	5-2-1
5-2-3. Taxi Clearance .....	5-2-2
5-2-4. Line Up and Wait (LUAW) .....	5-2-2
5-2-5. Abbreviated IFR Departure Clearance (Cleared. . .as Filed) Procedures .....	5-2-3
5-2-6. Departure Restrictions, Clearance Void Times, Hold for Release, and Release Times .....	5-2-4
5-2-7. Departure Control .....	5-2-5
5-2-8. Instrument Departure Procedures (DP) – Obstacle Departure Procedures (ODP) and Standard Instrument Departures (SID) .....	5-2-6

### Section 3. En Route Procedures

Paragraph	Page
5-3-1. ARTCC Communications .....	5-3-1
5-3-2. Position Reporting .....	5-3-3
5-3-3. Additional Reports .....	5-3-4
5-3-4. Airways and Route Systems .....	5-3-5
5-3-5. Airway or Route Course Changes .....	5-3-7
5-3-6. Changeover Points (COPs) .....	5-3-8
5-3-7. Minimum Turning Altitude (MTA) .....	5-3-8
5-3-8. Holding .....	5-3-8

### Section 4. Arrival Procedures

5-4-1. Standard Terminal Arrival (STAR) Procedures .....	5-4-1
5-4-2. Local Flow Traffic Management Program .....	5-4-3
5-4-3. Approach Control .....	5-4-3
5-4-4. Advance Information on Instrument Approach .....	5-4-4
5-4-5. Instrument Approach Procedure (IAP) Charts .....	5-4-5
5-4-6. Approach Clearance .....	5-4-24
5-4-7. Instrument Approach Procedures .....	5-4-26
5-4-8. Special Instrument Approach Procedures .....	5-4-27
5-4-9. Procedure Turn and Hold-in-lieu of Procedure Turn .....	5-4-28
5-4-10. Timed Approaches from a Holding Fix .....	5-4-31
5-4-11. Radar Approaches .....	5-4-34
5-4-12. Radar Monitoring of Instrument Approaches .....	5-4-35
5-4-13. ILS Approaches to Parallel Runways .....	5-4-36
5-4-14. Parallel ILS Approaches (Dependent) (See FIG 5-4-20.) .....	5-4-38
5-4-15. Simultaneous (Parallel) Independent ILS/RNAV/GLS Approaches (See FIG 5-4-21.) .....	5-4-40
5-4-16. Simultaneous Close Parallel ILS PRM/RNAV PRM/GLS PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA) (See FIG 5-4-22.) .....	5-4-42
5-4-17. Simultaneous Converging Instrument Approaches .....	5-4-49
5-4-18. RNP AR Instrument Approach Procedures .....	5-4-50
5-4-19. Side-step Maneuver .....	5-4-52
5-4-20. Approach and Landing Minimums .....	5-4-52
5-4-21. Missed Approach .....	5-4-55
5-4-22. Use of Enhanced Flight Vision Systems (EFVS) on Instrument Approaches .....	5-4-57
5-4-23. Visual Approach .....	5-4-60
5-4-24. Charted Visual Flight Procedure (CVFP) .....	5-4-61
5-4-25. Contact Approach .....	5-4-62
5-4-26. Landing Priority .....	5-4-62
5-4-27. Overhead Approach Maneuver .....	5-4-62

### Section 5. Pilot/Controller Roles and Responsibilities

5-5-1. General .....	5-5-1
5-5-2. Air Traffic Clearance .....	5-5-1
5-5-3. Contact Approach .....	5-5-2
5-5-4. Instrument Approach .....	5-5-2
5-5-5. Missed Approach .....	5-5-3
5-5-6. Radar Vectors .....	5-5-3
5-5-7. Safety Alert .....	5-5-3

<b>Paragraph</b>	<b>Page</b>
5-5-8. See and Avoid .....	5-5-4
5-5-9. Speed Adjustments .....	5-5-4
5-5-10. Traffic Advisories (Traffic Information) .....	5-5-5
5-5-11. Visual Approach .....	5-5-5
5-5-12. Visual Separation .....	5-5-6
5-5-13. VFR-on-top .....	5-5-6
5-5-14. Instrument Departures .....	5-5-7
5-5-15. Minimum Fuel Advisory .....	5-5-7
5-5-16. RNAV and RNP Operations .....	5-5-7

**Section 6. National Security and Interception Procedures**

5-6-1. National Security .....	5-6-1
5-6-2. National Security Requirements .....	5-6-1
5-6-3. Definitions .....	5-6-1
5-6-4. ADIZ Requirements .....	5-6-2
5-6-5. Civil Aircraft Operations To or From U.S. Territorial Airspace .....	5-6-3
5-6-6. Civil Aircraft Operations Within U.S. Territorial Airspace .....	5-6-4
5-6-7. Civil Aircraft Operations Transiting U.S. Territorial Airspace .....	5-6-5
5-6-8. Foreign State Aircraft Operations .....	5-6-6
5-6-9. FAA/TSA Airspace Waivers .....	5-6-7
5-6-10. TSA Aviation Security Programs .....	5-6-7
5-6-11. FAA Flight Routing Authorizations .....	5-6-7
5-6-12. Emergency Security Control of Air Traffic (ESCAT) .....	5-6-7
5-6-13. Interception Procedures .....	5-6-8
5-6-14. Law Enforcement Operations by Civil and Military Organizations .....	5-6-10
5-6-15. Interception Signals .....	5-6-11
5-6-16. ADIZ Boundaries and Designated Mountainous Areas (See FIG 5-6-3.) ..	5-6-13
5-6-17. Visual Warning System (VWS) .....	5-6-14

**Chapter 6. Emergency Procedures**

**Section 1. General**

6-1-1. Pilot Responsibility and Authority .....	6-1-1
6-1-2. Emergency Condition— Request Assistance Immediately .....	6-1-1

**Section 2. Emergency Services Available to Pilots**

6-2-1. Radar Service for VFR Aircraft in Difficulty .....	6-2-1
6-2-2. Transponder Emergency Operation .....	6-2-1
6-2-3. Intercept and Escort .....	6-2-1
6-2-4. Emergency Locator Transmitter (ELT) .....	6-2-2
6-2-5. FAA K-9 Explosives Detection Team Program .....	6-2-3
6-2-6. Search and Rescue .....	6-2-4

**Section 3. Distress and Urgency Procedures**

6-3-1. Distress and Urgency Communications .....	6-3-1
6-3-2. Obtaining Emergency Assistance .....	6-3-1
6-3-3. Ditching Procedures .....	6-3-3
6-3-4. Special Emergency (Air Piracy) .....	6-3-6



<b>Paragraph</b>	<b>Page</b>
6-3-5. Fuel Dumping .....	6-3-7

#### **Section 4. Two-way Radio Communications Failure**

6-4-1. Two-way Radio Communications Failure .....	6-4-1
6-4-2. Transponder Operation During Two-way Communications Failure .....	6-4-2
6-4-3. Reestablishing Radio Contact .....	6-4-2

#### **Section 5. Aircraft Rescue and Fire Fighting Communications**

6-5-1. Discrete Emergency Frequency .....	6-5-1
6-5-2. Radio Call Signs .....	6-5-1
6-5-3. ARFF Emergency Hand Signals .....	6-5-1

### **Chapter 7. Safety of Flight**

#### **Section 1. Meteorology**

7-1-1. National Weather Service Aviation Weather Service Program .....	7-1-1
7-1-2. FAA Weather Services .....	7-1-2
7-1-3. Use of Aviation Weather Products .....	7-1-2
7-1-4. Preflight Briefing .....	7-1-5
7-1-5. Inflight Aviation Weather Advisories .....	7-1-8
7-1-6. Categorical Outlooks .....	7-1-14
7-1-7. Telephone Information Briefing Service (TIBS) .....	7-1-15
7-1-8. Transcribed Weather Broadcast (TWEB) (Alaska Only) .....	7-1-15
7-1-9. Inflight Weather Broadcasts .....	7-1-15
7-1-10. Flight Information Services (FIS) .....	7-1-18
7-1-11. Weather Observing Programs .....	7-1-22
7-1-12. Weather Radar Services .....	7-1-30
7-1-13. ATC Inflight Weather Avoidance Assistance .....	7-1-34
7-1-14. Runway Visual Range (RVR) .....	7-1-36
7-1-15. Reporting of Cloud Heights .....	7-1-38
7-1-16. Reporting Prevailing Visibility .....	7-1-38
7-1-17. Estimating Intensity of Rain and Ice Pellets .....	7-1-38
7-1-18. Estimating Intensity of Snow or Drizzle (Based on Visibility) .....	7-1-39
7-1-19. Pilot Weather Reports (PIREPs) .....	7-1-39
7-1-20. PIREPs Relating to Airframe Icing .....	7-1-40
7-1-21. Definitions of Inflight Icing Terms .....	7-1-41
7-1-22. PIREPs Relating to Turbulence .....	7-1-43
7-1-23. Wind Shear PIREPs .....	7-1-44
7-1-24. Clear Air Turbulence (CAT) PIREPs .....	7-1-44
7-1-25. Microbursts .....	7-1-44
7-1-26. PIREPs Relating to Volcanic Ash Activity .....	7-1-55
7-1-27. Thunderstorms .....	7-1-55
7-1-28. Thunderstorm Flying .....	7-1-56
7-1-29. Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR) .....	7-1-58
7-1-30. International Civil Aviation Organization (ICAO) Weather Formats .....	7-1-60

**Section 2. Altimeter Setting Procedures**

<b>Paragraph</b>	<b>Page</b>
7-2-1. General .....	7-2-1
7-2-2. Procedures .....	7-2-1
7-2-3. Altimeter Errors .....	7-2-3
7-2-4. High Barometric Pressure .....	7-2-4
7-2-5. Low Barometric Pressure .....	7-2-4

**Section 3. Wake Turbulence**

7-3-1. General .....	7-3-1
7-3-2. Vortex Generation .....	7-3-1
7-3-3. Vortex Strength .....	7-3-1
7-3-4. Vortex Behavior .....	7-3-2
7-3-5. Operations Problem Areas .....	7-3-5
7-3-6. Vortex Avoidance Procedures .....	7-3-5
7-3-7. Helicopters .....	7-3-6
7-3-8. Pilot Responsibility .....	7-3-6
7-3-9. Air Traffic Wake Turbulence Separations .....	7-3-7

**Section 4. Bird Hazards and Flight Over National Refuges, Parks, and Forests**

7-4-1. Migratory Bird Activity .....	7-4-1
7-4-2. Reducing Bird Strike Risks .....	7-4-1
7-4-3. Reporting Bird Strikes .....	7-4-1
7-4-4. Reporting Bird and Other Wildlife Activities .....	7-4-1
7-4-5. Pilot Advisories on Bird and Other Wildlife Hazards .....	7-4-2
7-4-6. Flights Over Charted U.S. Wildlife Refuges, Parks, and Forest Service Areas ..	7-4-2

**Section 5. Potential Flight Hazards**

7-5-1. Accident Cause Factors .....	7-5-1
7-5-2. VFR in Congested Areas .....	7-5-1
7-5-3. Obstructions To Flight .....	7-5-1
7-5-4. Avoid Flight Beneath Unmanned Balloons .....	7-5-2
7-5-5. Unmanned Aircraft Systems .....	7-5-2
7-5-6. Mountain Flying .....	7-5-3
7-5-7. Use of Runway Half-way Signs at Unimproved Airports .....	7-5-5
7-5-8. Seaplane Safety .....	7-5-6
7-5-9. Flight Operations in Volcanic Ash .....	7-5-7
7-5-10. Emergency Airborne Inspection of Other Aircraft .....	7-5-8
7-5-11. Precipitation Static .....	7-5-9
7-5-12. Light Amplification by Stimulated Emission of Radiation (Laser) Operations and Reporting Illumination of Aircraft .....	7-5-10
7-5-13. Flying in Flat Light and White Out Conditions .....	7-5-11
7-5-14. Operations in Ground Icing Conditions .....	7-5-12
7-5-15. Avoid Flight in the Vicinity of Exhaust Plumes (Smoke Stacks and Cooling Towers) .....	7-5-13

## Section 6. Safety, Accident, and Hazard Reports

<b>Paragraph</b>	<b>Page</b>
7-6-1. Aviation Safety Reporting Program .....	7-6-1
7-6-2. Aircraft Accident and Incident Reporting .....	7-6-1
7-6-3. Near Midair Collision Reporting .....	7-6-2
7-6-4. Unidentified Flying Object (UFO) Reports .....	7-6-3
7-6-5. Safety Alerts For Operators (SAFO) and Information For Operators (InFO) .	7-6-3

## Chapter 8. Medical Facts for Pilots

### Section 1. Fitness for Flight

8-1-1. Fitness For Flight .....	8-1-1
8-1-2. Effects of Altitude .....	8-1-3
8-1-3. Hyperventilation in Flight .....	8-1-5
8-1-4. Carbon Monoxide Poisoning in Flight .....	8-1-5
8-1-5. Illusions in Flight .....	8-1-5
8-1-6. Vision in Flight .....	8-1-6
8-1-7. Aerobatic Flight .....	8-1-8
8-1-8. Judgment Aspects of Collision Avoidance .....	8-1-8

## Chapter 9. Aeronautical Charts and Related Publications

### Section 1. Types of Charts Available

9-1-1. General .....	9-1-1
9-1-2. Obtaining Aeronautical Charts .....	9-1-1
9-1-3. Selected Charts and Products Available .....	9-1-1
9-1-4. General Description of Each Chart Series .....	9-1-1
9-1-5. Where and How to Get Charts of Foreign Areas .....	9-1-13

## Chapter 10. Helicopter Operations

### Section 1. Helicopter IFR Operations

10-1-1. Helicopter Flight Control Systems .....	10-1-1
10-1-2. Helicopter Instrument Approaches .....	10-1-3
10-1-3. Helicopter Approach Procedures to VFR Heliports .....	10-1-5
10-1-4. The Gulf of Mexico Grid System .....	10-1-6

### Section 2. Special Operations

10-2-1. Offshore Helicopter Operations .....	10-2-1
10-2-2. Helicopter Night VFR Operations .....	10-2-7
10-2-3. Landing Zone Safety .....	10-2-10
10-2-4. Emergency Medical Service (EMS) Multiple Helicopter Operations .....	10-2-16

## Appendices

<b>Paragraph</b>	<b>Page</b>
Appendix 1. Bird/Other Wildlife Strike Report .....	Appendix 1-1
Appendix 2. Volcanic Activity Reporting Form (VAR) .....	Appendix 2-1
Appendix 3. Abbreviations/Acronyms .....	Appendix 3-1
PILOT/CONTROLLER GLOSSARY .....	PCG-1
INDEX .....	I-1

# Chapter 1. Air Navigation

## Section 1. Navigation Aids

### 1-1-1. General

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

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

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

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

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

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

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

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

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

#### *NOTE-*

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

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

**c.** The only positive method of identifying a VOR is by its Morse Code identification or by the recorded automatic voice identification which is always indicated by use of the word “VOR” following the range’s name. Reliance on determining the identification of an omnirange should never be placed on listening to voice transmissions by the Flight Service Station (FSS) (or approach control facility) involved. Many FSSs remotely operate several omniranges with different names. In some cases, none of the VORs have the name of the “parent” FSS. During periods of maintenance, the facility may radiate a T-E-S-T code (— ● ●● —) or the code may be

removed. Some VOR equipment decodes the identifier and displays it to the pilot for verification to charts, while other equipment simply displays the expected identifier from a database to aid in verification to the audio tones. You should be familiar with your equipment and use it appropriately. If your equipment automatically decodes the identifier, it is not necessary to listen to the audio identification.

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

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

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

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

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

**f. The VOR Minimum Operational Network (MON).** As flight procedures and route structure based on VORs are gradually being replaced with Performance-Based Navigation (PBN) procedures, the FAA is removing selected VORs from service. PBN procedures are primarily enabled by GPS and its augmentation systems, collectively referred to as Global Navigation Satellite System (GNSS). Aircraft that carry DME/DME equipment can also use RNAV which provides a backup to continue flying PBN

during a GNSS disruption. For those aircraft that do not carry DME/DME, the FAA is retaining a limited network of VORs, called the VOR MON, to provide a basic conventional navigation service for operators to use if GNSS becomes unavailable. During a GNSS disruption, the MON will enable aircraft to navigate through the affected area or to a safe landing at a MON airport without reliance on GNSS. Navigation using the MON will not be as efficient as the new PBN route structure, but use of the MON will provide nearly continuous VOR signal coverage at 5,000 feet AGL across the NAS, outside of the Western U.S. Mountainous Area (WUSMA).

**NOTE–**

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

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

**1. Distance to a MON airport.** Within the contiguous United States (CONUS), the VOR MON is designed to ensure that an airport that has an instrument approach that is not dependent on GPS, ADF, DME or radar within 100 NM of any location. These airports are referred to as “MON airports” and will have an ILS approach or a VOR approach if an ILS is not available. VORs to support these approaches will be retained in the VOR MON. MON airports are charted on low-altitude en route charts and are contained in the Chart Supplement U.S. and other appropriate publications.

**NOTE–**

*Any suitable airport can be used to land in the event of a VOR outage. For example, an airport with a DME-required ILS approach may be available and could be used by aircraft that are equipped with DME. The intent of the MON airport is to provide an approach that can be used by aircraft without ADF or DME when radar may not be available.*

**2. Navigating to an airport.** The VOR MON will retain sufficient VORs and increase VOR service volume to ensure that pilots will have nearly continuous signal reception of a VOR when flying at 5,000 feet AGL. A key concept of the MON is to ensure that an aircraft will always be within 100 NM

of an airport with an instrument approach that is not dependent on GPS. (See paragraph 1-1-8.) If the pilot encounters a GPS outage, the pilot will be able to proceed via VOR-to-VOR navigation at 5,000 feet AGL through the GPS outage area or to a safe landing at a MON airport or another suitable airport, as appropriate. Nearly all VORs inside of the WUSMA and outside the CONUS are being retained. In these areas, pilots use the existing (Victor and Jet) route structure and VORs to proceed through a GPS outage or to a landing.

### 3. Using the VOR MON.

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

#### **NOTE-**

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

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

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

(2) Also, in case of a GPS outage, pilots may coordinate with ATC and elect to continue through the outage or land. The VOR MON is designed to ensure that an aircraft is within 100 NM of an airport, but pilots may decide to proceed to any appropriate airport where a landing can be made.

WAAS users flying under Part 91 are not required to carry VOR avionics. These users do not have the ability or requirement to use the VOR MON. Prudent flight planning, by these WAAS-only aircraft, should consider the possibility of a GPS outage.

#### **NOTE-**

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

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

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

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

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

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

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

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

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

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

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

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

**CAUTION–**

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

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

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

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

**a.** For reasons peculiar to military or naval operations (unusual siting conditions, the pitching and rolling of a naval vessel, etc.) the civil VOR/Distance Measuring Equipment (DME) system of air navigation was considered unsuitable for military or naval use. A new navigational system, TACAN, was therefore developed by the military and naval forces to more readily lend itself to military and naval requirements. As a result, the FAA has integrated TACAN facilities with the civil VOR/DME program. Although the theoretical, or technical principles of operation of TACAN equipment are quite different from those of VOR/DME facilities, the end result, as far as the navigating pilot is concerned, is the same. These integrated facilities are called VORTACs.

**b.** TACAN ground equipment consists of either a fixed or mobile transmitting unit. The airborne unit in conjunction with the ground unit reduces the transmitted signal to a visual presentation of both azimuth and distance information. TACAN is a pulse system and operates in the Ultrahigh Frequency (UHF) band of frequencies. Its use requires TACAN airborne equipment and does not operate through conventional VOR equipment.

### **1–1–6. VHF Omni-directional Range/Tactical Air Navigation (VORTAC)**

**a.** A VORTAC is a facility consisting of two components, VOR and TACAN, which provides three individual services: VOR azimuth, TACAN azimuth and TACAN distance (DME) at one site. Although consisting of more than one component,



incorporating more than one operating frequency, and using more than one antenna system, a VORTAC is considered to be a unified navigational aid. Both components of a VORTAC are envisioned as operating simultaneously and providing the three services at all times.

**b.** Transmitted signals of VOR and TACAN are each identified by three-letter code transmission and are interlocked so that pilots using VOR azimuth with TACAN distance can be assured that both signals being received are definitely from the same ground station. The frequency channels of the VOR and the TACAN at each VORTAC facility are “paired” in accordance with a national plan to simplify airborne operation.

### **1-1-7. Distance Measuring Equipment (DME)**

**a.** In the operation of DME, paired pulses at a specific spacing are sent out from the aircraft (this is the interrogation) and are received at the ground station. The ground station (transponder) then transmits paired pulses back to the aircraft at the same pulse spacing but on a different frequency. The time required for the round trip of this signal exchange is measured in the airborne DME unit and is translated into distance (nautical miles) from the aircraft to the ground station.

**b.** Operating on the line-of-sight principle, DME furnishes distance information with a very high degree of accuracy. Reliable signals may be received at distances up to 199 NM at line-of-sight altitude with an accuracy of better than  $\frac{1}{2}$  mile or 3 percent of the distance, whichever is greater. Distance information received from DME equipment is SLANT RANGE distance and not actual horizontal distance.

**c.** Operating frequency range of a DME according to ICAO Annex 10 is from 960 MHz to 1215 MHz. Aircraft equipped with TACAN equipment will receive distance information from a VORTAC automatically, while aircraft equipped with VOR must have a separate DME airborne unit.

**d.** VOR/DME, VORTAC, Instrument Landing System (ILS)/DME, and localizer (LOC)/DME navigation facilities established by the FAA provide course and distance information from collocated components under a frequency pairing plan. Aircraft

receiving equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC, ILS/DME, and LOC/DME are selected.

**e.** Due to the limited number of available frequencies, assignment of paired frequencies is required for certain military noncollocated VOR and TACAN facilities which serve the same area but which may be separated by distances up to a few miles.

**f.** VOR/DME, VORTAC, ILS/DME, and LOC/DME facilities are identified by synchronized identifications which are transmitted on a time share basis. The VOR or localizer portion of the facility is identified by a coded tone modulated at 1020 Hz or a combination of code and voice. The TACAN or DME is identified by a coded tone modulated at 1350 Hz. The DME or TACAN coded identification is transmitted one time for each three or four times that the VOR or localizer coded identification is transmitted. When either the VOR or the DME is inoperative, it is important to recognize which identifier is retained for the operative facility. A single coded identification with a repetition interval of approximately 30 seconds indicates that the DME is operative.

**g.** Aircraft equipment which provides for automatic DME selection assures reception of azimuth and distance information from a common source when designated VOR/DME, VORTAC and ILS/DME navigation facilities are selected. Pilots are cautioned to disregard any distance displays from automatically selected DME equipment when VOR or ILS facilities, which do not have the DME feature installed, are being used for position determination.

### **1-1-8. Navigational Aid (NAVAID) Service Volumes**

**a.** Most air navigation radio aids which provide positive course guidance have a designated standard service volume (SSV). The SSV defines the reception limits of unrestricted NAVAIDs which are usable for random/unpublished route navigation.

**b.** A NAVAID will be classified as restricted if it does not conform to flight inspection signal strength and course quality standards throughout the published SSV. However, the NAVAID should not be considered usable at altitudes below that which could

be flown while operating under random route IFR conditions (14 CFR Section 91.177), even though these altitudes may lie within the designated SSV. Service volume restrictions are first published in Notices to Airmen (NOTAMs) and then with the alphabetical listing of the NAVAIDs in the Chart Supplement U.S.

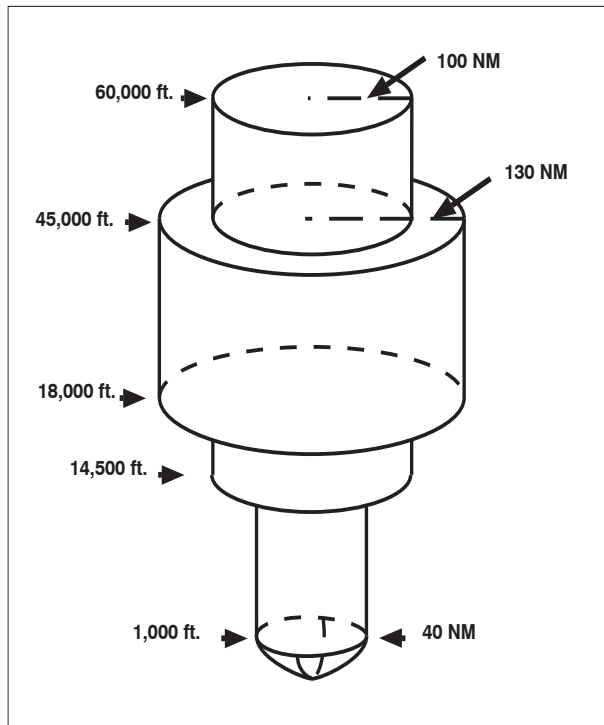
c. Standard Service Volume limitations do not apply to published IFR routes or procedures.

d. VOR/DME/TACAN Standard Service Volumes (SSV).

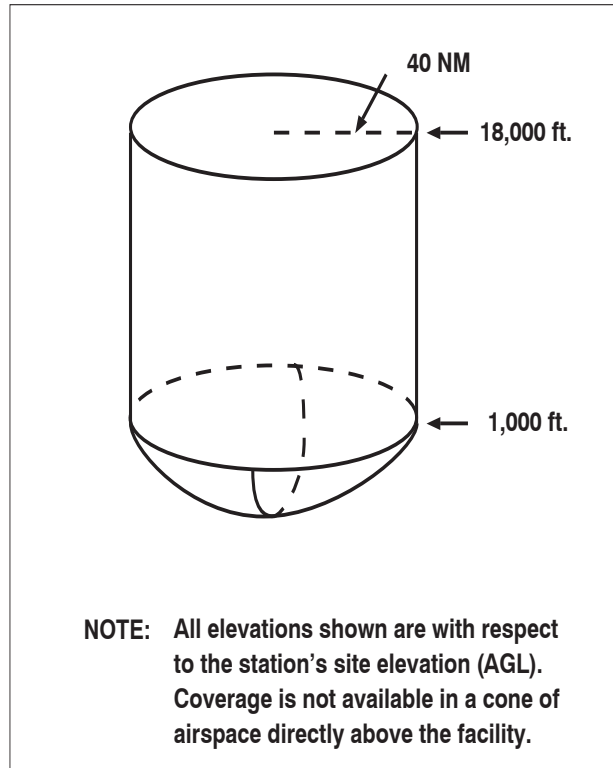
1. Standard service volumes (SSVs) are graphically shown in FIG 1-1-1, FIG 1-1-2, FIG 1-1-3, FIG 1-1-4, and FIG 1-1-5. The SSV of a station is indicated by using the class designator as a prefix to the station type designation.

**EXAMPLE-**  
TVOR, LDME, and HVORTAC.

**FIG 1-1-1**  
**Standard High Altitude Service Volume**  
(See FIG 1-1-5 for altitudes below 1,000 feet).



**FIG 1-1-2**  
**Standard Low Altitude Service Volume**  
(See FIG 1-1-5 for altitudes below 1,000 feet).



2. Within 25 NM, the bottom of the T service volume is defined by the curve in FIG 1-1-4. Within 40 NM, the bottoms of the L and H service volumes are defined by the curve in FIG 1-1-5. (See TBL 1-1-1.)

e. Nondirectional Radio Beacon (NDB)

1. NDBs are classified according to their intended use.

2. The ranges of NDB service volumes are shown in TBL 1-1-2. The distances (radius) are the same at all altitudes.

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

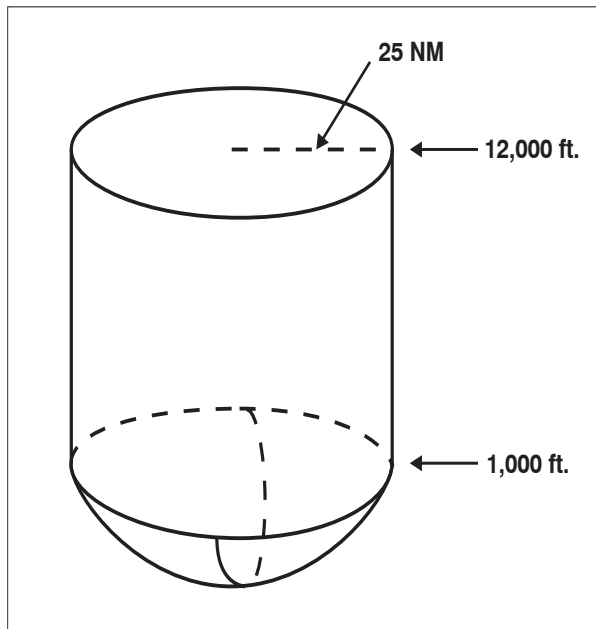
SSV Class Designator	Altitude and Range Boundaries
T (Terminal) . . . . .	From 1,000 feet above ground level (AGL) up to and including 12,000 feet AGL at radial distances out to 25 NM.
L (Low Altitude) . . . .	From 1,000 feet AGL up to and including 18,000 feet AGL at radial distances out to 40 NM.
H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

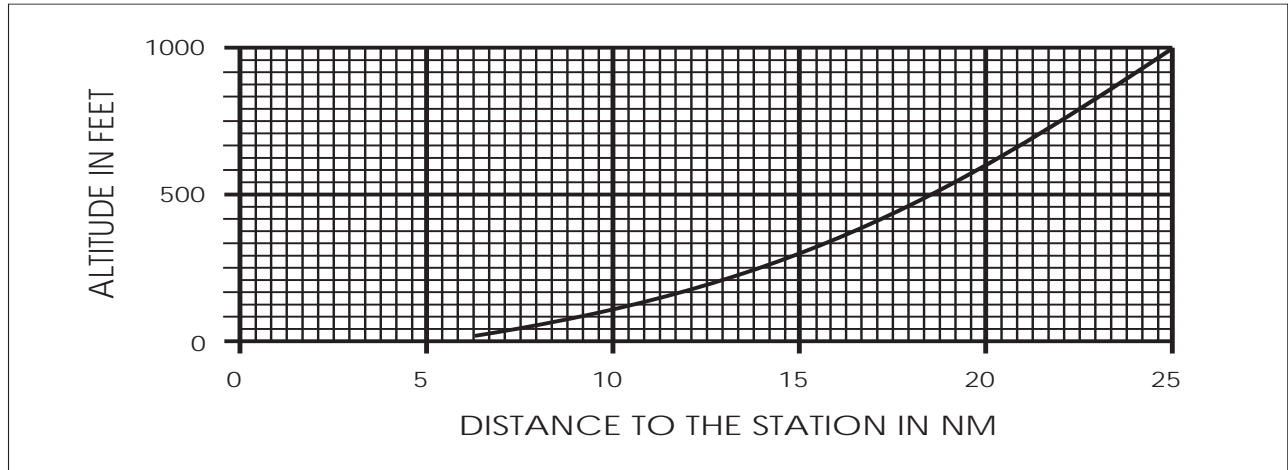
Class	Distance (Radius)
Compass Locator	15 NM
MH	25 NM
H	50 NM*
HH	75 NM

*\*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.*

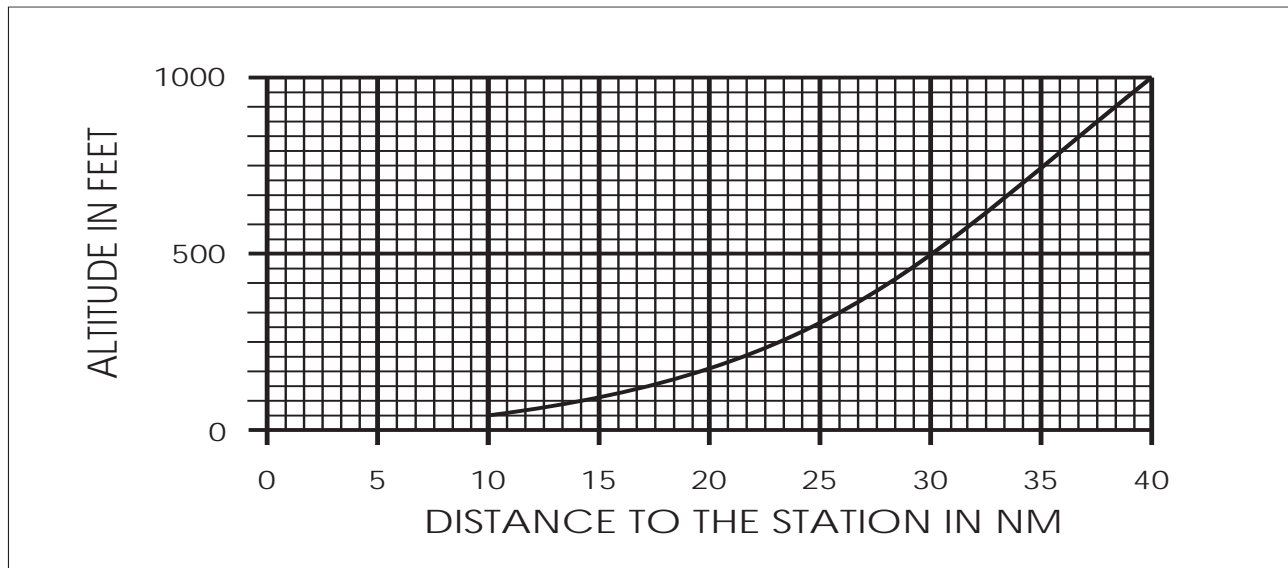
**FIG 1-1-3**  
**Standard Terminal Service Volume**  
 (See FIG 1-1-4 for altitudes below 1,000 feet).



**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 ground equipment consists of two highly directional transmitting systems and, along the approach, three (or fewer) marker beacons. The directional transmitters are known as the localizer and glide slope transmitters.

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

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

(b) **Range information:** marker beacon, DME; and

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

4. Precision radar, or compass locators located at the Outer Marker (OM) or Middle Marker (MM), may be substituted for marker beacons. DME, when

specified in the procedure, may be substituted for the OM.

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.

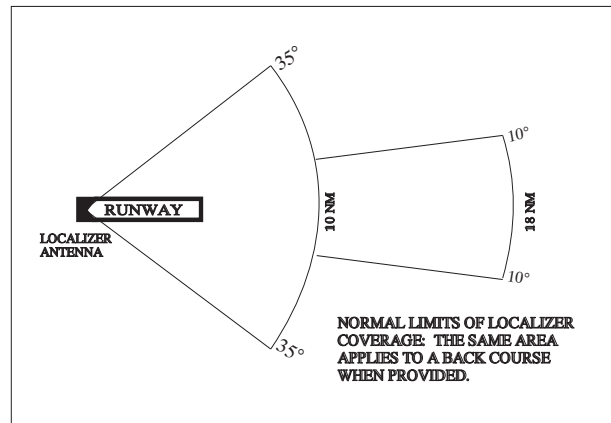
#### EXAMPLE- I-DIA

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.

#### 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. Ordinarily, there are two marker beacons associated with an ILS, the OM and MM. Locations with a Category II ILS also have an Inner Marker (IM). When an aircraft passes over a marker, the pilot will receive the indications shown in TBL 1-1-3.

(a) The OM normally indicates a position at which an aircraft at the appropriate altitude on the localizer course will intercept the ILS glide path.

(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.

(c) The IM will indicate a point at which an aircraft is at a designated decision height (DH) on the glide path between the MM and landing threshold.

**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
Localizer MHz	Glide Slope
110.70	330.20
110.75	330.05
110.90	330.80
110.95	330.65
111.10	331.70
111.15	331.55
111.30	332.30
111.35	332.15
111.50	332.9
111.55	332.75
111.70	333.5
111.75	333.35
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.** Less than ceiling 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, when conditions are less than reported ceiling 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.

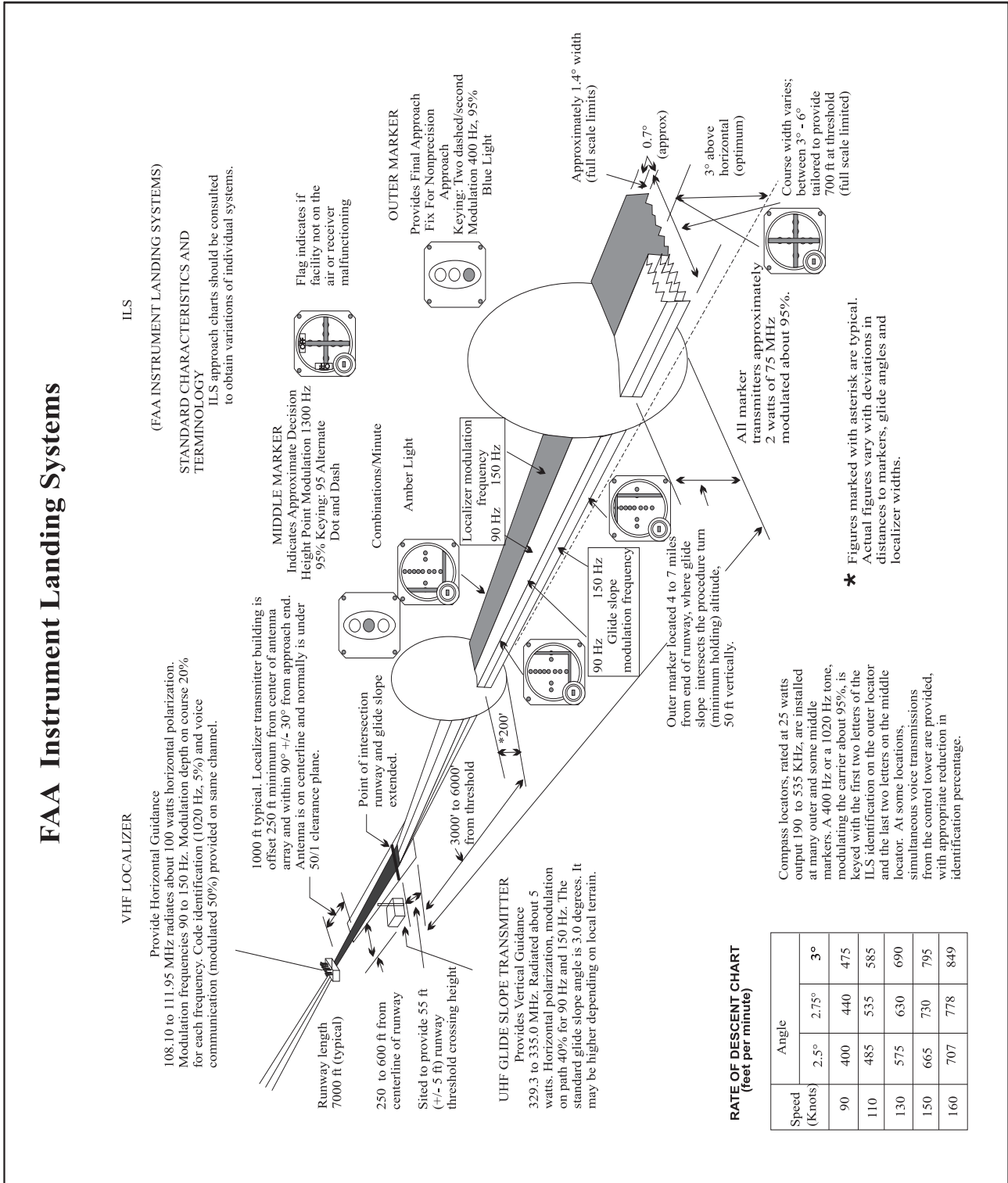
d. Usable off-course indications are limited to 35 degrees either side of the course centerline. Instrument indications received beyond 35 degrees should be disregarded.

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. The voice communication is available on some facilities. Hazardous Inflight Weather Advisory Service (HIWAS) broadcast capability is available on selected VOR sites throughout the conterminous U.S. and does not provide two-way voice communication. The availability of two-way voice communication and HIWAS is indicated in the 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 can 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 may 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 equipment 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 aug-

mentation 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 web site. 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 Advisory Circular (AC) 20-138(), *Airworthiness Approval of Positioning and Navigation Systems*.

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

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

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

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

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

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

**EXAMPLE–**

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

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 AVAIL-

ABLE (AVBL) NOTAMS indicate loss or malfunction of the WAAS system. In flight, Air Traffic Control will advise pilots requesting a GPS or RNAV (GPS) approach of WAAS NOT AVBL NOTAMS if not contained in the ATIS broadcast.

**EXAMPLE–**

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

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

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

**NOTE–**

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

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

**EXAMPLE–**

*!FDC 4/3406 (PAZA A0173/14) ZAN NAV WAAS SIGNAL MAY NOT BE AVBL NORTH OF LINE FROM 7000N150000W TO 6400N16400W. RMK WAAS USERS SHOULD CONFIRM RAIM AVAILABILITY FOR IFR OPERATIONS IN THIS AREA. T-ROUTES IN THIS SECTOR NOT AVBL. ANY REQUIRED ALTERNATE AIRPORT IN THIS AREA MUST HAVE AN APPROVED INSTRUMENT APPROACH PROCEDURE OTHER THAN GPS THAT IS ANTICIPATED TO BE 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. It provides differential augmentation to the Global Navigation Satellite System (GNSS).

#### **NOTE–**

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

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

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

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

#### **b. Procedure**

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

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

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

### **1–1–20. 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 5-4-7f, Instrument Approach Procedures*





following systems qualify as a suitable RNAV system:

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

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

**[http://www.faa.gov/about/office\\_org/headquarters\\_offices/avs/offices/afs/afs400/afs470/policy\\_guidance/](http://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afs/afs400/afs470/policy_guidance/)**

**NOTE–**

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

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

1. Determine aircraft position relative to, or distance from a VOR (see NOTE 6 below), TACAN, NDB, compass locator, DME fix; or a named fix defined by a VOR radial, TACAN course, NDB bearing, or compass locator bearing intersecting a VOR or localizer course.

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

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

4. Fly an arc based upon DME.

**NOTE–**

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

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

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

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

5. *Use of a suitable RNAV system as a means to navigate on the final approach segment of an instrument approach procedure based on a VOR, TACAN or NDB signal, is allowable. The underlying NAVAID must be operational and the NAVAID monitored for final segment course alignment.*

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

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

using TSO-C145/-C146 WAAS equipment. For further WAAS guidance, see paragraph 1-1-18.

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

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

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

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

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

3. This restriction does not apply to TSO-C145() and TSO-C146() equipped users (WAAS users). For further WAAS guidance, see paragraph 1-1-18.

#### 1-2-4. Pilots and Air Traffic Controllers Recognizing Interference or Spoofing

a. Pilots need to maintain position awareness while navigating. This awareness may be facilitated by keeping relevant ground-based, legacy navigational aids tuned and available. By utilizing this practice, situational awareness is promoted and guards against significant pilot delay in recognizing

the onset of GPS interference. Pilots may find cross-checks of other airborne systems (for example, DME/DME/IRU or VOR) useful to mitigate this otherwise undetected hazard.

#### REFERENCE-

*AIM Paragraph 1-1-17, Global Positioning System (GPS)*

*AIM Paragraph 1-1-18, Wide Area Augmentation System (WAAS)*

b. During preflight planning, pilots should be particularly alert for NOTAMs which could affect navigation (GPS or WAAS) along their route of flight, such as Department of Defense electronic signal tests with GPS.

#### REFERENCE-

*AIM Paragraph 1-1-17, Global Positioning System (GPS)*

*AIM Paragraph 1-1-18, Wide Area Augmentation System (WAAS)*

c. If the pilot experiences interruptions while navigating with GPS, the pilot and ATC may both incur a higher workload. In the aircraft, the pilot may need to change to ground-based NAVAIDs (for example, DME/DME/IRU or VOR). If the pilot's aircraft is under ATC radar or multilateration surveillance, ATC may be able to provide radar vectors out of the interference affected area or to an alternate destination upon pilot request. An ADS-B Out aircraft's broadcast information may be incorrect and should not be relied upon for surveillance when interference or spoofing is suspected unless its accuracy can be verified by independent means. During the approach phase, a pilot might elect to continue in visual conditions or may need to execute the published missed approach. If the published missed approach procedure is GPS-based, the pilot will need alternate instructions. If the pilot were to choose to continue in visual conditions, the pilot could aid the controller by cancelling his/her IFR flight plan and proceeding to the airport to land. ATC would cancel the pilot's IFR clearance and issue a VFR squawk; freeing up the controller to handle other aircraft.

d. The FAA requests that pilots notify ATC if they experience interruptions to their GPS navigation or surveillance. GPS interference or outages associated with a known testing NOTAM should not be reported to ATC unless the interference/outage affects the pilot's ability to navigate his/her aircraft.

#### REFERENCE-

*AIM Paragraph 1-1-13, User Reports Requested on NAVAID or Global Navigation Satellite System (GNSS) Performance or Interference.*

proceed according to their best judgment while understanding the illuminated lights indicate that continuing the takeoff is unsafe. Contact ATC at the earliest possible opportunity.

**d. Runway Intersection Lights (RIL):** The RIL system is composed of flush mounted, in-pavement, unidirectional 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 “On” when departing the gate or parking area until it is shutdown upon arrival at the gate or parking area. This ensures interaction with the FAA surveillance systems 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)**

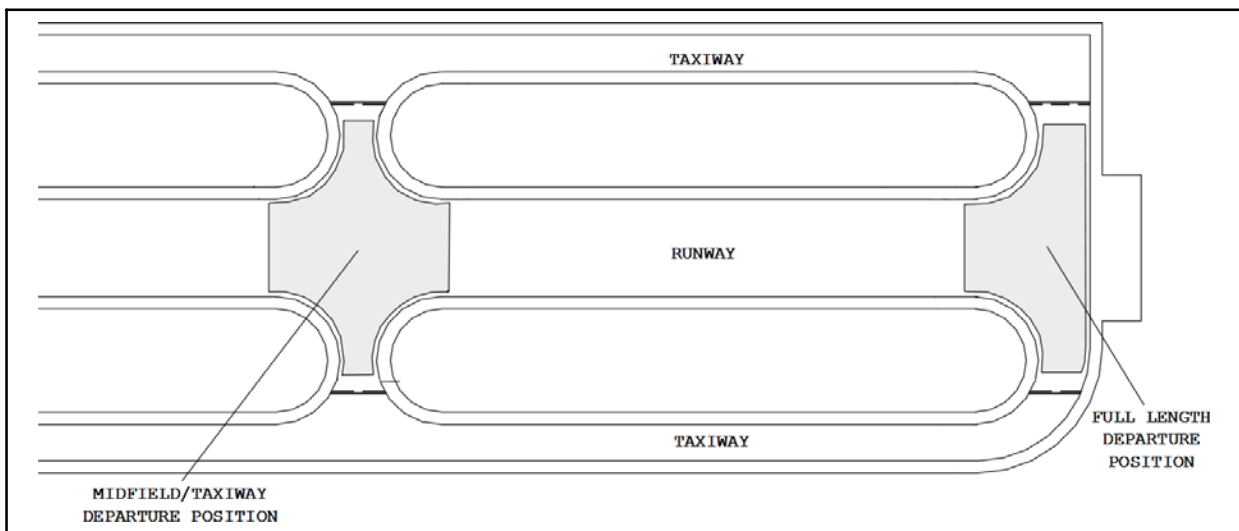
**a. Introduction:**

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, 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 4. Air Traffic Control

### Section 1. Services Available to Pilots

#### 4-1-1. Air Route Traffic Control Centers

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

#### 4-1-2. Control Towers

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

**REFERENCE-**

*AIM, Paragraph 5-4-3, Approach Control*

#### 4-1-3. Flight Service Stations

Flight Service Stations (FSSs) are air traffic facilities which provide pilot briefings, flight plan processing, en route flight advisories, search and rescue services, and assistance to lost aircraft and aircraft in emergency situations. FSSs also relay ATC clearances, process Notices to Airmen, broadcast aviation weather and aeronautical information, and advise Customs and Border Protection of transborder flights. In Alaska, designated FSSs also provide TWEB recordings, take weather observations, and provide Airport Advisory Services (AAS).

#### 4-1-4. Recording and Monitoring

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

evaluation, and technical evaluation and repair of control and communications systems.

b. Where the public access telephone is recorded, a beeper tone is not required. In place of the “beep” tone the FCC has substituted a mandatory requirement that persons to be recorded be given notice they are to be recorded and give consent. Notice is given by this entry, consent to record is assumed by the individual placing a call to the operational facility.

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

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

**REFERENCE-**

*AIM, Paragraph 5-4-4, Advance Information on Instrument Approach*

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

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

**REFERENCE-**

*FAA Order 1600.69, FAA Facility Security Management Program*

#### 4-1-7. Operation Rain Check

Operation Rain Check is a program designed and managed by local air traffic control facility management. Its purpose is to familiarize pilots and aspiring pilots with the ATC system, its functions, responsibilities and benefits.

**REFERENCE-**

FAA Order JO 7210.3, Paragraph 4-2-2, Pilot Education  
FAA Order 1600.69, FAA Facility Security Management Program

#### 4-1-8. Approach Control Service for VFR Arriving Aircraft

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

**NOTE-**

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

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

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

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

**REFERENCE-**

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

**NOTE-**

Approach control services for VFR aircraft are normally dependent on ATC radar. These services are not available during periods of a radar outage. Approach control services for VFR aircraft are limited when CENRAP is in use.

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

(See TBL 4-1-1.)

#### a. Airport Operations Without Operating Control Tower

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

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

**NOTE-**

FSS airport advisories are available only in Alaska.

3. Many airports are now providing completely automated weather, radio check capability and airport advisory information on an automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the UNICOM frequency. Availability of the automated UNICOM will be published in the Chart Supplement U.S. and approach charts.

#### b. Communicating on a Common Frequency

1. The key to communicating at an airport without an operating control tower is selection of the correct common frequency. The acronym CTAF which stands for Common Traffic Advisory Frequency, is synonymous with this program. A CTAF is a frequency designated for the purpose of carrying out airport advisory practices while operating to or from an airport without an operating control tower. The CTAF may be a UNICOM, MULTICOM, FSS, or tower frequency and is identified in appropriate aeronautical publications.

**NOTE-**

FSS frequencies are available only in Alaska.

*TBL 4-1-3***Other Frequency Usage Designated by FCC**

Use	Frequency
Air-to-air communication (private fixed wing aircraft).	122.750
Air-to-air communications (general aviation helicopters).	123.025
Aviation instruction, Glider, Hot Air Balloon ( <b>not to be used for advisory service</b> ).	123.300 123.500

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

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

- a. Revision to proposed departure time.
- b. Takeoff, arrival, or flight plan cancellation time.
- c. ATC clearance, provided arrangements are made between the ATC facility and the UNICOM licensee to handle such messages.

**4-1-13. Automatic Terminal Information Service (ATIS)**

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

b. ATIS information includes:

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

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

5. Instrument approach and runway in use.

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

**EXAMPLE-**

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

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

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

**EXAMPLE–**

*“Information Sierra received.”*

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

**EXAMPLE–**

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

**NOTE–**

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

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

g. To serve frequency limited aircraft, FSSs are equipped to transmit on the omnirange frequency at most en route VORs used as ATIS voice outlets. Such communication interrupts the ATIS broadcast. Pilots of aircraft equipped to receive on other FSS frequencies are encouraged to do so in order that these override transmissions may be kept to an absolute minimum.

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

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

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

1. The AFIS broadcast will automate the repetitive transmission of essential but routine information (for example, weather, favored runway,

braking action, airport NOTAMs, etc.). The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS frequency).

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

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

**EXAMPLE–**

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

**NOTE–**

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

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

**NOTE–**

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

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

**EXAMPLE–**

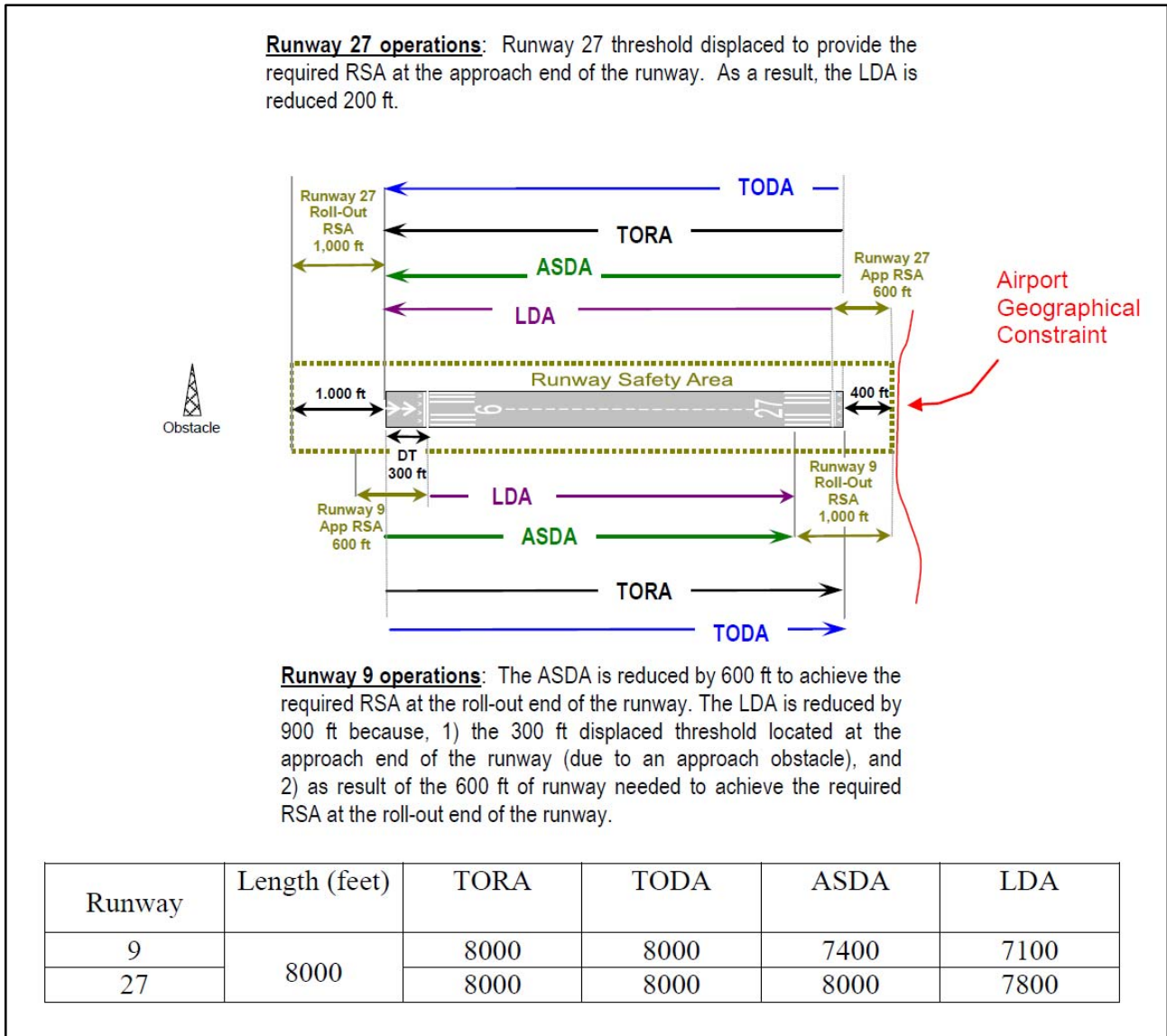
*“Information Alpha received.”*

d. While it is a good operating practice for pilots to make use of the Alaska FSS AFIS broadcast where it is available, some pilots use the phrase “have



FIG 4-3-6

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



**NOTE-**

A runway's RSA begins a set distance prior to the threshold and will extend a set distance beyond the end of the runway depending on the runway's design criteria. If these required lengths cannot be achieved, the ASDA and/or LDA will be reduced as necessary to obtain the required lengths to the extent practicable.

#### 4-3-7. Low Level Wind Shear/Microburst Detection Systems

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

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

**EXAMPLE-**

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

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

**EXAMPLE-**

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

**REFERENCE-**

*AIM, Paragraph 7-1-25, Microbursts*

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

d. The WSP provides weather processor enhancements to selected Airport Surveillance Radar (ASR)-9 facilities. The WSP provides Air Traffic with detection and alerting of hazardous weather such as wind shear, microbursts, and significant thunderstorm activity. The WSP displays terminal area 6 level weather, storm cell locations and movement, as well as the location and predicted future position

and intensity of wind shifts that may affect airport operations. Controllers will receive and issue alerts based on Areas Noted for Attention (ARENA). An ARENA extends on the runway center line from a 3 mile final to the runway to a 2 mile departure.

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

#### 4-3-8. Braking Action Reports and Advisories

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

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

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

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

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

d. During the time that braking action advisories are in effect, ATC will issue the most recent braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for

deteriorating braking conditions and should request current runway condition information if not issued by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing.

#### 4-3-9. Runway Condition Reports

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

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

**NOTE-**

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

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

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

- (a) Runway(s) in use
- (b) Time of the assessment
- (c) Runway condition codes for each zone (touchdown, mid-point, roll-out)

(d) Pilot-reported braking action report (if available)

(e) The contaminant (for example, wet snow, dry snow, slush, ice, etc.)

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

**NOTE-**

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

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

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

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

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

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

**REFERENCE-**

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

**FIG 4-3-7  
Runway Condition Assessment Matrix (RCAM)**

Assessment Criteria		Control/Braking Assessment Criteria	
Runway Condition Description	RwyCC	Deceleration or Directional Control Observation	Pilot Reported Braking Action
<ul style="list-style-type: none"> <li>• Dry</li> </ul>	6	---	---
<ul style="list-style-type: none"> <li>• Frost</li> <li>• Wet (Includes damp and 1/8 inch depth or less of water)</li> </ul> <p><b>1/8 inch (3mm) depth or less of:</b></p> <ul style="list-style-type: none"> <li>• Slush</li> <li>• Dry Snow</li> <li>• Wet Snow</li> </ul>	5	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
<p><b>-15°C and Colder outside air temperature:</b></p> <ul style="list-style-type: none"> <li>• Compacted Snow</li> </ul>	4	Braking deceleration OR directional control is between Good and Medium.	Good to Medium
<ul style="list-style-type: none"> <li>• Slippery When Wet (wet runway)</li> <li>• Dry Snow or Wet Snow (any depth) over Compacted Snow</li> </ul> <p><b>Greater than 1/8 inch (3 mm) depth of:</b></p> <ul style="list-style-type: none"> <li>• Dry Snow</li> <li>• Wet Snow</li> </ul> <p><b>Warmer than -15°C outside air temperature:</b></p> <ul style="list-style-type: none"> <li>• Compacted Snow</li> </ul>	3	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
<p><b>Greater than 1/8 inch(3 mm) depth of:</b></p> <ul style="list-style-type: none"> <li>• Water</li> <li>• Slush</li> </ul>	2	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
<ul style="list-style-type: none"> <li>• Ice</li> </ul>	1	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	Poor
<ul style="list-style-type: none"> <li>• Wet Ice</li> <li>• Slush over Ice</li> <li>• Water over Compacted Snow</li> <li>• Dry Snow or Wet Snow over Ice</li> </ul>	0	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	Nil

#### 4-3-10. Intersection Takeoffs

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

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

**REFERENCE-**

*AIM, Paragraph 4-3-6, Use of Runways/Declared Distances*

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

**REFERENCE-**

*FAA Order JO 7110.65, Paragraph 3-7-1, Ground Traffic Movement*

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

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

**EXAMPLE-**

*Cleveland Tower, Apache Three Seven Two Two Papa, at the intersection of taxiway Oscar and runway two three right, ready for departure.*

f. Controllers are required to separate small aircraft that are departing from an intersection on the same runway (same or opposite direction) behind a large nonheavy aircraft (except B757), by ensuring that at least a 3-minute interval exists between the

time the preceding large aircraft has taken off and the succeeding small aircraft begins takeoff roll. The 3-minute separation requirement will also be applied to small aircraft with a maximum certificated takeoff weight of 12,500 pounds or less departing behind a small aircraft with a maximum certificated takeoff weight of more than 12,500 pounds. To inform the pilot of the required 3-minute hold, the controller will state, “Hold for wake turbulence.” If after considering wake turbulence hazards, the pilot feels that a lesser time interval is appropriate, the pilot may request a waiver to the 3-minute interval. To initiate such a request, simply say “Request waiver to 3-minute interval” or a similar statement. Controllers may then issue a takeoff clearance if other traffic permits, since the pilot has accepted the responsibility for wake turbulence separation.

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

h. A 4-minute interval is mandatory for small, large, and heavy aircraft behind a super aircraft. The 3-minute interval is mandatory behind a heavy aircraft in all cases, and for small aircraft behind a B757.

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

a. LAHSO is an acronym for “Land and Hold Short Operations.” These operations include landing and holding short of an **intersecting runway**, an **intersecting taxiway**, or some other designated **point on a runway** other than an intersecting runway or taxiway. (See FIG 4-3-8, FIG 4-3-9, FIG 4-3-10.)

##### b. Pilot Responsibilities and Basic Procedures.

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

2. At controlled airports, air traffic may clear a pilot to land and hold short. Pilots may accept such a

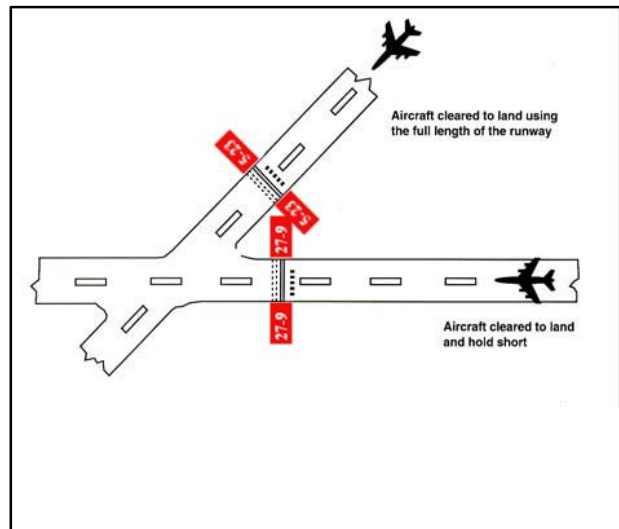
clearance provided that the pilot-in-command determines that the aircraft can safely land and stop within the Available Landing Distance (ALD). ALD data are published in the special notices section of the Chart Supplement U.S. and in the U.S. Terminal Procedures Publications. Controllers will also provide ALD data upon request. Student pilots or pilots not familiar with LAHSO should **not** participate in the program.

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

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

decision making is knowing in advance whether one can accept a LAHSO clearance if offered.

**FIG 4-3-8**  
**Land and Hold Short of an Intersecting Runway**



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

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

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

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

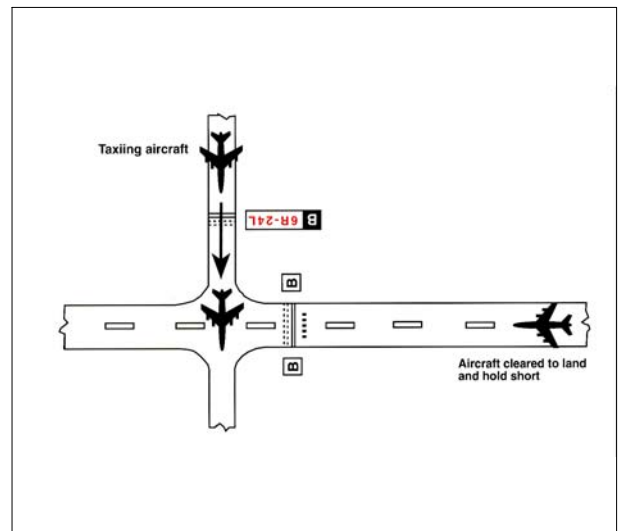
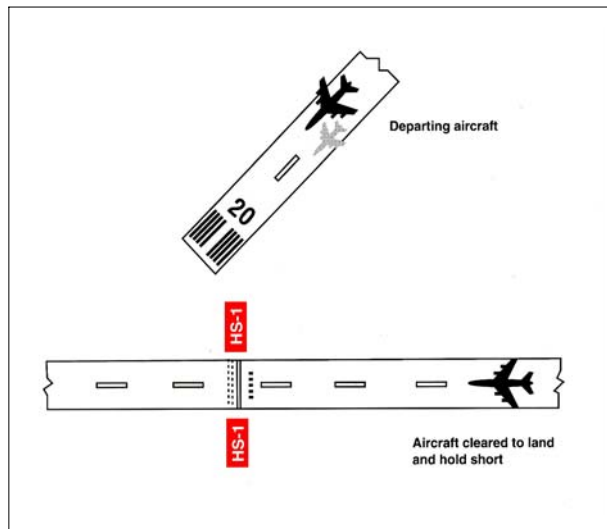


FIG 4-3-10  
**Land and Hold Short of a Designated Point  
 on a Runway Other Than an Intersecting  
 Runway or Taxiway**



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

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

7. Controllers need a full read back of all LAHSO clearances. Pilots should read back their LAHSO clearance and include the words, “HOLD SHORT OF (RUNWAY/TAXIWAY/OR POINT)” in their acknowledgment of **all** LAHSO clearances. In order to reduce frequency congestion, pilots are encouraged to read back the LAHSO clearance

without prompting. Don’t make the controller have to ask for a read back!

### c. LAHSO Situational Awareness

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

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

#### EXAMPLE–

**ATC:** “(Aircraft ID) cleared to land runway six right, hold short of taxiway bravo for crossing traffic (type aircraft).”

**Aircraft:** “(Aircraft ID), wilco, cleared to land runway six right to hold short of taxiway bravo.”

**ATC:** “(Aircraft ID) cross runway six right at taxiway bravo, landing aircraft will hold short.”

**Aircraft:** “(Aircraft ID), wilco, cross runway six right at bravo, landing traffic (type aircraft) to hold.”

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

4. Situational awareness also includes a thorough understanding of the airport markings, signage, and lighting associated with LAHSO. These visual aids consist of a three–part system of **yellow hold–short markings, red and white signage** and, in certain cases, **in–pavement lighting**. Visual aids assist the pilot in determining where to hold short. FIG 4–3–8, FIG 4–3–9, FIG 4–3–10 depict how these markings, signage, and lighting combinations will appear once installed. Pilots are cautioned that not all airports conducting LAHSO have installed any or all of the above markings, signage, or lighting.

5. Pilots should only receive a LAHSO clearance when there is a minimum ceiling of 1,000 feet and 3 statute miles visibility. The intent of having “basic” VFR weather conditions is to allow pilots to maintain visual contact with other aircraft and ground vehicle operations. Pilots should consider the effects of prevailing inflight visibility (such as landing into the sun) and how it may affect overall

situational awareness. Additionally, surface vehicles and aircraft being taxied by maintenance personnel may also be participating in LAHSO, especially in those operations that involve crossing an active runway.

#### **4-3-12. Low Approach**

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

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

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

#### **REFERENCE-**

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

#### **4-3-13. Traffic Control Light Signals**

**a.** The following procedures are used by ATCTs in the control of aircraft, ground vehicles, equipment,

and personnel not equipped with radio. These same procedures will be used to control aircraft, ground vehicles, equipment, and personnel equipped with radio if radio contact cannot be established. ATC personnel use a directive traffic control signal which emits an intense narrow light beam of a selected color (either red, white, or green) when controlling traffic by light signals.

**b.** Although the traffic signal light offers the advantage that some control may be exercised over nonradio equipped aircraft, pilots should be cognizant of the disadvantages which are:

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

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

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

**d.** Airport Traffic Control Tower Light Gun Signals. (See TBL 4-3-1.)

**e.** During daylight hours, acknowledge tower transmissions or light signals by moving the ailerons or rudder. At night, acknowledge by blinking the landing or navigation lights. If radio malfunction occurs after departing the parking area, watch the tower for light signals or monitor tower frequency.



*TBL 4-3-1*  
**Airport Traffic Control Tower Light Gun Signals**

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

#### 4-3-14. Communications

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

**NOTE-**

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

**REFERENCE-**

*AIM, Paragraph 4-1-13, Automatic Terminal Information Service (ATIS)*

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

**c.** The majority of ground control frequencies are in the 121.6–121.9 MHz bandwidth. Ground control frequencies are provided to eliminate frequency congestion on the tower (local control) frequency and are limited to communications between the tower and aircraft on the ground and between the tower and utility vehicles on the airport, provide a clear VHF channel for arriving and departing aircraft. They are used for issuance of taxi information, clearances, and other necessary contacts between the tower and aircraft or other vehicles operated on the airport. A pilot who has just landed should not change from the

tower frequency to the ground control frequency until directed to do so by the controller. Normally, only one ground control frequency is assigned at an airport; however, at locations where the amount of traffic so warrants, a second ground control frequency and/or another frequency designated as a clearance delivery frequency, may be assigned.

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

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

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

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

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

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

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

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

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

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

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

##### a. General.

1. The following ATC procedures and phraseologies recognize the unique capabilities of helicopters and were developed to improve service to all users. Helicopter design characteristics and user needs often require operations from movement areas and nonmovement areas within the airport boundary. In order for ATC to properly apply these procedures, it is essential that pilots familiarize themselves with the local operations and make it known to controllers when additional instructions are necessary.

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

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

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

1. The phraseology *taxi* is used when it is intended or expected that the helicopter will taxi on the airport surface, either via taxiways or other prescribed routes. *Taxi* is used primarily for helicopters equipped with wheels or in response to a

pilot request. Preference should be given to this procedure whenever it is necessary to minimize effects of rotor downwash.

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

3. *Air taxi* is the preferred method for helicopter ground movements on airports provided ground operations and conditions permit. Unless otherwise requested or instructed, pilots are expected to remain below 100 feet AGL. However, if a higher than normal airspeed or altitude is desired, the request should be made prior to lift-off. The pilot is solely responsible for selecting a safe airspeed for the altitude/operation being conducted. Use of *air taxi* enables the pilot to proceed at an optimum airspeed/altitude, minimize downwash effect, conserve fuel, and expedite movement from one point to another. Helicopters should avoid overflight of other aircraft, vehicles, and personnel during air-taxi operations. Caution must be exercised concerning active runways and pilots must be certain that air taxi instructions are understood. Special precautions may be necessary at unfamiliar airports or airports with multiple/intersecting active runways. The taxi procedures given in Paragraph 4-3-18, Taxiing, Paragraph 4-3-19, Taxi During Low Visibility, and Paragraph 4-3-20, Exiting the Runway After Landing, also apply.

**REFERENCE-**

*Pilot/Controller Glossary Term- Taxi.*

*Pilot/Controller Glossary Term- Hover Taxi.*

*Pilot/Controller Glossary Term- Air Taxi.*

**c. Takeoff and Landing Procedures.**

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

These areas may be improved or unimproved and may be separate from or located on an airport/heliport. ATC will issue takeoff clearances from *movement* areas other than active runways, or in diverse directions from active runways, with additional instructions as necessary. Whenever possible, takeoff clearance will be issued in lieu of extended hover/air taxi operations. Phraseology will be “CLEARED FOR TAKEOFF FROM (taxiway, helipad, runway number, etc.), MAKE RIGHT/LEFT TURN FOR (direction, heading, NAVAID radial) DEPARTURE/DEPARTURE ROUTE (number, name, etc.)” Unless requested by the pilot, downwind takeoffs will not be issued if the tailwind exceeds 5 knots.

2. Pilots should be alert to wind information as well as to wind indications in the vicinity of the helicopter. ATC should be advised of the intended method of departing. A pilot request to takeoff in a given direction indicates that the pilot is willing to accept the wind condition and controllers will honor the request if traffic permits. Departure points could be a significant distance from the control tower and it may be difficult or impossible for the controller to determine the helicopter’s relative position to the wind.

3. If takeoff is requested from *nonmovement* areas, an area not authorized for helicopter use, an area not visible from the tower, an unlighted area at night, or an area off the airport, the phraseology “DEPARTURE FROM (requested location) WILL BE AT YOUR OWN RISK (additional instructions, as necessary). USE CAUTION (if applicable).” The pilot is responsible for operating in a safe manner and should exercise due caution.

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

#### 4-3-18. Taxiing

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

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

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

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

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

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

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

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

**NOTE-**

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

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

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

- (a) The runway assignment.

(b) Any clearance to enter a specific runway.

(c) Any instruction to hold short of a specific runway or line up and wait.

Controllers are required to request a readback of runway hold short assignment when it is not received from the pilot/vehicle.

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

**REFERENCE-**

*AIM, 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, hold short of runway three three left.”

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

**EXAMPLE–**

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

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

**NOTE–**

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

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

**EXAMPLE–**

**Aircraft:** “Dulles ground, Beechcraft One Four Two Six

One clearing runway one right on taxiway echo three, request clearance to Page.”

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

or

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

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

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

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

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

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

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

**NOTE–**

Specific lighting systems and surface markings may be found in Paragraph 2–1–11, Taxiway Lights, and Paragraph 2–3–4, Taxiway Markings.

d. When low visibility conditions exist, pilots should focus their entire attention on the safe

operation of the aircraft while it is moving. Checklists and nonessential communication should be withheld until the aircraft is stopped and the brakes set.

#### 4-3-20. Exiting the Runway After Landing

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

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

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

**NOTE-**

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

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

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

**NOTE-**

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

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

#### 4-3-21. Practice Instrument Approaches

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

**b.** Before practicing an instrument approach, pilots should inform the approach control facility or the tower of the type of practice approach they desire to make and how they intend to terminate it, i.e., full-stop landing, touch-and-go, or missed or low approach maneuver. This information may be furnished progressively when conducting a series of approaches. Pilots on an IFR flight plan, who have

made a series of instrument approaches to full stop landings should inform ATC when they make their final landing. The controller will control flights practicing instrument approaches so as to ensure that they do not disrupt the flow of arriving and departing itinerant IFR or VFR aircraft. The priority afforded itinerant aircraft over practice instrument approaches is not intended to be so rigidly applied that it causes grossly inefficient application of services. A minimum delay to itinerant traffic may be appropriate to allow an aircraft practicing an approach to complete that approach.

**NOTE—**

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

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

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

**e.** VFR aircraft practicing instrument approaches are not automatically authorized to execute the missed approach procedure. This authorization must be specifically requested by the pilot and approved by the controller. Separation will not be provided unless the missed approach has been approved by ATC.

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

**g.** At radar approach control locations when a full approach procedure (procedure turn, etc.,) cannot be

approved, pilots should expect to be vectored to a final approach course for a practice instrument approach which is compatible with the general direction of traffic at that airport.

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

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

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

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

#### **4-3-22. Option Approach**

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

examinee under changing conditions, the pilot would not have to discontinue an approach in the middle of the procedure due to student error or pilot proficiency requirements, and finally it allows more flexibility and economy in training programs. This procedure will only be used at those locations with an operational control tower and will be subject to ATC approval.

#### 4-3-23. Use of Aircraft Lights

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

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

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

er's recommendations for operation of landing lights and electrical systems should be observed.

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

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

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

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

#### 4-3-24. Flight Inspection/'Flight Check' Aircraft in Terminal Areas

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

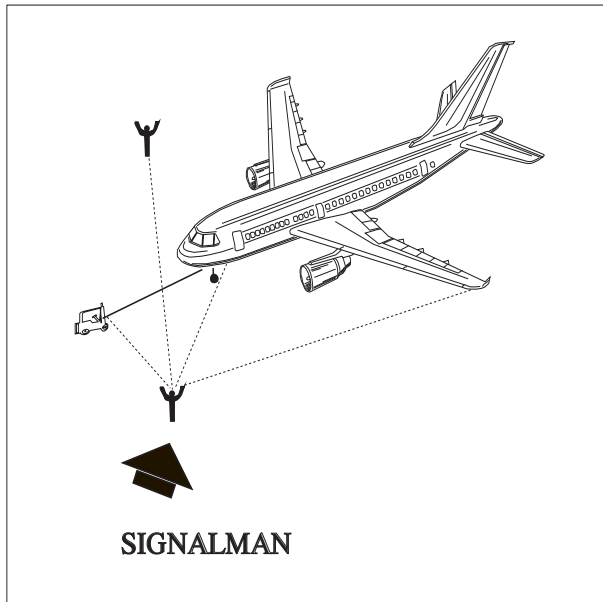


DME arcs, and tracks, including low passes along the full length of the runway to verify NAVAID performance.

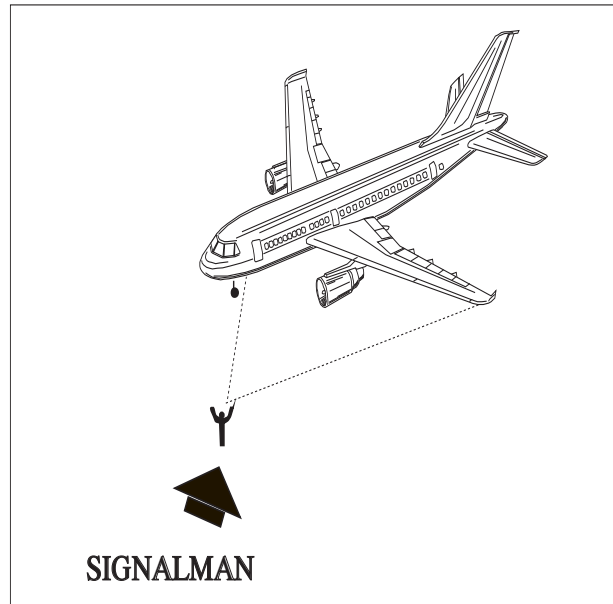
b. Pilots should be especially watchful and avoid the flight paths of any aircraft using the call sign “Flight Check.” These flights will normally receive special handling from ATC. Pilot patience and cooperation in allowing uninterrupted recordings can significantly help expedite flight inspections,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

**4-3-25. Hand Signals**

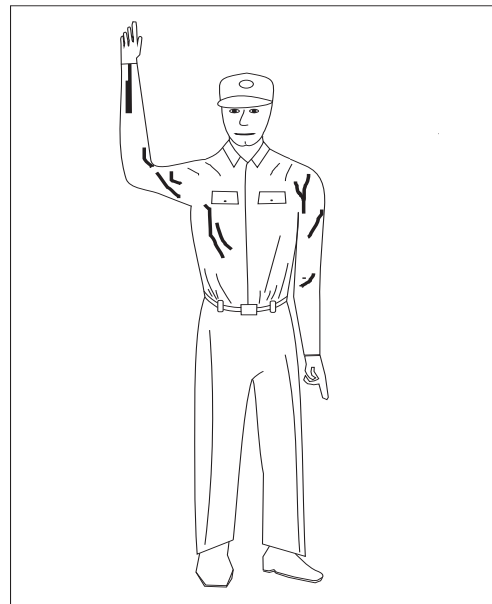
*FIG 4-3-11*  
**Signalman Directs Towing**



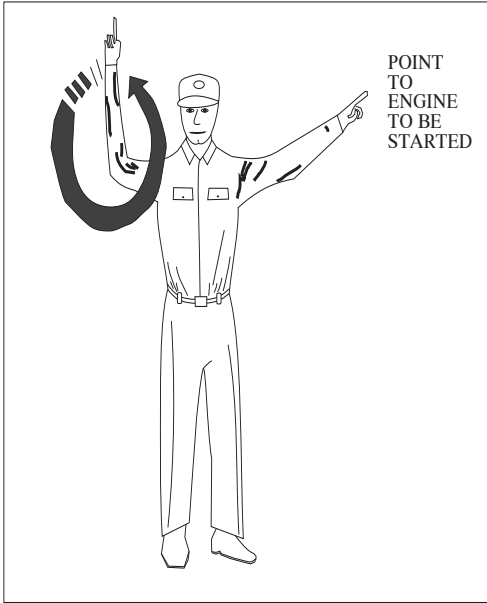
*FIG 4-3-12*  
**Signalman's Position**



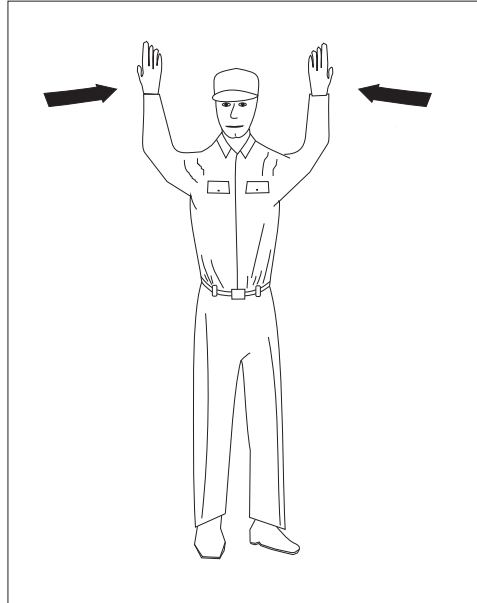
*FIG 4-3-13*  
**All Clear (O.K.)**



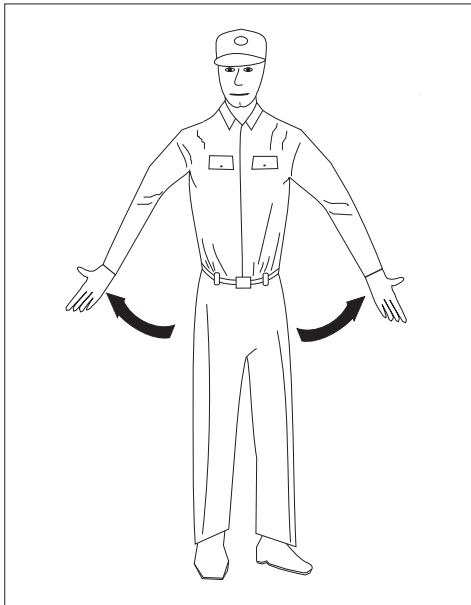
**FIG 4-3-14**  
**Start Engine**



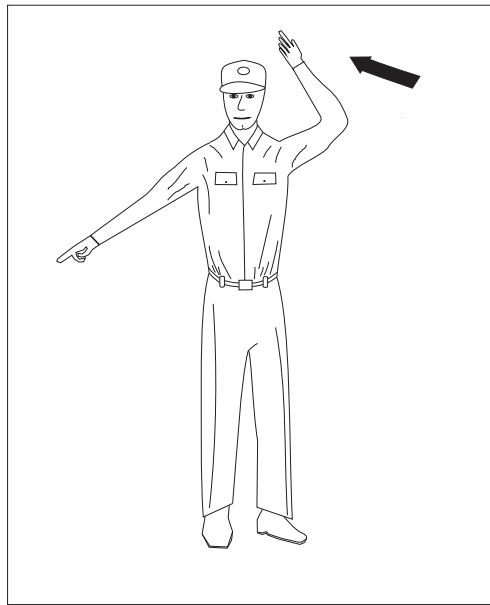
**FIG 4-3-16**  
**Proceed Straight Ahead**



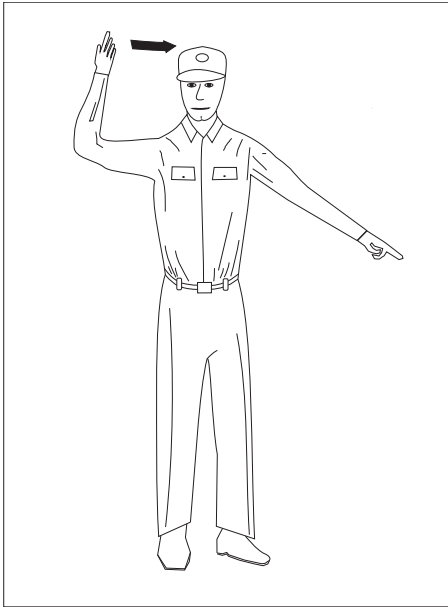
**FIG 4-3-15**  
**Pull Chocks**



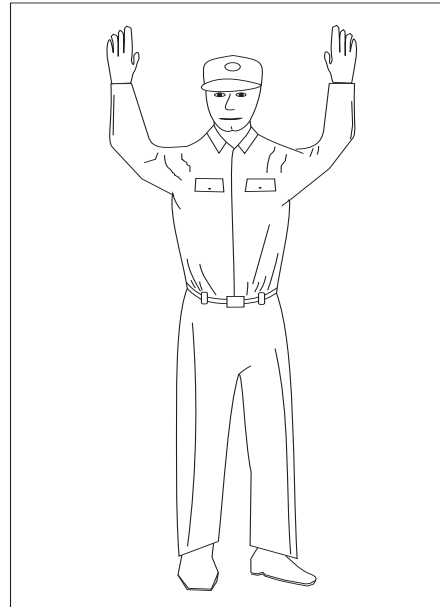
**FIG 4-3-17**  
**Left Turn**



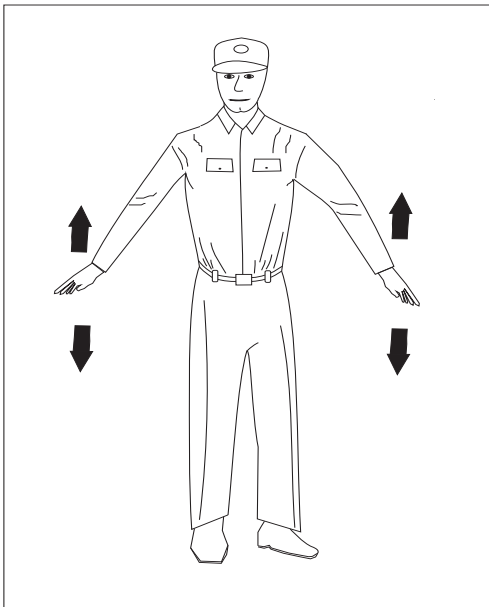
**FIG 4-3-18**  
**Right Turn**



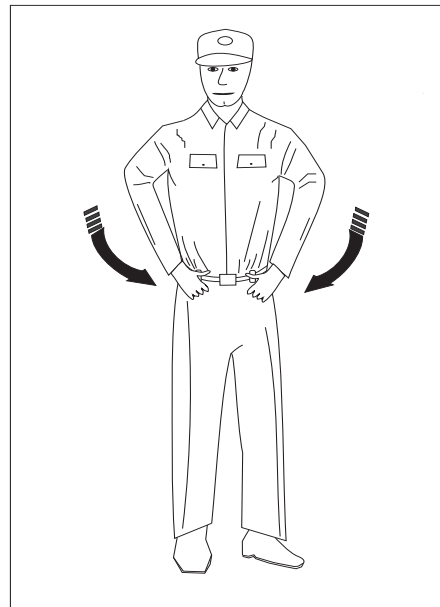
**FIG 4-3-20**  
**Flagman Directs Pilot**



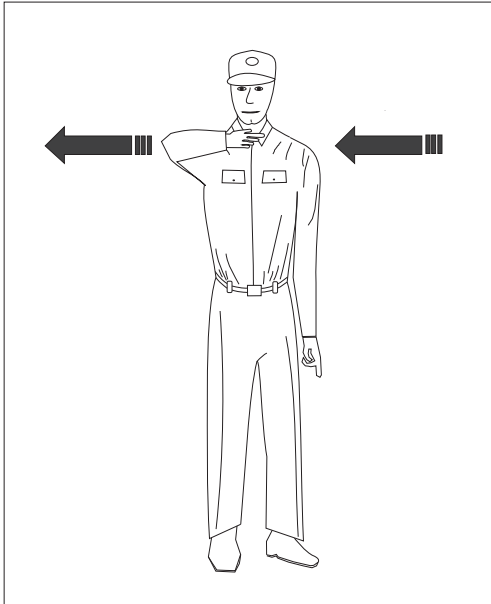
**FIG 4-3-19**  
**Slow Down**



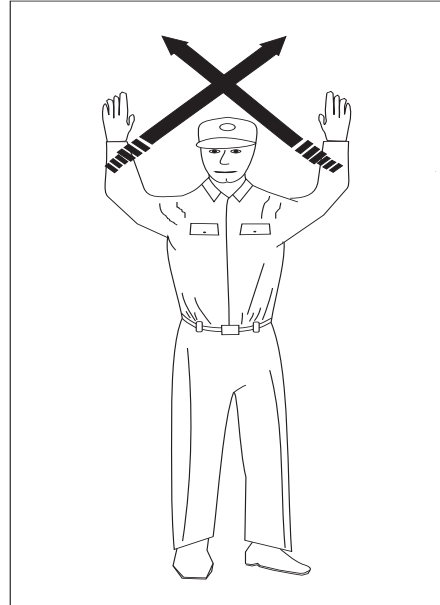
**FIG 4-3-21**  
**Insert Chocks**



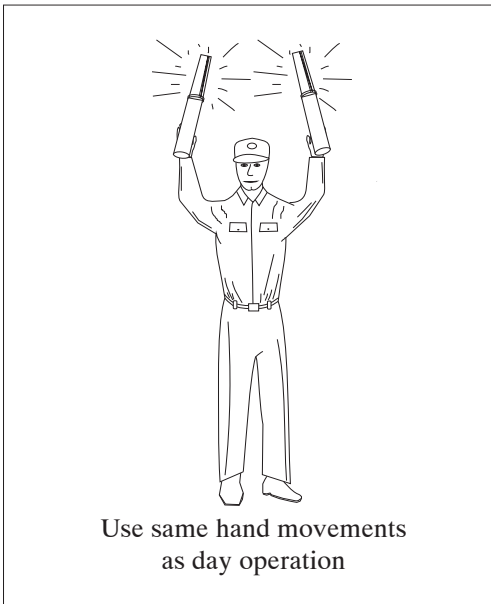
**FIG 4-3-22**  
**Cut Engines**



**FIG 4-3-24**  
**Stop**



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



#### **4-3-26. Operations at Uncontrolled Airports With Automated Surface Observing System (ASOS)/Automated Weather Sensor System(AWSS)/Automated Weather Observing System (AWOS)**

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

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

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

**EXAMPLE-**

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

**REFERENCE-**

*AIM, Paragraph 7-1-11 , Weather Observing Programs*



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 required or desired spacing.

**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 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 (TAs) and resolution advisories (RAs). Resolution advisories provide recommended maneuvers in a vertical direction (climb or descend only) to avoid conflicting traffic. Airline aircraft, and larger commuter and business aircraft holding 31 passenger seats or more, use TCAS II equipment.

1. Each pilot who deviates from an ATC clearance in response to a TCAS II RA must notify ATC of that deviation as soon as practicable and expeditiously return to the current ATC clearance when the traffic conflict is resolved.

2. Deviations from rules, policies, or clearances should be kept to the minimum necessary to satisfy a TCAS II RA.

3. The serving IFR air traffic facility is not responsible to provide approved standard IFR separation to an aircraft after a TCAS II RA maneuver until one of the following conditions exists:

- (a) The aircraft has returned to its assigned altitude and course.

- (b) Alternate ATC instructions have been issued.

- c. 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.

**d.** 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.

### 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.

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.**

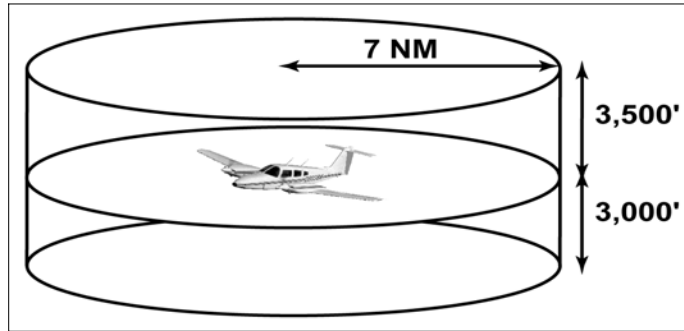
The Traffic Information Service (TIS) provides information to the cockpit via data link, that is similar to VFR radar traffic advisories normally received over voice radio. Among the first FAA–provided data services, TIS is intended to improve the safety and efficiency of “see and avoid” flight through 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 an precise distance. TIS will alert the pilot to aircraft (under surveillance of the Mode S radar) that are estimated to be within 34 seconds of potential collision, regardless of distance of altitude. TIS surveillance data is derived from the same radar used by ATC; this data is uplinked to the client aircraft on each radar scan (nominally every 5 seconds).

**b. Requirements.**

1. In order to use TIS, the client and any intruder aircraft must be equipped with the appropriate cockpit equipment and fly within the radar coverage volume of a Mode S radar capable of providing TIS.

Typically, this will be within 55 NM of the sites depicted in FIG 4-5-5, Terminal Mode S Radar Sites. ATC communication is not a requirement to receive TIS, although it may be required by the particular airspace or flight operations in which TIS is being used.

**FIG 4-5-4  
TIS Proximity Coverage Volume**



**FIG 4-5-5  
Terminal Mode S Radar Sites**

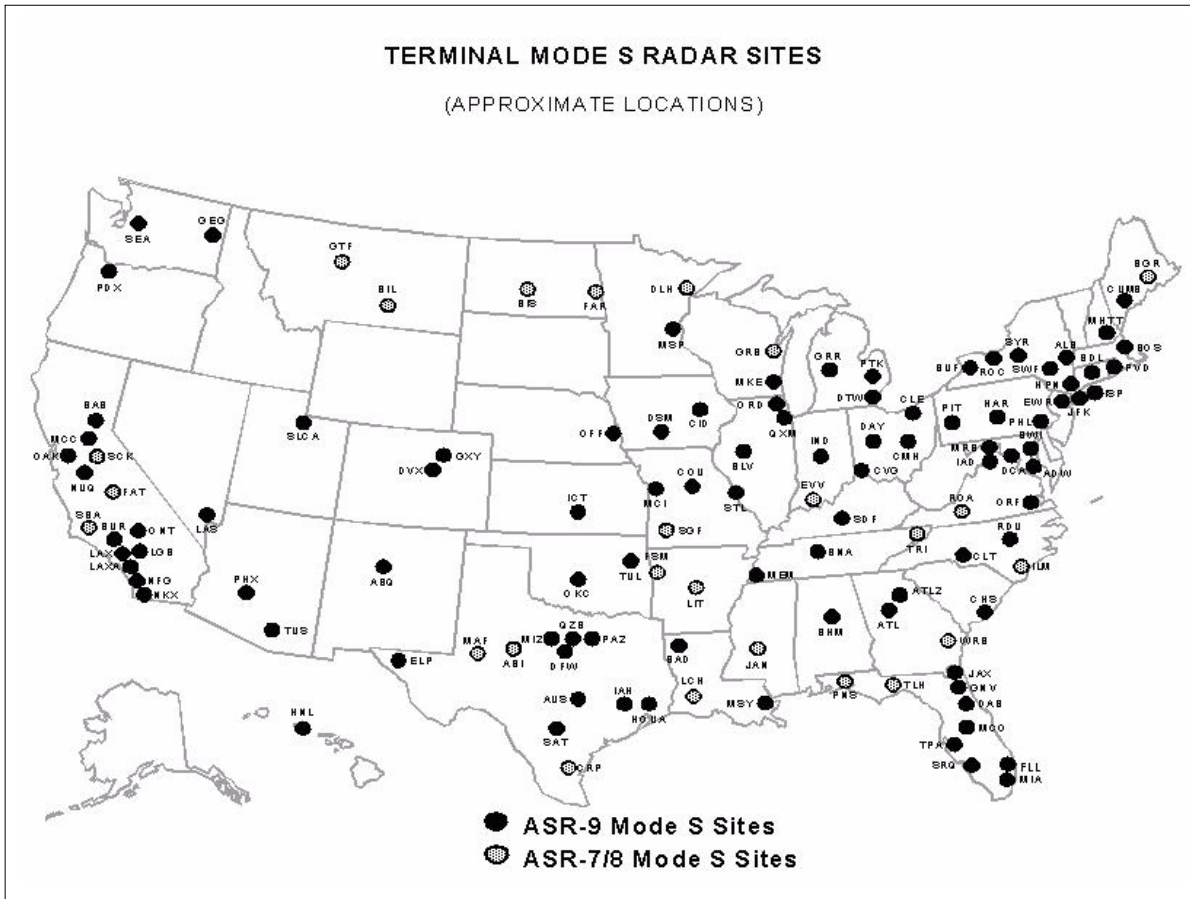
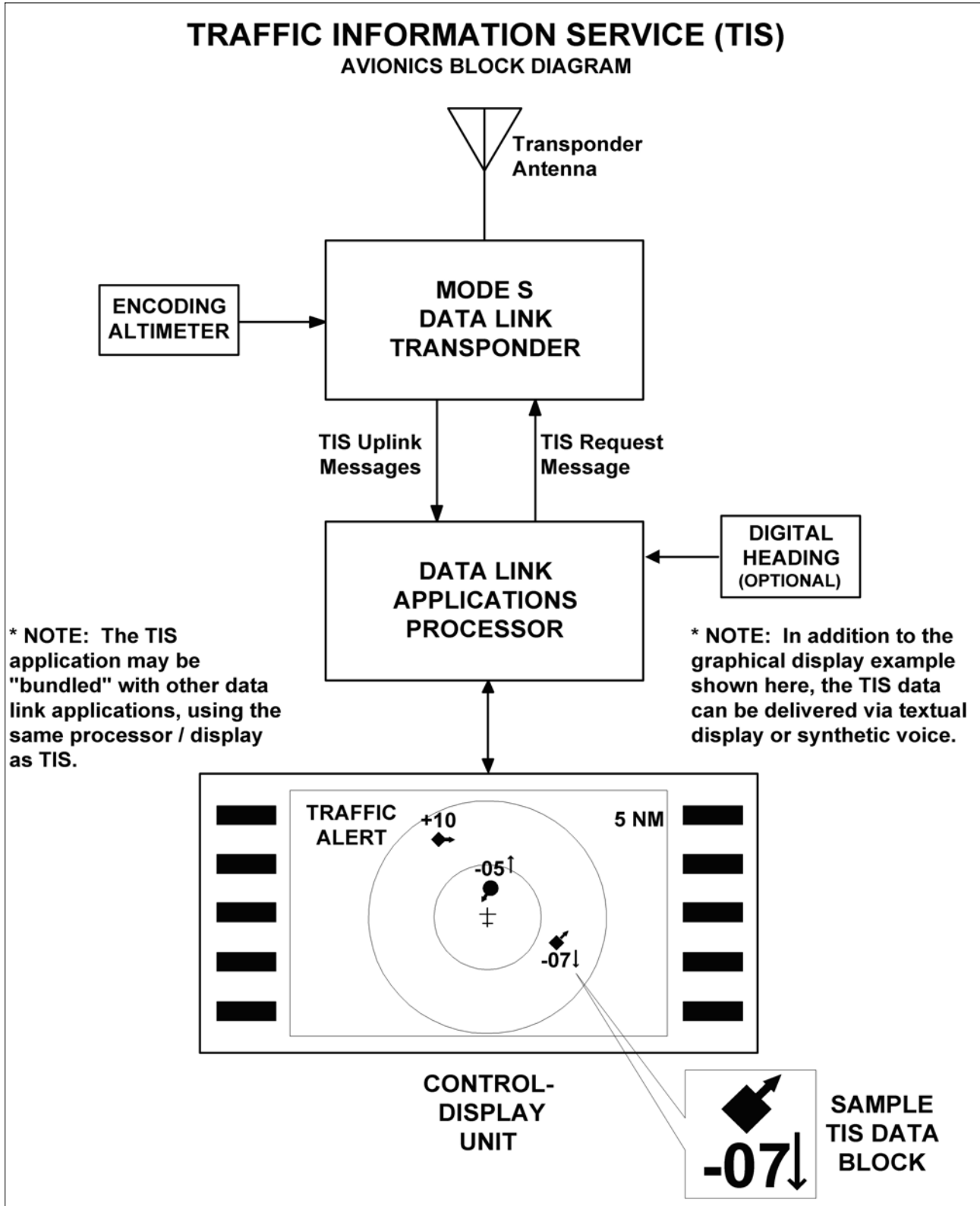


FIG 4-5-6  
Traffic Information Service (TIS)  
Avionics Block Diagram





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

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

3. 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. The ICAO address is programmable 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.

Aircraft that is equipped with ADS-B avionics on the UAT datalink have a feature that allows it 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. After January 1, 2020, and in the airspace identified in § 91.225, the UAT anonymous 24-bit

address feature may only be used when the operator has not filed a flight plan and is not requesting ATC services. In the anonymity mode, the aircraft's beacon code must set to 1200, and depending on the manufacturer's implementation, the aircraft's call sign might not be transmitted. Operators should be aware that in UAT anonymous mode they will not be eligible to receive ATC separation and flight following services, and will likely not benefit from enhanced ADS-B search and rescue capabilities

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

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

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

##### **1. Preflight:**

If a request for ATC services is predicated on ADS-B and such services are anticipated when either a VFR or IFR flight plan is filed, the aircraft's FLT ID as entered in Item 7 of the ICAO flight plan (Block 2 of FAA domestic flight plan) must be entered in the ADS-B avionics.

##### **2. Inflight:**

When requesting ADS-B services while airborne, pilots should ensure that their ADS-B equipment is transmitting their aircraft's registration number or the approved FAA/ICAO company or organizational designator, prior to contacting ATC. Aircraft equipped with a "VFR" or anonymous feature, will not broadcast the appropriate aircraft identification information and should disable the anonymous feature before contacting ATC.

**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.

**e. ADS-B Limitations.**

1. The ADS-B cockpit display of traffic is NOT intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" other aircraft. (See paragraph 5-5-8, See and Avoid). ADS-B 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 nor authorized, as a direct result of an ADS-B target being displayed in the cockpit.

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

**NOTE-**

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

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

Users of ADS-B can provide valuable assistance in the correction of malfunctions by reporting instances of undesirable system performance. 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**

<b>Product</b>	<b>FIS-B Service Update Interval<sup>1</sup></b>	<b>FIS-B Service Transmission Interval<sup>2</sup></b>
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.

## **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 5–2–8, 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 which exceed NAVAID service volume limits. 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.

**5.** At times, ATC will initiate a direct route in a radar environment which exceeds NAVAID service volume limits. In such cases ATC will provide radar monitoring and navigational assistance as necessary.

**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)**

**1.** Random impromptu routes can only be approved in a radar environment. 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.

**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 RNAV capability certification 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. These waypoints must be located within 200 NM of the preceding center's boundary.

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

1. When customs notification is required on flights to Canada and Mexico and a predeparture flight plan cannot be filed or an advise customs message (ADCUS) cannot be included in a predeparture flight plan, call the nearest en route domestic or International FSS as soon as radio communication can be established and file a VFR or DVFR flight plan, as required, and include as the last item the advise customs information. The station with which such a flight plan is filed will forward it to the appropriate FSS who will notify the customs office responsible for the destination airport.

2. If the pilot fails to include ADCUS in the radioed flight plan, it will be assumed that other arrangements have been made and FAA will not advise customs.

3. The FAA assumes no responsibility for any delays in advising customs if the flight plan is given too late for delivery to customs before arrival of the aircraft. **It is still the pilot's responsibility to give timely notice even though a flight plan is given to FAA.**

4. Air Commerce Regulations of the Treasury Department's Customs Service require all private aircraft arriving in the U.S. via:

(a) The U.S./Mexican border or the Pacific Coast from a foreign place in the Western Hemisphere south of 33 degrees north latitude and between 97 degrees and 120 degrees west longitude; or

(b) The Gulf of Mexico and Atlantic Coasts from a foreign place in the Western Hemisphere south of 30 degrees north latitude, must furnish a notice of arrival to the Customs service at the nearest designated airport. This notice may be furnished directly to Customs by:

(1) Radio through the appropriate FAA Flight Service Station.

(2) Normal FAA flight plan notification procedures (a flight plan filed in Mexico does not meet this requirement due to unreliable relay of data); or

(3) Directly to the district Director of Customs or other Customs officer at place of first intended landing but must be furnished at least 1 hour prior to crossing the U.S./Mexican border or the U.S. coastline.

(c) This notice will be valid as long as actual arrival is within 15 minutes of the original ETA, otherwise a new notice must be given to Customs. Notices will be accepted up to 23 hours in advance. Unless an exemption has been granted by Customs, private aircraft are required to make first landing in the U.S. at one of the following designated airports nearest to the point of border or coastline crossing:

### Designated Airports

#### ARIZONA

Bisbee Douglas Intl Airport  
Douglas Municipal Airport  
Nogales Intl Airport  
Tucson Intl Airport  
Yuma MCAS–Yuma Intl Airport

#### CALIFORNIA

Calexico Intl Airport  
Brown Field Municipal Airport (San Diego)

#### FLORIDA

Fort Lauderdale Executive Airport  
Fort Lauderdale/Hollywood Intl Airport  
Key West Intl Airport (Miami Intl Airport)  
Opa Locka Airport (Miami)  
Kendall–Tamiami Executive Airport (Miami)  
St. Lucie County Intl Airport (Fort Pierce)  
Tampa Intl Airport  
Palm Beach Intl Airport (West Palm Beach)

#### LOUISIANA

New Orleans Intl Airport (Moisant Field)  
New Orleans Lakefront Airport

#### NEW MEXICO

Las Cruces Intl Airport

#### NORTH CAROLINA

New Hanover Intl Airport (Wilmington)

#### TEXAS

Brownsville/South Padre Island Intl Airport  
Corpus Christi Intl Airport  
Del Rio Intl Airport  
Eagle Pass Municipal Airport  
El Paso Intl Airport  
William P. Hobby Airport (Houston)  
Laredo Intl Airport  
McAllen Miller Intl Airport  
Presidio Lely Intl Airport

### 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 web site;

3. Operators may contact a Flight Service Station (not DUATS) 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*

## Section 2. Departure Procedures

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

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

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

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

**a.** Many airports in the National Airspace System are equipped with the Terminal Data Link System (TDLS) that includes the Pre-Departure Clearance (PDC) and Controller Pilot Data Link Communication-Departure Clearance (CPDLC-DCL) functions. Both the PDC and CPDLC-DCL functions automate the Clearance Delivery operations in the ATCT for participating users. Both functions display IFR clearances from the ARTCC to the ATCT. The Clearance Delivery controller in the ATCT can append local departure information and transmit the clearance via

data link to participating airline/service provider computers for PDC. The airline/service provider will then deliver the clearance via the Aircraft Communications Addressing and Reporting System (ACARS) or a similar data link system, or for non-data link equipped aircraft, via a printer located at the departure gate. For CPDLC-DCL, the departure clearance is uplinked from the ATCT via the Future Air Navigation System (FANS) to the aircraft avionics and requires a response from the flight crew. Both PDC and CPDLC-DCL reduce frequency congestion, controller workload, and are intended to mitigate delivery/read back errors.

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

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

#### 1. PDC

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

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

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

#### 2. CPDLC-DCL

**(a)** No limitation to the number of clearances received.

**(b)** Allows delivery of revised flight data, including revised departure clearances.

**(c)** A response from the flight crew is required.

**(d)** Requires a logon using the International Civil Aviation Organization (ICAO) airport facility identification (for example, KSLC utilizing the ATC FANS application).

**(e)** To be eligible, operators must have received CPDLC/FANS authorization from the

responsible civil aviation authority, and file appropriate equipment information in ICAO field 10a and in the ICAO field 18 DAT (Other Data Applications) of the flight plan.

### 5-2-3. Taxi Clearance

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

### 5-2-4. Line Up and Wait (LUAW)

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

#### **EXAMPLE-**

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

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

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

#### **EXAMPLE-**

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

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

#### **NOTE-**

*FAA analysis of accidents and incidents involving aircraft holding in position indicate that two minutes or more elapsed between the time the instruction was issued to line up and wait and the resulting event (for example, land-over or go-around). Pilots should consider the length of time that they have been holding in position whenever they*

*HAVE NOT been advised of any expected delay to determine when it is appropriate to query the controller.*

#### **REFERENCE-**

*Advisory Circulars 91-73A, Part 91 and Part 135 Single-Pilot Procedures during Taxi Operations, and 120-74A, Parts 91, 121, 125, and 135 Flightcrew Procedures during Taxi Operations*

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

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

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

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

#### **EXAMPLE-**

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

**h.** If landing traffic is a factor during line up and wait operations, ATC will inform the aircraft in position of the closest traffic within 6 flying miles requesting a full-stop, touch-and-go, stop-and-go, or an unrestricted low approach to the same runway. Pilots should take care to note the position of landing traffic. ATC will also advise the landing traffic when an aircraft is authorized to “line up and wait” on the same runway.

**EXAMPLE–**

*Tower: “Cessna 234AR, Runway 24L, line up and wait. Traffic a Boeing 737, six mile final.”*

*Tower: “Delta 1011, continue, traffic a Cessna 210 holding in position Runway 24L.”*

**NOTE–**

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

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

**NOTE–**

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

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

**a.** ATC facilities will issue an abbreviated IFR departure clearance based on the ROUTE of flight filed in the IFR flight plan, provided the filed route can be approved with little or no revision. These abbreviated clearance procedures are based on the following conditions:

**1.** The aircraft is on the ground or it has departed visual flight rules (VFR) and the pilot is requesting IFR clearance while airborne.

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

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

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

**(a)** Amended, or

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

**NOTE–**

*The facility issuing a clearance may not have received the*

*revised route or the revised flight plan by the time a pilot requests clearance.*

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

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

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

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

**f.** “Cleared to (destination) airport as filed” does NOT include the en route altitude filed in a flight plan. An en route altitude will be stated in the clearance or the pilot will be advised to expect an assigned or filed altitude within a given time frame or at a certain point after departure. This may be done verbally in the departure instructions or stated in the DP.

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

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

**EXAMPLE–**

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

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

**NOTE–**

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

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

**EXAMPLE–**

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

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

**EXAMPLE–**

*Cessna Three One Six Zero Foxtrot cleared to Charlotte Airport as filed via Brooke, maintain seven thousand.*

h. To ensure success of the program, pilots should:

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

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

**EXAMPLE–**

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

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

**EXAMPLE–**

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

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

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

**EXAMPLE–**

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

### **5–2–6. Departure Restrictions, Clearance Void Times, Hold for Release, and Release Times**

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

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

**NOTE–**

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

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

**EXAMPLE–**

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

**2. Hold for Release.** ATC may issue “hold for release” instructions in a clearance to delay an aircraft’s departure for traffic management reasons (i.e., weather, traffic volume, etc.). When ATC states in the clearance, “hold for release,” the pilot may not depart utilizing that IFR clearance until a release time or additional instructions are issued by ATC. In addition, ATC will include departure delay information in conjunction with “hold for release” instructions. The ATC instruction, “hold for release,” applies to the IFR clearance and does not prevent the

pilot from departing under VFR. However, prior to takeoff the pilot should cancel the IFR flight plan and operate the transponder on the appropriate VFR code. An IFR clearance may not be available after departure.

**EXAMPLE–**

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

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

**EXAMPLE–**

*(Aircraft identification) released for departure at (time in hours and/or minutes).*

**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.

### 5–2–7. 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.

**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 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.

### **5–2–8. Instrument Departure Procedures (DP) – Obstacle Departure Procedures (ODP) and Standard Instrument Departures (SID)**

Instrument departure procedures are preplanned 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 (ODPs), printed either textually or graphically, and Standard Instrument Departures (SIDs), 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, e.g., 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, e.g., 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. 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.

**a.** 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 5–2–8b3) 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.

**b.** 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 and SIDs 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–8261–1.)

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.)

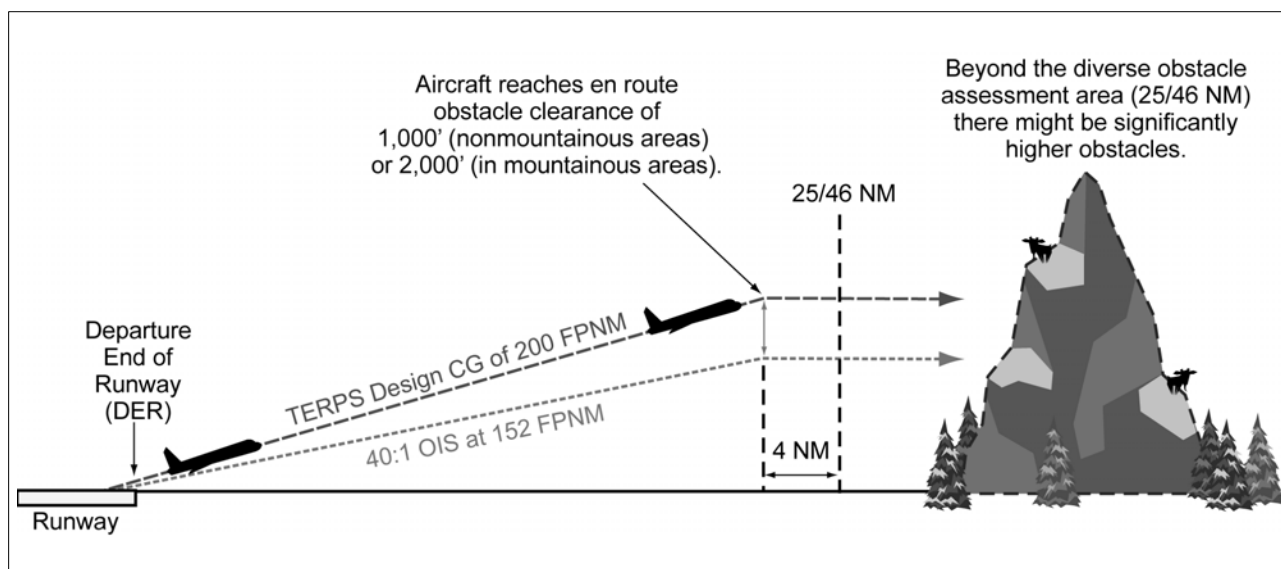
**NOTE—**

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. The purpose of this note 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, e.g., 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 maneuver may be necessary immediately after takeoff to avoid the obstruction(s).

FIG 5–2–1

**Diverse Departure Obstacle Assessment to 25/46 NM**



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. Additionally, ATC required crossing restrictions may also require climb gradients greater than 200 FPNM. These climb gradients may be amended or canceled at ATC's discretion. Multiple ATC climb gradients are permitted. An ATC climb gradient will not be used on an ODP.

**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, ATC climb of 310' per NM to 4000 ft.” A climb of at least 280 FPNM is required to 2500 and is mandatory when the departure procedure is included in the ATC clearance. ATC requires a climb gradient of 310 FPNM to 4000, however, this ATC climb gradient may be amended or canceled.*

6. Climb gradients may be specified only to an altitude/fix, above which the normal gradient applies.

**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 Keemmling radial zero three three to Keemmling VORTAC.”*

c. 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 enroute altitude, unless specified otherwise.

2. ATC may assume responsibility for obstacle clearance by vectoring the aircraft prior to reaching the minimum vectoring altitude by using a Diverse Vector Area (DVA). 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.

(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 Air Traffic facilities may utilize a climb gradient greater than the standard 200 FPNM in a DVA. This information will be identified in the DVA text for pilot evaluation against the aircraft's available climb performance. Pilots should note that the DVA has been assessed for departures which do not follow a specific ground track. ATC may also vector an aircraft off a previously assigned DP. In all cases, the minimum 200 FPNM climb gradient is assumed unless a higher climb gradient is specified on the departure, and obstacle clearance is not provided by ATC until the controller begins to provide navigational guidance in the form of radar vectors.

**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.*

3. Pilots must preplan to determine if the aircraft can meet the climb gradient (expressed in feet per nautical mile) required by the departure procedure, 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.

d. Where are DPs located? DPs will be listed by airport in the IFR Takeoff Minimums and (Obstacle) Departure Procedures Section, Section L, of the Terminal Procedures Publications (TPPs). 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 nontowered airport when compliance with the ODP is necessary for aircraft separation. Pilots may use the ODP to help ensure separation from terrain and obstacles.

e. 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.*

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 an 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 restrictions, pilots should expect the controller to issue an altitude to maintain. 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 not be vectored off of an ODP or issued an altitude lower than a published altitude on an ODP until at or above the MVA/MIA, at which time the ODP is canceled.

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—**

*FAAO 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 alti-

tude 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.

**f. RNAV Departure Procedures**

All public RNAV SIDs and graphic ODPs are RNAV 1. These procedures generally start with an initial RNAV 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 RNAV systems that satisfy the criteria discussed in AC 90–100A, U.S. Terminal and En Route Area Navigation (RNAV) Operations. RNAV 1 procedures must maintain a total system error of not more than 1 NM for 95% of the total flight time.

**REFERENCE–**

AIM, Global Positioning System (GPS)  
Paragraph 1–1–17 k, Impact of Magnetic Variation on PBN Systems

level airspace means an airspace designated and defined as such in the Designated Airspace Handbook.)

(b) Unless issued a VFR flight clearance by ATC, regardless of the weather conditions or the height of the terrain, no person may operate an aircraft under VMC within Class B airspace.

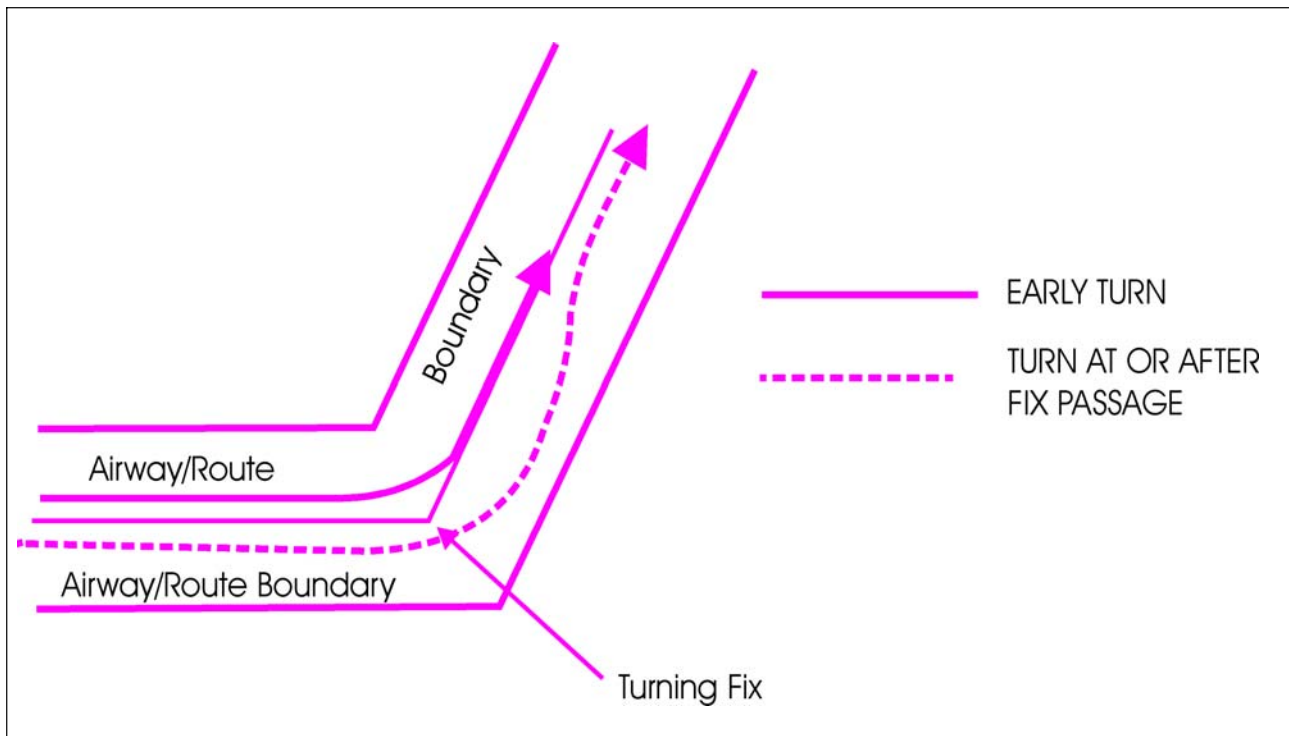
(c) The requirement for entry into Class B

airspace is a student pilot permit (under the guidance or control of a flight instructor).

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

2. Segments of VOR airways and high level routes in Canada are based on L/MF navigation aids and are charted in brown color instead of blue on en route charts.

FIG 5-3-1  
Adhering to Airways or Routes



### 5-3-5. Airway or Route Course Changes

a. Pilots of aircraft are required to adhere to airways or routes being flown. Special attention must be given to this requirement during course changes. Each course change consists of variables that make the technique applicable in each case a matter only the pilot can resolve. Some variables which must be considered are turn radius, wind effect, airspeed, degree of turn, and cockpit instrumentation. An early turn, as illustrated below, is one method of adhering to airways or routes. The use of any available cockpit

instrumentation, such as Distance Measuring Equipment, may be used by the pilot to lead the turn when making course changes. This *is consistent* with the intent of 14 CFR Section 91.181, which requires pilots to operate along the centerline of an airway and along the direct course between navigational aids or fixes.

b. Turns which begin at or after fix passage may exceed airway or route boundaries. FIG 5-3-1 contains an example flight track depicting this, together with an example of an early turn.

c. Without such actions as leading a turn, aircraft operating in excess of 290 knots true air speed (TAS) can exceed the normal airway or route boundaries depending on the amount of course change required, wind direction and velocity, the character of the turn fix (DME, overhead navigation aid, or intersection), and the pilot's technique in making a course change. For example, a flight operating at 17,000 feet MSL with a TAS of 400 knots, a 25 degree bank, and a course change of more than 40 degrees would exceed the width of the airway or route; i.e., 4 nautical miles each side of centerline. However, in the airspace below 18,000 feet MSL, operations in excess of 290 knots TAS are not prevalent and the provision of additional IFR separation in all course change situations for the occasional aircraft making a turn in excess of 290 knots TAS creates an unacceptable waste of airspace and imposes a penalty upon the preponderance of traffic which operate at low speeds. Consequently, the FAA expects pilots to lead turns and take other actions they consider necessary during course changes to adhere as closely as possible to the airways or route being flown.

### 5-3-6. Changeover Points (COPs)

a. COPs are prescribed for Federal airways, jet routes, area navigation routes, or other direct routes for which an MEA is designated under 14 CFR Part 95. The COP is a point along the route or airway segment between two adjacent navigation facilities or waypoints where changeover in navigation guidance should occur. At this point, the pilot should change navigation receiver frequency from the station behind the aircraft to the station ahead.

b. The COP is normally located midway between the navigation facilities for straight route segments, or at the intersection of radials or courses forming a dogleg in the case of dogleg route segments. When the COP is NOT located at the midway point, aeronautical charts will depict the COP location and give the mileage to the radio aids.

c. COPs are established for the purpose of preventing loss of navigation guidance, to prevent frequency interference from other facilities, and to prevent use of different facilities by different aircraft in the same airspace. Pilots are urged to observe COPs to the fullest extent.

### 5-3-7. Minimum Turning Altitude (MTA)

Due to increased airspeeds at 10,000 ft MSL or above, the published minimum enroute altitude (MEA) may not be sufficient for obstacle clearance when a turn is required over a fix, NAVAID, or waypoint. In these instances, an expanded area in the vicinity of the turn point is examined to determine whether the published MEA is sufficient for obstacle clearance. In some locations (normally mountainous), terrain/obstacles in the expanded search area may necessitate a higher minimum altitude while conducting the turning maneuver. Turning fixes requiring a higher minimum turning altitude (MTA) will be denoted on government charts by the minimum crossing altitude (MCA) icon ("x" flag) and an accompanying note describing the MTA restriction. An MTA restriction will normally consist of the air traffic service (ATS) route leading to the turn point, the ATS route leading from the turn point, and the required altitude; e.g., MTA V330 E TO V520 W 16000. When an MTA is applicable for the intended route of flight, pilots must ensure they are at or above the charted MTA not later than the turn point and maintain at or above the MTA until joining the centerline of the ATS route following the turn point. Once established on the centerline following the turning fix, the MEA/MOCA determines the minimum altitude available for assignment. An MTA may also preclude the use of a specific altitude or a range of altitudes during a turn. For example, the MTA may restrict the use of 10,000 through 11,000 ft MSL. In this case, any altitude greater than 11,000 ft MSL is unrestricted, as are altitudes less than 10,000 ft MSL provided MEA/MOCA requirements are satisfied.

### 5-3-8. Holding

a. Whenever an aircraft is cleared to a fix other than the destination airport and delay is expected, it is the responsibility of ATC to issue complete holding instructions (unless the pattern is charted), an EFC time and best estimate of any additional en route/terminal delay.

#### **NOTE-**

*Only those holding patterns depicted on U.S. government or commercially produced (meeting FAA requirements) low/high altitude en route, and area or STAR charts should be used.*

b. If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the



appropriate chart. When the pattern is charted on the assigned procedure or route being flown, ATC may omit all holding instructions except the charted holding direction and the statement *AS PUBLISHED*; for example, *HOLD EAST AS PUBLISHED*. ATC must always issue complete holding instructions when pilots request them.

**c.** If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching the fix. This procedure will eliminate the possibility of an aircraft entering a holding pattern other than that desired by ATC. If unable to obtain holding instructions prior to reaching the fix (due to frequency congestion, stuck microphone, etc.), then enter a standard pattern on the course on which the aircraft approached the fix and request further clearance as soon as possible. In this event, the altitude/flight level of the aircraft at the clearance limit will be protected so that separation will be provided as required.

**d.** When an aircraft is 3 minutes or less from a clearance limit and a clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that the aircraft will cross the fix, initially, at or below the maximum holding airspeed.

**e.** When no delay is expected, the controller should issue a clearance beyond the fix as soon as possible and, whenever possible, at least 5 minutes before the aircraft reaches the clearance limit.

**f.** Pilots should report to ATC the time and altitude/flight level at which the aircraft reaches the clearance limit and report leaving the clearance limit.

**NOTE—**

*In the event of two-way communications failure, pilots are required to comply with 14 CFR Section 91.185.*

**g.** When holding at a VOR station, pilots should begin the turn to the outbound leg at the time of the first complete reversal of the to/from indicator.

**h.** Patterns at the most generally used holding fixes are depicted (charted) on U.S. Government or commercially produced (meeting FAA requirements) Low or High Altitude En Route, Area, Departure Procedure, and STAR Charts. Pilots are expected to hold in the pattern depicted unless specifically advised otherwise by ATC.

**NOTE—**

*Holding patterns that protect for a maximum holding airspeed other than the standard may be depicted by an icon, unless otherwise depicted. The icon is a standard holding pattern symbol (racetrack) with the airspeed restriction shown in the center. In other cases, the airspeed restriction will be depicted next to the standard holding pattern symbol.*

**REFERENCE—**

*AIM, Paragraph 5-3-8 j2, Holding*

**i.** An ATC clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information: (See FIG 5-3-2.)

**1.** Direction of holding from the fix in terms of the eight cardinal compass points (i.e., N, NE, E, SE, etc.).

**2.** Holding fix (the fix may be omitted if included at the beginning of the transmission as the clearance limit).

**3.** Radial, course, bearing, airway or route on which the aircraft is to hold.

**4.** Leg length in miles if DME or RNAV is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary).

**5.** Direction of turn if left turns are to be made, the pilot requests, or the controller considers it necessary.

**6.** Time to expect further clearance and any pertinent additional delay information.

FIG 5-3-2  
Holding Patterns

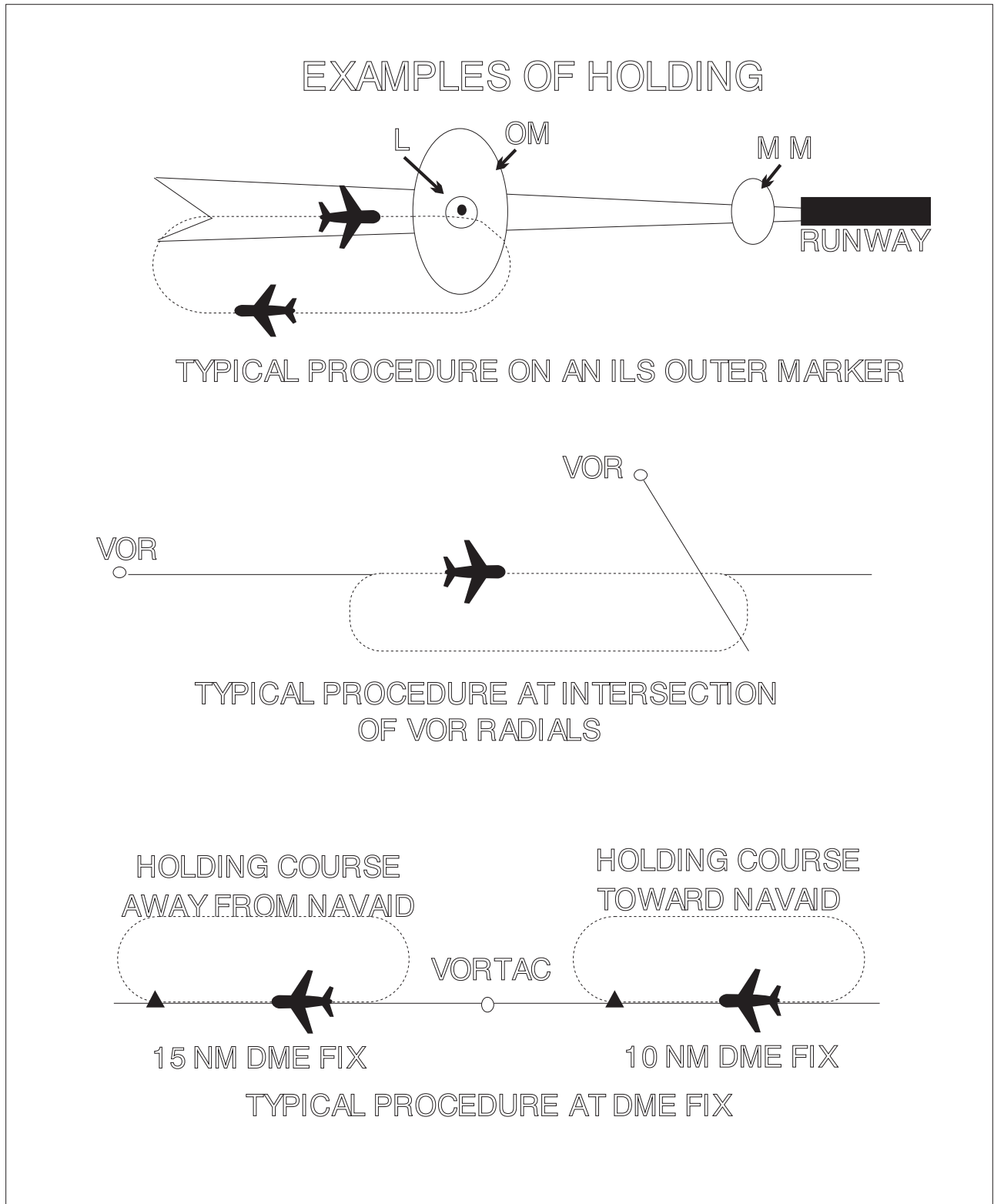
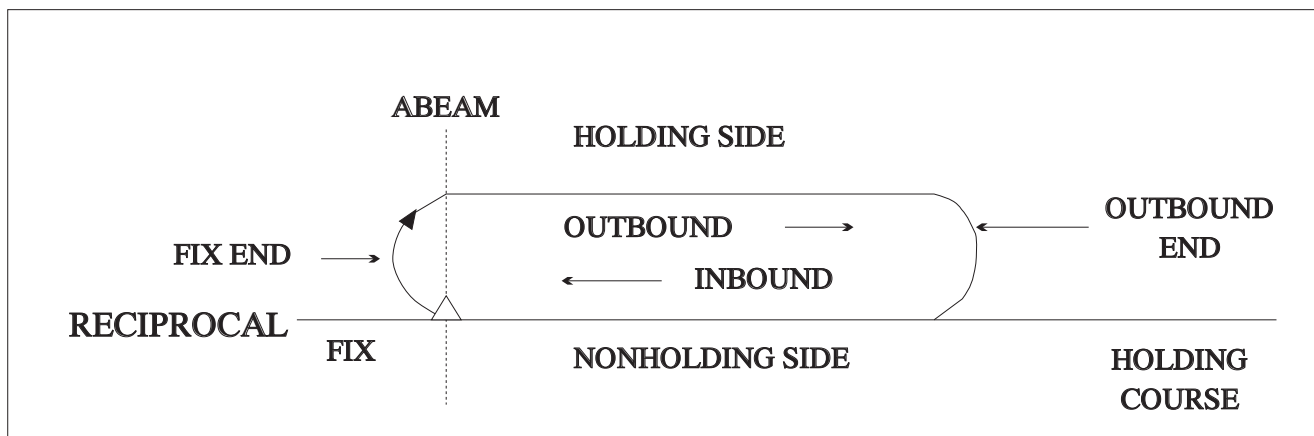


FIG 5-3-3  
Holding Pattern Descriptive Terms



j. Holding pattern airspace protection is based on the following procedures.

**1. Descriptive Terms.**

(a) **Standard Pattern.** Right turns  
(See FIG 5-3-3.)

(b) **Nonstandard Pattern.** Left turns

**2. Airspeeds.**

(a) All aircraft may hold at the following altitudes and maximum holding airspeeds:

TBL 5-3-1

Altitude (MSL)	Airspeed (KIAS)
MHA - 6,000'	200
6,001' - 14,000'	230
14,001' and above	265

**NOTE-**

These are the maximum indicated air speeds applicable to all holding.

(b) The following are exceptions to the maximum holding airspeeds:

(1) Holding patterns from 6,001' to 14,000' may be restricted to a maximum airspeed of 210 KIAS. This nonstandard pattern will be depicted by an icon.

(2) Holding patterns may be restricted to a maximum speed. The speed restriction is depicted in parenthesis inside the holding pattern on the chart: e.g., (175). The aircraft should be at or below the maximum speed prior to initially crossing the holding

fix to avoid exiting the protected airspace. Pilots unable to comply with the maximum airspeed restriction should notify ATC.

(3) Holding patterns at USAF airfields only - 310 KIAS maximum, unless otherwise depicted.

(4) Holding patterns at Navy fields only - 230 KIAS maximum, unless otherwise depicted.

(5) All helicopter/power lift aircraft holding on a "COPTER" instrument procedure is predicated on a minimum airspeed of 90 KIAS unless charted otherwise.

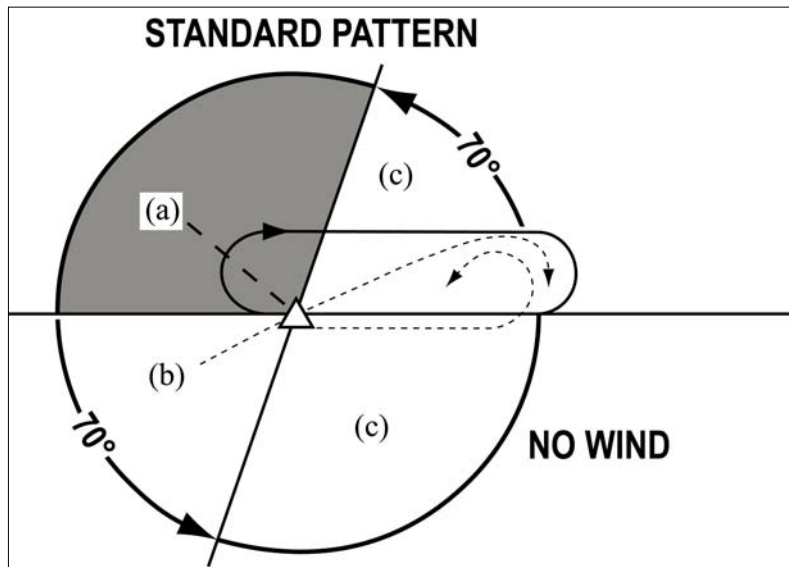
(6) When a climb-in hold is specified by a published procedure (for example, "Climb-in holding pattern to depart XYZ VORTAC at or above 10,000." or "All aircraft climb-in TRUCK holding pattern to cross TRUCK Int at or above 11,500 before proceeding on course."), additional obstacle protection area has been provided to allow for greater airspeeds in the climb for those aircraft requiring them. A maximum airspeed of 310 KIAS is permitted in Climb-in-holding, unless a maximum holding airspeed is published, in which case that maximum airspeed is applicable. The airspeed limitations in 14 CFR Section 91.117, Aircraft Speed, still apply.

(c) The following phraseology may be used by an ATCS to advise a pilot of the maximum holding airspeed for a holding pattern airspace area.

**PHRASEOLOGY-**

(AIRCRAFT IDENTIFICATION) (holding instructions, when needed) MAXIMUM HOLDING AIRSPEED IS (speed in knots).

FIG 5-3-4  
Holding Pattern Entry Procedures



**3. Entry Procedures.** Holding protected airspace is designed based in part on pilot compliance with the three recommended holding pattern entry procedures discussed below. Deviations from these recommendations, coupled with excessive airspeed crossing the holding fix, may in some cases result in the aircraft exceeding holding protected airspace. (See FIG 5-3-4.)

**(a) Parallel Procedure.** When approaching the holding fix from anywhere in sector (a), the parallel entry procedure would be to turn to a heading to parallel the holding course outbound on the nonholding side for one minute, turn in the direction of the holding pattern through more than 180 degrees, and return to the holding fix or intercept the holding course inbound.

**(b) Teardrop Procedure.** When approaching the holding fix from anywhere in sector (b), the teardrop entry procedure would be to fly to the fix, turn outbound to a heading for a 30 degree teardrop entry within the pattern (on the holding side) for a period of one minute, then turn in the direction of the holding pattern to intercept the inbound holding course.

**(c) Direct Entry Procedure.** When approaching the holding fix from anywhere in sector (c), the direct entry procedure would be to fly

directly to the fix and turn to follow the holding pattern.

**(d)** While other entry procedures may enable the aircraft to enter the holding pattern and remain within protected airspace, the parallel, teardrop and direct entries are the procedures for entry and holding recommended by the FAA, and were derived as part of the development of the size and shape of the obstacle protection areas for holding.

**(e) Nonstandard Holding Pattern.** Fix end and outbound end turns are made to the left. Entry procedures to a nonstandard pattern are oriented in relation to the 70 degree line on the holding side just as in the standard pattern.

#### 4. Timing.

##### (a) Inbound Leg.

- (1) At or below 14,000 feet MSL: 1 minute.
- (2) Above 14,000 feet MSL: 1<sup>1</sup>/<sub>2</sub> minutes.

##### NOTE-

*The initial outbound leg should be flown for 1 minute or 1<sup>1</sup>/<sub>2</sub> minutes (appropriate to altitude). Timing for subsequent outbound legs should be adjusted, as necessary, to achieve proper inbound leg time. Pilots may use any navigational means available; i.e., DME, RNAV, etc., to ensure the appropriate inbound leg times.*

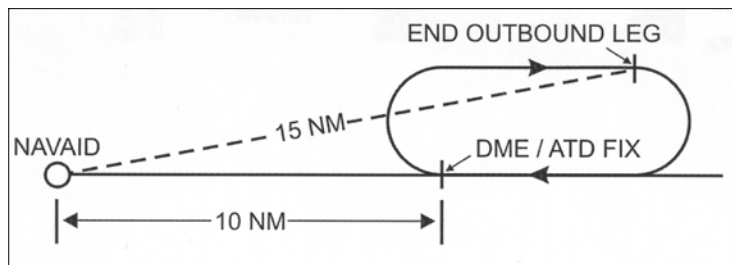
**(b) Outbound leg** timing begins over/abeam the fix, whichever occurs later. If the abeam position

cannot be determined, start timing when turn to outbound is completed.

**5. Distance Measuring Equipment (DME)/GPS Along-Track Distance (ATD).** DME/GPS holding is subject to the same entry and holding procedures except that distances (nautical miles) are used in lieu of time values. The outbound course of the DME/GPS holding pattern is called the outbound leg of the pattern. The controller or the instrument approach procedure chart will specify the length of the outbound leg. The end of the outbound leg is determined by the DME or ATD readout. The holding fix on conventional procedures, or controller defined

holding based on a conventional navigation aid with DME, is a specified course or radial and distances are from the DME station for both the inbound and outbound ends of the holding pattern. When flying published GPS overlay or stand alone procedures with distance specified, the holding fix will be a waypoint in the database and the end of the outbound leg will be determined by the ATD. Some GPS overlay and early stand alone procedures may have timing specified. (See FIG 5-3-5, FIG 5-3-6 and FIG 5-3-7.) See Paragraph 1-1-17, Global Positioning System (GPS), for requirements and restriction on using GPS for IFR operations.

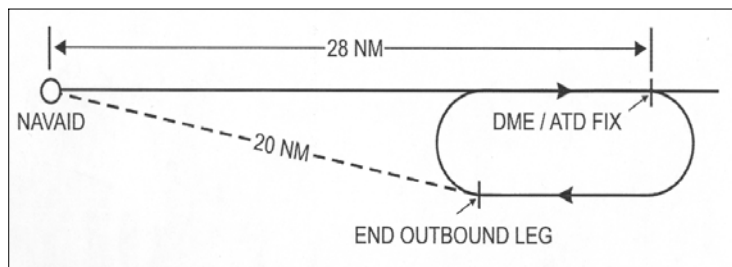
FIG 5-3-5  
Inbound Toward NAVAID



**NOTE-**

When the inbound course is toward the NAVAID, the fix distance is 10 NM, and the leg length is 5 NM, then the end of the outbound leg will be reached when the DME reads 15 NM.

FIG 5-3-6  
Inbound Leg Away from NAVAID



**NOTE-**

When the inbound course is away from the NAVAID and the fix distance is 28 NM, and the leg length is 8 NM, then the end of the outbound leg will be reached when the DME reads 20 NM.

**6. Use of RNAV Distance in lieu of DME Distance.** Substitution of RNAV computed distance to or from a NAVAID in place of DME distance is permitted when holding. However, the actual holding location and pattern flown will be further from the NAVAID than designed due to the lack of slant range in the position solution (see FIG 5-3-7). This may result in a slight difference between RNAV distance readout in reference to the NAVAID and the DME

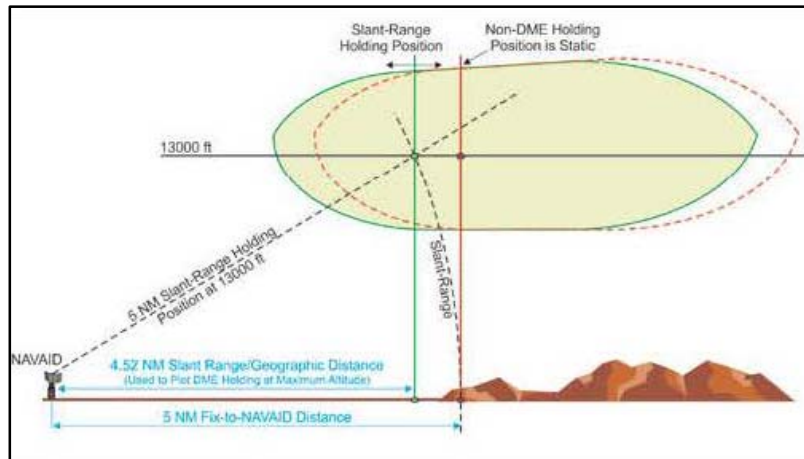
readout, especially at higher altitudes. When used solely for DME substitution, the difference between RNAV distance to/from a fix and DME slant range distance can be considered negligible and no pilot action is required.

**REFERENCE-**

*AIM Paragraph 1-2-3, Use of Suitable Area Navigation (RNAV) Systems on Conventional Procedures and Routes*

**FIG 5-3-7**

**Difference Between DME Distance From NAVAID & RNAV Computed Distance From NAVAID**



**7. Use of RNAV Guidance and Holding.** RNAV systems, including multi-sensor Flight Management Systems (FMS) and stand-alone GPS receivers, may be used to furnish lateral guidance when executing a hold. The manner in which holding is implemented in an RNAV system varies widely between aircraft and RNAV system manufacturers. Holding pattern data may be extracted from the RNAV database for published holds or may be manually entered for ad-hoc ATC-assigned holds. Pilots are expected to be familiar with the capabilities and limitations of the specific RNAV system used for holding.

(a) All holding, including holding defined on an RNAV or RNP procedure, is based on the conventional NAVAID holding design criteria, including the holding protected airspace construction. There are differences between the holding entry and flight track assumed in conventional holding pattern design and the entry and track that may be flown when RNAV guidance is used to execute holding. Individually, these differences may not affect the ability of the aircraft to remain within holding pattern protected airspace. However, cumu-

latively, they can result in deviations sufficient to result in excursions up to limits of the holding pattern protected airspace, and in some circumstances beyond protected airspace. The following difference and considerations apply when an RNAV system furnishes the lateral guidance used to fly a holding pattern:

(1) Many systems use ground track angle instead of heading to select the entry method. While the holding pattern design allows a 5 degree tolerance, this may result in an unexpected entry when the winds induce a large drift angle.

(2) The holding protected airspace is based on the assumption that the aircraft will fly-over the holding fix upon initial entry. RNAV systems may execute a “fly-by” turn when approaching the holding fix prior to entry. A “fly-by” turn during a direct entry from the holding side of holding course may result in excursions beyond protected airspace, especially as the intercept angle and ground speed increase.

(3) During holding, RNAV systems furnish lateral steering guidance using either a constant bank or constant radius to achieve the desired inbound and

outbound turns. An aircraft's flight guidance system may use reduced bank angles for all turns including turns in holding, especially at higher altitudes, that may result in exceeding holding protected airspace. Use of a shallower bank angle will expand both the width and length of the aircraft track, especially as wind speed increases. If the flight guidance system's bank angle limit feature is pilot-selectable, a minimum 25 degree bank angle should be selected regardless of altitude unless aircraft operating limitations specify otherwise and the pilot advises ATC.

(4) Where a holding distance is published, the turn from the outbound leg begins at the published distance from the holding fix, thus establishing the

design turn point required to remain within protected airspace. RNAV systems apply a database coded or pilot-entered leg distance as a maximum length of the inbound leg to the holding fix. The RNAV system then calculates a turn point from the outbound leg required to achieve this inbound leg length. This often results in an RNAV-calculated turn point on the outbound leg beyond the design turn point. (See FIG 5-3-8). With a strong headwind against the outbound leg, RNAV systems may fly up to and possibly beyond the limits of protected airspace before turning inbound. (See FIG 5-3-9.) This is especially true at higher altitudes where wind speeds are greater and ground speed results in a wider holding pattern.

FIG 5-3-8

**RNAV Lateral Guidance and Holding – No Wind**

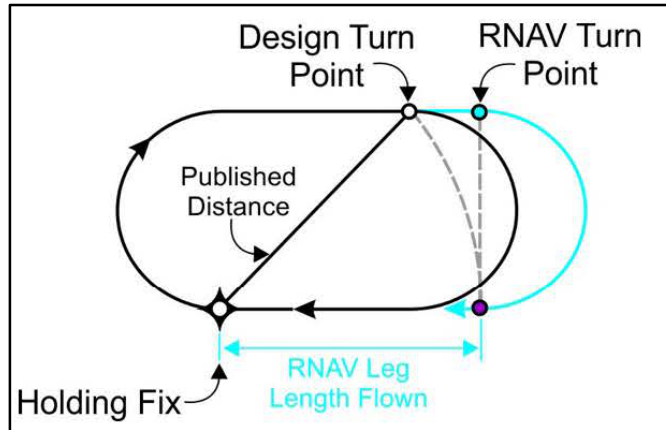
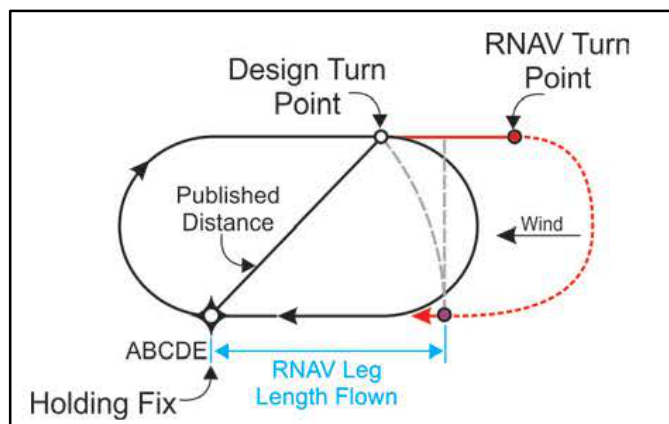


FIG 5-3-9

**RNAV Lateral Guidance and Holding – Effect of Wind**



(5) Some RNAV systems compute the holding pattern based on the aircraft's altitude and speed at a point prior to entering the hold. If the indicated airspeed is not reduced to comply with the maximum holding speed before this point, the computed pattern may exceed the protected airspace. Loading or executing a holding pattern may result in the speed and time limits applicable to the aircraft's current altitude being used to define the holding pattern for RNAV lateral guidance. This may result in an incorrect hold being flown by the RNAV system. For example, entering or executing the holding pattern above 14,000 feet when intending to hold below 14,000 feet may result in applying 1 ½ minute timing below 14,000 feet.

**NOTE—**

*Some systems permit the pilot to modify leg time of holding patterns defined in the navigation database; for example, a hold-in-lieu of procedure turn. In most RNAV systems, the holding pattern time remains at the pilot-modified time and will not revert back to the coded time if the aircraft descends to a lower altitude where a shorter time interval applies.*

(b) RNAV systems are not able to alert the pilot for excursions outside of holding pattern protected airspace since the dimensions of this airspace are not included in the navigation database. In addition, the dimensions of holding pattern protected airspace vary with altitude for a charted holding pattern, even when the hold is used for the same application. Close adherence to the pilot actions described in this section reduce the likelihood of exceeding the boundary of holding pattern protected airspace when using RNAV lateral guidance to conduct holding.

(c) Holding patterns may be stored in the RNAV system's navigation database and include coding with parameters defining how the RNAV system will conduct the hold. For example, coding will determine whether holding is conducted to manual termination (HM), continued holding until the aircraft reaches a specified altitude (HA), or holding is conducted until the holding fix is crossed the first time after entry (HF). Some systems do not store all holding patterns, and may only store patterns associated with missed approaches and hold-in-lieu of procedure turn (HILPT). Some store all holding as standard patterns and require pilot action to conduct non-standard holding (left turns).

(1) Pilots are cautioned that multiple holding patterns may be established at the same fix. These holding patterns may differ in respect to turn directions and leg lengths depending on their application as an en route holding pattern, a holding pattern charted on a SID or STAR, or when used on an instrument approach procedure. Many RNAV systems limit the database coding at a particular fix to a single holding pattern definition. Pilots extracting the holding pattern from the navigation database are responsible for confirming that the holding pattern conforms to the assigned charted holding pattern in terms of turn direction, speed limit, timing, and distance.

(2) If ATC assigns holding that is not charted, then the pilot is responsible for programming the RNAV system with the assigned holding course, turn direction, speed limit, leg length, or leg time.

(3) Changes made after the initial execution may not apply until the next circuit of the holding pattern if the aircraft is in close proximity to the holding fix.

**8. Pilot Action.** The following actions are recommended to ensure that the aircraft remains within holding protected airspace when holding is performed using either conventional NAVAID guidance or when using RNAV lateral guidance.

(a) Speed. When ATC furnishes advance notice of holding, start speed reduction to be at or below the maximum holding speed allowed at least 3 minutes prior to crossing the holding fix. If advance notice by ATC is not provided, begin speed reduction as expeditiously as practical. It is acceptable to allow RNAV systems to determine an appropriate deceleration point prior to the holding fix and to manage the speed reduction to the RNAV computed holding speed. If the pilot does not permit the RNAV system to manage the deceleration from the computed point, the actual hold pattern size at holding entry may differ from the holding pattern size computed by the RNAV system.

(1) Aircraft are expected to enter holding at or below the maximum holding speed established in paragraph 5-3-8 j 2(a) or the charted maximum holding speed.

[a] All fixed wing aircraft conducting holding should fly at speeds at or above 90 KIAS to minimize the influence of wind drift.



**[b]** When RNAV lateral guidance is used in fixed wing airplanes, it is desirable to enter and conduct holding at the lowest practical airspeed consistent with the airplane's recommended holding speed to address the cumulative errors associated with RNAV holding and increase the probability of remaining within protected airspace. It is acceptable to allow RNAV systems to determine a recommended holding speed *that is at or below the maximum holding speed*.

**[c]** Helicopter holding is based on a minimum airspeed of 90 KIAS.

**(2)** Advise ATC immediately if unable to comply with the maximum holding airspeed and request an alternate clearance.

**NOTE—**

*Speeds above the maximum or published holding speed may be necessary due to turbulence, icing, etc. Exceeding maximum holding airspeed may result in aircraft excursions beyond the holding pattern protected airspace. In a non-radar environment, the pilot should advise ATC that they cannot accept the assigned hold.*

**(3)** Ensure the RNAV system applies the proper time and speed restrictions to a holding pattern. This is especially critical when climbing or descending to a holding pattern altitude where time and speed restrictions are different than at the present aircraft altitude

**(b)** Bank Angle. For holding not involving the use of RNAV lateral guidance, make all turns during entry and while holding at:

**(1)** 3 degrees per second, or

**(2)** 30 degree bank angle, or

**(3)** 25 degree bank angle, provided a flight director system is used.

**NOTE—**

*Use whichever requires the least bank angle.*

**(4)** When using RNAV lateral guidance to conduct holding, it is acceptable to permit the RNAV system to calculate the appropriate bank angle for the outbound and inbound turns. Do not use flight guidance system bank angle limiting functions of less than 25 degrees unless the feature is not pilot-selectable, required by the aircraft limitations, or its use is necessary to comply with the aircraft's minimum

maneuvering speed margins. If the bank angle must be limited to less than 25 degrees, advise ATC that additional area for holding is required.

**(c)** Compensate for wind effect primarily by drift correction on the inbound and outbound legs. When outbound, triple the inbound drift correction to avoid major turning adjustments; for example, if correcting left by 8 degrees when inbound, correct right by 24 degrees when outbound.

**(d)** Determine entry turn from aircraft heading upon arrival at the holding fix; +/- 5 degrees in heading is considered to be within allowable good operating limits for determining entry. When using RNAV lateral guidance for holding, it is permissible to allow the system to compute the holding entry.

**(e)** RNAV lateral guidance may execute a fly-by turn beginning at an excessively large distance from the holding fix. Reducing speed to the maximum holding speed at least 3 minutes prior to reaching the holding fix and using the recommended 25 degree bank angle will reduce potential excursions beyond protected airspace.

**(f)** When RNAV guidance is used for holding, pilots should be prepared to intervene if the turn from outbound leg to the inbound leg does not begin within a reasonable distance of the charted leg length, especially when holding is used as a course reversal HILPT. Pilot intervention is not required when holding in an ATC-assigned holding pattern that is not charted. However, notify ATC when the outbound leg length becomes excessive when RNAV guidance is used for holding.

**k.** When holding at a fix and instructions are received specifying the time of departure from the fix, the pilot should adjust the aircraft's flight path within the limits of the established holding pattern in order to leave the fix at the exact time specified. After departing the holding fix, normal speed is to be resumed with respect to other governing speed requirements, such as terminal area speed limits, specific ATC requests, etc. Where the fix is associated with an instrument approach and timed approaches are in effect, a procedure turn must not be executed unless the pilot advises ATC, since aircraft holding are expected to proceed inbound on final approach directly from the holding pattern when approach clearance is received.

1. Radar surveillance of holding pattern airspace areas.

1. Whenever aircraft are holding, ATC will usually provide radar surveillance of the holding airspace on the controller's radar display.

2. The controller will attempt to detect any holding aircraft that stray outside the holding airspace and will assist any detected aircraft to return to the assigned airspace.

**NOTE—**

*Many factors could prevent ATC from providing this additional service, such as workload, number of targets, precipitation, ground clutter, and radar system capability. These circumstances may make it unfeasible to maintain radar identification of aircraft to detect aircraft straying from the holding pattern. The provision of this service depends entirely upon whether controllers believe they are in a position to provide it and does not relieve a pilot of their responsibility to adhere to an accepted ATC clearance.*

3. ATC is responsible for traffic and obstruction separation when they have assigned holding that is

not associated with a published (charted) holding pattern. Altitudes assigned will be at or above the minimum vectoring or minimum IFR altitude.

4. If an aircraft is established in a published holding pattern at an assigned altitude above the published minimum holding altitude and subsequently cleared for the approach, the pilot may descend to the published minimum holding altitude. The holding pattern would only be a segment of the IAP *if* it is published on the instrument procedure chart and is used in lieu of a procedure turn.

m. For those holding patterns where there are no published minimum holding altitudes, the pilot, upon receiving an approach clearance, must maintain the last assigned altitude until leaving the holding pattern and established on the inbound course. Thereafter, the published minimum altitude of the route segment being flown will apply. It is expected that the pilot will be assigned a holding altitude that will permit a normal descent on the inbound course.

**Procedure** *The aircraft on the offset course approach must see the runway-landing environment and, if ATC has advised that traffic on the straight-in approach is a factor, the offset course approach aircraft must visually acquire the straight-in approach aircraft and report it in sight to ATC prior to reaching the DA for the offset course approach.*

**CC** *The Clear of Clouds point is the position on the offset final approach course where aircraft first operate in visual meteorological conditions below the ceiling, when the actual weather conditions are at, or near, the minimum ceiling for SOIA operations. Ceiling is defined by the Aeronautical Information Manual.*

**d. Attention All Users Page (AAUP).** Multiple PRM approach charts at the same airport have a single AAUP associated with them that must be referred to in preparation for conducting the approach.

Bullet points are published which summarize the PRM procedures which apply to each approach and must be briefed before conducting a PRM approach. The following information may be summarized in the bullet points or published in more detail in the Expanded Procedures section of the AAUP. Briefing on the Expanded Procedures is optional.

**1. ATIS.** When the ATIS broadcast advises ILS PRM approaches are in progress (or ILS PRM and LDA PRM approaches in the case of SOIA), pilots should brief to fly the ILS PRM or LDA PRM approach. If later advised to expect the ILS or LDA approach (should one be published), the ILS PRM or LDA PRM chart may be used after completing the following briefing items. The pilot may also request to fly the RNAV (GPS) PRM in lieu of either the ILS PRM or LDAPRM approach. In the event of the loss of ground based NAVAIDS, the ATIS may advertise RNAV (GPS) PRM approaches to the affected runway or runways.

(a) Minimums and missed approach procedures are unchanged.

(b) PRM Monitor frequency no longer required.

(c) ATC may assign a lower altitude for glide slope intercept.

**NOTE-**

*In the case of the LDA PRM approach, this briefing procedure only applies if an LDA-DME approach is also published.*

In the case of the SOIA ILS PRM and LDA PRM procedure, the AAUP describes the weather conditions in which simultaneous approaches are authorized:

Simultaneous approach weather minimums are X,XXX feet (ceiling), x miles (visibility).

**2. Dual VHF Communications Required.**

To avoid blocked transmissions, each runway will have two frequencies, a primary and a PRM monitor frequency. The tower controller will transmit on both frequencies. The monitor controller's transmissions, if needed, will override both frequencies. Pilots will ONLY transmit on the tower controller's frequency, but will listen to both frequencies. Select the PRM monitor frequency audio only when instructed by ATC to contact the tower. The volume levels should be set about the same on both radios so that the pilots will be able to hear transmissions on at least one frequency if the other is blocked. Site specific procedures take precedence over the general information presented in this paragraph. Refer to the AAUP for applicable procedures at specific airports.

**NOTE-**

*At SFO, pilots conducting SOIA operations select the monitor frequency audio when communicating with the final radar controller. In this special case, the monitor controller's transmissions, if required, override the final controller's frequency.*

**3. Breakouts.** Breakouts differ from other types of abandoned approaches in that they can happen anywhere and unexpectedly. Pilots directed by ATC to break off an approach must assume that an aircraft is blundering toward them and a breakout must be initiated **immediately**.

(a) **Hand-fly breakouts.** All breakouts are to be hand-flown to ensure the maneuver is accomplished in the shortest amount of time.

(b) **ATC Directed "Breakouts."** ATC directed breakouts will consist of a turn and a climb or descent. Pilots must always initiate the breakout in response to an air traffic controller's instruction. Controllers will give a descending breakout only when there are no other reasonable options available, but in no case will the descent be below the minimum

vectoring altitude (MVA) which provides at least 1,000 feet required obstruction clearance. The AAUP may provide the MVA in the final approach segment as X,XXX feet at (Name) Airport.

**NOTE—**

*“TRAFFIC ALERT.” If an aircraft enters the “NO TRANSGRESSION ZONE (NTZ),” the controller will breakout the threatened aircraft on the adjacent approach. The phraseology for the breakout will be:*

**PHRASEOLOGY—**

*TRAFFIC ALERT, (aircraft call sign) TURN (left/right) IMMEDIATELY, HEADING (degrees), CLIMB/ DESCEND AND MAINTAIN (altitude).*

**4. ILS PRM Glideslope Navigation.** The pilot may find crossing altitudes published along the final approach course. If the approach geometry warrants it, the pilot is advised on the AAUP that descending on the ILS or LDA glideslope ensures complying with any charted crossing restrictions.

**5. SOIA and ILS PRM differences as noted on the AAUP.**

**(a) ILS PRM, LDA Traffic (only published on the AAUP when the ILS PRM approach is used in conjunction with an LDA PRM approach to the adjacent runway).** To provide better situational awareness, and because traffic on the LDA may be visible on the ILS aircraft’s TCAS, pilots are reminded of the fact that aircraft will be maneuvering behind them to align with the adjacent runway. While conducting the ILS PRM approach to Runway XXX, other aircraft may be conducting the offset LDA PRM approach to Runway XXX. These aircraft will approach from the (left/right) rear and will realign with Runway XXX after making visual contact with the ILS traffic. Under normal circumstances, these aircraft will not pass the ILS traffic.

**(b) SOIA LDA PRM Items.** The AAUP section for the SOIA LDA PRM approach contains most information found in the ILS PRM section. It replaces certain information as seen below and provides pilots with the procedures to be used in the visual segment of the LDA PRM approach from the LDA MAP until landing.

**(c) SOIA LDA PRM Navigation (replaces ILS PRM (4) and (a) above).** The pilot may find crossing altitudes published along the final approach course. The pilot is advised that descending on the LDA glideslope ensures complying with any charted crossing restrictions. Remain on the LDA course un-

til passing XXXXX (LDA MAP name) intersection prior to maneuvering to align with the centerline of Runway XXX.

**(d) SOIA (Name) Airport Visual Segment (replaces ILS PRM (4) above).** Pilot procedures for navigating beyond the LDA MAP are spelled out. If ATC advises that there is traffic on the adjacent ILS, pilots are authorized to continue past the LDA MAP to align with runway centerline when:

**(1)** the ILS traffic is in sight and is expected to remain in sight,

**(2)** ATC has been advised that “traffic is in sight.” (ATC is not required to acknowledge this transmission),

**(3)** the runway environment is in sight. Otherwise, a missed approach must be executed. Between the LDA MAP and the runway threshold, pilots conducting the LDA PRM approach are responsible for separating themselves visually from traffic conducting the ILS PRM approach to the adjacent runway, which means maneuvering the aircraft as necessary to avoid that traffic until landing, and providing wake turbulence avoidance, if applicable. Pilots maintaining visual separation should advise ATC, as soon as practical, if visual contact with the aircraft conducting the ILS PRM approach is lost and execute a missed approach unless otherwise instructed by ATC.

**e. Differences between Simultaneous ILS and ILS PRM or LDA PRM approaches of importance to the pilot.**

**1. Runway Spacing.** Prior to simultaneous close parallel approaches, most ATC directed breakouts were the result of two aircraft in-trail on the same final approach course getting too close together. Two aircraft going in the same direction did not mandate quick reaction times. With PRM closely spaced approaches, two aircraft could be alongside each other, navigating on courses that are separated by less than 4,300 feet. In the unlikely event that an aircraft “blunders” off its course and makes a worst case turn of 30 degrees toward the adjacent final approach course, closing speeds of 135 feet per second could occur that constitute the need for quick reaction. A blunder has to be recognized by the monitor controller, and breakout instructions issued to the endangered aircraft. The pilot will not have any warning that a breakout is imminent because the blundering aircraft will be on another frequency. It is important

### 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 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.*

## 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-**

*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.*

*(a) 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.*

*(b) 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.*



## Section 6. National Security and Interception Procedures

### 5-6-1. National Security

National security in the control of air traffic is governed by 14 Code of Federal Regulations (CFR) Part 99, *Security Control of Air Traffic*.

### 5-6-2. National Security Requirements

**a.** Pursuant to 14 CFR 99.7, *Special Security Instructions*, each person operating an aircraft in an Air Defense Identification Zone (ADIZ) or Defense Area must, in addition to the applicable rules of Part 99, comply with special security instructions issued by the FAA Administrator in the interest of national security, pursuant to agreement between the FAA and the Department of Defense (DOD), or between the FAA and a U.S. Federal security or intelligence agency.

**b.** In addition to the requirements prescribed in this section, national security requirements for aircraft operations to or from, within, or transiting U.S. territorial airspace are in effect pursuant to 14 CFR 99.7; 49 United States Code (USC) 40103, *Sovereignty and Use of Airspace*; and 49 USC 41703, *Navigation of Foreign Civil Aircraft*. Aircraft operations to or from, within, or transiting U.S. territorial airspace must also comply with all other applicable regulations published in 14 CFR.

**c.** Due to increased security measures in place at many areas and in accordance with 14 CFR 91.103, *Preflight Action*, prior to departure, pilots must become familiar with all available information concerning that flight. Pilots are responsible to comply with 14 CFR 91.137 (*Temporary flight restrictions in the vicinity of disaster/hazard areas*), 91.138 (*Temporary flight restrictions in national disaster areas in the State of Hawaii*), 91.141 (*Flight restrictions in the proximity of the Presidential and other parties*), and 91.143 (*Flight limitation in the proximity of space flight operations*) when conducting flight in an area where a temporary flight restrictions area is in effect, and should check appropriate NOTAMs during flight planning. In addition, NOTAMs may be issued for National Security Areas (NSA) that temporarily prohibit flight operations under the provisions of 14 CFR 99.7.

#### REFERENCE-

*AIM, Paragraph 3-4-8, National Security Areas*

*AIM, Paragraph 3-5-3, Temporary Flight Restrictions*

**d.** Noncompliance with the national security requirements for aircraft operations contained in this section may result in denial of flight entry into U.S. territorial airspace or ground stop of the flight at a U.S. airport.

**e.** Pilots of aircraft that do not adhere to the procedures in the national security requirements for aircraft operations contained in this section may be intercepted, and/or detained and interviewed by federal, state, or local law enforcement or other government personnel.

### 5-6-3. Definitions

**a.** *Air Defense Identification Zone (ADIZ)* means an area of airspace over land or water, in which the ready identification, location, and control of all aircraft (except Department of Defense and law enforcement aircraft) is required in the interest of national security.

**b.** *Defense Area* means any airspace of the contiguous U.S. that is not an ADIZ in which the control of aircraft is required for reasons of national security.

**c.** *U.S. territorial airspace*, for the purposes of this section, means the airspace over the U.S., its territories, and possessions, and the airspace over the territorial sea of the U.S., which extends 12 nautical miles from the baselines of the U.S., determined in accordance with international law.

**d.** *To U.S. territorial airspace* means any flight that enters U.S. territorial airspace after departure from a location outside of the U.S., its territories or possessions, for landing at a destination in the U.S., its territories or possessions.

**e.** *From U.S. territorial airspace* means any flight that exits U.S. territorial airspace after departure from a location in the U.S., its territories or possessions, and lands at a destination outside the U.S., its territories or possessions.

**f.** *Within U.S. territorial airspace* means any flight departing from a location inside of the U.S., its territories or possessions, which operates en route to

a location inside the U.S., its territories or possessions.

**g.** *Transit or transiting U.S. territorial airspace* means any flight departing from a location outside of the U.S., its territories or possessions, which operates in U.S. territorial airspace en route to a location outside the U.S., its territories or possessions without landing at a destination in the U.S., its territories or possessions.

**h.** *Aeronautical facility*, for the purposes of this section, means a communications facility where flight plans or position reports are normally filed during flight operations.

#### 5-6-4. ADIZ Requirements

**a.** To facilitate early identification of all aircraft in the vicinity of U.S. airspace boundaries, Air Defense Identification Zones (ADIZ) have been established. All aircraft must meet certain requirements to facilitate early identification when operating into, within, and across an ADIZ, as described in 14 CFR 99.

**b.** Requirements for aircraft operations are as follows:

**1. Transponder Requirements.** Unless otherwise authorized by ATC, each aircraft conducting operations into, within, or across the contiguous U.S. ADIZ must be equipped with an operable radar beacon transponder having altitude reporting capability, and that transponder must be turned on and set to reply on the appropriate code or as assigned by ATC. (See 14 CFR 99.13, *Transponder-On Requirements*, for additional information.)

**2. Two-way Radio.** In accordance with 14 CFR 99.9, *Radio Requirements*, any person operating in an ADIZ must maintain two-way radio communication with an appropriate aeronautical facility. For two-way radio communications failure, follow instructions contained in 14 CFR 99.9.

**3. Flight Plan.** In accordance with 14 CFR 99.11, *Flight Plan Requirements*, and 14 CFR 99.9, except as specified in subparagraph 5-6-4e, no person may operate an aircraft into, within, or from a departure point within an ADIZ, unless the person files, activates, and closes a flight plan with an appropriate aeronautical facility, or is otherwise authorized by air traffic control as follows:

**(a)** Pilots must file an Instrument Flight Rules (IFR) flight plan or file a Defense Visual Flight Rules (DVFR) flight plan containing the time and point of ADIZ penetration;

**(b)** The pilot must activate the DVFR flight plan with U.S. Flight Service and set the aircraft transponder to the assigned discrete beacon code prior to entering the ADIZ;

**(c)** The IFR or DVFR aircraft must depart within 5 minutes of the estimated departure time contained in the flight plan, except for (d) below;

**(d)** If the airport of departure within the Alaskan ADIZ has no facility for filing a flight plan, the flight plan must be filed immediately after takeoff or when within range of an appropriate aeronautical facility;

**(e)** State aircraft (U.S. or foreign) planning to operate through an ADIZ should enter ICAO Code M in Item 8 of the flight plan to assist in identification of the aircraft as a state aircraft.

#### **c. Position Reporting Before Penetration of ADIZ.**

In accordance with 14 CFR 99.15, *Position Reports*, before entering the ADIZ, the pilot must report to an appropriate aeronautical facility as follows:

**1. IFR flights in controlled airspace.** The pilot must maintain a continuous watch on the appropriate frequency and report the time and altitude of passing each designated reporting point or those reporting points specified or requested by ATC, except that while the aircraft is under radar control, only the passing of those reporting points specifically requested by ATC need be reported. (See 14 CFR 91.183(a), *IFR Communications*.)

#### **2. DVFR flights and IFR flights in uncontrolled airspace:**

**(a)** The time, position, and altitude at which the aircraft passed the last reporting point before penetration and the estimated time of arrival over the next appropriate reporting point along the flight route;

**(b)** If there is no appropriate reporting point along the flight route, the pilot reports at least 15 minutes before penetration: the estimated time, position, and altitude at which the pilot will penetrate; or

**(c)** If the departure airport is within an ADIZ or so close to the ADIZ boundary that it prevents the

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. Maintain two-way radio communications with ATC;
4. 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;

**5.** 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

**6.** 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. 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. 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);

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 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 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; and

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.

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. 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.

**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 web site <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 web site [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.

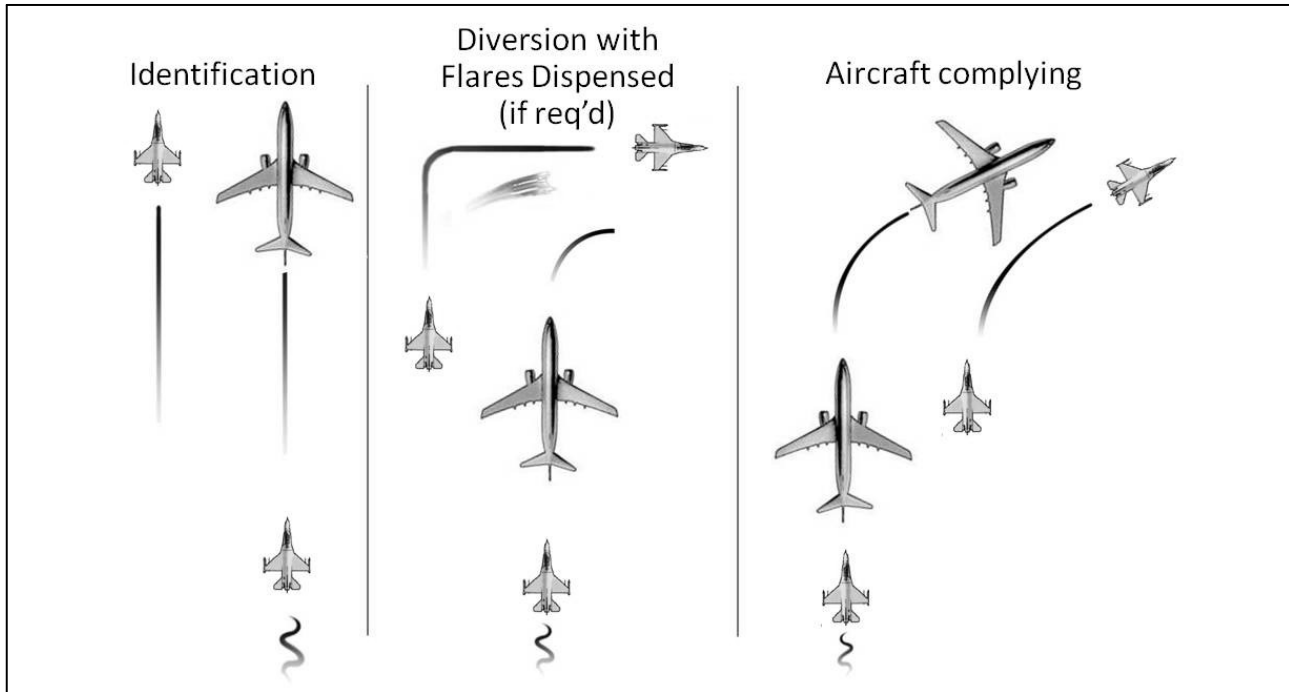
#### NOTE-

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.

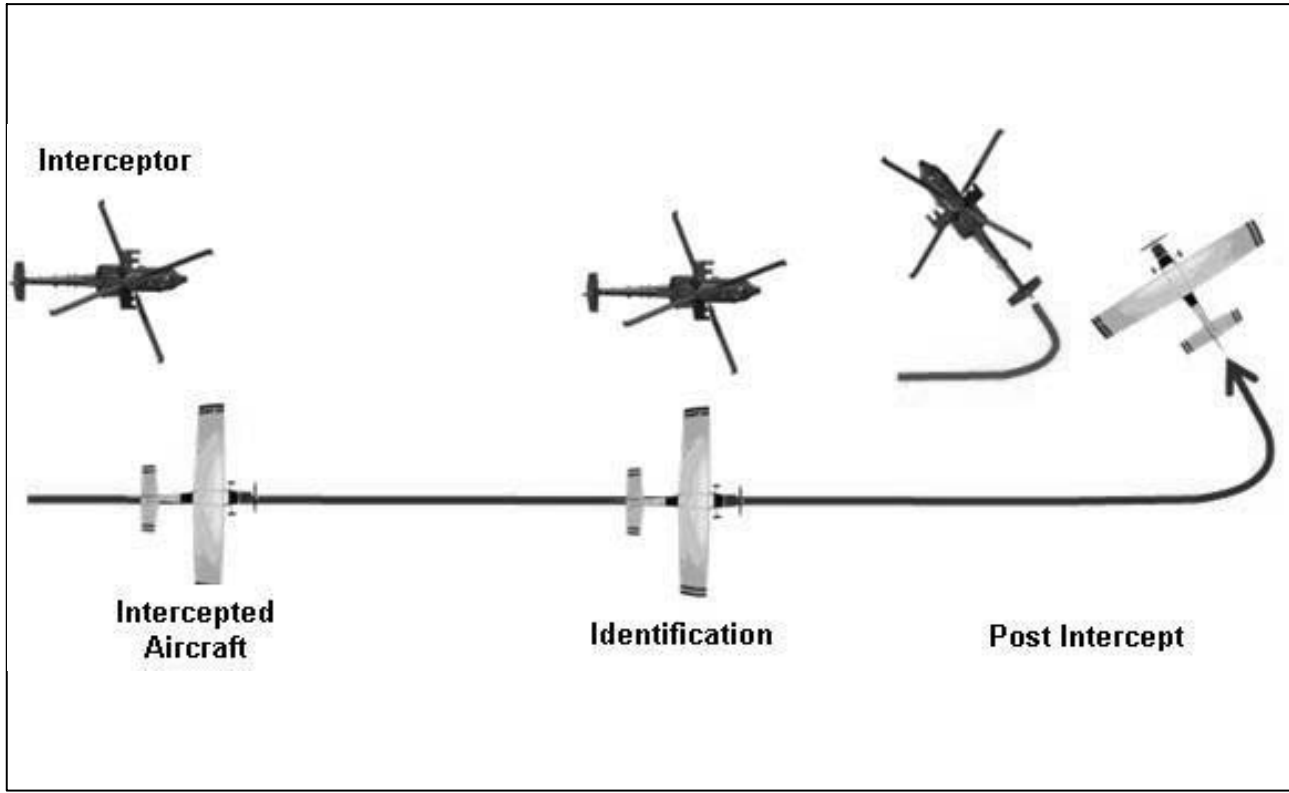
#### 3. Post Intercept Phase.

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.

## 5-6-15. Interception Signals

TBL 5-6-1 and TBL 5-6-2.

### TBL 5-6-1 Intercepting Signals

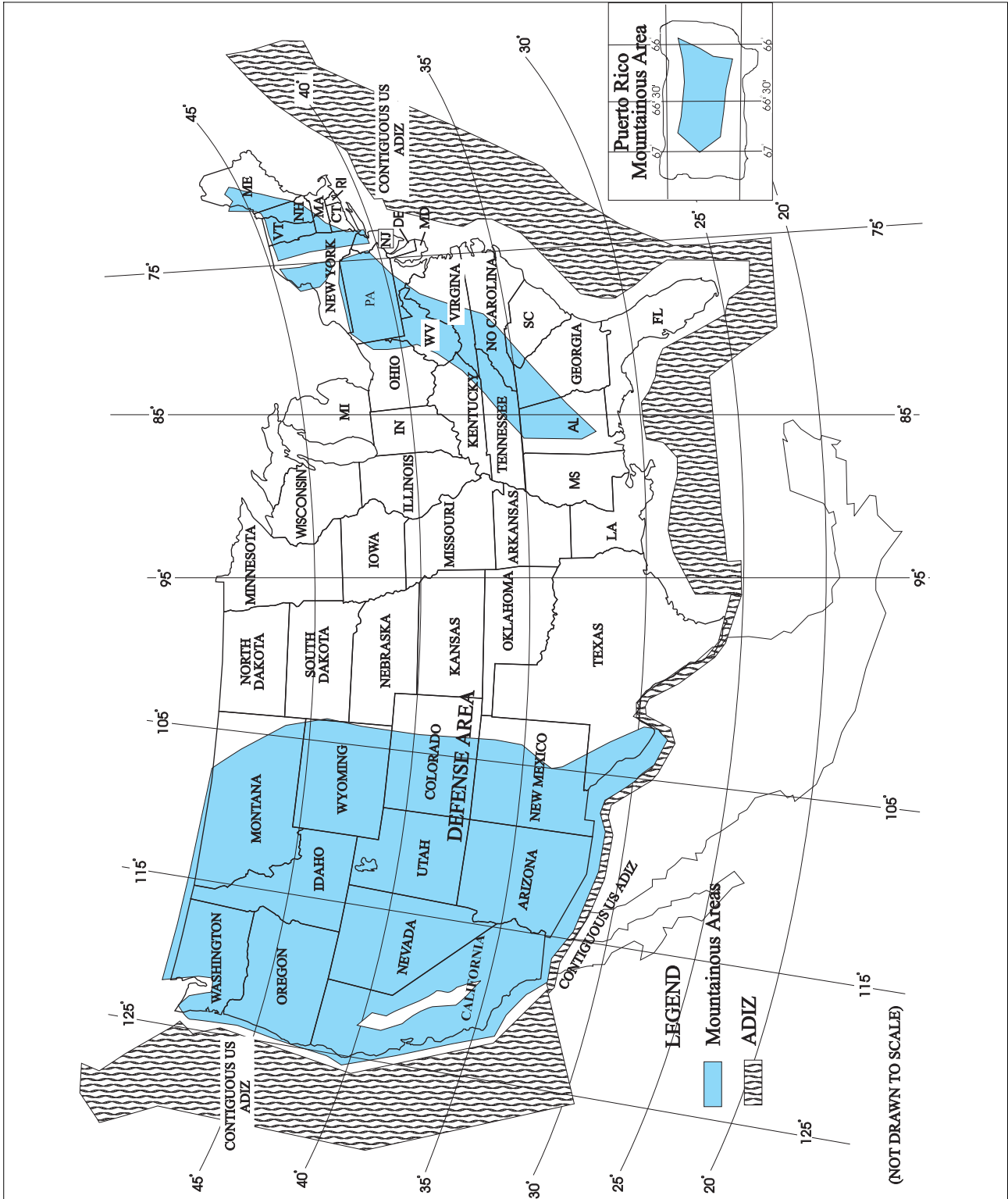
<b>INTERCEPTING SIGNALS</b>				
<b>Signals initiated by intercepting aircraft and responses by intercepted aircraft (as set forth in ICAO Annex 2-Appendix 1, 2.1)</b>				
Series	INTERCEPTING Aircraft Signals	Meaning	INTERCEPTED Aircraft Responds	Meaning
1	<p>DAY-Rocking wings from a position slightly above and ahead of, and normally to the left of, the intercepted aircraft and, after acknowledgement, a slow level turn, normally to the left, on to the desired heading.</p> <p>NIGHT-Same and, in addition, flashing navigational lights at irregular intervals.</p> <p><i>NOTE 1-Meteorological conditions or terrain may require the intercepting aircraft to take up a position slightly above and ahead of, and to the right of, the intercepted aircraft and to make the subsequent turn to the right.</i></p> <p><i>NOTE 2-If the intercepted aircraft is not able to keep pace with the intercepting aircraft, the latter is expected to fly a series of race-track patterns and to rock its wings each time it passes the intercepted aircraft.</i></p>	You have been intercepted. Follow me.	<p>AEROPLANES: DAY-Rocking wings and following.</p> <p>NIGHT-Same and, in addition, flashing navigational lights at irregular intervals.</p> <p>HELICOPTERS: DAY or NIGHT-Rocking aircraft, flashing navigational lights at irregular intervals and following.</p>	Understood, will comply.
2	DAY or NIGHT-An abrupt break-away maneuver from the intercepted aircraft consisting of a climbing turn of 90 degrees or more without crossing the line of flight of the intercepted aircraft.	You may proceed.	<p>AEROPLANES: DAY or NIGHT-Rocking wings.</p> <p>HELICOPTERS: DAY or NIGHT-Rocking aircraft.</p>	Understood, will comply.
3	<p>DAY-Circling aerodrome, lowering landing gear and overflying runway in direction of landing or, if the intercepted aircraft is a helicopter, overflying the helicopter landing area.</p> <p>NIGHT-Same and, in addition, showing steady landing lights.</p>	Land at this aerodrome.	<p>AEROPLANES: DAY-Lowering landing gear, following the intercepting aircraft and, if after overflying the runway landing is considered safe, proceeding to land.</p> <p>NIGHT-Same and, in addition, showing steady landing lights (if carried).</p> <p>HELICOPTERS: DAY or NIGHT-Following the intercepting aircraft and proceeding to land, showing a steady landing light (if carried).</p>	Understood, will comply.

*TBL 5-6-2*  
**Intercepting Signals**

<b>INTERCEPTING SIGNALS</b>				
<b>Signals and Responses During Aircraft Intercept</b>				
<b>Signals initiated by intercepted aircraft and responses by intercepting aircraft</b>				
<b>(as set forth in ICAO Annex 2-Appendix 1, 2.2)</b>				
Series	INTERCEPTED Aircraft Signals	Meaning	INTERCEPTING Aircraft Responds	Meaning
4	DAY or NIGHT-Raising landing gear (if fitted) and flashing landing lights while passing over runway in use or helicopter landing area at a height exceeding 300m (1,000 ft) but not exceeding 600m (2,000 ft) (in the case of a helicopter, at a height exceeding 50m (170 ft) but not exceeding 100m (330 ft) above the aerodrome level, and continuing to circle runway in use or helicopter landing area. If unable to flash landing lights, flash any other lights available.	Aerodrome you have designated is inadequate.	DAY or NIGHT-If it is desired that the intercepted aircraft follow the intercepting aircraft to an alternate aerodrome, the intercepting aircraft raises its landing gear (if fitted) and uses the Series 1 signals prescribed for intercepting aircraft.  If it is decided to release the intercepted aircraft, the intercepting aircraft uses the Series 2 signals prescribed for intercepting aircraft.	Understood, follow me.  Understood, you may proceed.
5	DAY or NIGHT-Regular switching on and off of all available lights but in such a manner as to be distinct from flashing lights.	Cannot comply.	DAY or NIGHT-Use Series 2 signals prescribed for intercepting aircraft.	Understood.
6	DAY or NIGHT-Irregular flashing of all available lights.	In distress.	DAY or NIGHT-Use Series 2 signals prescribed for intercepting aircraft.	Understood.

5-6-16. ADIZ Boundaries and Designated Mountainous Areas (See FIG 5-6-3.)

FIG 5-6-3  
Air Defense Identification Zone Boundaries  
Designated Mountainous Areas



### ■ 5-6-17. Visual Warning System (VWS)

The VWS signal consists of highly-focused red and green colored laser lights designed to illuminate in an alternating red and green signal pattern. These lasers may be directed at specific aircraft suspected of making unauthorized entry into the Washington, DC Special Flight Rules Area (DC SFRA) proceeding on a heading or flight path that may be interpreted as a threat or that operate contrary to the operating rules for the DC SFRA. The beam is neither hazardous to the eyes of pilots/aircrew or passengers, regardless of altitude or distance from the source nor will the beam affect aircraft systems.

**a.** If you are communicating with ATC, and this signal is directed at your aircraft, you are required to contact ATC and advise that you are being illuminated by a visual warning system.

**b.** If this signal is directed at you, and you are not communicating with ATC, you are advised to turn to the most direct heading away from the center of the DC SFRA as soon as possible. Immediately contact

ATC on an appropriate frequency, VHF Guard 121.5 or UHF Guard 243.0, and provide your aircraft identification, position, and nature of the flight. Failure to follow these procedures may result in interception by military aircraft. Further noncompliance with interceptor aircraft or ATC may result in the use of force.

**c.** Pilots planning to operate aircraft in or near the DC SFRA are to familiarize themselves with aircraft intercept procedures. This information applies to all aircraft operating within the DC SFRA including DOD, Law Enforcement, and aircraft engaged in aeromedical operations and does not change procedures established for reporting unauthorized laser illumination as published in FAA Advisory Circulars and Notices.

**REFERENCE-**  
*CFR 91.161*

**d.** More details including a video demonstration of the VWS are available from the following FAA web site: [www.faa.gov/VisualWarningSystem/VisualWarning.htm](http://www.faa.gov/VisualWarningSystem/VisualWarning.htm).

### 7-2-3. Altimeter Errors

a. Most pressure altimeters are subject to mechanical, elastic, temperature, and installation errors. (Detailed information regarding the use of pressure altimeters is found in the Instrument Flying Handbook, Chapter IV.) Although manufacturing and installation specifications, as well as the periodic test and inspections required by regulations (14 CFR Part 43, Appendix E), act to reduce these errors, any scale error may be observed in the following manner:

1. Set the current reported altimeter setting on the altimeter setting scale.

2. Altimeter should now read field elevation if you are located on the same reference level used to establish the altimeter setting.

3. Note the variation between the known field elevation and the altimeter indication. If this variation is in the order of plus or minus 75 feet, the accuracy of the altimeter is questionable and the problem should be referred to an appropriately rated repair station for evaluation and possible correction.

b. Once in flight, it is very important to obtain frequently current altimeter settings en route. If you do not reset your altimeter when flying *from* an area of high pressure into an area of low pressure, *your aircraft will be closer to the surface than your altimeter indicates*. An inch error in the altimeter setting equals 1,000 feet of altitude. To quote an old saying: **“GOING FROM A HIGH TO A LOW, LOOK OUT BELOW.”**

c. Temperature also has an effect on the accuracy of altimeters and your altitude. The crucial values to consider are standard temperature versus the ambient (at altitude) temperature and the elevation above the altitude setting reporting source. It is these “differences” that cause the error in indicated altitude. When the column of air is warmer than standard, you are higher than your altimeter indicates. Subsequently, when the column of air is colder than standard, you are lower than indicated. It is the magnitude of these “differences” that determine the magnitude of the error. When flying into a cooler air mass while maintaining a constant indicated altitude, you are losing true altitude. However, flying into a cooler air mass does not necessarily mean you will be lower than indicated if the *difference* is still on the plus side. For example, while flying at 10,000 feet (where **STANDARD** temperature is -5 degrees

Celsius (C)), the outside air temperature cools from +5 degrees C to 0 degrees C, the temperature error will nevertheless cause the aircraft to be **HIGHER** than indicated. It is the extreme “cold” difference that normally would be of concern to the pilot. Also, when flying in cold conditions over mountainous terrain, the pilot should exercise caution in flight planning both in regard to route and altitude to ensure adequate en route and terminal area terrain clearance.

**NOTE-**

*Non-standard temperatures can result in a change to effective vertical paths and actual descent rates while using aircraft Baro-VNAV equipment for vertical guidance on final approach segments. A higher than standard temperature will result in a steeper gradient and increased actual descent rate. Indications of these differences are often not directly related to vertical speed indications. Conversely, a lower than standard temperature will result in a shallower descent gradient and reduced actual descent rate. Pilots should consider potential consequences of these effects on approach minimums, power settings, sight picture, visual cues, etc., especially for high-altitude or terrain-challenged locations and during low-visibility conditions.*

d. TBL 7-2-3, derived from ICAO formulas, indicates how much error can exist when operating in cold temperatures. To use the table, find the reported temperature in the left column, read across the top row to locate the height above the airport/reporting station (i.e., subtract the airport/ reporting elevation from the intended flight altitude). The intersection of the column and row is how much *lower* the aircraft may actually be as a result of the possible cold temperature induced error.

e. Pilots are responsible to compensate for cold temperature altimetry errors when operating into an airport with any published cold temperature restriction and a reported airport temperature at or below the published temperature restriction. Pilots must ensure compensating aircraft are correcting on the proper segment or segments of the approach. Manually correct if compensating aircraft system is inoperable. Pilots manually correcting, are responsible to calculate and apply a cold temperature altitude correction derived from TBL 7-2-3 to the affected approach segment or segments. Pilots must advise the cold temperature altitude correction to Air Traffic Control (ATC). Pilots are not required to advise ATC of a cold temperature altitude correction inside of the final approach fix.

*TBL 7-2-3*  
**ICAO Cold Temperature Error Table**  
**Height Above Airport in Feet**

Reported Temp °C	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
<b>+10</b>	10	10	10	10	20	20	20	20	20	30	40	60	80	90
<b>0</b>	20	20	30	30	40	40	50	50	60	90	120	170	230	280
<b>-10</b>	20	30	40	50	60	70	80	90	100	150	200	290	390	490
<b>-20</b>	30	50	60	70	90	100	120	130	140	210	280	420	570	710
<b>-30</b>	40	60	80	100	120	140	150	170	190	280	380	570	760	950
<b>-40</b>	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
<b>-50</b>	60	90	120	150	180	210	240	270	300	450	590	890	1190	1500

**EXAMPLE-**

*Temperature -10 degrees Celsius, and the aircraft altitude is 1,000 feet above the airport elevation. The chart shows that the reported current altimeter setting may place the aircraft as much as 100 feet below the altitude indicated by the altimeter.*

**7-2-4. High Barometric Pressure**

a. Cold, dry air masses may produce barometric pressures in excess of 31.00 inches of Mercury, and many altimeters do not have an accurate means of being adjusted for settings of these levels. When the altimeter cannot be set to the higher pressure setting, the aircraft actual altitude will be higher than the altimeter indicates.

**REFERENCE-**

*AIM, Paragraph 7-2-3, Altimeter Errors.*

b. When the barometric pressure exceeds 31.00 inches, air traffic controllers will issue the actual altimeter setting, and:

**1. En Route/Arrivals.** Advise pilots to remain set on 31.00 inches until reaching the final approach segment.

**2. Departures.** Advise pilots to set 31.00 inches prior to reaching any mandatory/crossing altitude or 1,500 feet, whichever is lower.

c. The altimeter error caused by the high pressure will be in the opposite direction to the error caused by the cold temperature.

**7-2-5. Low Barometric Pressure**

When abnormally low barometric pressure conditions occur (below 28.00), flight operations by aircraft unable to set the actual altimeter setting are not recommended.

**NOTE-**

*The true altitude of the aircraft is lower than the indicated altitude if the pilot is unable to set the actual altimeter setting.*



# 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 web site 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,

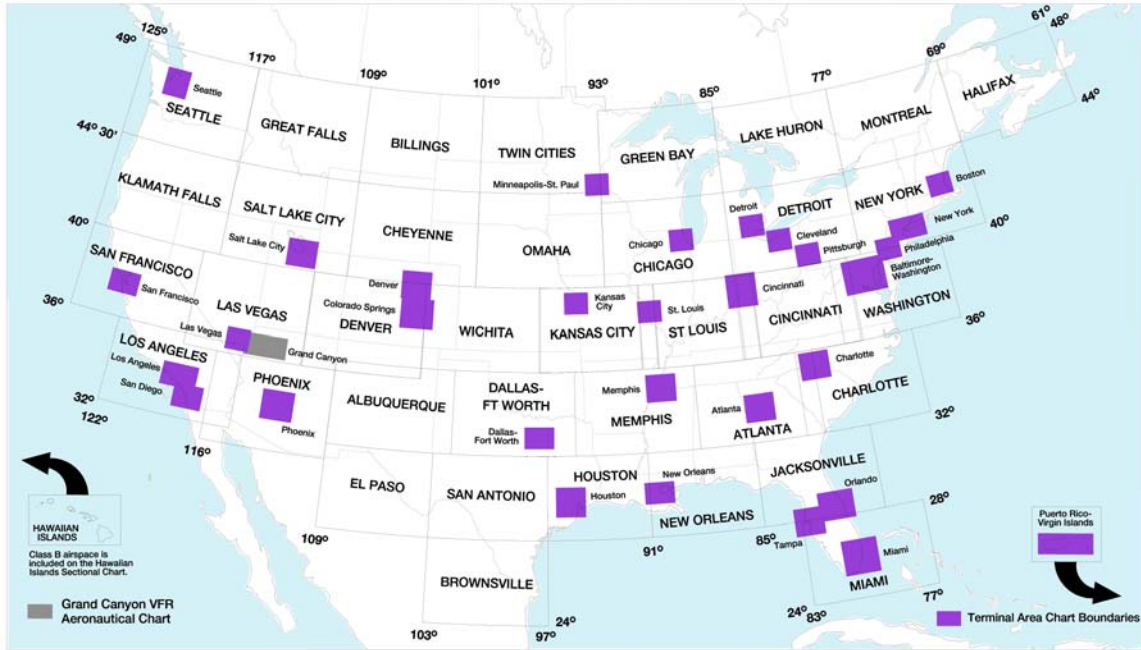
roads, railroads, and other distinct landmarks. The aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, special-use airspace, obstructions, and related data. Scale 1 inch = 6.86nm/1:500,000. 60 x 20 inches folded to 5 x 10 inches. Revised biannually, except most Alaskan charts are revised annually. (See FIG 9-1-1 and FIG 9-1-2.)

**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 = 3.43nm/1:250,000. Charts are revised biannually, except Puerto Rico-Virgin Islands which is revised annually. (See FIG 9-1-1 and FIG 9-1-2.)

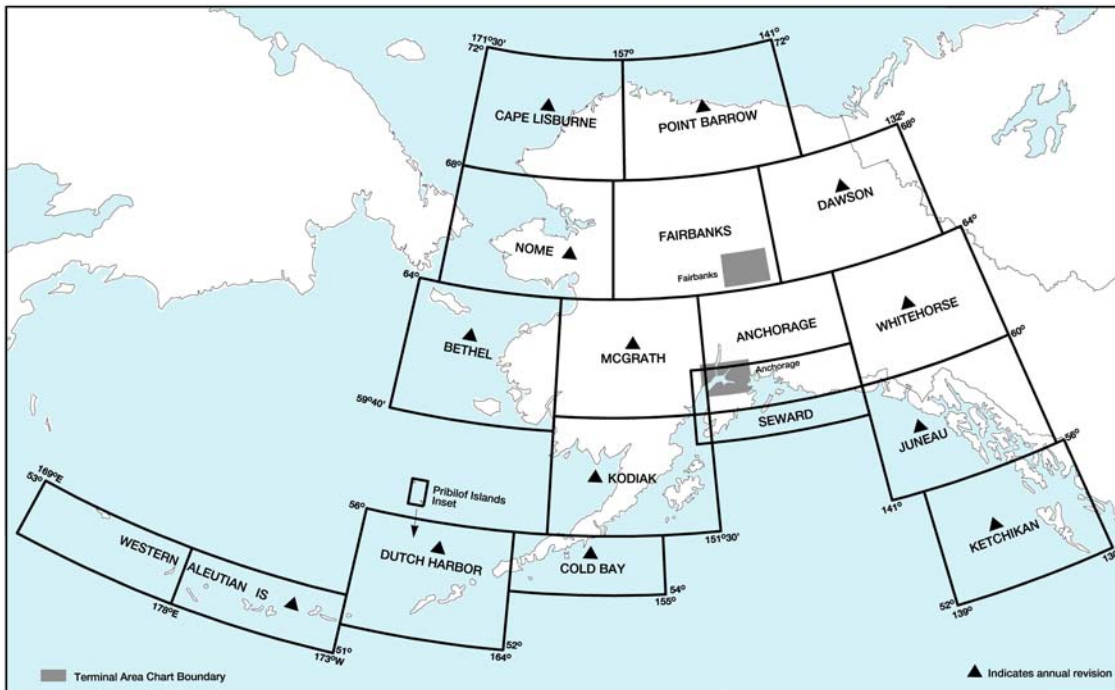
**3. U.S. Gulf Coast VFR Aeronautical Chart.** The Gulf Coast Chart is designed primarily for helicopter operation in the Gulf of Mexico area. Information depicted includes offshore mineral leasing areas and blocks, oil drilling platforms, and high density helicopter activity areas. Scale 1 inch = 13.7nm/1:1,000,000. 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.

**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**



**3. U.S. Terminal Procedures Publication (TPP).** TPPs are published in 24 loose-leaf or perfect bound volumes covering the conterminous U.S., Puerto Rico and the Virgin Islands. A Change Notice is published at the midpoint between revisions in bound volume format and is available on the internet for free download at the AIS web site. (See FIG 9-1-15.) The TPPs include:

**(a) Instrument Approach Procedure (IAP)**

**Charts.** IAP charts portray the aeronautical data that is required to execute instrument approaches to airports. Each chart depicts the IAP, all related navigation data, communications information, and an airport sketch. Each procedure is designated for use with a specific electronic navigational aid, such as ILS, VOR, NDB, RNAV, etc.

**(b) Instrument Departure Procedure (DP)**

**Charts.** DP charts are designed to expedite clearance delivery and to facilitate transition between takeoff and en route operations. They furnish pilots' departure routing clearance information in graphic and textual form.

**(c) Standard Terminal Arrival (STAR)**

**Charts.** STAR charts are designed to expedite ATC arrival procedures and to facilitate transition between en route and instrument approach operations. They depict preplanned IFR ATC arrival procedures in graphic and textual form. Each STAR procedure is presented as a separate chart and may serve either a single airport or more than one airport in a given geographic area.

**(d) Airport Diagrams.** Full page airport diagrams are designed to assist in the movement of ground traffic at locations with complex runway/taxiway configurations and provide information for updating geodetic position navigational systems aboard aircraft. Airport diagrams are available for free download at the AIS web site.

**4. Alaska Terminal Procedures Publication.**

This publication contains all terminal flight procedures for civil and military aviation in Alaska.

Included are IAP charts, DP charts, STAR charts, airport diagrams, radar minimums, and supplementary support data such as IFR alternate minimums, take-off minimums, rate of descent tables, rate of climb tables and inoperative components tables. Volume is 5-3/8 x 8-1/4 inch top bound. Publication revised every 56 days with provisions for a Terminal Change Notice, as required.

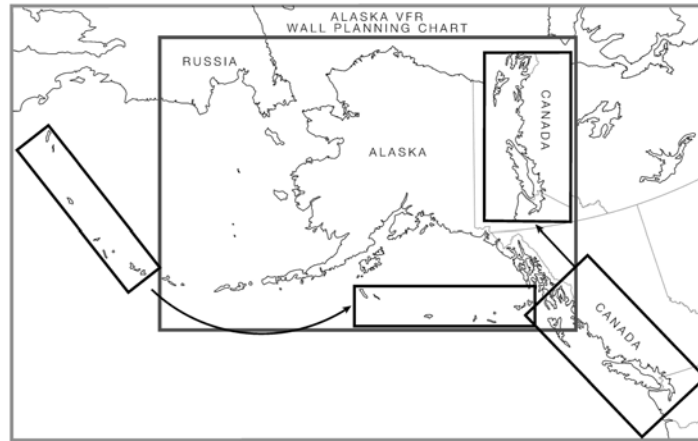
**c. Planning Charts.**

**1. U.S. IFR/VFR Low Altitude Planning Chart.** This chart is designed for preflight and en route flight planning for IFR/VFR flights. Depiction includes low altitude airways and mileage, NAVAIDs, airports, special use airspace, cities, times zones, major drainage, a directory of airports with their airspace classification, and a mileage table showing great circle distances between major airports. Scale 1 inch = 47nm/1:3,400,000. Chart revised annually, and is available either folded or unfolded for wall mounting. (See FIG 9-1-10.)

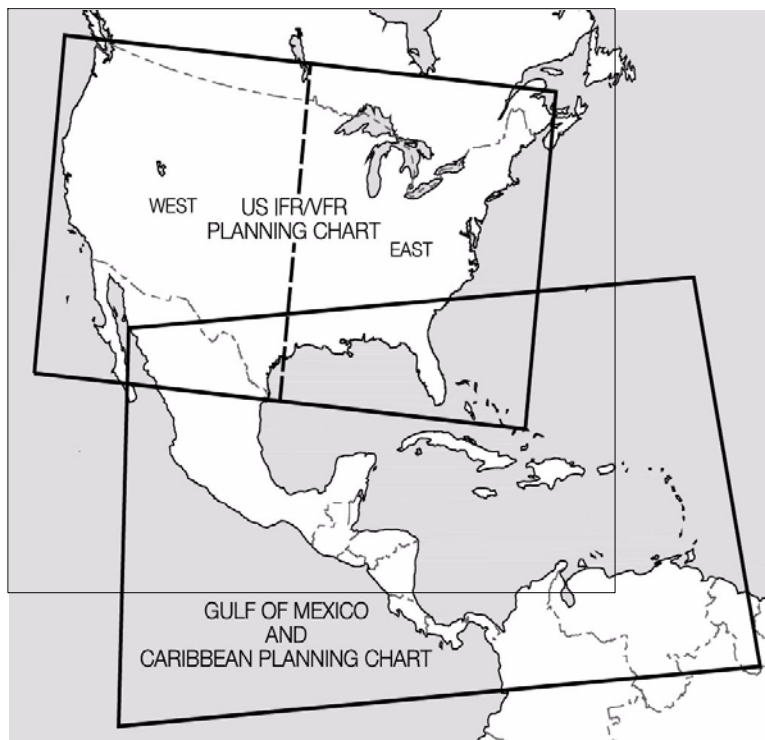
**2. Gulf of Mexico and Caribbean Planning Chart.** This is a VFR planning chart on the reverse side of the *Puerto Rico - Virgin Islands VFR Terminal Area Chart*. Information shown includes mileage between airports of entry, a selection of special use airspace and a directory of airports with their available services. Scale 1 inch = 85nm/1:6,192,178. 60 x 20 inches folded to 5 x 10 inches. Chart revised annually. (See FIG 9-1-10.)

**3. Alaska VFR Wall Planning Chart.** This chart is designed for VFR preflight planning and chart selection. It includes aeronautical and topographic information of the state of Alaska. The aeronautical information includes public and military airports; radio aids to navigation; and Class B, Class C, TRSA and special-use airspace. The topographic information includes city tint, populated places, principal roads, and shaded relief. Scale 1 inch = 27.4nm/1:2,000,000. The one sided chart is 58.5 x 40.75 inches and is designed for wall mounting. Chart is revised biennially. (See FIG 9-1-9.)

**FIG 9-1-9**  
**Alaska VFR Wall Planning Chart**



**FIG 9-1-10**  
**Planning Charts**



**4. U.S. VFR Wall Planning Chart.** This chart is designed for VFR preflight planning and chart selection. It includes aeronautical and topographic information of the conterminous U.S. The aeronautical information includes airports, radio aids to navigation, Class B airspace and special use airspace. The topographic information includes city tint, populated places, principal roads, drainage patterns, and shaded relief. Scale 1 inch = 43 nm/ 1:3,100,000. The one-sided chart is 59 x 36 inches and ships unfolded for wall mounting. Chart is revised biennially. (See FIG 9-1-11.)

FIG 9-1-11  
U.S. VFR Wall Planning Chart



**5. Charted VFR Flyway Planning Charts.** This chart is printed on the reverse side of selected TAC charts. The coverage is the same as the associated TAC. Flyway planning charts depict flight paths and altitudes recommended for use to bypass high traffic areas. Ground references are provided as a guide for visual orientation. Flyway planning charts are designed for use in conjunction with TACs and sectional charts and are not to be used for navigation. Chart scale 1 inch = 3.43nm/1:250,000.

**d. Supplementary Charts and Publications.**

**1. Chart Supplement U.S.** This 7-volume booklet series contains data on airports, seaplane bases, heliports, NAVAIDs, communications data, weather data sources, airspace, special notices, and operational procedures. Coverage includes the conterminous U.S., Puerto Rico, and the Virgin

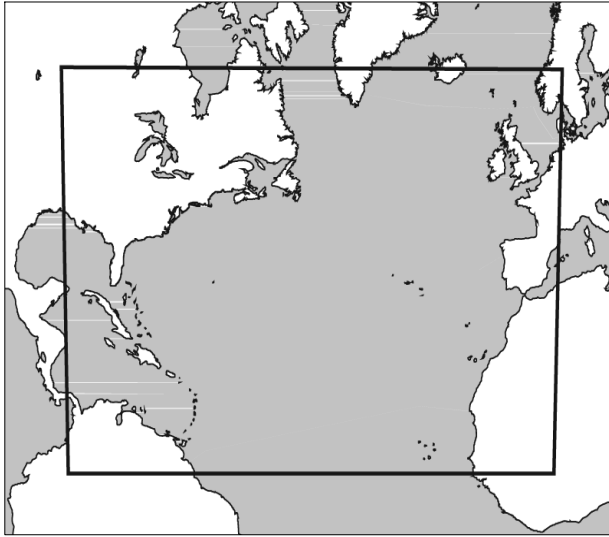
Islands. The Chart Supplement U.S. shows data that cannot be readily depicted in graphic form; for example, airport hours of operations, types of fuel available, runway widths, lighting codes, etc. The Chart Supplement U.S. also provides a means for pilots to update visual charts between edition dates (The Chart Supplement U.S. is published every 56 days while Sectional Aeronautical and VFR Terminal Area Charts are generally revised every six months). The Aeronautical Chart Bulletins (VFR Chart Update Bulletins) are available for free download at the AIS web site. Volumes are side-bound 5-3/8 x 8-1/4 inches. (See FIG 9-1-14.)

**2. Chart Supplement Alaska.** This is a civil/military flight information publication issued by FAA every 56 days. It is a single volume booklet designed for use with appropriate IFR or VFR charts. The Chart Supplement Alaska contains airport sketches, communications data, weather data sources, airspace, listing of navigational facilities, and special notices and procedures. Volume is side-bound 5-3/8 x 8-1/4 inches.

**3. Chart Supplement Pacific.** This supplement is designed for use with appropriate VFR or IFR en route charts. Included in this one-volume booklet are the chart supplement, communications data, weather data sources, airspace, navigational facilities, special notices, and Pacific area procedures. IAP charts, DP charts, STAR charts, airport diagrams, radar minimums, and supporting data for the Hawaiian and Pacific Islands are included. The manual is published every 56 days. Volume is side-bound 5-3/8 x 8-1/4 inches.

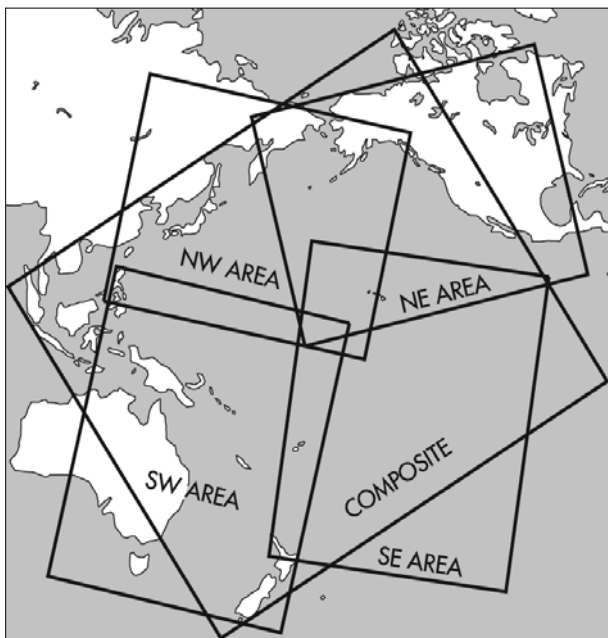
**4. North Atlantic Route Chart.** Designed for FAA controllers to monitor transatlantic flights, this 5-color chart shows oceanic control areas, coastal navigation aids, oceanic reporting points, and NAVAID geographic coordinates. Full Size Chart: Scale 1 inch = 113.1nm/1:8,250,000. Chart is shipped flat only. Half Size Chart: Scale 1 inch = 150.8nm/1:11,000,000. Chart is 29-3/4 x 20-1/2 inches, shipped folded to 5 x 10 inches only. Chart revised every 56 weeks. (See FIG 9-1-12.)

FIG 9-1-12  
North Atlantic Route Charts



**5. North Pacific Route Charts.** These charts are designed for FAA controllers to monitor transoceanic flights. They show established intercontinental air routes, including reporting points with geographic positions. Composite Chart: Scale 1 inch = 164nm/1:12,000,000. 48 x 41-1/2 inches. Area Charts: Scale 1 inch = 95.9nm/1:7,000,000. 52 x 40-1/2 inches. All charts shipped unfolded. Charts revised every 56 days. (See FIG 9-1-13.)

FIG 9-1-13  
North Pacific Oceanic Route Charts



**6. Airport Obstruction Charts (OC).** The OC is a 1:12,000 scale graphic depicting 14 CFR Part 77, Objects Affecting Navigable Airspace, surfaces, a representation of objects that penetrate these surfaces, aircraft movement and apron areas, navigational aids, prominent airport buildings, and a selection of roads and other planimetric detail in the airport vicinity. Also included are tabulations of runway and other operational data.

**7. FAA Aeronautical Chart User's Guide.** A booklet designed to be used as a teaching aid and reference document. It describes the substantial amount of information provided on FAA's aeronautical charts and publications. It includes explanations and illustrations of chart terms and symbols organized by chart type. The users guide is available for free download at the AIS web site.

**e. Digital Products.**

**1. The Digital Aeronautical Information CD (DAICD).** The DAICD is a combination of the NAVAID Digital Data File, the Digital Chart Supplement, and the Digital Obstacle File on one Compact Disk. These three digital products are no longer sold separately. The files are updated every 56 days and are available by subscription only.

**(a) The NAVAID Digital Data File.** This file contains a current listing of NAVAIDs that are compatible with the National Airspace System. This file contains all NAVAIDs including ILS and its components, in the U.S., Puerto Rico, and the Virgin Islands plus bordering facilities in Canada, Mexico, and the Atlantic and Pacific areas.

**(b) The Digital Obstacle File.** This file describes all obstacles of interest to aviation users in the U.S., with limited coverage of the Pacific, Caribbean, Canada, and Mexico. The obstacles are assigned unique numerical identifiers, accuracy codes, and listed in order of ascending latitude within each state or area.

**(c) The Digital Aeronautical Chart Supplement (DACS).** The DACS is specifically designed to provide digital airspace data not otherwise readily available. The supplement includes a *Change Notice* for IAPFIX.dat at the mid-point between revisions. The *Change Notice* is available only by free download at the AIS web site.



The DACS individual data files are:

ENHIGH.DAT: High altitude airways (conterminous U.S.)

ENLOW.DAT: Low altitude airways (conterminous U.S.)

IAPFIX.DAT: Selected instrument approach procedure NAVAID and fix data.

MTRFIX.DAT: Military training routes data.

ALHIGH.DAT: Alaska high altitude airways data.

ALLOW.DAT: Alaska low altitude airways data.

PR.DAT: Puerto Rico airways data.

HAWAII.DAT: Hawaii airways data.

BAHAMA.DAT: Bahamas routes data.

OCEANIC.DAT: Oceanic routes data.

STARS.DAT: Standard terminal arrivals data.

DP.DAT: Instrument departure procedures data.

LOPREF.DAT: Preferred low altitude IFR routes data.

HIPREF.DAT: Preferred high altitude IFR routes data.

ARF.DAT: Air route radar facilities data.

ASR.DAT: Airport surveillance radar facilities data.

**2. The Coded Instrument Flight Procedures (CIFP) (ARINC 424 [Ver 13 & 15]).** The CIFP is a basic digital dataset, modeled to an international

standard, which can be used as a basis to support GPS navigation. Initial data elements included are: Airport and Helicopter Records, VHF and NDB Navigation aids, en route waypoints and airways. Additional data elements will be added in subsequent releases to include: departure procedures, standard terminal arrivals, and GPS/RNAV instrument approach procedures. The database is updated every 28 days. The data is available by subscription only and is distributed on CD-ROM or by ftp download.

**3. digital-Visual Charts (d-VC).** These digital VFR charts are geo-referenced images of FAA Sectional Aeronautical, TAC, and Helicopter Route charts. Additional digital data may easily be overlaid on the raster image using commonly available Geographic Information System software. Data such as weather, temporary flight restrictions, obstacles, or other geospatial data can be combined with d-VC data to support a variety of needs. The file resolution is 300 dots per inch and the data is 8-bit color. The data is provided as a GeoTIFF and distributed on DVD-R media and on the AIS web site. The root mean square error of the transformation will not exceed two pixels. Digital-VC DVDs are updated every 28 days and are available by subscription only.

FIG 9-1-14

Chart Supplement U.S. Geographic Areas

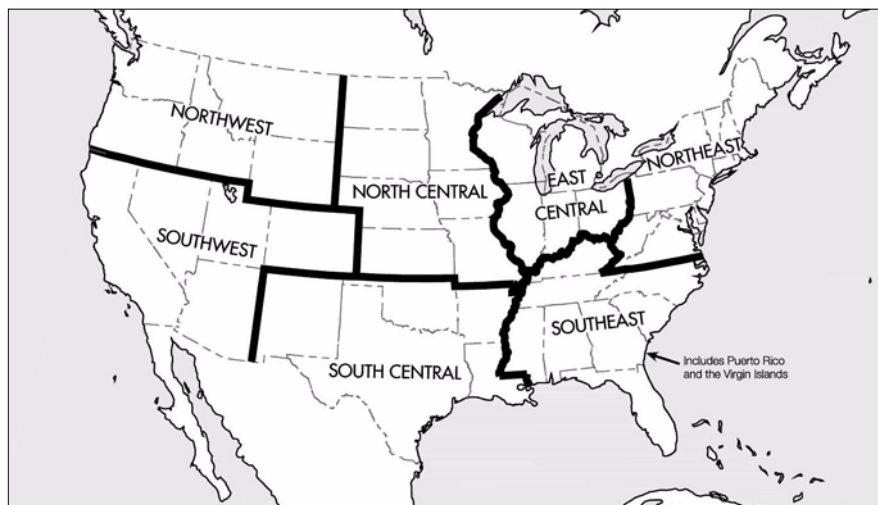
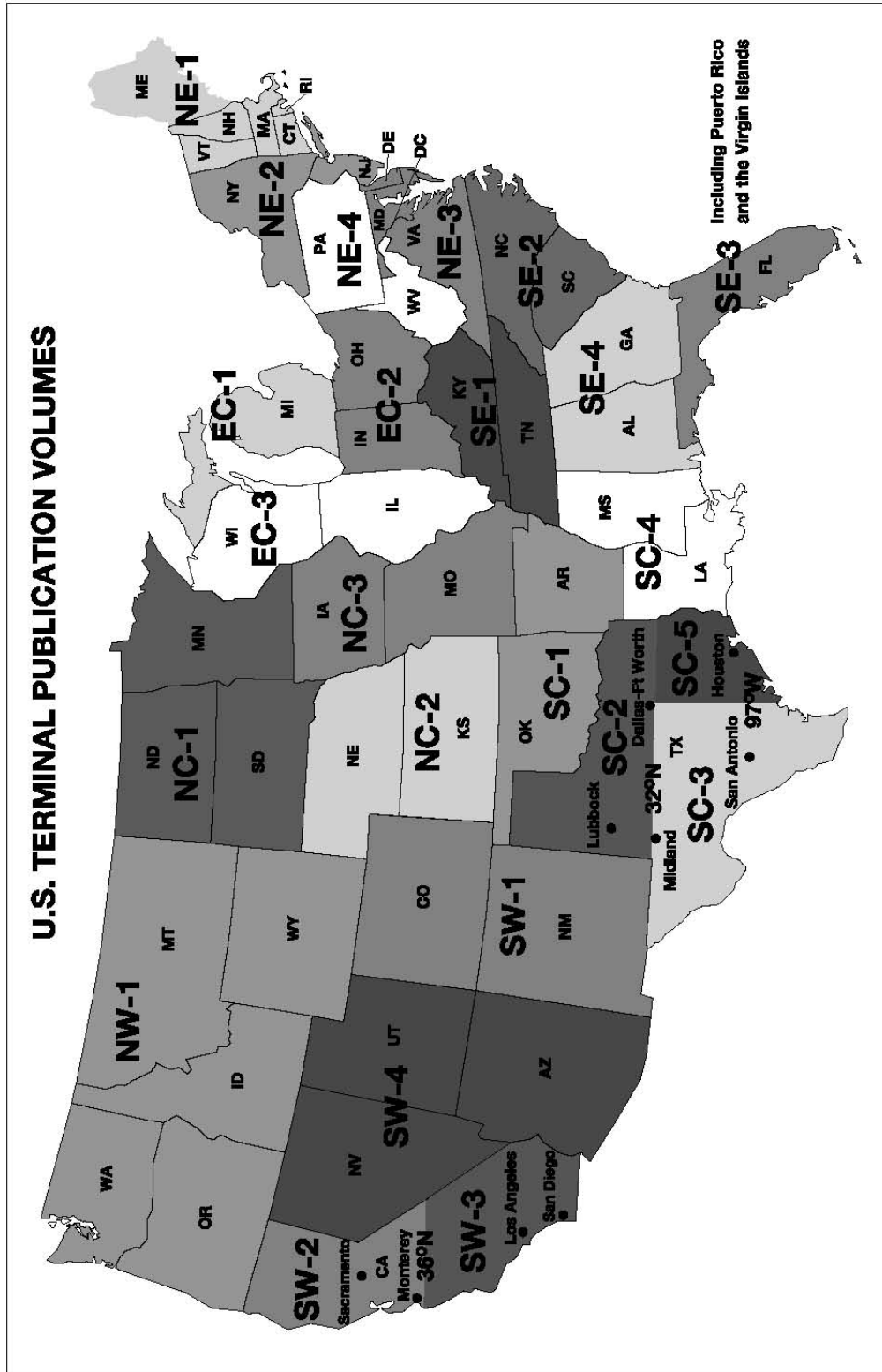


FIG 9-1-15  
U.S. Terminal Publication Volumes





## 9-1-5. Where and How to Get Charts of Foreign Areas

**a. National Geospatial-Intelligence Agency (NGA) Products.** For the latest information regarding publication availability visit the NGA web site: <https://www.nga.mil/ProductsServices/Aeronautical/Pages/default.aspx>

### 1. Flight Information Publication (FLIP) Planning Documents.

General Planning (GP)

Area Planning

Area Planning – Special Use Airspace – Planning Charts

### 2. FLIP En Route Charts and Chart Supplements.

Pacific, Australasia, and Antarctica

U.S. – IFR and VFR Supplements

Flight Information Handbook

Caribbean and South America – Low Altitude

Caribbean and South America – High Altitude

Europe, North Africa, and Middle East – Low Altitude

Europe, North Africa, and Middle East – High Altitude

Africa

Eastern Europe and Asia

Area Arrival Charts

### 3. FLIP Instrument Approach Procedures (IAPs).

Africa

Canada and North Atlantic

Caribbean and South America

Eastern Europe and Asia

Europe, North Africa, and Middle East

Pacific, Australasia, and Antarctica

VFR Arrival/Departure Routes – Europe and Korea

U.S.

### 4. Miscellaneous DOD Charts and Products.

Aeronautical Chart Updating Manual (CHUM)

DOD Weather Plotting Charts (WPC)

Tactical Pilotage Charts (TPC)

Operational Navigation Charts (ONC)

Global Navigation and Planning Charts (GNC)

Jet Navigation Charts (JNC) and Universal Jet Navigation Charts (JNU)

Jet Navigation Charts (JNCA)

Aerospace Planning Charts (ASC)

Oceanic Planning Charts (OPC)

Joint Operations Graphics – Air (JOG-A)

Standard Index Charts (SIC)

Universal Plotting Sheet (VP-OS)

Sight Reduction Tables for Air Navigation (PUB249)

Plotting Sheets (VP-30)

Dial-Up Electronic CHUM

**b. Canadian Charts.** Information on available Canadian charts and publications may be obtained by contacting the:

NAV CANADA

Aeronautical Publications

Sales and Distribution Unit

P.O. Box 9840, Station T

Ottawa, Ontario K1G 6S8 Canada

Telephone: 613-744-6393 or 1-866-731-7827

Fax: 613-744-7120 or 1-866-740-9992

**c. Mexican Charts.** Information on available Mexican charts and publications may be obtained by contacting:

Dirección de Navegación Aérea

Blvd. Puerto Aéreo 485

Zona Federal Del Aeropuerto Int'l

15620 Mexico D.F.

Mexico

**d. International Civil Aviation Organization (ICAO).** A free *ICAO Publications and Audio-Visual Training Aids Catalogue* is available from:

International Civil Aviation Organization

ATTN: Document Sales Unit

999 University Street

Montreal, Quebec

H3C 5H7, Canada

Telephone: (514) 954-8022

Fax: (514) 954-6769

E-mail: [sales\\_unit@icao.org](mailto:sales_unit@icao.org)

Internet: <http://www.icao.org/cgi/goto.pl?icao/en/sales.htm>

Sitatex: YULCAYA

Telex: 05-24513



## 10-1-2. Helicopter Instrument Approaches

a. Helicopters are capable of flying any published 14 CFR Part 97, Standard Instrument Approach Procedures (SIAPs), for which they are properly equipped, subject to the following limitations and conditions:

1. Helicopters flying conventional (non-Copter) SIAPs may reduce the visibility minima to not less than one half the published Category A landing visibility minima, or  $\frac{1}{4}$  statute mile visibility/1200 RVR, whichever is greater unless the procedure is annotated with “**Visibility Reduction by Helicopters NA.**” This annotation means that there are penetrations of the final approach obstacle identification surface (OIS) and that the 14 CFR Section 97.3 visibility reduction rule does not apply and you must take precaution to avoid any obstacles in the visual segment. No reduction in MDA/DA is permitted. The helicopter may initiate the final approach segment at speeds up to the upper limit of the highest approach category authorized by the procedure, but must be slowed to no more than 90 KIAS at the missed approach point (MAP) in order to apply the visibility reduction. Pilots are cautioned that such a decelerating approach may make early identification of wind shear on the approach path difficult or impossible. If required, use the Inoperative Components and Visual Aids Table provided in the front cover of the U.S. Terminal Procedures Volume to derive the Category A minima before applying the 14 CFR Section 97.3(d-1) rule.

2. Helicopters flying Copter SIAPs may use the published minima, with no reductions allowed. The maximum airspeed is 90 KIAS on any segment of the approach or missed approach.

3. Helicopters flying GPS Copter SIAPs must limit airspeed to 90 KIAS or less when flying any segment of the procedure, except speeds must be limited to no more than 70 KIAS on the final and missed approach segments. Military GPS Copter SIAPs are limited to no more than 90 KIAS throughout the procedure. If annotated, holding may

also be limited to no more than 70 KIAS. Use the published minima, no reductions allowed.

### **NOTE-**

*Obstruction clearance surfaces are based on the aircraft speed and have been designed on these approaches for 70 knots. If the helicopter is flown at higher speeds, it may fly outside of protected airspace. Some helicopters have a  $V_{MINI}$  greater than 70 knots; therefore, they cannot meet the 70 knot limitation to conduct this type of procedure. Some helicopter autopilots, when used in the “go-around” mode, are programmed with a  $V_{YI}$  greater than 70 knots, therefore when using the autopilot “go-around” mode, they cannot meet the 70 knot limitation to conduct this type of approach. It may be possible to use the autopilot for the missed approach in the other than the “go-around” mode and meet the 70 knot limitation to conduct this type of approach. When operating at speeds other than  $V_{YI}$  or  $V_Y$ , performance data may not be available in the RFM to predict compliance with climb gradient requirements. Pilots may use observed performance in similar weight/altitude/temperature/speed conditions to evaluate the suitability of performance. Pilots are cautioned to monitor climb performance to ensure compliance with procedure requirements.*

4. TBL 10-1-1 summarizes these requirements.

5. Even with weather conditions reported at or above landing minima, some combinations of reduced cockpit cutoff angle, minimal approach/runway lighting, and high MDA/DH coupled with a low visibility minima, the pilot may not be able to identify the required visual reference(s) during the approach, or those references may only be visible in a very small portion of the pilot’s available field of view. Even if identified by the pilot, these visual references may not support normal maneuvering and normal rates of descent to landing. The effect of such a combination may be exacerbated by other conditions such as rain on the windshield, or incomplete windshield defogging coverage.

6. Pilots are cautioned to be prepared to execute a missed approach even though weather conditions may be reported at or above landing minima.

### **NOTE-**

*See paragraph 5-4-21, Missed Approach, for additional information on missed approach procedures.*

*TBL 10-1-1*

**Helicopter Use of Standard Instrument Approach Procedures**

<b>Procedure</b>	<b>Helicopter Visibility Minima</b>	<b>Helicopter MDA/DA</b>	<b>Maximum Speed Limitations</b>
<b>Conventional (non-Copter)</b>	The greater of: one half the Category A visibility minima, 1/4 statute mile visibility, or 1200 RVR	As published for Category A	The helicopter may initiate the final approach segment at speeds up to the upper limit of the highest Approach Category authorized by the procedure, but must be slowed to no more than 90 KIAS at the MAP in order to apply the visibility reduction.
<b>Copter Procedure</b>	As published	As published	90 KIAS when on a published route/track.
<b>GPS Copter Procedure</b>	As published	As published	90 KIAS when on a published route or track, EXCEPT 70 KIAS when on the final approach or missed approach segment and, if annotated, in holding. Military procedures are limited to 90 KIAS for all segments.

**NOTE-**

Several factors affect the ability of the pilot to acquire and maintain the visual references specified in 14 CFR Section 91.175(c), even in cases where the flight visibility may be at the minimum derived by TBL 10-1-1. These factors include, but are not limited to:

1. Cockpit cutoff angle (the angle at which the cockpit or other airframe structure limits downward visibility below the horizon).

2. Combinations of high MDA/DH and low visibility minimum, such as a conventional nonprecision approach with a reduced helicopter visibility minima (per 14 CFR Section 97.3).

3. Type, configuration, and intensity of approach and runway lighting systems.

4. Type of obscuring phenomenon and/or windshield contamination.

(a) The helicopter must be equipped for IFR operations and equipped with IFR approved GPS navigational units.

(b) The operator must obtain prior written approval from the appropriate Flight Standards District Office through a Letter of Authorization or Operations Specification, as appropriate.

(c) The operator must be a signatory to the Houston ARTCC Letter of Agreement.

4. Operators who wish to benefit from ADS-B based ATC separation services must meet the following additional requirements:

(a) The Operator's installed ADS-B Out equipment must meet the performance requirements of one of the following FAA Technical Standard Orders (TSO), or later revisions: TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equip-

ment, or TSO-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information.

(b) Flight crews must comply with the procedures prescribed in the Houston ARTCC Letter of Agreement dated December 17, 2009, or later.

**NOTE-**

*The unique ADS-B architecture in the Gulf of Mexico depends upon reception of an aircraft's Mode C in addition to the other message elements described in 14 CFR 91.227. Flight crews must be made aware that loss of Mode C also means that ATC will not receive the aircraft's ADS-B signal.*

5. FAA/AIS publishes the grid system waypoints on the IFR Gulf of Mexico Vertical Flight Reference Chart. A commercial equivalent is also available. The chart is updated annually and is available from an FAA approved print provider or FAA directly, web site address: [http://www.faa.gov/air\\_traffic/flight\\_info/aeronav](http://www.faa.gov/air_traffic/flight_info/aeronav).



## 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
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
AWSS . . . . .	Automated Weather Sensor 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 . . . . .	Charted 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

<b>Abbreviation/ Acronym</b>	<b>Meaning</b>
DH . . . . .	Decision Height
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
DUATS . . . . .	Direct User Access Terminal System
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

<b>Abbreviation/ Acronym</b>	<b>Meaning</b>
FSS . . . . .	Flight Service Station
GBAS . . . . .	Ground Based Augmentation System
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
HIWAS . . . . .	Hazardous Inflight Weather Advisory Service
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
IFIM . . . . .	International Flight Information Manual
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



# PILOT/CONTROLLER GLOSSARY

---

## PURPOSE

a. This Glossary was compiled to promote a common understanding of the terms used in the Air Traffic Control system. It includes those terms which are intended for pilot/controller communications. Those terms most frequently used in pilot/controller communications are printed in *bold italics*. The definitions are primarily defined in an operational sense applicable to both users and operators of the National Airspace System. Use of the Glossary will preclude any misunderstandings concerning the system's design, function, and purpose.

b. Because of the international nature of flying, terms used in the Lexicon, published by the International Civil Aviation Organization (ICAO), are included when they differ from FAA definitions. These terms are followed by "[ICAO]." For the reader's convenience, there are also cross references to related terms in other parts of the Glossary and to other documents, such as the Code of Federal Regulations (CFR) and the Aeronautical Information Manual (AIM).

c. This Glossary will be revised, as necessary, to maintain a common understanding of the system.

## EXPLANATION OF CHANGES

### d. Terms Added:

ATS SURVEILLANCE SERVICE [ICAO]  
 ATS SURVEILLANCE SYSTEM [ICAO]  
 BUFFER AREA  
 FLIGHT TERMINATION  
 IDENTIFICATION [ICAO]  
 LOST LINK  
 LOST LINK PROECDURE  
 PROCEDURAL CONTROL [ICAO]  
 PROCEDURAL SEPARATION [ICAO]

### e. Terms Deleted:

FLIGHT MANAGEMENT SYSTEM PROCEDURE (FMSP)  
 NONRADAR SEPARATION [ICAO]  
 RADAR IDENTIFICATION

### f. Terms Modified:

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER (ATCSCC)  
 AIRPORT SURFACE DETECTION EQUIPMENT (ASDE)  
 ALONG-TRACK DISTANCE (ATD)  
 SAFETY LOGIC SYSTEM  
 TEMPORARY FLIGHT RESTRICTION (TFR)

g. Editorial/format changes were made where necessary. Revision bars were not used due to the insignificant nature of the changes.



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.

## AIRMEN'S METEOROLOGICAL INFORMATION–

(See AIRMET.)

**AIRMET**– In-flight weather advisories issued only to amend the 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 FAAO 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**– 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**– 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.)



**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**– A precoordinated process, specifically defined in facility directives, during which a transfer of altitude control and/or radar identification is accomplished without verbal coordination between controllers using information communicated in a full data block.

**AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM**– A facility which can deliver, in a matter of minutes, a surface picture (SURPIC) of vessels in the area of a potential or actual search and

rescue incident, including their predicted positions and their characteristics.

(See FAAO JO 7110.65, Para 10-6-4, INFLIGHT CONTINGENCIES.)

**AUTOMATED PROBLEM DETECTION (APD)**– An Automation Processing capability that compares trajectories in order to predict conflicts.

**AUTOMATED PROBLEM DETECTION BOUNDARY (APB)**– The adapted distance beyond a facilities boundary defining the airspace within which 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, programmable automated radar terminal system. ARTS IIIA detects, tracks, and predicts primary as well as secondary radar-derived aircraft targets. This more sophisticated computer-driven system upgrades the existing ARTS III system by providing improved tracking, continuous data recording, and fail-soft capabilities.

**b. Common ARTS.** Includes ARTS IIE, ARTS IIIE; and ARTS IIIE with ACD (see DTAS) which combines functionalities of the previous ARTS systems.

**AUTOMATED WEATHER SYSTEM**– Any of the automated weather sensor platforms that collect weather data at airports and disseminate the weather information via radio and/or landline. The systems currently consist of the Automated Surface Observing System (ASOS), Automated Weather Sensor System (AWSS) and Automated Weather Observation System (AWOS).

**AUTOMATED UNICOM**– Provides completely automated weather, radio check capability and airport advisory information on an Automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the

UNICOM frequency. Availability will be published in the 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 GPS-derived position and other information such as velocity over the data link, which is received by a ground-based transmitter/receiver (transceiver) for processing and display at an air traffic control facility.

(See GLOBAL POSITIONING SYSTEM.)

(See GROUND-BASED TRANSCEIVER.)

**AUTOMATIC DEPENDENT SURVEILLANCE–CONTRACT (ADS-C)**– A data link position reporting system, controlled by a ground station, that establishes contracts with an aircraft's avionics that occur automatically whenever specific events occur, or specific time intervals are reached.

**AUTOMATIC DEPENDENT SURVEILLANCE–REBROADCAST (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.

**AUTOMATIC DIRECTION FINDER**– An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum.

(See BEARING.)

(See NONDIRECTIONAL BEACON.)

**AUTOMATIC FLIGHT INFORMATION SERVICE (AFIS) – ALASKA FSSs ONLY**– The continuous broadcast of recorded non-control information at airports in Alaska where a FSS provides local airport advisory service. The AFIS broadcast automates the repetitive transmission of essential but routine information such as weather, wind, altimeter, favored runway, breaking action, airport NOTAMs, and other applicable information. The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS/AWSS/AWOS frequency.)

**AUTOMATIC TERMINAL INFORMATION SERVICE**– The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g., “Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five

Left approach in use, Runway Two Five Right closed, advise you have Alfa.”

(See ICAO term AUTOMATIC TERMINAL INFORMATION SERVICE.)

(Refer to AIM.)

**AUTOMATIC TERMINAL INFORMATION SERVICE [ICAO]**– The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

**AUTOROTATION**– A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

**a. Autorotative Landing/Touchdown** Autorotation. Used by a pilot to indicate that the landing will be made without applying power to the rotor.

**b. Low Level Autorotation.** Commences at an altitude well below the traffic pattern, usually below 100 feet AGL and is used primarily for tactical military training.

**c. 180 degrees Autorotation.** Initiated from a downwind heading and is commenced well inside the normal traffic pattern. “Go around” may not be possible during the latter part of this maneuver.

**AVAILABLE LANDING DISTANCE (ALD)**– The portion of a runway available for landing and roll-out for aircraft cleared for LAHSO. This distance is measured from the landing threshold to the hold-short point.

**AVIATION WEATHER SERVICE**– A service provided by the National Weather Service (NWS) and FAA which collects and disseminates pertinent weather information for pilots, aircraft operators, and ATC. Available aviation weather reports and forecasts are displayed at each NWS office and FAA FSS.

(See TRANSCRIBED WEATHER BROADCAST.)

(See WEATHER ADVISORY.)

(Refer to AIM.)

**AWW**–

(See SEVERE WEATHER FORECAST ALERTS.)

# B

**BACK-TAXI**– A term used by air traffic controllers to taxi an aircraft on the runway opposite to the traffic flow. The aircraft may be instructed to back-taxi to the beginning of the runway or at some point before reaching the runway end for the purpose of departure or to exit the runway.

**BASE LEG**–

(See TRAFFIC PATTERN.)

**BEACON**–

(See AERONAUTICAL BEACON.)

(See AIRPORT ROTATING BEACON.)

(See AIRWAY BEACON.)

(See MARKER BEACON.)

(See NONDIRECTIONAL BEACON.)

(See RADAR.)

**BEARING**– The horizontal direction to or from any point, usually measured clockwise from true north, magnetic north, or some other reference point through 360 degrees.

(See NONDIRECTIONAL BEACON.)

**BELOW MINIMUMS**– Weather conditions below the minimums prescribed by regulation for the particular action involved; e.g., landing minimums, takeoff minimums.

**BLAST FENCE**– A barrier that is used to divert or dissipate jet or propeller blast.

**BLAST PAD**– A surface adjacent to the ends of a runway provided to reduce the erosive effect of jet blast and propeller wash.

**BLIND SPEED**– The rate of departure or closing of a target relative to the radar antenna at which cancellation of the primary radar target by moving target indicator (MTI) circuits in the radar equipment causes a reduction or complete loss of signal.

(See ICAO term BLIND VELOCITY.)

**BLIND SPOT**– An area from which radio transmissions and/or radar echoes cannot be received. The term is also used to describe portions of the airport not visible from the control tower.

**BLIND TRANSMISSION**–

(See TRANSMITTING IN THE BLIND.)

**BLIND VELOCITY [ICAO]**– The radial velocity of a moving target such that the target is not seen on primary radars fitted with certain forms of fixed echo suppression.

**BLIND ZONE**–

(See BLIND SPOT.)

**BLOCKED**– Phraseology used to indicate that a radio transmission has been distorted or interrupted due to multiple simultaneous radio transmissions.

**BOTTOM ALTITUDE**– In reference to published altitude restrictions on a STAR or STAR runway transition, the lowest altitude authorized.

**BOUNDARY LIGHTS**–

(See AIRPORT LIGHTING.)

**BRAKING ACTION (GOOD, MEDIUM, POOR, OR NIL)**– A report of conditions on the airport movement area providing a pilot with a degree/quality of braking that he/she might expect. Braking action is reported in terms of good, fair, poor, or nil. Effective October 1, 2016, Braking Action will be categorized in the following terms: Good, Good to Medium, Medium, Medium to Poor, Poor, and Nil.

(See RUNWAY CONDITION READING.)

**BRAKING ACTION ADVISORIES**– When tower controllers have received runway braking action reports which include the terms “fair,” “poor,” or “nil,” or whenever weather conditions are conducive to deteriorating or rapidly changing runway braking conditions, the tower will include on the ATIS broadcast the statement, “Braking action advisories are in effect” on the ATIS broadcast. During the time braking action advisories are in effect, ATC will issue the latest braking action report for the runway in use to each arriving and departing aircraft. Pilots should be prepared for deteriorating braking conditions and should request current runway condition information if not volunteered by controllers. Pilots should also be prepared to provide a descriptive runway condition report to controllers after landing. Effective October 1, 2016, the term “fair” will be replaced with “medium”.

**BREAKOUT**– A technique to direct aircraft out of the approach stream. In the context of simultaneous (independent) parallel operations, a breakout is used

to direct threatened aircraft away from a deviating aircraft.

**BROADCAST**– Transmission of information for which an acknowledgement is not expected.

(See ICAO term **BROADCAST**.)

**BROADCAST [ICAO]**– A transmission of information relating to air navigation that is not addressed to a specific station or stations.

**BUFFER AREA**– As applied to an MVA or MIA chart, a depicted three (3) or five (5) NM radius MVA/MIA sector isolating a displayed obstacle for which the sector is established. A portion of a buffer area can also be inclusive of a MVA/MIA sector polygon boundary.

power or control. The standard overhead approach starts at a relatively high altitude over a runway (“high key”) followed by a continuous 180 degree turn to a high, wide position (“low key”) followed by a continuous 180 degree turn final. The standard straight-in pattern starts at a point that results in a straight-in approach with a high rate of descent to the runway. Flameout approaches terminate in the type approach requested by the pilot (normally fullstop).

**FLIGHT CHECK**– A call-sign prefix used by FAA aircraft engaged in flight inspection/certification of navigational aids and flight procedures. The word “recorded” may be added as a suffix; e.g., “Flight Check 320 recorded” to indicate that an automated flight inspection is in progress in terminal areas.

(See **FLIGHT INSPECTION**.)

(Refer to AIM.)

**FLIGHT FOLLOWING**–

(See **TRAFFIC ADVISORIES**.)

**FLIGHT INFORMATION REGION**– An airspace of defined dimensions within which Flight Information Service and Alerting Service are provided.

**a. Flight Information Service.** A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

**b. Alerting Service.** A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and to assist such organizations as required.

**FLIGHT INFORMATION SERVICE**– A service provided for the purpose of giving advice and information useful for the safe and efficient conduct of flights.

**FLIGHT INFORMATION SERVICE– BROADCAST (FIS–B)**– A ground broadcast service provided through the ADS–B Broadcast Services network over the UAT data link that operates on 978 MHz. The FIS–B system provides pilots and flight crews of properly equipped aircraft with a cockpit display of certain aviation weather and aeronautical information.

**FLIGHT INSPECTION**– Inflight investigation and evaluation of a navigational aid to determine whether it meets established tolerances.

(See **FLIGHT CHECK**.)

(See **NAVIGATIONAL AID**.)

**FLIGHT LEVEL**– A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury. Each is stated in three digits that represent hundreds of feet. For example, flight level (FL) 250 represents a barometric altimeter indication of 25,000 feet; FL 255, an indication of 25,500 feet.

(See ICAO term **FLIGHT LEVEL**.)

**FLIGHT LEVEL [ICAO]**– A surface of constant atmospheric pressure which is related to a specific pressure datum, 1013.2 hPa (1013.2 mb), and is separated from other such surfaces by specific pressure intervals.

Note 1: A pressure type altimeter calibrated in accordance with the standard atmosphere:

- a.** When set to a QNH altimeter setting, will indicate altitude;
- b.** When set to a QFE altimeter setting, will indicate height above the QFE reference datum; and
- c.** When set to a pressure of 1013.2 hPa (1013.2 mb), may be used to indicate flight levels.

Note 2: The terms ‘height’ and ‘altitude,’ used in Note 1 above, indicate altimetric rather than geometric heights and altitudes.

**FLIGHT LINE**– A term used to describe the precise movement of a civil photogrammetric aircraft along a predetermined course(s) at a predetermined altitude during the actual photographic run.

**FLIGHT MANAGEMENT SYSTEMS**– A computer system that uses a large data base to allow routes to be preprogrammed and fed into the system by means of a data loader. The system is constantly updated with respect to position accuracy by reference to conventional navigation aids. The sophisticated program and its associated data base ensures that the most appropriate aids are automatically selected during the information update cycle.

**FLIGHT PATH**– A line, course, or track along which an aircraft is flying or intended to be flown.

(See **COURSE**.)

(See **TRACK**.)

**FLIGHT PLAN**– Specified information relating to the intended flight of an aircraft that is filed orally or in writing with an FSS or an ATC facility.

(See **FAST FILE**.)

(See **FILED**.)

(Refer to AIM.)

**FLIGHT PLAN AREA (FPA)**– The geographical area assigned to a flight service station (FSS) for the

purpose of establishing primary responsibility for services that may include search and rescue for VFR aircraft, issuance of NOTAMs, pilot briefings, inflight services, broadcast services, emergency services, flight data processing, international operations, and aviation weather services. Large consolidated FSS facilities may combine FPAs into larger areas of responsibility (AOR).

(See FLIGHT SERVICE STATION.)

(See TIE-IN FACILITY.)

**FLIGHT RECORDER**– A general term applied to any instrument or device that records information about the performance of an aircraft in flight or about conditions encountered in flight. Flight recorders may make records of airspeed, outside air temperature, vertical acceleration, engine RPM, manifold pressure, and other pertinent variables for a given flight.

(See ICAO term FLIGHT RECORDER.)

**FLIGHT RECORDER [ICAO]**– Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

Note: See Annex 6 Part I, for specifications relating to flight recorders.

**FLIGHT SERVICE STATION (FSS)**– An air traffic facility which provides pilot briefings, flight plan processing, en route flight advisories, search and rescue services, and assistance to lost aircraft and aircraft in emergency situations. FSS also relay ATC clearances, process Notices to Airmen, broadcast aviation weather and aeronautical information, and advise Customs and Immigration of transborder flights. In Alaska, FSS provide Airport Advisory Services.

(See FLIGHT PLAN AREA.)

(See TIE-IN FACILITY.)

**FLIGHT STANDARDS DISTRICT OFFICE**– An FAA field office serving an assigned geographical area and staffed with Flight Standards personnel who serve the aviation industry and the general public on matters relating to the certification and operation of air carrier and general aviation aircraft. Activities include general surveillance of operational safety, certification of airmen and aircraft, accident prevention, investigation, enforcement, etc.

**FLIGHT TERMINATION**– The intentional and deliberate process of terminating the flight of a UA in the event of an unrecoverable lost link, loss of

control, or other failure that compromises the safety of flight.

**FLIGHT TEST**– A flight for the purpose of:

a. Investigating the operation/flight characteristics of an aircraft or aircraft component.

b. Evaluating an applicant for a pilot certificate or rating.

**FLIGHT VISIBILITY**–

(See VISIBILITY.)

**FLIP**–

(See DOD FLIP.)

**FLY HEADING (DEGREES)**– Informs the pilot of the heading he/she should fly. The pilot may have to turn to, or continue on, a specific compass direction in order to comply with the instructions. The pilot is expected to turn in the shorter direction to the heading unless otherwise instructed by ATC.

**FLY-BY WAYPOINT**– A fly-by waypoint requires the use of turn anticipation to avoid overshoot of the next flight segment.

**FLY-OVER WAYPOINT**– A fly-over waypoint precludes any turn until the waypoint is overflown and is followed by an intercept maneuver of the next flight segment.

**FLY VISUAL TO AIRPORT**–

(See PUBLISHED INSTRUMENT APPROACH PROCEDURE VISUAL SEGMENT.)

**FMA**–

(See FINAL MONITOR AID.)

**FMS**–

(See FLIGHT MANAGEMENT SYSTEM.)

**FORMATION FLIGHT**– More than one aircraft which, by prior arrangement between the pilots, operate as a single aircraft with regard to navigation 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.

**FRICTION 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/CARTS]-** 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).



# 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.)

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 or 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.

**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.)

IFIM–

(See INTERNATIONAL FLIGHT INFORMATION MANUAL.)

**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.

**ILS PRM APPROACH–** An instrument landing system (ILS) approach conducted to parallel runways whose extended centerlines are separated by less than 4,300 feet and at least 3,000 feet where independent closely spaced approaches are permitted. Also used in conjunction with an LDA PRM, RNAV PRM or GLS PRM approach to conduct Simultaneous Offset Instrument Approach (SOIA) operations. No Transgression Zone (NTZ) monitoring is required to conduct these approaches. ATC utilizes an enhanced display with alerting and, with certain runway spacing, a high update rate PRM surveillance sensor. Use of a secondary monitor frequency, pilot PRM training, and publication of an Attention All Users Page are also required for all PRM approaches.

(Refer to AIM)

**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.

**INCREASE SPEED TO (SPEED)**–  
(See SPEED ADJUSTMENT.)

**INERTIAL NAVIGATION SYSTEM**– 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**– A request originated by an FSS for information concerning an overdue VFR aircraft.

**INITIAL APPROACH FIX**– 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 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 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 [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 PROCEDURES 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**– 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**– 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**– 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.)

(Refer to IFIM.)

**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.

**a.** Regions include:

1. African-Indian Ocean Region
2. Caribbean Region
3. European Region
4. Middle East/Asia Region
5. North American Region
6. North Atlantic Region
7. Pacific Region
8. South American Region

**INTERNATIONAL FLIGHT INFORMATION MANUAL**— A publication designed primarily as a pilot's preflight planning guide for flights into foreign airspace and for flights returning to the U.S. from foreign locations.

**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**– Indicates the confidence level of the track requires 5NM separation. 3NM separation, 1 1/2NM separation, and target resolution cannot be used.



at least 750 feet. NTZ monitoring is required to conduct these approaches.

(See **SIMULTANEOUS OFFSET INSTRUMENT APPROACH (SOIA)**.)

(Refer to AIM.)

**LOCALIZER USABLE DISTANCE**– The maximum distance from the localizer transmitter at a specified altitude, as verified by flight inspection, at which reliable course information is continuously received.

(Refer to AIM.)

**LOCATOR [ICAO]**– An LM/MF NDB used as an aid to final approach.

Note: A locator usually has an average radius of rated coverage of between 18.5 and 46.3 km (10 and 25 NM).

**LONG RANGE NAVIGATION**–

(See **LORAN**.)

**LONGITUDINAL SEPARATION**– The longitudinal spacing of aircraft at the same altitude by a minimum distance expressed in units of time or miles.

(See **SEPARATION**.)

(Refer to AIM.)

**LORAN**– An electronic navigational system by which hyperbolic lines of position are determined by measuring the difference in the time of reception of synchronized pulse signals from two fixed transmitters. Loran A operates in the 1750-1950 kHz frequency band. Loran C and D operate in the 100-110 kHz frequency band. In 2010, the U.S. Coast Guard terminated all U.S. LORAN-C transmissions.

(Refer to AIM.)

**LOST COMMUNICATIONS**– Loss of the ability to communicate by radio. Aircraft are sometimes referred to as **NORDO (No Radio)**. Standard pilot procedures are specified in 14 CFR Part 91. Radar controllers issue procedures for pilots to follow in the event of lost communications during a radar approach when weather reports indicate that an aircraft will likely encounter IFR weather conditions during the approach.

(Refer to 14 CFR Part 91.)

(Refer to AIM.)

**LOST LINK**– An interruption or loss of the control link, or when the pilot is unable to effect control of the aircraft and, as a result, the UA will perform a predictable or planned maneuver. Loss of command and control link between the Control Station and the aircraft. There are two types of links:

a. An uplink which transmits command instructions to the aircraft, and

b. A downlink which transmits the status of the aircraft and provides situational awareness to the pilot.

**LOST LINK PROCEDURE**– Preprogrammed or predetermined mitigations to ensure the continued safe operation of the UA in the event of a lost link (LL). In the event positive link cannot be established, flight termination must be implemented.

**LOW ALTITUDE AIRWAY STRUCTURE**– The network of airways serving aircraft operations up to but not including 18,000 feet MSL.

(See **AIRWAY**.)

(Refer to AIM.)

***LOW ALTITUDE ALERT, CHECK YOUR ALTITUDE IMMEDIATELY***–

(See **SAFETY ALERT**.)

**LOW APPROACH**– An approach over an airport or runway following an instrument approach or a VFR approach including the go-around maneuver where the pilot intentionally does not make contact with the runway.

(Refer to AIM.)

**LOW FREQUENCY**– The frequency band between 30 and 300 kHz.

(Refer to AIM.)

**LPV**– A type of approach with vertical guidance (APV) based on WAAS, published on RNAV (GPS) approach charts. This procedure takes advantage of the precise lateral guidance available from WAAS. The minima is published as a decision altitude (DA).

**LUAW**–

(See **LINE UP AND WAIT**.)



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– 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 current NOTAM information considered essential to the safety of flight as well as supplemental data to other aeronautical publications. The contraction NTAP is used in NOTAM text.

(See NOTICE TO AIRMEN.)

NRR–

(See NON-RESTRICTIVE ROUTING.)

NRS–

(See NAVIGATION REFERENCE SYSTEM.)

NTAP–

(See NOTICES TO AIRMEN PUBLICATION.)

**NUMEROUS TARGETS VICINITY (LOCATION)–** A traffic advisory issued by ATC to advise pilots that targets on the radar scope are too numerous to issue individually.

(See TRAFFIC ADVISORIES.)

**PRECISION APPROACH RADAR**– Radar equipment in some ATC facilities operated by the FAA and/or the military services at joint-use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach (PAR) wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), the glidepath (elevation), and the distance (range) from the touchdown point on the runway as displayed on the radar scope.

Note: The abbreviation "PAR" is also used to denote preferential arrival routes in ARTCC computers.

(See GLIDEPATH.)

(See PAR.)

(See PREFERENTIAL ROUTES.)

(See ICAO term PRECISION APPROACH RADAR.)

(Refer to AIM.)

**PRECISION APPROACH RADAR [ICAO]**– Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

Note: Precision approach radars are designed to enable pilots of aircraft to be given guidance by radio communication during the final stages of the approach to land.

**PRECISION OBSTACLE FREE ZONE (POFZ)**– An 800 foot wide by 200 foot long area centered on the runway centerline adjacent to the threshold designed to protect aircraft flying precision approaches from ground vehicles and other aircraft when ceiling is less than 250 feet or visibility is less than 3/4 statute mile (or runway visual range below 4,000 feet.)

**PRECISION RUNWAY MONITOR (PRM) 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 onboard some aircraft to alert the flight crew to the presence of a potential wind shear. PWS systems typically monitor 3 miles ahead and 25 degrees left and right of the aircraft's heading at or below 1200' AGL. Departing flights may receive a wind shear alert after they start the takeoff roll and may elect to abort the takeoff. Aircraft on approach receiving an alert may elect to go around or perform a wind shear escape maneuver.

**PREFERENTIAL ROUTES**– Preferential routes (PDRs, PARs, and PDARs) are adapted in ARTCC computers to accomplish inter/intrafacility controller coordination and to assure that flight data is posted at the proper control positions. Locations having a need for these specific inbound and outbound routes normally publish such routes in local facility bulletins, and their use by pilots minimizes flight plan route amendments. When the workload or traffic situation permits, controllers normally provide radar vectors or assign requested routes to minimize circuitous routing. Preferential routes are usually confined to one ARTCC's area and are referred to by the following names or acronyms:

**a.** Preferential Departure Route (PDR). A specific departure route from an airport or terminal area to an en route point where there is no further need for flow control. It may be included in an Instrument Departure Procedure (DP) or a Preferred IFR Route.

**b.** Preferential Arrival Route (PAR). A specific arrival route from an appropriate en route point to an airport or terminal area. It may be included in a Standard Terminal Arrival (STAR) or a Preferred IFR Route. The abbreviation "PAR" is used primarily within the ARTCC and should not be confused with the abbreviation for Precision Approach Radar.

**c.** Preferential Departure and Arrival Route (PDAR). A route between two terminals which are within or immediately adjacent to one ARTCC's area. PDARs are not synonymous with Preferred IFR Routes but may be listed as such as they do accomplish essentially the same purpose.

(See PREFERRED IFR ROUTES.)

**PREFERRED IFR ROUTES**– Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals. IFR clearances are issued on the basis of these routes except when severe weather avoidance procedures or other factors dictate otherwise. Preferred IFR Routes are listed in the 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 ILS PRM APPROACH and PRECISION RUNWAY MONITOR SYSTEM.)

**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.)

**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 which, by measuring the time interval between transmission and reception of radio pulses and correlating the angular orientation of the radiated antenna beam or beams in azimuth and/or elevation, provides information on range, azimuth, and/or elevation of objects in the path of the transmitted pulses.

**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 INTERROGATOR.)

(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) (Army).**

**2. Radar Air Traffic Control Facility (RATCF) (Navy/FAA).**

**3. Radar Approach Control (RAPCON) (Air Force/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.)

(See ICAO term RADAR IDENTIFICATION.)

**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 FAAO JO 7110.65, Para 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**.)

**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**– An unmanned communications facility remotely controlled by air traffic personnel. RCOs serve FSSs. RTRs 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**–

(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.

# S

## SAA–

(See SPECIAL ACTIVITY AIRSPACE.)

**SAFETY ALERT–** A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller’s judgment, places the aircraft in unsafe proximity to terrain, obstructions, or other aircraft. The controller may discontinue the issuance of further alerts if the pilot advises he/she is taking action to correct the situation or has the other aircraft in sight.

**a. Terrain/Obstruction Alert–** A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller’s judgment, places the aircraft in unsafe proximity to terrain/obstructions; e.g., “Low Altitude Alert, check your altitude immediately.”

**b. Aircraft Conflict Alert–** A safety alert issued by ATC to aircraft under their control if ATC is aware of an aircraft that is not under their control at an altitude which, in the controller’s judgment, places both aircraft in unsafe proximity to each other. With the alert, ATC will offer the pilot an alternate course of action when feasible; e.g., “Traffic Alert, advise you turn right heading zero niner zero or climb to eight thousand immediately.”

**Note:** The issuance of a safety alert is contingent upon the capability of the controller to have an awareness of an unsafe condition. The course of action provided will be predicated on other traffic under ATC control. Once the alert is issued, it is solely the pilot’s prerogative to determine what course of action, if any, he/she will take.

**SAFETY LOGIC SYSTEM–** A software enhancement to ASDE–3, ASDE–X, and ASSC, that predicts the path of aircraft landing and/or departing, and/or vehicular movements on runways. Visual and aural alarms are activated when the safety logic projects a potential collision. The Airport Movement Area Safety System (AMASS) is a safety logic system enhancement to the ASDE–3. The Safety Logic System for ASDE–X and ASSC is an integral part of the software program.

## SAFETY LOGIC SYSTEM ALERTS–

**a. ALERT–** An actual situation involving two real safety logic tracks (aircraft/aircraft, aircraft/vehicle,

or aircraft/other tangible object) that safety logic has predicted will result in an imminent collision, based upon the current set of Safety Logic parameters.

### **b. FALSE ALERT–**

**1.** Alerts generated by one or more false surface–radar targets that the system has interpreted as real tracks and placed into safety logic.

**2.** Alerts in which the safety logic software did not perform correctly, based upon the design specifications and the current set of Safety Logic parameters.

**3.** The alert is generated by surface radar targets caused by moderate or greater precipitation.

**c. NUISANCE ALERT–** An alert in which one or more of the following is true:

**1.** The alert is generated by a known situation that is not considered an unsafe operation, such as LAHSO or other approved operations.

**2.** The alert is generated by inaccurate secondary radar data received by the Safety Logic System.

**3.** One or more of the aircraft involved in the alert is not intending to use a runway (for example, helicopter, pipeline patrol, non–Mode C overflight, etc.).

**d. VALID NON–ALERT–** A situation in which the safety logic software correctly determines that an alert is not required, based upon the design specifications and the current set of Safety Logic parameters.

**e. INVALID NON–ALERT–** A situation in which the safety logic software did not issue an alert when an alert was required, based upon the design specifications.

**SAIL BACK–** A maneuver during high wind conditions (usually with power off) where float plane movement is controlled by water rudders/opening and closing cabin doors.

**SAME DIRECTION AIRCRAFT–** Aircraft are operating in the same direction when:

**a.** They are following the same track in the same direction; or

**b.** Their tracks are parallel and the aircraft are flying in the same direction; or

**c.** Their tracks intersect at an angle of less than 45 degrees.

SAR–

(See SEARCH AND RESCUE.)

**SAY AGAIN**– Used to request a repeat of the last transmission. Usually specifies transmission or portion thereof not understood or received; e.g., “Say again all after ABRAM VOR.”

**SAY ALTITUDE**– Used by ATC to ascertain an aircraft’s specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet.

**SAY HEADING**– Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft.

**SCHEDULED TIME OF ARRIVAL (STA)**– A STA is the desired time that an aircraft should cross a certain point (landing or metering fix). It takes other traffic and airspace configuration into account. A STA time shows the results of the TBFM scheduler that has calculated an arrival time according to parameters such as optimized spacing, aircraft performance, and weather.

SDF–

(See SIMPLIFIED DIRECTIONAL FACILITY.)

**SEA LANE**– A designated portion of water outlined by visual surface markers for and intended to be used by aircraft designed to operate on water.

**SEARCH AND RESCUE**– A service which seeks missing aircraft and assists those found to be in need of assistance. It is a cooperative effort using the facilities and services of available Federal, state and local agencies. The U.S. Coast Guard is responsible for coordination of search and rescue for the Maritime Region, and the U.S. Air Force is responsible for search and rescue for the Inland Region. Information pertinent to search and rescue should be passed through any air traffic facility or be transmitted directly to the Rescue Coordination Center by telephone.

(See FLIGHT SERVICE STATION.)

(See RESCUE COORDINATION CENTER.)

(Refer to AIM.)

**SEARCH AND RESCUE FACILITY**– A facility responsible for maintaining and operating a search and rescue (SAR) service to render aid to persons and property in distress. It is any SAR unit, station, NET, or other operational activity which can be usefully

employed during an SAR Mission; e.g., a Civil Air Patrol Wing, or a Coast Guard Station.

(See SEARCH AND RESCUE.)

SECNOT–

(See SECURITY NOTICE.)

**SECONDARY RADAR TARGET**– A target derived from a transponder return presented on a radar display.

**SECTIONAL AERONAUTICAL CHARTS**–

(See AERONAUTICAL CHART.)

**SECTOR LIST DROP INTERVAL**– A parameter number of minutes after the meter fix time when arrival aircraft will be deleted from the arrival sector list.

**SECURITY NOTICE (SECNOT)** – A SECNOT is a request originated by the Air Traffic Security Coordinator (ATSC) for an extensive communications search for aircraft involved, or suspected of being involved, in a security violation, or are considered a security risk. A SECNOT will include the aircraft identification, search area, and expiration time. The search area, as defined by the ATSC, could be a single airport, multiple airports, a radius of an airport or fix, or a route of flight. Once the expiration time has been reached, the SECNOT is considered to be cancelled.

**SECURITY SERVICES AIRSPACE** – Areas established through the regulatory process or by NOTAM, issued by the Administrator under title 14, CFR, sections 99.7, 91.141, and 91.139, which specify that ATC security services are required; i.e., ADIZ or temporary flight rules areas.

**SEE AND AVOID**– When weather conditions permit, pilots operating IFR or VFR are required to observe and maneuver to avoid other aircraft. Right-of-way rules are contained in 14 CFR Part 91.

**SEGMENTED CIRCLE**– A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

(Refer to AIM.)

**SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE**– An instrument approach procedure may have as many as four separate segments depending on how the approach procedure is structured.

**a. Initial Approach**– The segment between the initial approach fix and the intermediate fix or the

# 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**– 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 an analog display resulting from a primary radar return or a radar beacon reply.

(See ASSOCIATED.)

(See DIGITAL TARGET.)

(See DIGITIZED RADAR TARGET.)

(See FUSED TARGET)

(See PRIMARY RADAR TARGET.)

(See RADAR.)

(See SECONDARY RADAR TARGET.)

(See TARGET SYMBOL.)

(See ICAO term TARGET.)

(See UNASSOCIATED.)

**TARGET [ICAO]**– In radar:

**a.** Generally, any discrete object which reflects or retransmits energy back to the radar equipment.

**b.** Specifically, an object of radar search or surveillance.

**TARGET RESOLUTION**– A process to ensure that correlated radar targets do not touch. Target resolution must be applied as follows:

**a.** Between the edges of two primary targets or the edges of the ASR-9/11 primary target symbol.

**b.** Between the end of the beacon control slash and the edge of a primary target.

**c.** Between the ends of two beacon control slashes.

Note 1: Mandatory traffic advisories and safety alerts must be issued when this procedure is used.

Note 2: This procedure must not be used when utilizing mosaic radar systems or multi-sensor mode.

**TARGET SYMBOL**– A computer-generated indication shown on a radar display resulting from a primary radar return or a radar beacon reply.

**TARMAC DELAY**– The holding of an aircraft on the ground either before departure or after landing with no opportunity for its passengers to deplane.

**TARMAC DELAY AIRCRAFT**– An aircraft whose pilot-in-command has requested to taxi to the ramp, gate, or alternate deplaning area to comply with the Three-hour Tarmac Rule.

**TARMAC DELAY REQUEST**– A request by the pilot-in-command to taxi to the ramp, gate, or alternate deplaning location to comply with the Three-hour Tarmac Rule.

**TAS**–

(See **TERMINAL AUTOMATION SYSTEMS**.)

**TAWS**–

(See **TERRAIN AWARENESS WARNING SYSTEM**.)

**TAXI**– The movement of an airplane under its own power on the surface of an airport (14 CFR Section 135.100 [Note]). Also, it describes the surface movement of helicopters equipped with wheels.

(See **AIR TAXI**.)

(See **HOVER TAXI**.)

(Refer to 14 CFR Section 135.100.)

(Refer to **AIM**.)

**TAXI PATTERNS**– Patterns established to illustrate the desired flow of ground traffic for the different runways or airport areas available for use.

**TCAS**–

(See **TRAFFIC ALERT AND COLLISION AVOIDANCE SYSTEM**.)

**TCH**–

(See **THRESHOLD CROSSING HEIGHT**.)

**TCLT**–

(See **TENTATIVE CALCULATED LANDING TIME**.)

**TDLS**–

(See **TERMINAL DATA LINK SYSTEM**.)

**TDZE**–

(See **TOUCHDOWN ZONE ELEVATION**.)

**TELEPHONE INFORMATION BRIEFING SERVICE**– A continuous telephone recording of meteorological and/or aeronautical information.

(Refer to **AIM**.)

**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**– 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



# INDEX

[References are to page numbers]

## A

- Accident, Aircraft, Reporting, 7-6-1
- Accident Cause Factors, 7-5-1
- Adherence to Clearance, 4-4-5
- ADS-B. *See* Automatic Dependent Broadcast Services
- ADS-R. *See* Automatic Dependent Surveillance-Rebroadcast
- Advisories
  - Braking Action, 4-3-12
  - Inflight Aviation Weather, 7-1-8
  - Minimum Fuel, 5-5-7
  - Traffic, 5-5-5
- Aerobatic Flight, 8-1-8
- Aerodrome Forecast (TAF), 7-1-66, 7-1-67, 7-1-68
- Aeronautical
  - Charts, 9-1-1
  - Publications, 9-1-1
- Aeronautical Light Beacons, 2-2-1
- AFIS. *See* Automatic Flight Information Service
- AHRS. *See* Attitude Heading Reference System
- Air Ambulance Flights, 4-2-4
- Air Defense Identification Zones, 5-6-13
- Air Route Surveillance Radar, 4-5-7
- Air Route Traffic Control Centers, 4-1-1
- Air Traffic Control
  - Aircraft Separation, 4-4-1
  - Clearances, 4-4-1
  - Pilot Services, 4-1-1
    - Air Route Traffic Control Centers, 4-1-1
    - Airport Reservations, 4-1-18
    - Approach Control Service, Arriving VFR Aircraft, 4-1-2
    - Automatic Terminal Information Service, 4-1-7
    - Communications, Release of IFR Aircraft, Airports without Operating Control Tower, 4-1-1
    - Control Towers, 4-1-1
    - Flight Service Stations, 4-1-1
    - Ground Vehicle Operations, 4-1-6
    - IFR Approaches, 4-1-6
    - Operation Rain Check, 4-1-2
    - Radar Assistance to VFR Aircraft, 4-1-11
    - Radar Traffic Information Service, 4-1-9
    - Recording and Monitoring, 4-1-1
    - Safety Alert, 4-1-10
    - Terminal Radar Services for VFR Aircraft, 4-1-12
    - Tower En Route Control, 4-1-14
    - Traffic Advisory Practices, Airports Without Operating Control Towers, 4-1-2
    - Transponder Operation, 4-1-15
    - Unicom, Use for ATC Purposes, 4-1-7
    - Unicom/Multicom, 4-1-6
- Air Traffic Control Radar Beacon System, 4-1-15, 4-5-2
- Aircraft
  - Arresting Devices, 2-3-30
  - Call Signs, 4-2-3
  - Lights, Use in Airport Operations, 4-3-26
  - Unmanned, 7-5-2
  - VFR, Emergency Radar Service, 6-2-1
- Aircraft Conflict Alert, 4-1-11
- Airport
  - Aids, Marking, 2-3-1
    - Holding Position, 2-3-12
    - Pavement, 2-3-1
      - Holding Position, 2-3-1
      - Other, 2-3-1
      - Runway, 2-3-1
      - Taxiway, 2-3-1
  - Airport Advisory/Information Services, 3-5-1
  - Lighting Aids, 2-1-1
  - Local Airport Advisory (LAA), 4-1-4
  - Operations, 4-3-1
    - Communications, 4-3-19
    - Exiting the Runway, After Landing, 4-3-24
    - Flight Check Aircraft, In Terminal Areas, 4-3-26
    - Flight Inspection, 4-3-26
    - Gate Holding, Departure Delays, 4-3-20
    - Intersection Takeoffs, 4-3-15
    - Low Approach, 4-3-18
    - Low Level Wind Shear/Microburst Detection Systems, 4-3-12
    - Option Approach, 4-3-25
    - Signals, Hand, 4-3-27
    - Taxi During Low Visibility, 4-3-23
    - Traffic Control Light Signals, 4-3-18
    - Traffic Patterns, 4-3-1, 4-3-2
    - Use of Aircraft Lights, 4-3-26
    - Use of Runways, 4-3-7
    - VFR Flights in Terminal Areas, 4-3-20
    - VFR Helicopter at Controlled Airports, 4-3-20
      - With Operating Control Tower, 4-3-1
      - Without Operating Control Tower, 4-3-6
  - Remote Airport Advisory (RAA), 3-5-1

**[References are to page numbers]**

- Remote Airport Information Service (RAIS), 3-5-1, 4-1-4
- Signs, 2-3-1, 2-3-19
  - Destination, 2-3-28
  - Direction, 2-3-25
  - Information, 2-3-29
  - Location, 2-3-23
  - Mandatory Instruction, 2-3-20
  - Runway Distance Remaining, 2-3-29
- Airport Reservations, 4-1-18
- Airport Surface Detection Equipment, 4-5-7
- Airport Surface Surveillance Capability, 4-5-7
- Airport Surveillance Radar, 4-5-7
- Airspace, 3-1-1
  - Basic VFR Weather Minimums, 3-1-1
  - Class D, 3-2-8
  - Class E, 3-2-9
  - Class G, 3-3-1
  - Controlled, 3-2-1
    - Advisories, Traffic, 3-2-1
    - Alerts, Safety, 3-2-1
    - Class A, 3-2-2
    - Class B, 3-2-2
    - Class C, 3-2-4
    - IFR Requirements, 3-2-1
    - IFR Separation, 3-2-1
    - Parachute Jumps, 3-2-2
    - Ultralight Vehicles, 3-2-2
    - Unmanned Free Balloons, 3-2-2
    - VFR Requirements, 3-2-1
  - Flight Levels, 3-1-2
  - General Dimensions, Segments, 3-1-1
  - Military Training Routes, 3-5-1
  - Other Areas, 3-5-1
  - Parachute Jumping, 3-5-5
  - Special Use, 3-4-1
  - Temporary Flight Restrictions, 3-5-2
  - Terminal Radar Service Areas, 3-5-9
  - VFR Cruising Altitudes, 3-1-2
  - VFR Routes, Published, 3-5-5
    - Class B Airspace, VFR Transition Routes, 3-5-7
    - VFR Corridors, 3-5-7
    - VFR Flyways, 3-5-5
- Airway, 5-3-5
- Airways, Course Changes, 5-3-7
- Alcohol, 8-1-1
- Alert, Safety, 4-1-10, 5-5-3
- Alert Areas, 3-4-2
- Alignment of Elements Approach Slope Indicator, 2-1-5
- Alphabet, Phonetic, 4-2-5
- ALS. *See* Approach Light Systems
- Altimeter
  - Density Altitude, 7-5-4
  - Errors, 7-2-3
  - Setting, 7-2-1
    - High Barometric Pressure, 7-2-4
    - Low Barometric Pressure, 7-2-4
- Altitude
  - Automatic Reporting, 4-1-16
  - Effects, 8-1-3
    - Hypoxia, 8-1-3
  - High Altitude Destinations, 5-1-27
  - Mandatory, 5-4-7
  - Maximum, 5-4-7
  - Minimum, 5-4-7
- Ambulance, Air, 4-2-4
- Amended Clearances, 4-4-2
- Approach
  - Advance Information, Instrument Approach, 5-4-4
  - Approach Control, 5-4-3
  - Clearance, 5-4-24
  - Contact, 5-4-62, 5-5-2
  - Instrument, 5-5-2
  - Instrument Approach Procedure, Charts, 5-4-5
  - Instrument Approach Procedures, 5-4-26
  - Low, 4-3-18
  - Minimums, 5-4-52
  - Missed, 5-4-55, 5-5-3
  - No-Gyro, 5-4-35
  - Option, 4-3-25
  - Overhead Approach Maneuver, 5-4-62
  - Precision, 5-4-34
  - Surveillance, 5-4-34
  - Visual, 5-4-60, 5-5-5
- Approach Control Service, VFR Arriving Aircraft, 4-1-2
- Approach Light Systems, 2-1-1
- Approaches
  - IFR, 4-1-6
  - Parallel Runways, ILS/RNAV/GLS, 5-4-36
  - Radar, 5-4-34
  - Timed, 5-4-31
- Area Navigation (RNAV), 5-1-14, 5-3-6, 5-5-7 *See also* Area Navigation
- Area Navigation (RNAV) Routes, 5-3-6

**[References are to page numbers]**

ARFF (Aircraft Rescue and Fire Fighting) Emergency Hand Signals, 6-5-1

ARFF (Aircraft Rescue and Fire Fighting) Radio Call Sign, 6-5-1

Arresting Devices, Aircraft, 2-3-30

ARSR. *See* Air Route Surveillance Radar

ARTCC. *See* Air Route Traffic Control Centers

ASDE-X. *See* Airport Surface Detection Equipment-Model X

Ash, Volcanic, 7-5-7

ASOS. *See* Automated Surface Observing System

ASR. *See* Airport Surveillance Radar; Surveillance Approach

ASSC, 4-5-7

ATCRBS. *See* Air Traffic Control Radar Beacon System

ATCT. *See* Control Towers

ATIS. *See* Automatic Terminal Information Service

Attitude Heading Reference System (AHRS), 1-1-16

Authority, Statutory, 1-1-1

Automated Surface Observing System (ASOS), 4-3-31, 7-1-25

Automated Weather Observing System (AWOS), 4-3-31, 7-1-22

Automated Weather Sensor System (AWSS), 4-3-31

Automated Weather Sensor System (AWSS), 7-1-25

Automatic Altitude Reporting, 4-1-16

Automatic Dependent Surveillance-Broadcast Services, 4-5-14

Automatic Dependent Surveillance-Rebroadcast, 4-5-21

Automatic Flight Information Service (AFIS) – Alaska FSSs Only, 4-1-8

Automatic Terminal Information Service, 4-1-7

AWOS. *See* Automated Weather Observing System

**B**

Balloons, Unmanned, 7-5-2  
Free, 3-2-2

Beacon

Index

Aeronautical Light, 2-2-1  
Code, 2-2-1  
Marker, 1-1-10  
Nondirectional Radio, 1-1-1

Beacons, Airport/Heliport, 2-1-14

Bird  
Bird Strike  
Reduction, 7-4-1  
Reporting, 7-4-1  
Hazards, 7-4-1  
Migratory, 7-4-1

Bird/Other Wildlife Strike Reporting, Form. *See* Appendix 1

Braking Action Advisories, 4-3-12

Braking Action Reports, 4-3-12

Briefing, Preflight, 7-1-5

**C**

Call Signs  
Aircraft, 4-2-3  
Ground Station, 4-2-4

Carbon Monoxide Poisoning, 8-1-5

CAT. *See* Clear Air Turbulence

CDR. *See* Coded Departure Route

Changeover Points, 5-3-8

Charted Visual Flight Procedures, 5-4-61

Charts, Aeronautical, 9-1-1

Class A Airspace, 3-2-2  
Definition, 3-2-2  
Operating Rules, 3-2-2  
Pilot/Equipment Requirements, 3-2-2

Class B Airspace, 3-2-2  
ATC Clearances, 3-2-3  
Definition, 3-2-2  
Flight Procedures, 3-2-3  
Mode C Veil, 3-2-3  
Operating Rules, 3-2-2  
Pilot/Equipment Requirements, VFR Operations, 3-2-2  
Proximity Operations, 3-2-4  
Separation, 3-2-3  
VFR Transition Routes, 3-5-7

Class C Airspace, 3-2-4  
Air Traffic Services, 3-2-5  
Aircraft Separation, 3-2-5

**[References are to page numbers]**

- Definition, 3-2-4
  - Operating Rules, 3-2-4
  - Outer Area, 3-2-5
  - Pilot/Equipment Requirements, 3-2-4
  - Secondary Airports, 3-2-6
  - Class D Airspace, 3-2-8
    - Definition, 3-2-8
    - Operating Rules, 3-2-8
    - Pilot/Equipment Requirements, 3-2-8
    - Separation for VFR Aircraft, 3-2-9
  - Class E Airspace, 3-2-9
    - Definition, 3-2-9
    - Operating Rules, 3-2-9
    - Pilot/Equipment Requirements, 3-2-9
    - Separation for VFR Aircraft, 3-2-10
    - Types, 3-2-9
    - Vertical Limits, 3-2-9
  - Class G Airspace, 3-3-1
    - IFR Requirements, 3-3-1
    - VFR Requirements, 3-3-1
  - Clear Air Turbulence, 7-1-44
  - Clearance
    - Abbreviated IFR Departure, 5-2-3
    - Adherence, 4-4-5
    - Air Traffic, 5-5-1
    - Air Traffic Control, 4-4-1
    - Amended, 4-4-2
    - Approach, 5-4-24
    - IFR, VFR-on-Top, 4-4-4
    - IFR Flights, 4-4-5
    - Issuance, Pilot Responsibility, 4-4-4
    - Items, 4-4-1
      - Altitude Data, 4-4-2
      - Clearance Limit, 4-4-1
      - Departure Procedure, 4-4-1
      - Holding Instructions, 4-4-2
      - Route of Flight, 4-4-1
    - Pre-Taxi, 5-2-1
    - Prefix, 4-4-1
    - Taxi, 5-2-2
    - VFR Flights, 4-4-5
    - Void Times, 5-2-4
  - Clearances, Special VFR Clearances, 4-4-3
  - Clearing Procedures, Visual, 4-4-11
  - Coded Departure Route, 4-4-3
  - Cold Temperature Operations, 5-1-31
    - Pilot Responsibilities, 5-5-2, 5-5-3
  - Collision, Avoidance, Judgment, 8-1-8
  - Communication, Radio
    - Contact, Reestablishing, 6-4-2
    - Two-way Failure, 6-4-1
      - IFR Conditions, 6-4-1
      - Transponder Usage, 6-4-2
      - VFR Conditions, 6-4-1
  - Communications
    - ARTCC, 5-3-1
      - Additional Reports, 5-3-4
      - Position Reporting, 5-3-3
    - Distress, 6-3-1
    - Radio, 4-2-1
      - Phonetic Alphabet, 4-2-5
    - Release, 4-1-1
    - Urgency, 6-3-1
  - Conflict Alert, Aircraft, 4-1-11
  - Contact Approach, 5-4-62
  - Contact Procedures, 4-2-1
    - Initial Contact, 4-2-1
  - Control of Lighting Systems, 2-1-11
  - Control Towers, 4-1-1
  - Controlled Firing Areas, 3-4-2
  - Controller, Responsibility, 5-3-8, 5-4-61, 5-5-1
  - COP. *See* Changeover Points
  - CORONA, 7-5-9
  - Course Lights, 2-2-1
  - CVFP. *See* Charted Visual Flight Procedures
- D**
- Decompression Sickness, 8-1-4
  - Density Altitude, Effects, 7-5-4
  - Departure, Restrictions, 5-2-4
  - Departure Control, 5-2-5
  - Departures, Instrument, 5-5-7
  - Discrete Emergency Frequency, 6-5-1
  - Distance Measuring Equipment, 1-1-5, 1-1-10, 5-3-13
  - Distress, 6-3-1
  - Ditching Procedures, 6-3-3
  - DME. *See* Distance Measuring Equipment
  - Doppler Radar, 1-1-16
- E**
- Ear Block, 8-1-4

**[References are to page numbers]**

EFVS. *See* Enhanced Flight Vision Systems  
 ELT. *See* Emergency Locator Transmitters  
 Emergency, 6-1-1  
   Air Piracy, 6-3-6  
   Airborne Aircraft Inspection, 7-5-8  
   Aircraft, Overdue, 6-2-5  
   Body Signals, 6-2-6  
   Ditching Procedures, 6-3-3  
   Explosives Detection, FAA K-9 Team Program, 6-2-3  
   Fuel Dumping, 6-3-7  
   Inflight Monitoring and Reporting, 6-2-3  
   Intercept and Escort, 6-2-1  
   Locator Transmitters, 6-2-2  
   Obtaining Assistance, 6-3-1  
   Pilot Authority, 6-1-1  
   Pilot Responsibility, 6-1-1  
   Request Assistance Immediately, 6-1-1  
   Search and Rescue, 6-2-4  
   Services, 6-2-1  
     Radar Service for VFR Aircraft in Difficulty, 6-2-1  
   Survival Equipment, 6-2-6  
   Transponder Operation, 6-2-1  
   VFR Search and Rescue Protection, 6-2-5  
 Emergency Locator Transmitter, 6-2-2  
 Enhanced Flight Vision Systems, 5-4-57  
 Escort, 6-2-1  
 Explosives, FAA K-9 Detection Team Program, 6-2-3

**F**

FAROS. *See* Final Approach Runway Occupancy Signal (FAROS)  
 Final Approach Runway Occupancy Signal (FAROS), 2-1-9  
 Final Guard, 3-5-1  
 FIS-B. *See* Flight Information Service-Broadcast  
 Fitness, Flight  
   Alcohol, 8-1-1  
   Emotion, 8-1-2  
   Fatigue, 8-1-2  
   Hypoxia, 8-1-3  
   Stress, 8-1-2  
 Flight  
   Aerobatic, 8-1-8  
   Fitness, 8-1-1  
   Illusions, 8-1-5

Over National Forests, 7-4-1  
 Over National Parks, 7-4-1  
 Over National Refuges, 7-4-1  
 Safety, Meteorology, 7-1-1  
 Vision, 8-1-6  
 Flight Check Aircraft, 4-3-26  
 Flight Information Service-Broadcast, 4-5-19  
 Flight Information Services, 7-1-18  
 Flight Inspections Aircraft, 4-3-26  
 Flight Management System, 1-2-4, 5-1-12  
 Flight Plan  
   Change, 5-1-30  
     Proposed Departure Time, 5-1-30  
   Closing  
     DVFR, 5-1-30  
     VFR, 5-1-30  
   Composite, VFR/IFR, 5-1-11  
   DVFR Flights, 5-1-10  
   Explanation of IFR, 5-1-15  
   Explanation of VFR, 5-1-9  
   Form 7233-1, 5-1-9, 5-1-16  
   IFR, Canceling, 5-1-30  
   IFR Flights, Domestic, 5-1-11  
   VFR Flights, 5-1-7  
 Flight Restrictions, Temporary, 3-5-2  
 Flight Service Stations, 4-1-1  
 Flights, Outside the United States, 5-1-28  
 Flying, Mountain, 7-5-3  
 FMS. *See* Flight Management System  
 Forms  
   Bird Strike Incident/Ingestion Report, Appendix 1-1  
   Volcanic Activity Reporting Form, Appendix 2-1  
 Frequency, Instrument Landing System, 1-1-11  
 FSS. *See* Flight Service Stations  
 Fuel Dumping, 6-3-7

**G**

Gate Holding, 4-3-20  
 GBAS. *See* Ground Based Augmentation System  
 Glideslope, Visual Indicators, 2-1-1  
 Global Navigation Satellite System, 1-1-15, 1-1-34, 5-1-12  
 Global Positioning System, 1-1-16

**[References are to page numbers]**

GNSS. *See* Global Navigation Satellite System

GPS. *See* Global Positioning System

Ground Based Augmentation System (GBAS), 1-1-35

Ground Based Augmentation System (GBAS) Landing System (GLS), 1-1-34

Ground Station, Call Signs, 4-2-4

Ground Vehicle Operations, 4-1-6

Gulf of Mexico Grid System, 10-1-6

**H**

Half-Way Signs, 7-5-5

Hand Signals, 4-3-27

Hazard

Antenna Tower, 7-5-1

Bird, 7-4-1

Flight

Obstructions to Flight, 7-5-1

Potential, 7-5-1

VFR in Congested Areas, 7-5-1

Ground Icing Conditions, 7-5-12

Mountain Flying, 7-5-3

Overhead Wires, 7-5-2

Thermal Plumes, 7-5-13

Unmanned Balloons, 7-5-2

Volcanic Ash, 7-5-7

HDTA. *See* High Density Traffic Airports

Helicopter

IFR Operations, 10-1-1

Landing Area Markings, 2-3-19

VFR Operations at Controlled Airports, 4-3-20

Special Operations, 10-2-1

Wake Turbulence, 7-3-6

High Density Traffic Airports, 4-1-18

Hold, For Release, 5-2-4

Holding, 5-3-8

Holding Position Markings, 2-3-1, 2-3-12

for Instrument Landing Systems, 2-3-12

for Taxiway/Taxiway Intersections, 2-3-12

Holding Position Signs, Surface Painted, 2-3-12

Hypoxia, 8-1-3

**I**

Icing Terms, 7-1-41

IFR, 4-4-4

Operations, To High Altitude Destinations, 5-1-27

Procedures, Use When Operating VFR, 5-1-2

IFR

Approaches, 4-1-6

Military Training Routes, 3-5-1

Separation Standards, 4-4-7

ILS. *See* Instrument Landing System

In-Runway Lighting, 2-1-6

Taxiway Centerline Lead-off Lights, 2-1-6

Taxiway Centerline Lead-On Lights, 2-1-6

Touchdown Zone Lighting, 2-1-6

Incident, Aircraft, Reporting, 7-6-1

Inertial Navigation System, 1-1-16

Inertial Reference Unit (IRU), 1-1-16, 5-1-12

Initial Contact, 4-2-1

INS. *See* Internal Navigation System

Instrument Departure Procedures (DP), 5-2-7

Instrument Landing System, 1-1-8

Category, 1-1-12

Compass Locator, 1-1-11

Course, Distortion, 1-1-12

Distance Measuring Equipment, 1-1-10

Frequency, 1-1-11

Glide Path, 1-1-10

Glide Slope, 1-1-10

Critical Area, 1-1-12

Holding Position Markings, 2-3-12

Inoperative Components, 1-1-12

Localizer, 1-1-9

Critical Area, 1-1-12

Locators, Compass, 1-1-8

Marker Beacon, 1-1-10

Minimums, 1-1-12

Instrument Meteorological Conditions (IMC), 5-2-7

Integrated Terminal Weather System, 4-3-12

Intercept, 6-2-1

Interception

Procedures, 5-6-8

Signals, 5-6-11

Interchange Aircraft, 4-2-4

International Flight Plan, IFR, Domestic, International, 5-1-17

**[References are to page numbers]**

International Flight Plan (FAA Form 7233-4)- IFR Flights (For Domestic or International Flights), 5-1-17

Intersection Takeoffs, 4-3-15

IR. *See* IFR Military Training Routes

IRU. *See* Inertial Reference Unit

ITWS. *See* Integrated Terminal Weather System

**K**

K-9 Explosives Detection Team, 6-2-3

**L**

LAHSO. *See* Land and Hold Short Operations

Land and Hold Short Lights, 2-1-6

Land and Hold Short Operations (LAHSO), 4-3-15

Landing

Minimums, 5-4-52

Priority, 5-4-62

Laser Operations, 7-5-10

Law Enforcement Operations

Civil, 5-6-10

Military, 5-6-10

LDA. *See* Localizer-Type Directional Aid

Leased Aircraft, 4-2-4

Lifeguard, 4-2-4

Light Signals, Traffic Control, 4-3-18

Lighting

Aeronautical Light Beacons, 2-2-1

Aids

Airport, 2-1-1

Approach Light Systems, 2-1-1

Control of Lighting Systems, 2-1-11

In-Runway Lighting, 2-1-6

Pilot Control of Airport Lighting, 2-1-11

Runway End Identifier Lights, 2-1-6

Taxiway Lights, 2-1-15

Airport/Heliport Beacons, 2-1-14

Airport, Radio Control, 4-1-6

Code Beacon, 2-2-1

Course, 2-2-1

Navigation, 2-2-1

Obstruction, 2-2-1

Line Up and Wait, 5-2-2

LLWAS. *See* Low Level Wind Shear Alert System

Local Airport Advisory (LAA), 3-5-1, 4-1-4

Local Flow Traffic Management Program, 5-4-3

Localizer-Type Directional Aid, 1-1-9

Locator, Compass, 1-1-11

Long Range Navigation, 1-1-16

LORAN. *See* Long Range Navigation

Low Approach, 4-3-18

Low Level Wind Shear Alert System (LLWAS), 4-3-12, 7-1-48

Low Level Wind Shear/Microburst Detection Systems, 4-3-12

LUAW. *See* Line Up and Wait

**M**

MAYDAY, 6-3-1

Medical

Carbon Monoxide Poisoning, 8-1-5

Decompression Sickness, 8-1-4

Facts, Pilots, 8-1-1

Flight, Ear Block, 8-1-4

Illness, 8-1-1

Medication, 8-1-1

Sinus Block, 8-1-4

Meteorology, 7-1-1

ATC InFlight Weather Avoidance, 7-1-34

Automated Surface Observing System, 7-1-25

Categorical Outlooks, 7-1-14

Clear Air Turbulence, 7-1-44

Cloud Heights, Reporting, 7-1-38

Drizzle, Intensity, 7-1-39

FAA Weather Services, 7-1-2

ICAO, Weather Formats, 7-1-60

Icing, Airframe, 7-1-40

Inflight Aviation Weather Advisories, 7-1-8

Inflight Weather Broadcasts, 7-1-15

Microbursts, 7-1-44

National Weather Service, Aviation Weather Service, 7-1-1

Pilot Weather Reports, 7-1-39

Precipitation, Intensity, 7-1-38

Preflight Briefing, 7-1-5

Runway Visual Range, 7-1-36

Telephone Information Briefing Service, 7-1-15

Thunderstorms, 7-1-55

**[References are to page numbers]**

Flying, 7-1-56  
 Transcribed Weather Broadcast, 7-1-15  
 Turbulence, 7-1-43  
 Visibility, Reporting, 7-1-38  
 Weather, Radar Services, 7-1-30  
 Weather Observing Programs, 7-1-22  
 Wind Shear, 7-1-44  
 Military NOTAMs, 5-1-3  
 Military Operations Areas, 3-4-2  
 Military Training Routes, 3-5-1  
     IFR, 3-5-1  
     VFR, 3-5-1  
 Minimum, Fuel Advisory, 5-5-7  
 Minimum Safe Altitudes, 5-4-8  
 Minimum Turning Altitude (MTA), 5-3-8  
 Minimum Vectoring Altitudes, 5-4-16  
 Minimums  
     Approach, 5-4-52  
     Instrument Landing Systems, 1-1-12  
     Landing, 5-4-52  
 Missed Approach, 5-4-55  
 MOA. *See* Military Operations Areas  
 Mode C, 4-1-16  
 Mountain Flying, 7-5-3  
 Mountain Wave, 7-5-4  
 Mountainous Areas, 5-6-13  
 MSA. *See* Minimum Safe Altitudes  
 MTA. *See* Minimum Turning Altitude (MTA)  
 Multicom, 4-1-6  
 MVA. *See* Minimum Vectoring Altitudes

**N**

National Forests, 7-4-1  
 National Geospatial-Intelligence Agency (NGA),  
     5-4-7  
 National Parks, 7-4-1  
 National Refuges, 7-4-1  
 National Security, 5-6-1  
     ADIZ, 5-6-1  
     ADIZ Requirements, 5-6-2

Civil Aircraft Operations, 5-6-3  
 Defense Area, 5-6-1  
 Requirements, 5-6-1  
 Territorial Airspace, 5-6-1  
 National Security Areas, 3-4-2  
 NAVAID  
     Identifier Removal During Maintenance, 1-1-15  
     Maintenance, 1-1-15  
     Performance, User Report, 1-1-15  
     Service Volumes, 1-1-5  
     with Voice, 1-1-15  
 Navigation, Aids, 1-1-1  
     Nondirectional Radio Beacon, 1-1-1  
     Radio, VHF Omni-directional Range, 1-1-1  
 Navigation Reference System (NRS), 5-1-15  
 Navigation Specifications (Nav Specs), 1-2-4  
 Navigational  
     Aids, Radio  
         Distance Measuring Equipment, 1-1-5  
         Doppler Radar, 1-1-16  
         Identifier Removal During Maintenance, 1-1-15  
         Instrument Landing System, 1-1-8  
         Localizer-Type Directional Aid, 1-1-9  
         Long Range Navigation, 1-1-16  
         Navaid Service Volumes, 1-1-5  
         NAVAIDs with Voice, 1-1-15  
         Performance, User Report, 1-1-15  
         Simplified Directional Facility, 1-1-13  
         Tactical Air Navigation, 1-1-4  
         VHF Omni-directional Range/Tactical Air  
         Navigation, 1-1-4  
         Inertial Navigation System, 1-1-16  
     NDB. *See* Nondirectional Radio Beacon  
     Near Midair Collision, 7-6-2  
     NGA. *See* National Geospatial-Intelligence Agency  
     NMAC. *See* Near Midair Collision  
     Nondirectional Radio Beacon, 1-1-1  
     Nonmovement Area Boundary Markings, 2-3-18  
     NOTAM. *See* Notice to Airmen  
     Notice to Airmen, 5-1-2  
         FDC NOTAM, 5-1-3  
         NOTAM Contractions, 5-1-6  
         NOTAM D, 5-1-3  
     Notice to Airmen System, 5-1-2  
     Notices to Airmen Publication, NTAP, 5-1-3

**O**

Obstacle Departure Procedures, 5-2-7



**[References are to page numbers]**

Obstruction Alert, 4-1-11  
 Operation Take-off, 4-1-2  
 Operational Information System (OIS), 5-1-10  
 Option Approach, 4-3-25

**P**

P-static, 7-5-9  
 PAN-PAN, 6-3-1  
 PAPI. *See* Precision Approach Path Indicator  
 PAR. *See* Precision Approach; Precision Approach Radar  
 Parachute Jumps, 3-2-2, 3-5-5  
 Performance-Based Navigation (PBN), 1-2-1  
 Phonetic Alphabet, 4-2-5  
 Pilot  
   Authority, 6-1-1  
   Responsibility, 4-1-14, 4-4-1, 4-4-4, 5-4-61, 5-5-1, 6-1-1, 7-3-6  
 Pilot Control of Airport Lighting, 2-1-11  
 Pilot Visits to Air Traffic Facilities, 4-1-1  
 Pilot Weather Reports, 7-1-39  
 Piracy, Air, Emergency, 6-3-6  
 PIREPs. *See* Pilot Weather Reports  
 Pointer NOTAMs, 5-1-3  
 Position Reporting, 5-3-3  
 Pre-Departure Clearance Procedures, 5-2-1  
 Precipitation Static, 7-5-9  
 Precision Approach, 5-4-34  
 Precision Approach Path Indicator, 2-1-4  
 Precision Approach Radar, 4-5-7  
 Precision Approach Systems, 1-1-34  
 Preflight, Preparation, 5-1-1  
 Priority, Landing, 5-4-62  
 Procedure Turn, 5-4-28  
   Limitations, 5-4-31  
 Procedures  
   Arrival, 5-4-1  
   En Route, 5-3-1  
   Instrument Approach, 5-4-26  
   Interception, 5-6-8

Prohibited Areas, 3-4-1  
 Publications, Aeronautical, 9-1-1  
 Pulsating Visual Approach Slope Indicator, 2-1-5

**R**

Radar  
   Air Traffic Control Radar Beacon System, 4-5-2  
   Airport Route Surveillance Radar, 4-5-7  
   Airport Surveillance Radar, 4-5-7  
   Approach Control, 5-4-3  
   Approaches, 5-4-34  
   Capabilities, 4-5-1  
   Doppler, 1-1-16  
   Limitations, 4-5-1  
   Monitoring of Instrument Approaches, 5-4-35  
   Precision Approach, 4-5-7  
   Precision Approach Radar, 4-5-7  
   Surveillance, 4-5-7  
   Vector, 5-5-3  
 Radar Assistance to VFR Aircraft, 4-1-11  
 Radar Beacon, Phraseology, 4-1-17  
 Radar Sequencing and Separation, VFR Aircraft, TRSA, 4-1-13  
 Radar Traffic Information Service, 4-1-9  
 Radio, Communications, 4-2-1  
   Altitudes, 4-2-6  
   Contact Procedures, 4-2-1  
   Directions, 4-2-6  
   Inoperative Transmitter, 4-2-7  
   Phonetic Alphabet, 4-2-5  
   Receiver Inoperative, 4-2-7  
   Speeds, 4-2-6  
   Student Pilots, 4-2-4  
   Technique, 4-2-1  
   Time, 4-2-6  
   Transmitter and Receiver Inoperative, 4-2-7  
   VFR Flights, 4-2-8  
 RCLS. *See* Runway Centerline Lighting  
 Receiver, VOR, Check, 1-1-3  
 REIL. *See* Runway End Identifier Lights  
 REL. *See* Runway Entrance Lights  
 Release Time, 5-2-4  
 Remote Airport Advisory (RAA), 3-5-1  
 Remote Airport Information Service (RAIS), 3-5-1, 4-1-4  
 Required Navigation Performance (RNP), 5-4-22

**[References are to page numbers]**

Required Navigation Performance (RNP) Operations,  
5-1-31, 5-5-7

Rescue Coordination Center

Air Force, 6-2-5

Alaska, 6-2-5

Coast Guard, 6-2-4

Joint Rescue, Hawaii, 6-2-5

Reservations, Airport, 4-1-18

Responsibility

Controller, 5-3-8, 5-4-61, 5-5-1

Pilot, 4-1-14, 4-4-1, 4-4-4, 5-4-61, 5-5-1, 6-1-1,  
7-3-6

Restricted Areas, 3-4-1

Restrictions

Departure, 5-2-4

Flight, Temporary, 3-5-2

RIL. *See* Runway Intersection Lights (RIL)

RNAV. *See* Area Navigation

Route

Coded Departure Route, 4-4-3

Course Changes, 5-3-7

Route System, 5-3-5

Runway

Aiming Point Markings, 2-3-2

Centerline Markings, 2-3-2

Closed

Lighting, 2-3-18

Marking, 2-3-18

Condition Reports, 4-3-13

Demarcation Bar, 2-3-4

Designators, 2-3-2

Holding Position Markings, 2-3-12

Markings, 2-3-1

Separation, 4-4-10

Shoulder Markings, 2-3-3

Side Stripe Markings, 2-3-3

Signs, Distance Remaining, 2-3-29

Threshold Bar, 2-3-4

Threshold Markings, 2-3-3

Touchdown Zone Markers, 2-3-2

Runway

Edge Light Systems, 2-1-6

End Identifier Lights, 2-1-6

Entrance Lights, 2-1-7

Centerline Lighting System, 2-1-6

Status Light (RWSL) System, 2-1-7, 2-1-8

Runway Intersection Lights (RIL), 2-1-9

RWSL System, Runway Status Light (RWSL) System.  
*See* Runway Status Light (RWSL) System

Runway, Visual Range, 7-1-36

Runways, Use, 4-3-7

RVR. *See* Runway Visual Range

**S**

Safety

Alert, 5-5-3

Alerts, 3-2-1

Aircraft Conflict, 3-2-1

Mode C Intruder, 3-2-1

Terrain/Obstruction, 3-2-1

Aviation, Reporting, 7-6-1

Seaplane, 7-5-6

Safety Alert, 4-1-10

Aircraft Conflict Alert, 4-1-11

Obstruction Alert, 4-1-11

Terrain Alert, 4-1-11

SAR. *See* Search and Rescue

SCAT-I DGPS. *See* Special Category I Differential  
GPS

Scuba Diving, Decompression Sickness, 8-1-4

SDF. *See* Simplified Directional Facility

Seaplane, Safety, 7-5-6

Search and Rescue, 6-2-1, 6-2-4

Security Identification Display Area, 2-3-31

See and Avoid, 5-5-4

Separation

IFR, Standards, 4-4-7

Runway, 4-4-10

Visual, 4-4-10, 5-5-6

Wake Turbulence, 7-3-7

Sequenced flashing lights (SFL), 2-1-11

SFL. *See* Sequenced flashing lights

SIDA. *See* Security Identifications Display Area

Side-Step Maneuver, 5-4-52

Signs

Airport, 2-3-1

Half-Way, 7-5-5

Simplified Directional Facility, 1-1-13

Sinus Block, 8-1-4

Special Category I Differential GPS (SCAT-I DGPS),  
1-1-35

**[References are to page numbers]**

Special Instrument Approach Procedures, 1-1-34,  
5-4-27

Special Traffic Management Programs, 4-1-18

Special Use Airspace, 3-4-1

Alert Areas, 3-4-2

Controlled Firing Areas, 3-4-2

Military Operations Areas, 3-4-2

Prohibited Areas, 3-4-1

Restricted Areas, 3-4-1

Warning Areas, 3-4-1

Special Use Airspace (SUA) NOTAMs, 5-1-3

Special VFR Clearances, 4-4-3

Speed, Adjustments, 4-4-7, 5-5-4

Spoofing, 1-2-8

Standard Instrument Departures, 5-2-7

Standard Terminal Arrival, 5-4-1

STAR. *See* Standard Terminal Arrival

Surface Painted Holding Position Signs, 2-3-12

Surveillance Approach, 5-4-34

Surveillance Radar, 4-5-7

Surveillance Systems, 4-5-1

**T**

TACAN. *See* Tactical Air Navigation

Tactical Air Navigation, 1-1-4

TAF. *See* Aerodrome Forecast

Takeoff Hold Lights (THL), 2-1-8

Takeoffs, Intersection, 4-3-15

Taxi

Clearance, 5-2-2

During Low Visibility, 4-3-23

Taxiway

Centerline Markings, 2-3-7

Closed

Lighting, 2-3-18

Marking, 2-3-18

Edge Markings, 2-3-7

Geographic Position Markings, 2-3-10

Holding Position Markings, 2-3-12

Markings, 2-3-1, 2-3-7

Shoulder Markings, 2-3-7

Surface Painted Direction Signs, 2-3-10

Surface Painted Location Signs, 2-3-10

Taxiway Centerline Lead-Off Lights, 2-1-6

Taxiway Lights, 2-1-15

Centerline, 2-1-15

Clearance Bar, 2-1-15

Edge, 2-1-15

Runway Guard, 2-1-15

Stop Bar, 2-1-15

TCAS. *See* Traffic Alert and Collision Avoidance System

TDWR. *See* Terminal Doppler Weather Radar

TDZL. *See* Touchdown Zone Lights

TEC. *See* Tower En Route Control

Telephone Information Briefing Service, 7-1-15

Temporary Flight Restrictions, 3-5-2

Terminal Arrival Area (TAA), 5-4-8

Terminal Doppler Weather Radar (TDWR), 4-3-12,  
7-1-49

Terminal Radar Service Areas, 3-5-9

Terminal Radar Services for VFR Aircraft, 4-1-12

Terminal Weather Information For Pilots System  
(TWIP), 7-1-54

Terrain Alert, 4-1-11

THL. *See* Takeoff Hold Lights

TIBS. *See* Telephone Information Briefing Service

Time

Clearance Void, 5-2-4

Release, 5-2-4

TIS. *See* Traffic Information Service

TIS-B. *See* Traffic Information Service-Broadcast

TLS. *See* Transponder Landing System

Touchdown Zone Lights (TDZL), 2-1-6

Tower, Antenna, 7-5-1

Tower En Route Control, 4-1-14

Traffic

Advisories, 5-5-5

Local Flow Traffic Management Program, 5-4-3

Traffic Advisory Practices, Airports Without Operating  
Control Towers, 4-1-2

Traffic Alert and Collision Avoidance System, 4-4-11

Traffic Control Light Signals, 4-3-18

Traffic Information Service, 4-5-8

Traffic Information Service (TIS), 4-4-12

**[References are to page numbers]**

Traffic Information Service–Broadcast , 4–5–18  
 Traffic Patterns, 4–3–2  
 Transcribed Weather Broadcast, 7–1–15  
 Transponder Landing System (TLS), 1–1–35  
 Transponder Operation, 4–1–15  
   Automatic Altitude Reporting, 4–1–16  
   Code Changes, 4–1–16  
   Emergency, 6–2–1  
   Ident Feature, 4–1–16  
   Mode C, 4–1–16  
   Under Visual Flight Rules, 4–1–17  
   VFR, 4–1–17  
 Tri–Color Visual Approach Slope Indicator, 2–1–4  
 TRSA. *See* Terminal Radar Service Areas  
 Turbulence, Wake, 7–3–1  
   Air Traffic Separation, 7–3–7  
   Helicopters, 7–3–6  
   Pilot Responsibility, 7–3–6  
   Vortex Behavior, 7–3–2  
   Vortex Generation, 7–3–1  
   Vortex Strength, 7–3–1  
 TWEB. *See* Transcribed Weather Broadcast  
 TWIP. *See* Terminal Weather Information For Pilots System

**U**

Ultralight Vehicles, 3–2–2  
 Unicom, 4–1–6  
 Unidentified Flying Object (UFO) Reports, 7–6–3  
 Unmanned Aircraft, 7–5–2  
 Urgency, 6–3–1

**V**

VASI. *See* Visual Approach Slope Indicator  
 VDP. *See* Visual Descent Points  
 Vector, Radar, 5–5–3  
 Vehicle Roadway Markings, 2–3–16  
 Vertical Navigation, 5–1–12  
 VFR Corridors, 3–5–7  
 VFR Flights in Terminal Areas, 4–3–20

VFR Flyways, 3–5–5  
 VFR Military Training Routes, 3–5–1  
 VFR Transition Routes, 3–5–7  
 VFR–on–Top, 5–5–6  
 VHF Omni–directional Range, 1–1–1  
   Minimum Operational Network (MON), 1–1–2  
 VHF Omni–directional Range/Tactical Air Navigation, 1–1–4  
 Visual  
   Approach, 5–4–60, 5–5–5  
   Clearing Procedures, 4–4–11  
   Glideslope Indicators, 2–1–1  
   Separation, 4–4–10, 5–5–6  
 Visual Approach Slope Indicator, 2–1–1  
 Visual Climb Over Airport, 5–2–9  
 Visual Descent Point, 5–4–18  
 Visual Meteorological Conditions (VMC), 5–2–7  
 VNAV. *See* Vertical Navigation  
 VOCA. *See* Visual Climb Over Airport  
 Void Times, Clearance, 5–2–4  
 Volcanic, Ash, 7–5–7  
 Volcanic Activity Reporting, Forms. *See* Appendix 2  
 VOR*See also* VHF Omni–directional Range Receiver Check, 1–1–3  
 VOR Receiver Checkpoint Markings, 2–3–16  
 VORTAC. *See* VHF Omni–directional Range/Tactical Air Navigation  
 VR. *See* VFR Military Training Routes

**W**

Waivers, 4–1–20  
 Wake, Turbulence, 7–3–1  
 Warning Areas, 3–4–1  
 Weather  
   Deviations in Oceanic Controlled Airspace, 7–1–35  
   ICAO, Weather Formats, 7–1–60  
 Weather System Processor (WSP), 4–1–20, 4–3–12, 7–1–50  
 WSP. *See* Weather System Processor

U.S. Department  
Of Transportation

**Federal Aviation  
Administration**

800 Independence Ave., S.W.  
Washington, D.C. 20591

**FORWARDING SERVICE REQUESTED**

Official Business  
Penalty for Private Use \$300

