



U.S. Department
of Transportation

**Federal Aviation
Administration**

AERONAUTICAL INFORMATION MANUAL

***Change 1
August 7, 2025***

**DO NOT DESTROY
BASIC DATED
February 20, 2025**

Aeronautical Information Manual

Explanation of Changes

Effective: August 7, 2025

**a. 2-3-10. DIRECTION SIGNS
2-3-11. DESTINATION SIGNS**

This change revises paragraph 2-3-11, Destination Signs. This change coincides with an update of AC 150/5340-18 thus establishing an authorized source that supports FAA adding standardized chart labels for parking areas to airport diagrams. The rewrite of paragraph 2-3-11 separates content for inbound destination signs from content for outbound destination. This DCP also revises and recaptions FIG 2-3-38 to depict more examples of inbound destination sign legends, and recaptions FIG 2-3-39 to reflect an outbound destination sign example, and moves them to paragraph 2-3-11.

b. 4-3-3. AIRPORTS WITH AN OPERATING CONTROL TOWER

This change realigns the AIM definition and graphic depiction of upwind leg at towered airports with current ATC use and expectation. ATC usage of upwind leg is an extension of departure. The AIM's current definition of upwind has led to confusion among pilots and controllers. The new proposed graphic depiction of upwind in FIG 4-3-1 as well as the definition in 4-3-2c aligns with common usage at towered airports. Additionally, the order of traffic pattern component definitions was reconfigured to align their definitions in a more logical sequence beginning with departure.

c. 5-2-9. INSTRUMENT DEPARTURE PROCEDURES (DP) – OBSTACLE DEPARTURE PROCEDURES (ODP), STANDARD INSTRUMENT DEPARTURES (SID), AND DIVERSE VECTOR AREAS (DVA)

This change incorporates changes to instrument departure criteria for minimums and obstacle notes. Language is added to identify the changes to departure charts and pilot/controller responsibilities.

d. 5-4-5. INSTRUMENT APPROACH PROCEDURE (IAP) CHARTS

This change updates information regarding instrument approach altimeter setting sources to include references to airport identifiers.

**e. 5-4-6. APPROACH CLEARANCE
5-4-7. INSTRUMENT APPROACH PROCEDURES**

This change realigns cleared approach procedures, which was inadvertently added to paragraph 5-4-7, to paragraph 5-4-6. It also addresses arrival to approach connectivity procedures to assure pilots recognize and implement the connection of arrivals (STARs) with an instrument approach procedure at the initial approach fix where they exist.

f. 5-4-13. SIMULTANEOUS APPROACHES TO PARALLEL RUNWAYS

This change addresses curved and angled paths that may be used to intercept the final approach course and emphasizes the importance of adhering to the approach procedure. Also, a correction is being made to the figure that corresponds to the textual description.

g. 5-4-22. USE OF ENHANCED FLIGHT VISION SYSTEMS (EFVS) ON INSTRUMENT APPROACHES

This updates the EFVS section of the AIM to note this change, as well as, to call attention to the AFS 410 EFVS website where each LED ALS is noted by runway end.

h. 7-1-1. NATIONAL WEATHER SERVICE AVIATION WEATHER SERVICE PROGRAM
7-1-3. USE OF AVIATION WEATHER PRODUCTS
7-1-9. FLIGHT INFORMATION SERVICES (FIS)

This change removes references to Advisory Circular 00-45, Aviation Weather Services, and replaces with FAA-H-8083-28, Aviation Weather Handbook. Making these changes will correct the AIM and bring it in alignment with other FAA documents and publications.

i. 7-1-7. CATEGORICAL OUTLOOKS

This change amends the paragraph to include reported weather data as to how the categorical ceiling and visibility terms are used.

j. 7-2-3. ALTIMETER ERRORS

This change assigns the waiver authority for 14 CFR § 91.144 to Air Traffic Organization (ATO) Service Center Directors in their areas of jurisdiction, since AFS waiver procedures were incompatible with the short life of a high barometric pressure NOTAM.

k. 7-6-18. AUTOMATIC LANDING OPERATIONS

This change adds guidance advising operators conducting automatic landing operations to first determine that the flight control guidance system being used is compatible with the instrument approach procedure and runway being used.

l. 9-1-3. SAFETY ALERTS, CHARTING NOTICES AND DATA PRODUCT NOTICES

This change adds descriptions of FAA published Safety Alerts (SA), Charting Notices (CN), and Data Product Notices (DPN), and provides a hyperlink to the FAA website containing these notices.

m. Editorial Changes

Editorial changes include relocating some subparagraphs in paragraph 5-3-1 to match the corresponding formatting in the Aeronautical Information Publication (AIP); correcting the title of paragraph 7-6-1 to Accident Causal Factors; a universal change replacing all prior references to the term Gulf of Mexico with the term Gulf of America in accordance with Executive Order 14172; and a universal change updating the term Notice to Air Missions (NOTAM) to Notice to Airmen (NOTAM).

n. Entire Publication

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

AIM Change 1

Page Control Chart

August 7, 2025

REMOVE PAGES	DATED	INSERT PAGES	DATED
Checklist of Pages CK-1 through CK-8	2/20/25	Checklist of Pages CK-1 through CK-8	8/7/25
Table of Contents i through xiii	2/20/25	Table of Contents i through xiii	8/7/25
1-1-5	2/20/25	1-1-5	2/20/25
1-1-6	2/20/25	1-1-6	8/7/25
1-1-11	2/20/25	1-1-11	8/7/25
1-1-12	2/20/25	1-1-12	2/20/25
1-1-21	2/20/25	1-1-21	2/20/25
1-1-22	2/20/25	1-1-22	8/7/25
1-1-25	2/20/25	1-1-25	2/20/25
1-1-26 through 1-1-33	2/20/25	1-1-26 through 1-1-33	8/7/25
1-1-34 and 1-1-35	2/20/25	1-1-34 and 1-1-35	2/20/25
1-1-36	2/20/25	1-1-36	8/7/25
1-2-9	2/20/25	1-2-9	8/7/25
1-2-10	2/20/25	1-2-10	2/20/25
1-2-11	2/20/25	1-2-11	8/7/25
1-2-12	2/20/25	1-2-12	2/20/25
2-1-1	2/20/25	2-1-1	8/7/25
2-1-2	2/20/25	2-1-2	2/20/25
2-3-31	2/20/25	2-3-31	2/20/25
2-3-32 through 2-3-36	2/20/25	2-3-32 through 2-3-37	8/7/25
3-2-9	2/20/25	3-2-9	2/20/25
3-2-10	2/20/25	3-2-10	8/7/25
3-5-11	2/20/25	3-5-11	8/7/25
4-1-1	2/20/25	4-1-1	8/7/25
4-1-2	2/20/25	4-1-2	2/20/25
4-1-11	2/20/25	4-1-11	8/7/25
4-1-12	2/20/25	4-1-12	2/20/25
4-1-19	2/20/25	4-1-19	2/20/25
4-1-20	2/20/25	4-1-20	8/7/25
4-3-1 through 4-3-3	2/20/25	4-3-1 through 4-3-3	8/7/25
4-3-4	2/20/25	4-3-4	2/20/25
4-3-13	2/20/25	4-3-13	2/20/25
4-3-14	2/20/25	4-3-14	8/7/25
4-5-3	2/20/25	4-5-3	2/20/25
4-5-4	2/20/25	4-5-4	8/7/25
4-5-17	2/20/25	4-5-17	2/20/25
4-5-18	2/20/25	4-5-18	8/7/25
4-6-1	2/20/25	4-6-1	8/7/25
4-6-2	2/20/25	4-6-2	2/20/25
4-7-1 and 4-7-2	2/20/25	4-7-1 and 4-7-2	8/7/25

5-1-1	2/20/25	5-1-1	8/7/25
5-1-2	2/20/25	5-1-2	2/20/25
5-1-3	2/20/25	5-1-3	8/7/25
5-1-4	2/20/25	5-1-4	2/20/25
5-2-7	2/20/25	5-2-7	2/20/25
5-2-8 through 5-2-15	2/20/25	5-2-8 through 5-2-16	8/7/25
5-3-1 and 5-3-2	2/20/25	5-3-1 and 5-3-2	8/7/25
5-3-11	2/20/25	5-3-11	2/20/25
5-3-12 through 5-3-21	2/20/25	5-3-12 through 5-3-21	8/7/25
5-3-22	2/20/25	5-3-22	2/20/25
5-4-7 through 5-4-9	2/20/25	5-4-7 through 5-4-9	8/7/25
5-4-10	2/20/25	5-4-10	2/20/25
5-4-27	2/20/25	5-4-27	2/20/25
5-4-28 through 5-4-34	2/20/25	5-4-28 through 5-4-34	8/7/25
5-4-39	2/20/25	5-4-39	2/20/25
5-4-40 and 5-4-41	2/20/25	5-4-40 and 5-4-41	8/7/25
5-4-42	2/20/25	5-4-42	2/20/25
5-4-63	2/20/25	5-4-63	2/20/25
5-4-64 through 5-4-68	2/20/25	5-4-64 through 5-4-68	8/7/25
5-5-1	2/20/25	5-5-1	8/7/25
5-5-2	2/20/25	5-5-2	2/20/25
7-1-1	2/20/25	7-1-1	2/20/25
7-1-2	2/20/25	7-1-2	8/7/25
7-1-5	2/20/25	7-1-5	2/20/25
7-1-6	2/20/25	7-1-6	8/7/25
7-1-9	2/20/25	7-1-9	2/20/25
7-1-10 and 7-1-11	2/20/25	7-1-10 and 7-1-11	8/7/25
7-1-12	2/20/25	7-1-12	2/20/25
7-1-15	2/20/25	7-1-15	2/20/25
7-1-16	2/20/25	7-1-16	8/7/25
7-1-21	2/20/25	7-1-21	2/20/25
7-1-22	2/20/25	7-1-22	8/7/25
7-1-25	2/20/25	7-1-25	8/7/25
7-1-26	2/20/25	7-1-26	2/20/25
7-2-3	2/20/25	7-2-3	8/7/25
7-6-1	2/20/25	7-6-1	8/7/25
7-6-2	2/20/25	7-6-2	2/20/25
7-6-3	2/20/25	7-6-3	8/7/25
7-6-4	2/20/25	7-6-4	2/20/25
7-6-13	2/20/25	7-6-13	8/7/25
7-6-14	2/20/25	7-6-14	2/20/25
7-6-17	2/20/25	7-6-17	2/20/25
7-6-18	2/20/25	7-6-18	8/7/25
9-1-1 through 9-1-14	2/20/25	9-1-1 through 9-1-15	8/7/25
10-1-5 through 10-1-7	2/20/25	10-1-5 through 10-1-7	8/7/25

10-1-8	2/20/25	10-1-8	2/20/25
10-2-1 through 10-2-3	2/20/25	10-2-1 through 10-2-3	8/7/25
10-2-4	2/20/25	10-2-4	2/20/25
11-8-3	2/20/25	11-8-3	2/20/25
11-8-4	2/20/25	11-8-4	8/7/25
Appendix 4-11 and Appendix 4-12	2/20/25	Appendix 4-11 and Appendix 4-12	8/7/25
PCG-1	2/20/25	PCG-1 and PCG-2	8/7/25
PCG A-7 through PCG A-19	2/20/25	PCG A-7 through PCG A-19	8/7/25
PCG A-20	2/20/25	PCG A-20	2/20/25
PCG F-5	2/20/25	PCG F-5	8/7/25
PCG F-6	2/20/25	PCG F-6	2/20/25
PCG H-1	2/20/25	PCG H-1	8/7/25
PCG H-2	2/20/25	PCG H-2	2/20/25
PCG L-1 through PCG L-4	2/20/25	PCG L-1 through PCG L-4	8/7/25
PCG N-1 through PCG N-4	2/20/25	PCG N-1 through PCG N-4	8/7/25
PCG P-3 through PCG P-6	2/20/25	PCG P-3 through PCG P-6	8/7/25
PCG R-7	2/20/25	PCG R-7	2/20/25
PCG R-8	2/20/25	PCG R-8	8/7/25
PCG S-1	2/20/25	PCG S-1	2/20/25
PCG S-2 through PCG S-12	2/20/25	PCG S-2 through PCG S-12	8/7/25
PCG T-9 through PCG T-12	2/20/25	PCG T-9 through PCG T-12	8/7/25
PCG V-1 through PCG V-5	2/20/25	PCG V-1 through PCG V-5	8/7/25
PCG W-1	2/20/25	PCG W-1	8/7/25
PCG W-2	2/20/25	PCG W-2	2/20/25
Index I-1 through Index 1-24	2/20/25	Index I-1 through I-13	8/7/25

Checklist of Pages

PAGE	DATE
Cover	8/7/25
Record of Changes	N/A
E of Chg-1	8/7/25
E of Chg-2	8/7/25
Checklist of Pages	
CK-1	8/7/25
CK-2	8/7/25
CK-3	8/7/25
CK-4	8/7/25
CK-5	8/7/25
CK-6	8/7/25
CK-7	8/7/25
CK-8	8/7/25
Subscription Info	2/20/25
Comments/Corr	2/20/25
Basic Flight Info	2/20/25
Publication Policy	2/20/25
Reg & Advis Cir	2/20/25
Table of Contents	
i	8/7/25
ii	8/7/25
iii	8/7/25
iv	8/7/25
v	8/7/25
vi	8/7/25
vii	8/7/25
viii	8/7/25
ix	8/7/25
x	8/7/25
xi	8/7/25
xii	8/7/25
xiii	8/7/25
Chapter 1. Air Navigation	
Section 1. Navigation Aids	
1-1-1	2/20/25
1-1-2	2/20/25
1-1-3	2/20/25
1-1-4	2/20/25
1-1-5	2/20/25
1-1-6	2/20/25
1-1-7	2/20/25
1-1-8	2/20/25
1-1-9	2/20/25
1-1-10	2/20/25

PAGE	DATE
1-1-11	8/7/25
1-1-12	2/20/25
1-1-13	2/20/25
1-1-14	2/20/25
1-1-15	2/20/25
1-1-16	2/20/25
1-1-17	2/20/25
1-1-18	2/20/25
1-1-19	2/20/25
1-1-20	2/20/25
1-1-21	2/20/25
1-1-22	8/7/25
1-1-23	2/20/25
1-1-24	2/20/25
1-1-25	2/20/25
1-1-26	8/7/25
1-1-27	8/7/25
1-1-28	8/7/25
1-1-29	8/7/25
1-1-30	8/7/25
1-1-31	8/7/25
1-1-32	8/7/25
1-1-33	8/7/25
1-1-34	2/20/25
1-1-35	2/20/25
1-1-36	2/20/25
1-1-37	2/20/25
1-1-38	2/20/25
1-1-39	2/20/25
1-1-40	2/20/25
1-1-41	2/20/25
Section 2. Performance-Based Navigation (PBN) and Area Navigation (RNAV)	
1-2-1	2/20/25
1-2-2	2/20/25
1-2-3	2/20/25
1-2-4	2/20/25
1-2-5	2/20/25
1-2-6	2/20/25
1-2-7	2/20/25
1-2-8	2/20/25
1-2-9	8/7/25
1-2-10	2/20/25
1-2-11	8/7/25
1-2-12	2/20/25

PAGE	DATE
Chapter 2. Aeronautical Lighting and Other Airport Visual Aids	
Section 1. Airport Lighting Aids	
2-1-1	8/7/25
2-1-2	2/20/25
2-1-3	2/20/25
2-1-4	2/20/25
2-1-5	2/20/25
2-1-6	2/20/25
2-1-7	2/20/25
2-1-8	2/20/25
2-1-9	2/20/25
2-1-10	2/20/25
2-1-11	2/20/25
2-1-12	2/20/25
2-1-13	2/20/25
2-1-14	2/20/25
Section 2. Air Navigation and Obstruction Lighting	
2-2-1	2/20/25
2-2-2	2/20/25
Section 3. Airport Marking Aids and Signs	
2-3-1	2/20/25
2-3-2	2/20/25
2-3-3	2/20/25
2-3-4	2/20/25
2-3-5	2/20/25
2-3-6	2/20/25
2-3-7	2/20/25
2-3-8	2/20/25
2-3-9	2/20/25
2-3-10	2/20/25
2-3-11	2/20/25
2-3-12	2/20/25
2-3-13	2/20/25
2-3-14	2/20/25
2-3-15	2/20/25
2-3-16	2/20/25
2-3-17	2/20/25
2-3-18	2/20/25
2-3-19	2/20/25
2-3-20	2/20/25
2-3-21	2/20/25
2-3-22	2/20/25

Checklist of Pages

PAGE	DATE
2-3-23	2/20/25
2-3-24	2/20/25
2-3-25	2/20/25
2-3-26	2/20/25
2-3-27	2/20/25
2-3-28	2/20/25
2-3-29	2/20/25
2-3-30	2/20/25
2-3-31	2/20/25
2-3-32	8/7/25
2-3-33	8/7/25
2-3-34	8/7/25
2-3-35	8/7/25
2-3-36	8/7/25
2-3-37	8/7/25
Chapter 3. Airspace	
Section 1. General	
3-1-1	2/20/25
3-1-2	2/20/25
3-1-3	2/20/25
Section 2. Controlled Airspace	
3-2-1	2/20/25
3-2-2	2/20/25
3-2-3	2/20/25
3-2-4	2/20/25
3-2-5	2/20/25
3-2-6	2/20/25
3-2-7	2/20/25
3-2-8	2/20/25
3-2-9	2/20/25
3-2-10	8/7/25
3-2-11	2/20/25
Section 3. Class G Airspace	
3-3-1	2/20/25
Section 4. Special Use Airspace	
3-4-1	2/20/25
3-4-2	2/20/25
3-4-3	2/20/25
Section 5. Other Airspace Areas	
3-5-1	2/20/25
3-5-2	2/20/25
3-5-3	2/20/25
3-5-4	2/20/25
3-5-5	2/20/25

PAGE	DATE
3-5-6	2/20/25
3-5-7	2/20/25
3-5-8	2/20/25
3-5-9	2/20/25
3-5-10	2/20/25
3-5-11	8/7/25
Chapter 4. Air Traffic Control	
Section 1. Services Available to Pilots	
4-1-1	8/7/25
4-1-2	2/20/25
4-1-3	2/20/25
4-1-4	2/20/25
4-1-5	2/20/25
4-1-6	2/20/25
4-1-7	2/20/25
4-1-8	2/20/25
4-1-9	2/20/25
4-1-10	2/20/25
4-1-11	8/7/25
4-1-12	2/20/25
4-1-13	2/20/25
4-1-14	2/20/25
4-1-15	2/20/25
4-1-16	2/20/25
4-1-17	2/20/25
4-1-18	2/20/25
4-1-19	2/20/25
4-1-20	8/7/25
4-1-21	2/20/25
4-1-22	2/20/25
4-1-23	2/20/25
Section 2. Radio Communications Phraseology and Techniques	
4-2-1	2/20/25
4-2-2	2/20/25
4-2-3	2/20/25
4-2-4	2/20/25
4-2-5	2/20/25
4-2-6	2/20/25
4-2-7	2/20/25
4-2-8	2/20/25
4-2-9	2/20/25

PAGE	DATE
Section 3. Airport Operations	
4-3-1	8/7/25
4-3-2	8/7/25
4-3-3	8/7/25
4-3-4	2/20/25
4-3-5	2/20/25
4-3-6	2/20/25
4-3-7	2/20/25
4-3-8	2/20/25
4-3-9	2/20/25
4-3-10	2/20/25
4-3-11	2/20/25
4-3-12	2/20/25
4-3-13	2/20/25
4-3-14	8/7/25
4-3-15	2/20/25
4-3-16	2/20/25
4-3-17	2/20/25
4-3-18	2/20/25
4-3-19	2/20/25
4-3-20	2/20/25
4-3-21	2/20/25
4-3-22	2/20/25
4-3-23	2/20/25
4-3-24	2/20/25
4-3-25	2/20/25
4-3-26	2/20/25
4-3-27	2/20/25
4-3-28	2/20/25
4-3-29	2/20/25
4-3-30	2/20/25
4-3-31	2/20/25
4-3-32	2/20/25
4-3-33	2/20/25
4-3-34	2/20/25
4-3-35	2/20/25
4-3-36	2/20/25
4-3-37	2/20/25
Section 4. ATC Clearances and Aircraft Separation	
4-4-1	2/20/25
4-4-2	2/20/25
4-4-3	2/20/25
4-4-4	2/20/25
4-4-5	2/20/25
4-4-6	2/20/25
4-4-7	2/20/25
4-4-8	2/20/25

Checklist of Pages

PAGE	DATE
4-4-9	2/20/25
4-4-10	2/20/25
4-4-11	2/20/25
4-4-12	2/20/25
4-4-13	2/20/25
4-4-14	2/20/25
Section 5. Surveillance Systems	
4-5-1	2/20/25
4-5-2	2/20/25
4-5-3	2/20/25
4-5-4	8/7/25
4-5-5	2/20/25
4-5-6	2/20/25
4-5-7	2/20/25
4-5-8	2/20/25
4-5-9	2/20/25
4-5-10	2/20/25
4-5-11	2/20/25
4-5-12	2/20/25
4-5-13	2/20/25
4-5-14	2/20/25
4-5-15	2/20/25
4-5-16	2/20/25
4-5-17	2/20/25
4-5-18	8/7/25
4-5-19	2/20/25
4-5-20	2/20/25
4-5-21	2/20/25
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	8/7/25
4-6-2	2/20/25
4-6-3	2/20/25
4-6-4	2/20/25
4-6-5	2/20/25
4-6-6	2/20/25
4-6-7	2/20/25
4-6-8	2/20/25
4-6-9	2/20/25
4-6-10	2/20/25

PAGE	DATE
Section 7. Operational Policy/Procedures for the Gulf of America 50 NM Lateral Separation Initiative	
4-7-1	8/7/25
4-7-2	8/7/25
Chapter 5. Air Traffic Procedures	
Section 1. Preflight	
5-1-1	8/7/25
5-1-2	2/20/25
5-1-3	8/7/25
5-1-4	2/20/25
5-1-5	2/20/25
5-1-6	2/20/25
5-1-7	2/20/25
5-1-8	2/20/25
5-1-9	2/20/25
5-1-10	2/20/25
5-1-11	2/20/25
5-1-12	2/20/25
5-1-13	2/20/25
5-1-14	2/20/25
5-1-15	2/20/25
5-1-16	2/20/25
5-1-17	2/20/25
5-1-18	2/20/25
5-1-19	2/20/25
5-1-20	2/20/25
5-1-21	2/20/25
Section 2. Departure Procedures	
5-2-1	2/20/25
5-2-2	2/20/25
5-2-3	2/20/25
5-2-4	2/20/25
5-2-5	2/20/25
5-2-6	2/20/25
5-2-7	2/20/25
5-2-8	8/7/25
5-2-9	8/7/25
5-2-10	8/7/25
5-2-11	8/7/25
5-2-12	8/7/25
5-2-13	8/7/25
5-2-14	8/7/25
5-2-15	8/7/25

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

Checklist of Pages

PAGE	DATE
5-4-15	2/20/25
5-4-16	2/20/25
5-4-17	2/20/25
5-4-18	2/20/25
5-4-19	2/20/25
5-4-20	2/20/25
5-4-21	2/20/25
5-4-22	2/20/25
5-4-23	2/20/25
5-4-24	2/20/25
5-4-25	2/20/25
5-4-26	2/20/25
5-4-27	2/20/25
5-4-28	8/7/25
5-4-29	8/7/25
5-4-30	8/7/25
5-4-31	8/7/25
5-4-32	8/7/25
5-4-33	8/7/25
5-4-34	8/7/25
5-4-35	2/20/25
5-4-36	2/20/25
5-4-37	2/20/25
5-4-38	2/20/25
5-4-39	2/20/25
5-4-40	8/7/25
5-4-41	8/7/25
5-4-42	2/20/25
5-4-43	2/20/25
5-4-44	2/20/25
5-4-45	2/20/25
5-4-46	2/20/25
5-4-47	2/20/25
5-4-48	2/20/25
5-4-49	2/20/25
5-4-50	2/20/25
5-4-51	2/20/25
5-4-52	2/20/25
5-4-53	2/20/25
5-4-54	2/20/25
5-4-55	2/20/25
5-4-56	2/20/25
5-4-57	2/20/25
5-4-58	2/20/25
5-4-59	2/20/25
5-4-60	2/20/25
5-4-61	2/20/25
5-4-62	2/20/25
5-4-63	2/20/25
5-4-64	8/7/25

PAGE	DATE
5-4-65	8/7/25
5-4-66	8/7/25
5-4-67	8/7/25
5-4-68	8/7/25
Section 5. Pilot/Controller Roles and Responsibilities	
5-5-1	8/7/25
5-5-2	2/20/25
5-5-3	2/20/25
5-5-4	2/20/25
5-5-5	2/20/25
5-5-6	2/20/25
5-5-7	2/20/25
5-5-8	2/20/25
5-5-9	2/20/25
5-5-10	2/20/25
Section 6. National Security and Interception Procedures	
5-6-1	2/20/25
5-6-2	2/20/25
5-6-3	2/20/25
5-6-4	2/20/25
5-6-5	2/20/25
5-6-6	2/20/25
5-6-7	2/20/25
5-6-8	2/20/25
5-6-9	2/20/25
5-6-10	2/20/25
5-6-11	2/20/25
5-6-12	2/20/25
5-6-13	2/20/25
5-6-14	2/20/25
5-6-15	2/20/25
Chapter 6. Emergency Procedures	
Section 1. General	
6-1-1	2/20/25
Section 2. Emergency Services Available to Pilots	
6-2-1	2/20/25
6-2-2	2/20/25
6-2-3	2/20/25
6-2-4	2/20/25
6-2-5	2/20/25
6-2-6	2/20/25

PAGE	DATE
6-2-7	2/20/25
6-2-8	2/20/25
6-2-9	2/20/25
6-2-10	2/20/25
6-2-11	2/20/25
6-2-12	2/20/25
6-2-13	2/20/25
6-2-14	2/20/25
6-2-15	2/20/25
6-2-16	2/20/25
Section 3. Distress and Urgency Procedures	
6-3-1	2/20/25
6-3-2	2/20/25
6-3-3	2/20/25
6-3-4	2/20/25
6-3-5	2/20/25
6-3-6	2/20/25
6-3-7	2/20/25
6-3-8	2/20/25
Section 4. Two-way Radio Communications Failure	
6-4-1	2/20/25
6-4-2	2/20/25
6-4-3	2/20/25
Section 5. Aircraft Rescue and Fire Fighting Communications	
6-5-1	2/20/25
6-5-2	2/20/25
Chapter 7. Safety of Flight	
Section 1. Meteorology	
7-1-1	2/20/25
7-1-2	8/7/25
7-1-3	2/20/25
7-1-4	2/20/25
7-1-5	2/20/25
7-1-6	8/7/25
7-1-7	2/20/25
7-1-8	2/20/25
7-1-9	2/20/25
7-1-10	8/7/25
7-1-11	8/7/25
7-1-12	2/20/25
7-1-13	2/20/25

Checklist of Pages

PAGE	DATE
7-1-14	2/20/25
7-1-15	2/20/25
7-1-16	8/7/25
7-1-17	2/20/25
7-1-18	2/20/25
7-1-19	2/20/25
7-1-20	2/20/25
7-1-21	2/20/25
7-1-22	8/7/25
7-1-23	2/20/25
7-1-24	2/20/25
7-1-25	8/7/25
7-1-26	2/20/25
7-1-27	2/20/25
7-1-28	2/20/25
7-1-29	2/20/25
7-1-30	2/20/25
7-1-31	2/20/25
7-1-32	2/20/25
7-1-33	2/20/25
7-1-34	2/20/25
7-1-35	2/20/25
7-1-36	2/20/25
7-1-37	2/20/25
7-1-38	2/20/25
7-1-39	2/20/25
7-1-40	2/20/25
7-1-41	2/20/25
7-1-42	2/20/25
7-1-43	2/20/25
7-1-44	2/20/25
7-1-45	2/20/25
7-1-46	2/20/25
7-1-47	2/20/25
7-1-48	2/20/25
7-1-49	2/20/25
7-1-50	2/20/25
7-1-51	2/20/25
7-1-52	2/20/25
7-1-53	2/20/25
7-1-54	2/20/25
7-1-55	2/20/25
7-1-56	2/20/25
7-1-57	2/20/25
7-1-58	2/20/25
7-1-59	2/20/25
7-1-60	2/20/25
7-1-61	2/20/25
7-1-62	2/20/25
7-1-63	2/20/25

PAGE	DATE
7-1-64	2/20/25
7-1-65	2/20/25
7-1-66	2/20/25
7-1-67	2/20/25
7-1-68	2/20/25
7-1-69	2/20/25
7-1-70	2/20/25
7-1-71	2/20/25
7-1-72	2/20/25
7-1-73	2/20/25
7-1-74	2/20/25
7-1-75	2/20/25
7-1-76	2/20/25
7-1-77	2/20/25
7-1-78	2/20/25
Section 2. Barometric Altimeter Errors and Setting Procedures	
7-2-1	2/20/25
7-2-2	2/20/25
7-2-3	8/7/25
Section 3. Cold Temperature Barometric Altimeter Errors, Setting Procedures and Cold Temperature Airports (CTA)	
7-3-1	2/20/25
7-3-2	2/20/25
7-3-3	2/20/25
7-3-4	2/20/25
7-3-5	2/20/25
7-3-6	2/20/25
7-3-7	2/20/25
7-3-8	2/20/25
Section 4. Wake Turbulence	
7-4-1	2/20/25
7-4-2	2/20/25
7-4-3	2/20/25
7-4-4	2/20/25
7-4-5	2/20/25
7-4-6	2/20/25
7-4-7	2/20/25
7-4-8	2/20/25
7-4-9	2/20/25
Section 5. Bird Hazards and Flight Over National Refuges, Parks, and Forests	
7-5-1	2/20/25

PAGE	DATE
7-5-2	2/20/25
Section 6. Potential Flight Hazards	
7-6-1	8/7/25
7-6-2	2/20/25
7-6-3	8/7/25
7-6-4	2/20/25
7-6-5	2/20/25
7-6-6	2/20/25
7-6-7	2/20/25
7-6-8	2/20/25
7-6-9	2/20/25
7-6-10	2/20/25
7-6-11	2/20/25
7-6-12	2/20/25
7-6-13	8/7/25
7-6-14	2/20/25
7-6-15	2/20/25
7-6-16	2/20/25
7-6-17	2/20/25
7-6-18	8/7/25
Section 7. Safety, Accident, and Hazard Reports	
7-7-1	2/20/25
7-7-2	2/20/25
7-7-3	2/20/25
7-7-4	2/20/25
Chapter 8. Medical Facts for Pilots	
Section 1. Fitness for Flight	
8-1-1	2/20/25
8-1-2	2/20/25
8-1-3	2/20/25
8-1-4	2/20/25
8-1-5	2/20/25
8-1-6	2/20/25
8-1-7	2/20/25
8-1-8	2/20/25
8-1-9	2/20/25
8-1-10	2/20/25
Chapter 9. Aeronautical Charts and Related Publications	
Section 1. Types of Charts Available	

Checklist of Pages

PAGE	DATE
9-1-1	8/7/25
9-1-2	8/7/25
9-1-3	8/7/25
9-1-4	8/7/25
9-1-5	8/7/25
9-1-6	8/7/25
9-1-7	8/7/25
9-1-8	8/7/25
9-1-9	8/7/25
9-1-10	8/7/25
9-1-11	8/7/25
9-1-12	8/7/25
9-1-13	8/7/25
9-1-14	8/7/25
9-1-15	8/7/25
 Chapter 10. Helicopter Operations	
Section 1. Helicopter IFR Operations	
10-1-1	2/20/25
10-1-2	2/20/25
10-1-3	2/20/25
10-1-4	2/20/25
10-1-5	8/7/25
10-1-6	8/7/25
10-1-7	8/7/25
10-1-8	2/20/25
 Section 2. Special Operations	
10-2-1	8/7/25
10-2-2	8/7/25
10-2-3	8/7/25
10-2-4	2/20/25
10-2-5	2/20/25
10-2-6	2/20/25
10-2-7	2/20/25
10-2-8	2/20/25
10-2-9	2/20/25
10-2-10	2/20/25
10-2-11	2/20/25
10-2-12	2/20/25
10-2-13	2/20/25
10-2-14	2/20/25
10-2-15	2/20/25
10-2-16	2/20/25
10-2-17	2/20/25
10-2-18	2/20/25
10-2-19	2/20/25
10-2-20	2/20/25

PAGE	DATE
Chapter 11. Unmanned Aircraft Systems (UAS)	
Section 1. General	
11-1-1	2/20/25
11-1-2	2/20/25
 Section 2. Small Unmanned Aircraft System (sUAS)	
11-2-1	2/20/25
11-2-2	2/20/25
11-2-3	2/20/25
 Section 3. Large UAS (MGOW 55 Pounds or More)	
11-3-1	2/20/25
11-3-2	2/20/25
11-3-3	2/20/25
11-3-4	2/20/25
11-3-5	2/20/25
11-3-6	2/20/25
 Section 4. Airspace Access for UAS	
11-4-1	2/20/25
11-4-2	2/20/25
11-4-3	2/20/25
11-4-4	2/20/25
11-4-5	2/20/25
11-4-6	2/20/25
11-4-7	2/20/25
11-4-8	2/20/25
11-4-9	2/20/25
 Section 5. UAS Pilot Testing, Certification and Responsibilities	
PAGE	DATE
11-5-1	2/20/25
11-5-2	2/20/25
11-5-3	2/20/25
 Section 6. Advanced Air Mobility	
11-6-1	2/20/25
 Section 7. UAS Operations on Airports	
11-7-1	2/20/25

PAGE	DATE
Section 8. Other Information and Best Practices	
11-8-1	2/20/25
11-8-2	2/20/25
11-8-3	2/20/25
11-8-4	8/7/25
 Appendices	
Appendix 1-1	2/20/25
Env	N/A
Appendix 2-1	2/20/25
Appendix 3-1	2/20/25
Appendix 3-2	2/20/25
Appendix 3-3	2/20/25
Appendix 3-4	2/20/25
Appendix 3-5	2/20/25
Appendix 4-1	2/20/25
Appendix 4-2	2/20/25
Appendix 4-3	2/20/25
Appendix 4-4	2/20/25
Appendix 4-5	2/20/25
Appendix 4-6	2/20/25
Appendix 4-7	2/20/25
Appendix 4-8	2/20/25
Appendix 4-9	2/20/25
Appendix 4-10	2/20/25
Appendix 4-11	8/7/25
Appendix 4-12	8/7/25
Appendix 4-13	2/20/25
Appendix 4-14	2/20/25
Appendix 4-15	2/20/25
Appendix 4-16	2/20/25
Appendix 4-17	2/20/25
Appendix 4-18	2/20/25
Appendix 4-19	2/20/25
Appendix 4-20	2/20/25
Appendix 4-21	2/20/25
Appendix 4-22	2/20/25
Appendix 4-23	2/20/25
Appendix 5-1	2/20/25
Appendix 5-2	2/20/25
Appendix 5-3	2/20/25

Checklist of Pages

PAGE	DATE
P/CG	
PCG-1	8/7/25
PCG-2	8/7/25
PCG A-1	2/20/25
PCG A-2	2/20/25
PCG A-3	2/20/25
PCG A-4	2/20/25
PCG A-5	2/20/25
PGC A-6	2/20/25
PCG A-7	8/7/25
PCG A-8	8/7/25
PCG A-9	8/7/25
PCG A-10	8/7/25
PCG A-11	8/7/25
PCG A-12	8/7/25
PCG A-13	8/7/25
PCG A-14	8/7/25
PCG A-15	8/7/25
PCG A-16	8/7/25
PCG A-17	8/7/25
PCG A-18	8/7/25
PCG A-19	8/7/25
PCG A-20	2/20/25
PCG A-21	2/20/25
PCG B-1	2/20/25
PCG B-2	2/20/25
PCG C-1	2/20/25
PCG C-2	2/20/25
PCG C-3	2/20/25
PCG C-4	2/20/25
PCG C-5	2/20/25
PCG C-6	2/20/25
PCG C-7	2/20/25
PCG C-8	2/20/25
PCG C-9	2/20/25
PCG C-10	2/20/25
PCG C-11	2/20/25
PCG C-12	2/20/25
PCG D-1	2/20/25
PCG D-2	2/20/25
PCG D-3	2/20/25
PCG D-4	2/20/25
PCG D-5	2/20/25
PCG E-1	2/20/25
PCG E-2	2/20/25
PCG E-3	2/20/25
PCG F-1	2/20/25
PCG F-2	2/20/25
PCG F-3	2/20/25

PAGE	DATE
PCG F-4	2/20/25
PCG F-5	8/7/25
PCG F-6	2/20/25
PCG F-7	2/20/25
PCG G-1	2/20/25
PCG G-2	2/20/25
PCG G-3	2/20/25
PCG H-1	8/7/25
PCG H-2	2/20/25
PCG H-3	2/20/25
PCG I-1	2/20/25
PCG I-2	2/20/25
PCG I-3	2/20/25
PCG I-4	2/20/25
PCG I-5	2/20/25
PCG I-6	2/20/25
PCG I-7	2/20/25
PCG J-1	2/20/25
PCG K-1	2/20/25
PCG L-1	8/7/25
PCG L-2	8/7/25
PCG L-3	8/7/25
PCG L-4	8/7/25
PCG M-1	2/20/25
PCG M-2	2/20/25
PCG M-3	2/20/25
PCG M-4	2/20/25
PCG M-5	2/20/25
PCG M-6	2/20/25
PCG M-7	2/20/25
PCG N-1	8/7/25
PCG N-2	8/7/25
PCG N-3	8/7/25
PCG N-4	8/7/25
PCG O-1	2/20/25
PCG O-2	2/20/25
PCG O-3	2/20/25
PCG O-4	2/20/25
PCG P-1	2/20/25
PCG P-2	2/20/25
PCG P-3	8/7/25
PCG P-4	8/7/25
PCG P-5	8/7/25
PCG P-6	8/7/25
PCG Q-1	2/20/25
PCG R-1	2/20/25
PCG R-2	2/20/25
PCG R-3	2/20/25
PCG R-4	2/20/25
PCG R-5	2/20/25

PAGE	DATE
PCG R-6	2/20/25
PCG R-7	2/20/25
PCG R-8	8/7/25
PCG R-9	2/20/25
PCG R-10	2/20/25
PCG R-11	2/20/25
PCG S-1	2/20/25
PCG S-2	8/7/25
PCG S-3	8/7/25
PCG S-4	8/7/25
PCG S-5	8/7/25
PCG S-6	8/7/25
PCG S-7	8/7/25
PCG S-8	8/7/25
PCG S-9	8/7/25
PCG S-10	8/7/25
PCG S-11	8/7/25
PCG S-12	8/7/25
PCG T-1	2/20/25
PCG T-2	2/20/25
PCG T-3	2/20/25
PCG T-4	2/20/25
PCG T-5	2/20/25
PCG T-6	2/20/25
PCG T-7	2/20/25
PCG T-8	2/20/25
PCG T-9	8/7/25
PCG T-10	8/7/25
PCG T-11	8/7/25
PCG T-12	8/7/25
PCG U-1	2/20/25
PCG U-2	2/20/25
PCG V-1	8/7/25
PCG V-2	8/7/25
PCG V-3	8/7/25
PCG V-4	8/7/25
PCG V-5	8/7/25
PCG W-1	8/7/25
PCG W-2	2/20/25
Index	
I-1	8/7/25
I-2	8/7/25
I-3	8/7/25
I-4	8/7/25
I-5	8/7/25
I-6	8/7/25

Checklist of Pages

PAGE	DATE
I-7	8/7/25
I-8	8/7/25
I-9	8/7/25
I-10	8/7/25
I-11	8/7/25
I-12	8/7/25
I-13	8/7/25
Back Cover	N/A

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)	1-1-5
1-1-7. Distance Measuring Equipment (DME)	1-1-5
1-1-8. NAVAID Service Volumes	1-1-6
1-1-9. Instrument Landing System (ILS)	1-1-11
1-1-10. Simplified Directional Facility (SDF)	1-1-18
1-1-11. NAVAID Identifier Removal During Maintenance	1-1-20
1-1-12. NAVAIDs with Voice	1-1-20
1-1-13. User Reports Requested on NAVAID Outages	1-1-20
1-1-14. LORAN	1-1-21
1-1-15. Inertial Reference Unit (IRU), Inertial Navigation System (INS), and Attitude Heading Reference System (AHRS)	1-1-21
1-1-16. Doppler Radar	1-1-22
1-1-17. Global Positioning System (GPS)	1-1-22
1-1-18. Wide Area Augmentation System (WAAS)	1-1-34
1-1-19. Ground Based Augmentation System (GBAS) Landing System (GLS)	1-1-39
1-1-20. Precision Approach Systems other than ILS and GLS	1-1-41

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

1-2-1. General	1-2-1
1-2-2. Required Navigation Performance (RNP)	1-2-5
1-2-3. Use of Suitable Area Navigation (RNAV) Systems on Conventional Procedures and Routes	1-2-8
1-2-4. Recognizing, Mitigating, and Adapting to GPS Jamming and/or Spoofing	1-2-10

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. Control of Lighting Systems	2-1-9
2-1-8. Pilot Control of Airport Lighting	2-1-9
2-1-9. Airport/Heliport Beacons	2-1-12

2-1-10. Taxiway Lights	2-1-13
------------------------------	--------

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
2-2-4. LED Lighting Systems	2-2-2

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	2-3-14
2-3-6. Other Markings	2-3-19
2-3-7. Airport Signs	2-3-24
2-3-8. Mandatory Instruction Signs	2-3-25
2-3-9. Location Signs	2-3-28
2-3-10. Direction Signs	2-3-30
2-3-11. Destination Signs	2-3-32
2-3-12. Information Signs	2-3-34
2-3-13. Runway Distance Remaining Signs	2-3-34
2-3-14. Aircraft Arresting Systems	2-3-35
2-3-15. Security Identification Display Area (SIDA)	2-3-36

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	3-1-2
3-1-5. VFR Cruising Altitudes and Flight Levels	3-1-3

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	3-2-5
3-2-5. Class D Airspace	3-2-8
3-2-6. Class E Airspace	3-2-10

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

Paragraph	Page
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	3-4-2
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	3-4-3
3-4-9. Obtaining Special Use Airspace Status	3-4-3

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	3-5-3
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
3-5-7. Special Air Traffic Rules (SATR) and Special Flight Rules Area (SFRA)	3-5-10
3-5-8. Washington, DC, Special Flight Rules Area (SFRA) including the Flight Restricted Zone (FRZ)	3-5-10
3-5-9. Weather Reconnaissance Area (WRA)	3-5-10
3-5-10. Other Non-Chartered Airspace Areas	3-5-11

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	4-1-7
4-1-11. Designated UNICOM/MULTICOM Frequencies	4-1-8
4-1-12. Use of UNICOM for ATC Purposes	4-1-9
4-1-13. Automatic Terminal Information Service (ATIS)	4-1-9
4-1-14. Automatic Flight Information Service (AFIS) – Alaska FSSs Only	4-1-10
4-1-15. Radar Traffic Information Service	4-1-11
4-1-16. Safety Alert	4-1-13
4-1-17. Radar Assistance to VFR Aircraft	4-1-14
4-1-18. Terminal Radar Services for VFR Aircraft	4-1-15
4-1-19. Tower En Route Control (TEC)	4-1-17
4-1-20. Transponder and ADS-B Out Operation	4-1-18
4-1-21. Airport Reservation Operations and Special Traffic Management Programs	4-1-22

Paragraph	Page
4-1-22. Requests for Waivers and Authorizations from Title 14, Code of Federal Regulations (14 CFR)	4-1-22
4-1-23. Weather Systems Processor	4-1-23

Section 2. Radio Communications Phraseology and Techniques

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

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	4-3-3
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	4-3-7
4-3-6. Use of Runways/Declared Distances	4-3-8
4-3-7. Low Level Wind Shear/Microburst Detection Systems	4-3-12
4-3-8. Braking Action Reports and Advisories	4-3-13
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)	4-3-16
4-3-12. Low Approach	4-3-19
4-3-13. Traffic Control Light Signals	4-3-19
4-3-14. Communications	4-3-20
4-3-15. Gate Holding Due to Departure Delays	4-3-21
4-3-16. VFR Flights in Terminal Areas	4-3-21
4-3-17. VFR Helicopter Operations at Controlled Airports	4-3-21
4-3-18. Taxiing	4-3-23
4-3-19. Taxi During Low Visibility	4-3-25
4-3-20. Standard Taxi Routes	4-3-26
4-3-21. Exiting the Runway After Landing	4-3-26
4-3-22. Practice Instrument Approaches	4-3-27
4-3-23. Option Approach	4-3-28
4-3-24. Use of Aircraft Lights	4-3-29
4-3-25. Flight Inspection/'Flight Check' Aircraft in Terminal Areas	4-3-29
4-3-26. Hand Signals	4-3-30

Paragraph	Page
4-3-27. Operations at Uncontrolled Airports With Automated Surface Observing System (ASOS)/Automated Weather Observing System (AWOS)	4-3-37

Section 4. ATC Clearances and Aircraft Separation

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	4-4-3
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	4-4-5
4-4-9. VFR/IFR Flights	4-4-6
4-4-10. Adherence to Clearance	4-4-6
4-4-11. IFR Separation Standards	4-4-8
4-4-12. Speed Adjustments	4-4-8
4-4-13. Runway Separation	4-4-11
4-4-14. Visual Separation	4-4-11
4-4-15. Use of Visual Clearing Procedures and Scanning Techniques	4-4-12
4-4-16. Traffic Alert and Collision Avoidance System (TCAS I & II)	4-4-13
4-4-17. Traffic Information Service (TIS)	4-4-14

Section 5. Surveillance Systems

4-5-1. Radar	4-5-1
4-5-2. Air Traffic Control Radar Beacon System (ATCRBS)	4-5-3
4-5-3. Surveillance Radar	4-5-4
4-5-4. Precision Approach Radar (PAR)	4-5-4
4-5-5. Airport Surface Detection Equipment (ASDE-X)/Airport Surface Surveillance Capability (ASSC)	4-5-4
4-5-6. Traffic Information Service (TIS)	4-5-5
4-5-7. Automatic Dependent Surveillance-Broadcast (ADS-B) Services	4-5-12
4-5-8. Traffic Information Service-Broadcast (TIS-B)	4-5-17
4-5-9. Flight Information Service-Broadcast (FIS-B)	4-5-18
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	4-6-3
4-6-5. Pilot RVSM Operating Practices and Procedures	4-6-4
4-6-6. Guidance on Severe Turbulence and Mountain Wave Activity (MWA)	4-6-4
4-6-7. Guidance on Wake Turbulence	4-6-6
4-6-8. Pilot/Controller Phraseology	4-6-6
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

Paragraph	Page
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 America 50 NM Lateral Separation Initiative

4-7-1. Introduction and General Policies	4-7-1
4-7-2. Accommodating Non-RNP 10 Aircraft	4-7-1
4-7-3. Obtaining RNP 10 or RNP 4 Operational Authorization	4-7-1
4-7-4. Authority for Operations with a Single Long-Range Navigation System	4-7-2
4-7-5. Flight Plan Requirements	4-7-2
4-7-6. Contingency Procedures	4-7-2

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	5-1-3
5-1-4. Operational Information System (OIS)	5-1-9
5-1-5. Flight Plan – VFR Flights	5-1-10
5-1-6. Flight Plan – IFR Flights	5-1-11
5-1-7. Flight Plans For Military/DoD Use Only	5-1-15
5-1-8. Flight Plan – Defense VFR (DVFR) Flights	5-1-15
5-1-9. Single Flights Conducted With Both VFR and IFR Flight Plans	5-1-16
5-1-10. IFR Operations to High Altitude Destinations	5-1-16
5-1-11. Flights Outside U.S. Territorial Airspace	5-1-17
5-1-12. Change in Flight Plan	5-1-18
5-1-13. Change in Proposed Departure Time	5-1-18
5-1-14. Closing VFR/DVFR Flight Plans	5-1-18
5-1-15. Canceling IFR Flight Plan	5-1-18
5-1-16. RNAV and RNP Operations	5-1-19
5-1-17. Cold Temperature Operations	5-1-20

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. IFR Clearances Off Uncontrolled Airports	5-2-2
5-2-4. Taxi Clearance	5-2-2
5-2-5. Line Up and Wait (LUAW)	5-2-2
5-2-6. Abbreviated IFR Departure Clearance (Cleared. . .as Filed) Procedures	5-2-4
5-2-7. Departure Restrictions, Clearance Void Times, Hold for Release, and Release Times	5-2-5
5-2-8. Departure Control	5-2-6
5-2-9. Instrument Departure Procedures (DP) – Obstacle Departure Procedures (ODP), Standard Instrument Departures (SID), and Diverse Vector Areas (DVA)	5-2-7

Section 3. En Route Procedures

5-3-1. ARTCC Communications	5-3-1
-----------------------------------	-------

Paragraph	Page
5-3-2. Position Reporting	5-3-14
5-3-3. Additional Reports	5-3-15
5-3-4. Airways and Route Systems	5-3-16
5-3-5. Airway or Route Course Changes	5-3-19
5-3-6. Changeover Points (COPs)	5-3-20
5-3-7. Minimum Turning Altitude (MTA)	5-3-20
5-3-8. Holding	5-3-20

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	5-4-4
5-4-4. Advance Information on Instrument Approach	5-4-5
5-4-5. Instrument Approach Procedure (IAP) Charts	5-4-5
5-4-6. Approach Clearance	5-4-28
5-4-7. Instrument Approach Procedures	5-4-30
5-4-8. Special Instrument Approach Procedures	5-4-32
5-4-9. Procedure Turn and Hold-in-lieu of Procedure Turn	5-4-33
5-4-10. Timed Approaches from a Holding Fix	5-4-36
5-4-11. Radar Approaches	5-4-38
5-4-12. Radar Monitoring of Instrument Approaches	5-4-39
5-4-13. Simultaneous Approaches to Parallel Runways	5-4-40
5-4-14. Simultaneous Dependent Approaches	5-4-42
5-4-15. Simultaneous Independent ILS/RNAV/GLS Approaches	5-4-44
5-4-16. Simultaneous Close Parallel PRM Approaches and Simultaneous Offset Instrument Approaches (SOIA)	5-4-46
5-4-17. Simultaneous Converging Instrument Approaches	5-4-53
5-4-18. RNP AR (Authorization Required) Instrument Procedures	5-4-53
5-4-19. Side-step Maneuver	5-4-55
5-4-20. Approach and Landing Minimums	5-4-55
5-4-21. Missed Approach	5-4-59
5-4-22. Use of Enhanced Flight Vision Systems (EFVS) on Instrument Approaches .	5-4-61
5-4-23. Visual Approach	5-4-65
5-4-24. Charted Visual Flight Procedure (CVFP)	5-4-66
5-4-25. Contact Approach	5-4-66
5-4-26. Landing Priority	5-4-67
5-4-27. Overhead Approach Maneuver	5-4-67

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. Vectors	5-5-4
5-5-7. Safety Alert	5-5-4
5-5-8. See and Avoid	5-5-5
5-5-9. Speed Adjustments	5-5-5
5-5-10. Traffic Advisories (Traffic Information)	5-5-6
5-5-11. Visual Approach	5-5-6

Paragraph	Page
5-5-12. Visual Separation	5-5-7
5-5-13. VFR-on-top	5-5-8
5-5-14. Instrument Departures	5-5-8
5-5-15. Minimum Fuel Advisory	5-5-9
5-5-16. RNAV and RNP Operations	5-5-9

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	5-6-4
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	5-6-8
5-6-10. TSA Aviation Security Programs	5-6-8
5-6-11. FAA Flight Routing Authorizations	5-6-8
5-6-12. Emergency Security Control of Air Traffic (ESCAT)	5-6-8
5-6-13. Interception Procedures	5-6-9
5-6-14. Interception Signals	5-6-11
5-6-15. ADIZ Boundaries and Designated Mountainous Areas (See FIG 5-6-3.) ..	5-6-14
5-6-16. Visual Warning System (VWS)	5-6-15

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	6-2-4
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)	6-3-7
6-3-5. Fuel Dumping	6-3-8

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

Paragraph	Page
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	7-1-3
7-1-4. Graphical Forecasts for Aviation (GFA)	7-1-6
7-1-5. Preflight Briefing	7-1-8
7-1-6. Inflight Aviation Weather Advisories	7-1-11
7-1-7. Categorical Ceiling and Visibility Conditions	7-1-22
7-1-8. Inflight Weather Advisory Broadcasts	7-1-22
7-1-9. Flight Information Services (FIS)	7-1-23
7-1-10. Weather Observing Programs	7-1-27
7-1-11. Weather Radar Services	7-1-36
7-1-12. ATC Inflight Weather Avoidance Assistance	7-1-40
7-1-13. Runway Visual Range (RVR)	7-1-42
7-1-14. Reporting of Cloud Heights	7-1-43
7-1-15. Reporting Prevailing Visibility	7-1-44
7-1-16. Estimating Intensity of Rain and Ice Pellets	7-1-44
7-1-17. Estimating Intensity of Snow or Drizzle (Based on Visibility)	7-1-44
7-1-18. Pilot Weather Reports (PIREPs)	7-1-44
7-1-19. PIREPs Relating to Airframe Icing	7-1-46
7-1-20. Definitions of Inflight Icing Terms	7-1-47
7-1-21. PIREPs Relating to Turbulence	7-1-48
7-1-22. Wind Shear PIREPs	7-1-49
7-1-23. Clear Air Turbulence (CAT) PIREPs	7-1-50
7-1-24. Microbursts	7-1-50
7-1-25. PIREPs Relating to Volcanic Ash Activity	7-1-61
7-1-26. Thunderstorms	7-1-62
7-1-27. Thunderstorm Flying	7-1-62
7-1-28. Key to Aerodrome Forecast (TAF) and Aviation Routine Weather Report (METAR)	7-1-65
7-1-29. International Civil Aviation Organization (ICAO) Weather Formats	7-1-67

Section 2. Barometric Altimeter Errors and Setting Procedures

7-2-1. General	7-2-1
7-2-2. Barometric Pressure Altimeter Errors	7-2-1
7-2-3. Altimeter Errors	7-2-1

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

Paragraph	Page
7-3-1. Effect of Cold Temperature on Barometric Altimeters	7-3-1
7-3-2. Pre-Flight Planning for Cold Temperature Altimeter Errors	7-3-1
7-3-3. Effects of Cold Temperature on Baro-Vertical Navigation (VNAV) Vertical Guidance	7-3-1
7-3-4. Cold Temperature Airports (CTA)	7-3-2
7-3-5. Cold Temperature Airport Procedures	7-3-3
7-3-6. Examples for Calculating Altitude Corrections on CTAs	7-3-6

Section 4. Wake Turbulence

7-4-1. General	7-4-1
7-4-2. Vortex Generation	7-4-1
7-4-3. Vortex Strength	7-4-1
7-4-4. Vortex Behavior	7-4-2
7-4-5. Operations Problem Areas	7-4-5
7-4-6. Vortex Avoidance Procedures	7-4-6
7-4-7. Helicopters	7-4-6
7-4-8. Pilot Responsibility	7-4-7
7-4-9. Air Traffic Wake Turbulence Separations	7-4-8
7-4-10. Development and New Capabilities	7-4-9

Section 5. Bird Hazards and Flight Over National Refuges, Parks, and Forests

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

Section 6. Potential Flight Hazards

7-6-1. Accident Causal Factors	7-6-1
7-6-2. Reporting Radio/Radar Altimeter Anomalies	7-6-1
7-6-3. VFR in Congested Areas	7-6-2
7-6-4. Obstructions To Flight	7-6-2
7-6-5. Avoid Flight Beneath Unmanned Balloons	7-6-4
7-6-6. Unmanned Aircraft Systems	7-6-4
7-6-7. Mountain Flying	7-6-5
7-6-8. Use of Runway Half-way Signs at Unimproved Airports	7-6-7
7-6-9. Seaplane Safety	7-6-8
7-6-10. Flight Operations in Volcanic Ash	7-6-9
7-6-11. Emergency Airborne Inspection of Other Aircraft	7-6-10
7-6-12. Precipitation Static	7-6-11
7-6-13. Light Amplification by Stimulated Emission of Radiation (Laser) Operations and Reporting Illumination of Aircraft	7-6-12
7-6-14. Flying in Flat Light, Brown Out Conditions, and White Out Conditions	7-6-13
7-6-15. Operations in Ground Icing Conditions	7-6-15
7-6-16. Avoid Flight in the Vicinity of Exhaust Plumes (Smoke Stacks and Cooling Towers)	7-6-16

Paragraph	Page
7-6-17. Space Launch and Reentry Area	7-6-17
7-6-18. Automatic Landing Operations	7-6-18

Section 7. Safety, Accident, and Hazard Reports

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

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	8-1-7
8-1-7. Aerobatic Flight	8-1-8
8-1-8. Judgment Aspects of Collision Avoidance	8-1-9

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. Safety Alerts, Charting Notices, and Data Product Notices	9-1-1
9-1-4. Selected Charts and Products Available	9-1-1
9-1-5. General Description of Each Chart Series	9-1-1
9-1-6. Where and How to Get Charts of Foreign Areas	9-1-14

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	10-1-2
10-1-3. Helicopter Approach Procedures to VFR Heliports	10-1-4
10-1-4. The Gulf of America Grid System	10-1-5
10-1-5. Departure Procedures	10-1-7

Section 2. Special Operations

10-2-1. Offshore Helicopter Operations	10-2-1
10-2-2. Helicopter Night VFR Operations	10-2-8
10-2-3. Landing Zone Safety	10-2-12
10-2-4. Emergency Medical Service (EMS) Multiple Helicopter Operations	10-2-18

Chapter 11. Unmanned Aircraft Systems (UAS)

Section 1. General

Paragraph	Page
11-1-1. General	11-1-1
11-1-2. Access to the National Airspace System (NAS) for UAS Operators	11-1-1

Section 2. Small Unmanned Aircraft System (sUAS)

11-2-1. Part 107 sUAS and Recreational Flyers	11-2-1
11-2-2. Registration Requirements	11-2-1

Section 3. Large UAS (MGOW 55 Pounds or More)

11-3-1. Large Public UAS Operations	11-3-1
11-3-2. Exemptions Under 49 USC 44807, Special Authority for Certain Unmanned Systems	11-3-4
11-3-3. Emerging Large UAS Civil Operations	11-3-5

Section 4. Airspace Access for UAS

11-4-1. Recreational Flyers	11-4-1
11-4-2. 14 CFR part 107 and Waivers to 14 CFR part 107	11-4-1
11-4-3. Airspace Access for Public Aircraft Operations (PAOs)	11-4-2
11-4-4. 14 CFR part 89 Remote Identification and FAA-Recognized Identification Areas (FRIAs)	11-4-3
11-4-5. Airspace Access for 14 CFR part 135 and 14 CFR part 137	11-4-4
11-4-6. Airspace Restrictions To Flight	11-4-6
11-4-7. UAS Traffic Management (UTM)	11-4-8

Section 5. UAS Pilot Testing, Certification and Responsibilities

11-5-1. UAS Pilot Certification and Requirements for Part 107 and Recreational Flyers	11-5-1
11-5-2. Pilot Certification and Requirements for Public Aircraft Operations (PAOs) .	11-5-3
11-5-3. Pilot Certification for 14 CFR part 135, Part 137, and Large Civil UAS	11-5-3
11-5-4. Foreign Pilot Certification	11-5-3

Section 6. Advanced Air Mobility

11-6-1. General	11-6-1
-----------------------	--------

Section 7. UAS Operations on Airports

11-7-1. UAS Operations on Airports	11-7-1
--	--------

Section 8. Other Information and Best Practices

11-8-1. Best Practices for UAS Operations	11-8-1
11-8-2. UAS Operations and Air Traffic Control (ATC)	11-8-1
11-8-3. Precautions: Flight Over or Near People, Vehicles, Manned Aircraft, and Night Operations	11-8-1
11-8-4. Accidents and Incidents: UAS Operator Responsibilities	11-8-2
11-8-5. Emergency UAS Authorizations Through Special Government Interest (SGI) Airspace Waivers	11-8-3
11-8-6. Environmental Best Practices	11-8-3
11-8-7. Resources for UAS Operators	11-8-4

Paragraph	Page
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
Appendix 4. FAA Form 7233–4 – International Flight Plan	Appendix 4–1
Appendix 5. FAA Form 7233–1 – Flight Plan	Appendix 5–1
PILOT/CONTROLLER GLOSSARY	PCG–1
INDEX	I–1

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. NAVAID Service Volumes

a. The FAA publishes Standard Service Volumes (SSVs) for most NAVAIDs. The SSV is a three-dimensional volume within which the FAA ensures that a signal can be received with adequate signal strength and course quality, and is free from interference from other NAVAIDs on similar frequencies (e.g., co-channel or adjacent-channel interference). However, the SSV signal protection does not include potential blockage from terrain or obstructions. The SSV is principally intended for off-route navigation, such as proceeding direct to or from a VOR when not on a published instrument procedure or route. Navigation on published instrument procedures (e.g., approaches or departures) or routes (e.g., Victor routes) may use NAVAIDs outside of the SSV, when Extended Service Volume (ESV) is approved, since adequate signal strength, course quality, and freedom from interference are verified by the FAA prior to the publishing of the instrument procedure or route.

NOTE—

A conical area directly above the NAVAID is generally not usable for navigation.

b. A NAVAID will have service volume restrictions if it does not conform to signal strength and course quality standards throughout the published 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. Service volume restrictions do not generally apply to published instrument procedures or routes unless published in NOTAMs for the affected instrument procedure or route.

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

1. The three original SSVs are shown in FIG 1-1-1 and are designated with three classes of NAVAIDs: Terminal (T), Low (L), and High (H). The usable distance of the NAVAID depends on the altitude Above the Transmitter Height (ATH) for each class. The lower edge of the usable distance when below 1,000 feet ATH is shown in FIG 1-1-2 for Terminal NAVAIDs and in FIG 1-1-3 for Low and High NAVAIDs.

TBL 1-1-2
NDB Service Volumes

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

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

a. General

1. The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.
2. The basic components of an ILS are the localizer, glide slope, and Outer Marker (OM) and, when installed for use with Category II or Category III instrument approach procedures, an Inner Marker (IM).
3. The system may be divided functionally into three parts:
 - (a) **Guidance information:** localizer, glide slope.
 - (b) **Range information:** marker beacon, DME.
 - (c) **Visual information:** approach lights, touchdown and centerline lights, runway lights.
4. The following means may be used to substitute for the OM:
 - (a) Compass locator; or
 - (b) Precision Approach Radar (PAR); or
 - (c) Airport Surveillance Radar (ASR); or
 - (d) Distance Measuring Equipment (DME), Very High Frequency Omni-directional Range (VOR), or Nondirectional beacon fixes authorized in the Standard Instrument Approach Procedure; or
 - (e) Very High Frequency Omni-directional Radio Range (VOR); or
 - (f) Nondirectional beacon fixes authorized in the Standard Instrument Approach Procedure; or
 - (g) A suitable RNAV system with Global Positioning System (GPS), capable of fix identification on a Standard Instrument Approach Procedure.
5. Where a complete ILS system is installed on each end of a runway; (i.e., the approach end of Runway 4 and the approach end of Runway 22) the ILS systems are not in service simultaneously.

b. Localizer

1. The localizer transmitter operates on one of 40 ILS channels within the frequency range of 108.10 to 111.95 MHz. Signals provide the pilot with course guidance to the runway centerline.
2. The approach course of the localizer is called the front course and is used with other functional parts, e.g., glide slope, marker beacons, etc. The localizer signal is transmitted at the far end of the runway. It is adjusted for a course width of (full scale fly-left to a full scale fly-right) of 700 feet at the runway threshold.
3. The course line along the extended centerline of a runway, in the opposite direction to the front course is called the back course.

CAUTION—

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

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

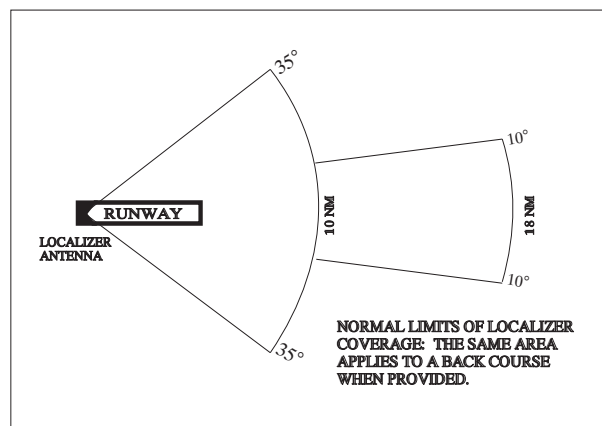
EXAMPLE—

I-DIA

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

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

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



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

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

3. Heading, altitude, type of aircraft (make/model/call sign),
4. Type of avionics/receivers in use (e.g., make/model/software series or version),
5. Number of satellites being tracked, if applicable,
6. Description of the position/navigation/timing anomaly observed, and duration of the event,
7. Consequences/operational impact(s) of the NAVAID or GPS anomaly,
8. Actions taken to mitigate the anomaly and/or remedy provided by the ATC facility,
9. Post flight pilot/maintenance actions taken.

e. Pilots operating an aircraft in controlled airspace under IFR shall comply with CFR § 91.187 and promptly report as soon as practical to ATC any malfunctions of navigational equipment occurring in flight; pilots should submit initial reports:

1. Immediately, by radio 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, GPS problems should be reported, post flight, by Internet via the GPS Anomaly Reporting Form at http://www.faa.gov/air_traffic/nas/gps_reports/.

f. To minimize ATC workload, GPS anomalies associated with known testing NOTAMs should NOT be reported in-flight to ATC in detail; EXCEPT when:

1. GPS degradation is experienced outside the NOTAMed area,
2. Pilot observes any unexpected consequences (e.g., equipment failure, suspected spoofing, failure of unexpected aircraft systems, such as TAWS).

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.

Approval of Positioning and Navigation Systems. Equipment approved in accordance with TSO-C115a does not meet the requirements of TSO-C129. Visual flight rules (VFR) and hand-held GPS systems are not authorized for IFR navigation, instrument approaches, or as a principal instrument flight reference.

(2) Aircraft using un-augmented GPS (TSO-C129() or TSO-C196()) for navigation under IFR must be equipped with an alternate approved and operational means of navigation suitable for navigating the proposed route of flight. (Examples of alternate navigation equipment include VOR or DME/DME/IRU capability). Active monitoring of alternative navigation equipment is not required when RAIM is available for integrity monitoring. Active monitoring of an alternate means of navigation is required when the GPS RAIM capability is lost.

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

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

(5) Aircraft navigating by IFR-approved GPS are considered to be performance-based navigation (PBN) aircraft and have special equipment suffixes. File the appropriate equipment suffix in accordance with Appendix 4, TBL 4-2, on the ATC flight plan. If GPS avionics become inoperative, the pilot should advise ATC and amend the equipment suffix.

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

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

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

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

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

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

[a] Preflight:

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

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

[b] Inflight:

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

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

NOTE—

There is no specific requirement to check each waypoint latitude and longitude, type of waypoint and/or altitude constraint, only the general relationship of waypoints in the procedure, or the logic of an individual waypoint's location.

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

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

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

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

NOTE—

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

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

[d] To satisfy the requirements 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, for example either DME/DME, IRU, or VOR for en route and terminal operations, and VOR and ILS for final approach. Since this system is to be used as a reversionary capability, single 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 augmentation system (WAAS) system is installed and operating. WAAS is the U.S. version of a satellite-based augmentation system (SBAS).

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

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

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

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

REFERENCE—

AIM, Para 5-3-4, Airways and Route Systems.

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

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

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

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

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

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

4. Departures and Instrument Departure Procedures (DPs)

The GPS receiver must be set to terminal (± 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 ± 5 NM either side of centerline to ± 1 NM terminal sensitivity. Where the IAWP is inside this 30 mile point, a CDI sensitivity change will occur once the approach mode is armed and the aircraft is inside 30 NM. Where the IAWP is beyond 30 NM from the

airport/heliport reference point and the approach is armed, the CDI sensitivity will not change until the aircraft is within 30 miles of the airport/heliport reference point. Feeder route obstacle clearance is predicated on the receiver being in terminal (± 1 NM) CDI sensitivity and RAIM within 30 NM of the airport/heliport reference point; therefore, the receiver should always be armed (if required) not later than the 30 NM annunciation.

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

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

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

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

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

(9) Pilots should pay particular attention to the exact operation of their GPS receivers for performing holding patterns and in the case of overlay approaches, operations such as procedure turns. These procedures may require manual intervention by the pilot to stop the sequencing of waypoints by the receiver and to resume automatic GPS navigation sequencing once the maneuver is complete. The same waypoint may appear in the route of flight more than once consecutively (for example, IAWP, FAWP, MAHWP on a procedure turn). Care must be exercised to ensure that the receiver is sequenced to the appropriate waypoint for the segment of the procedure being flown, especially if one or more fly-overs are skipped (for example, FAWP rather than IAWP

if the procedure turn is not flown). The pilot may have to sequence past one or more fly–overs of the same waypoint in order to start GPS automatic sequencing at the proper place in the sequence of waypoints.

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

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

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

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

(f) Missed Approach

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

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

(g) Receiver Autonomous Integrity Monitoring (RAIM)

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

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

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

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

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

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

(7) If the receiver does not sequence into the approach mode or a RAIM failure/status annunciation occurs prior to the FAWP, the pilot must not initiate the approach nor descend, but instead, proceed to the missed approach waypoint (MAWP) via the FAWP, perform a missed approach, and contact ATC as soon as practical. The GPS receiver may continue to operate after a RAIM flag/status annunciation appears, but the navigation information should be considered advisory only. Refer to the receiver operating manual for specific indications and instructions associated with loss of RAIM prior to the FAF.

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

(h) Waypoints

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

(2) A Computer Navigation Fix (CNF) is also a point defined by a latitude/longitude coordinate and is required to support Performance-Based Navigation (PBN) operations. The GPS receiver uses CNFs in conjunction with waypoints to navigate from point to point. However, CNFs are not recognized by ATC. ATC does not maintain CNFs in their database and they do not use CNFs for any air traffic control purpose. CNFs may or may not be charted on FAA aeronautical navigation products, are listed in the chart legends, and are for advisory purposes only. Pilots are not to use CNFs for point to point navigation (proceed direct), filing a flight plan, or in aircraft/ATC communications. CNFs that do appear on aeronautical charts allow pilots increased situational awareness by identifying points in the aircraft database route of flight with points on the aeronautical chart. CNFs are random five-letter identifiers, not pronounceable like waypoints and placed in parenthesis. Eventually, all CNFs will begin with the letters “CF” followed by three consonants (for example, CFWBG). This five-letter identifier will be found next to an “x” on enroute charts and possibly on an approach chart. On instrument approach procedures (charts) in the terminal procedures publication, CNFs may represent unnamed DME fixes, beginning and ending points of DME arcs, and sensor (ground-based signal i.e., VOR, NDB, ILS) final approach fixes on GPS overlay approaches. These CNFs provide the GPS with points on the procedure that allow the overlay approach to mirror the ground-based sensor approach. These points should only be used by the GPS system for navigation and should not be used by pilots for any other purpose on the approach. The CNF concept has not been adopted or recognized by the International Civil Aviation Organization (ICAO).

(3) GPS approaches use fly-over and fly-by waypoints to join route segments on an approach. Fly-by waypoints connect the two segments by allowing the aircraft to turn prior to the current waypoint in order to roll

out on course to the next waypoint. This is known as turn anticipation and is compensated for in the airspace and terrain clearances. The missed approach waypoint (MAWP) will always be a fly-over waypoint. A holding waypoint will always be designed as a fly-over waypoint in the navigational database but may be charted as a fly-by event unless the holding waypoint is used for another purpose in the procedure and both events require the waypoint to be a fly-over event. Some waypoints may have dual use; for example, as a fly-by waypoint when used as an IF for a NoPT route and as a fly-over waypoint when the same waypoint is also used as an IAF/IF hold-in-lieu of PT. Since the waypoint can only be charted one way, when this situation occurs, the fly-by waypoint symbol will be charted in all uses of the waypoint.

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

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

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

(j) Impact of Magnetic Variation on PBN Systems

(1) Differences may exist between PBN systems and the charted magnetic courses on ground-based NAVAID instrument flight procedures (IFP), enroute charts, approach charts, and Standard Instrument Departure/Standard Terminal Arrival (SID/STAR) charts. These differences are due to the magnetic variance used to calculate the magnetic course. Every leg of an instrument procedure is first computed along a desired ground track with reference to true north. A magnetic variation correction is then applied to the true course in order to calculate a magnetic course for publication. The type of procedure will determine what magnetic variation value is added to the true course. A ground-based NAVAID IFP applies the facility magnetic variation of record to the true course to get the charted magnetic course. Magnetic courses on PBN procedures are calculated two different ways. SID/STAR procedures use the airport magnetic variation of record, while IFR enroute charts use magnetic reference bearing. PBN systems make a correction to true north by adding a magnetic variation calculated with an algorithm based on aircraft position, or by adding the magnetic variation coded in their navigational database. This may result in the PBN system and the procedure designer using a different magnetic variation, which causes the magnetic course *displayed* by the PBN system and the magnetic course *charted* on the IFP plate to be different. It is important to understand, however, that PBN systems, (with the exception of VOR/DME RNAV equipment) navigate by reference to true north and display magnetic course only for pilot reference. As such, a *properly functioning* PBN system, containing a *current and accurate navigational database*, should fly the correct ground track for any loaded instrument procedure, despite differences in displayed magnetic course that may be attributed to magnetic variation application. Should significant differences between the approach chart and the PBN system avionics' application of the navigation database arise, the published approach chart, supplemented by NOTAMs, holds precedence.

(2) The course into a waypoint may not always be 180 degrees different from the course leaving the previous waypoint, due to the PBN system avionics' computation of geodesic paths, distance between

waypoints, and differences in magnetic variation application. Variations in distances may also occur since PBN system distance-to-waypoint values are ATDs computed to the next waypoint and the DME values published on underlying procedures are slant-range distances measured to the station. This difference increases with aircraft altitude and proximity to the NAVAID.

(k) GPS Familiarization

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

- (1) Using the receiver autonomous integrity monitoring (RAIM) prediction function;
- (2) Inserting a DP into the flight plan, including setting terminal CDI sensitivity, if required, and the conditions under which terminal RAIM is available for departure;
- (3) Programming the destination airport;
- (4) Programming and flying the approaches (especially procedure turns and arcs);
- (5) Changing to another approach after selecting an approach;
- (6) Programming and flying “direct” missed approaches;
- (7) Programming and flying “routed” missed approaches;
- (8) Entering, flying, and exiting holding patterns, particularly on approaches with a second waypoint in the holding pattern;
- (9) Programming and flying a “route” from a holding pattern;
- (10) Programming and flying an approach with radar vectors to the intermediate segment;
- (11) Indication of the actions required for RAIM failure both before and after the FAWP; and
- (12) Programming a radial and distance from a VOR (often used in departure instructions).

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

TSO-C129						
Equipment Class	RAIM	Int. Nav. Sys. to Prov. RAIM Equiv.	Oceanic	En Route	Terminal	Non-precision Approach Capable
Class A – GPS sensor and navigation capability.						
A1	yes		yes	yes	yes	yes
A2	yes		yes	yes	yes	no
Class B – GPS sensor data to an integrated navigation system (i.e., FMS, multi-sensor navigation system, etc.).						
B1	yes		yes	yes	yes	yes
B2	yes		yes	yes	yes	no
B3		yes	yes	yes	yes	yes
B4		yes	yes	yes	yes	no
Class C – GPS sensor data to an integrated navigation system (as in Class B) which provides enhanced guidance to an autopilot, or flight director, to reduce flight tech. errors. Limited to 14 CFR part 121 or equivalent criteria.						
C1	yes		yes	yes	yes	yes
C2	yes		yes	yes	yes	no
C3		yes	yes	yes	yes	yes
C4		yes	yes	yes	yes	no

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

Equipment Type¹	Installation Approval Required	Operational Approval Required	IFR En Route²	IFR Terminal²	IFR Approach³	Oceanic Remote	In Lieu of ADF and/or DME³
Hand held ⁴	X ⁵						
VFR Panel Mount ⁴	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–

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

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

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

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

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

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

a. General

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

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

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

4. In addition to providing the correction signal, the WAAS GEO provides an additional pseudorange measurement to the aircraft receiver, improving the availability of GPS by providing, in effect, an additional GPS satellite in view. The integrity of GPS is improved through real-time monitoring, and the accuracy is improved by providing differential corrections to reduce errors. The performance improvement is sufficient to enable approach procedures with GPS/WAAS glide paths (vertical guidance).

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

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

b. Instrument Approach Capabilities

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

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

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

NOTE-

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

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

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

c. General Requirements

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

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

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

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

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

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

EXAMPLE–

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

or

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

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

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

EXAMPLE–

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

NOTE–

1. Additional information and associated requirements are available in Advisory Circular 90-108 titled “Use of Suitable RNAV Systems on Conventional Routes and Procedures.”

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

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

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

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

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

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

https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afx/afs/afs400/afs410/media/AC90–100compliance.pdf

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. Recognizing, Mitigating, and Adapting to GPS Jamming and/or Spoofing

a. The low-strength data transmission signals from GPS satellites are vulnerable to various anomalies that can significantly reduce the reliability of the navigation signal. The GPS signal is vulnerable and has many uses in aviation (e.g., communication, navigation, surveillance, safety systems and automation); therefore, pilots must place additional emphasis on closely monitoring aircraft equipment performance for any anomalies and promptly inform Air Traffic Control (ATC) of any apparent GPS degradation. Pilots should also be prepared to operate without GPS navigation systems.

b. GPS signals are vulnerable to intentional and unintentional interference from a wide variety of sources, including radars, microwave links, ionosphere effects, solar activity, multi-path error, satellite communications,

GPS repeaters, and even some systems onboard the aircraft. In general, these types of unintentional interference are localized and intermittent. Of greater and growing concern is the intentional and unauthorized interference of GPS signals by persons using “jammers” or “spoofers” to disrupt air navigation by interfering with the reception of valid satellite signals.

NOTE—

The U.S. government regularly conducts GPS tests, training activities, and exercises that interfere with GPS signals. These events are geographically limited, coordinated, scheduled, and advertised via GPS and/or WAAS NOTAMS. Operators of GPS aircraft should always check for GPS and/or WAAS NOTAMS for their route of flight.

c. Manufacturers, operators, and air traffic controllers should be aware of the general impacts of GPS jamming and/or spoofing, which include, but are not limited to:

1. Inability to use GPS for navigation.
2. Inability to use hybrid GPS inertial systems for navigation.
3. Loss of, or degraded, performance-based navigation (PBN) capability (e.g., inability to fly required navigation performance (RNP) procedures).
4. Unreliable triggering of Terrain Awareness and Warning Systems (TAWS).
5. Inaccurate aircraft position on navigation display (e.g., moving map and electronic flight bag).
6. Loss of, or erroneous, Automatic Dependent Surveillance-Broadcast (ADS-B) outputs.
7. Unexpected effects when navigating with conventional NAVAIDS (e.g., if the aircraft is spoofed from the intended flight path, autotuning will not select the nearby NAVAID).
8. Unanticipated position-dependent flight management system effects (e.g., erroneous insufficient fuel indication).
9. Failure or degradation of Air Traffic Management (ATM) infrastructure and its associated systems reliant on GPS, resulting in potential airspace infringements and/or route deviations.
10. Failure of, or erroneous aircraft clocks (resulting in inability to log on to Controller-Pilot Data Link Communications CPDLC).
11. Erroneous wind and ground speed indications.

d. When flying IFR, pilots should have additional navigation equipment for their intended route to crosscheck their position. Routine checks of position against VOR or DME information, for example, could help detect a compromised GPS signal. Pilots transitioning to VOR navigation in response to GPS anomalies should refer to the Chart Supplement U.S. to identify airports with available conventional approaches associated with the VOR Minimum Operational Network (MON) program. (Reference 1-1-3f.)

e. Prior to departure, the FAA recommends operators to:

1. Be aware of potential risk locations.
2. Check for any relevant Notices to Airmen (NOTAMs).
3. Plan fuel contingencies.
4. Plan to use conventional NAVAIDS and appropriate arrival/approach procedures at the destination.
5. Follow the detailed guidance from the respective Original Equipment Manufacturer (OEM).

f. During flight, the FAA recommends operators do the following:

1. Be vigilant for any indication that the aircraft’s GPS is disrupted by reviewing the manufacturer’s guidance for that specific aircraft type and avionics equipage. Verify the aircraft position by means of conventional NAVAIDS, when available. Indications of jamming and/or spoofing may include:

- (a) Changes in actual navigation performance.

- (b) Aircraft clock changes (e.g., incorrect time).
 - (c) Incorrect Flight Management System (FMS) position.
 - (d) Large shift in displayed GPS position.
 - (e) Primary Flight Display (PFD)/Navigation Display (ND) warnings about position error.
 - (f) Other aircraft reporting clock issues, position errors, or requesting vectors.
2. Assess operational risks and limitations linked to the loss of GPS capability, including any on-board systems requiring inputs from a GPS signal.
3. Ensure NAVAIDs critical to the operation for the intended route/approach are available.
4. Remain prepared to revert to conventional instrument flight procedures.
5. Promptly notify ATC if they experience GPS anomalies. Pilots should not inform ATC of GPS jamming and/or spoofing when flying through known NOTAMed testing areas unless they require ATC assistance. (See paragraph 1-1-13)
- g. Post flight, the FAA recommends operators to:
- 1. Document any GPS jamming and/or spoofing in the maintenance log to ensure all faults are cleared.
 - 2. File a detailed report at the reporting site: *Report a GPS Anomaly Federal Aviation Administration*, www.faa.gov/air_traffic/nas/gps_reports.

Chapter 2. Aeronautical Lighting and Other Airport Visual Aids

Section 1. Airport Lighting Aids

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

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

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

2-1-2. Visual Glideslope Indicators

a. Visual Approach Slope Indicator (VASI)

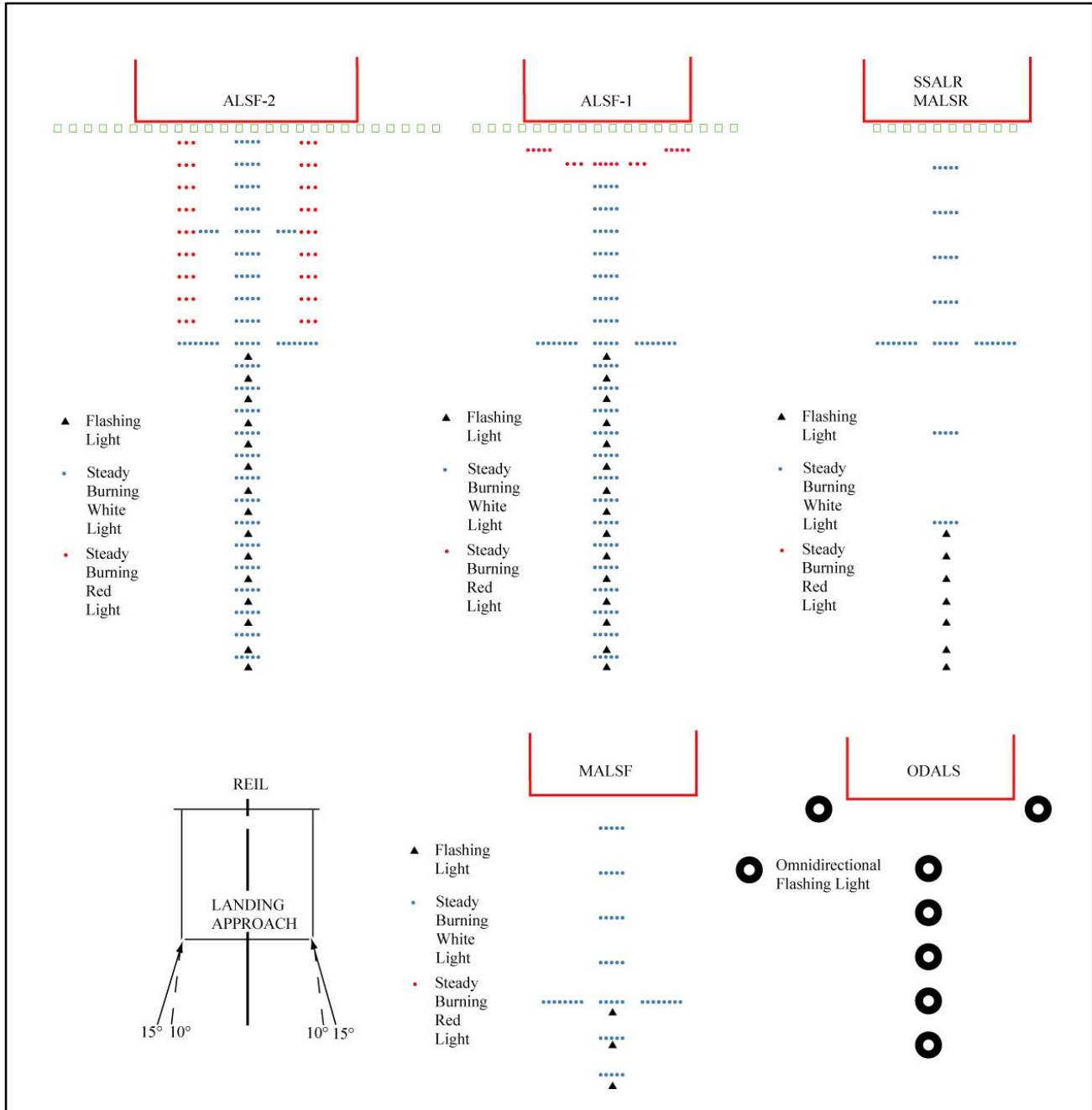
1. VASI installations may consist of either 2, 4, 6, 12, or 16 light units arranged in bars referred to as near, middle, and far bars. Most VASI installations consist of 2 bars, near and far, and may consist of 2, 4, or 12 light units. Some VASIs consist of three bars, near, middle, and far, which provide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

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

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

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

FIG 2-1-1
Precision & Nonprecision Configurations



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

FIG 2-3-35

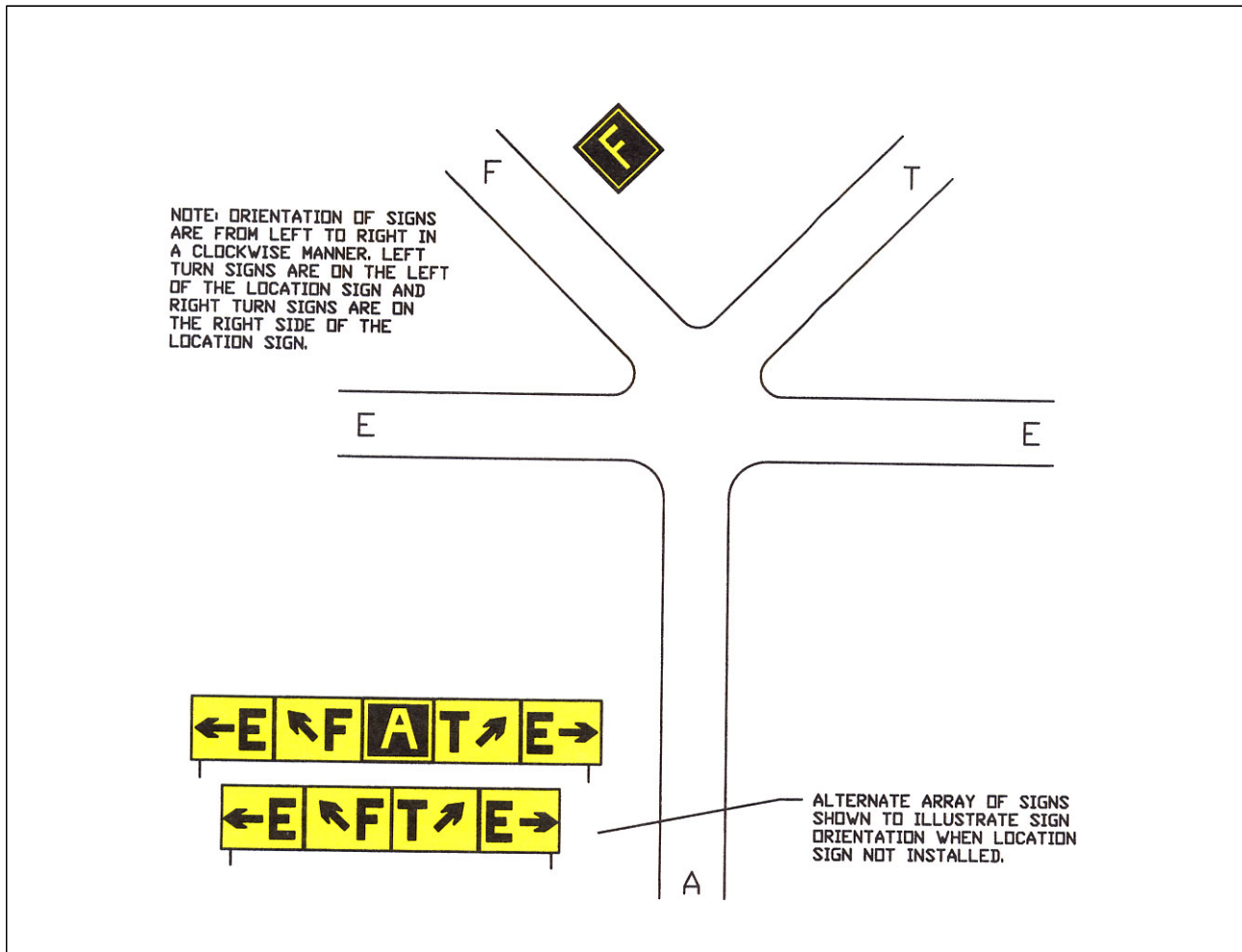
Direction Sign Array with Location Sign on Far Side of Intersection

FIG 2-3-36

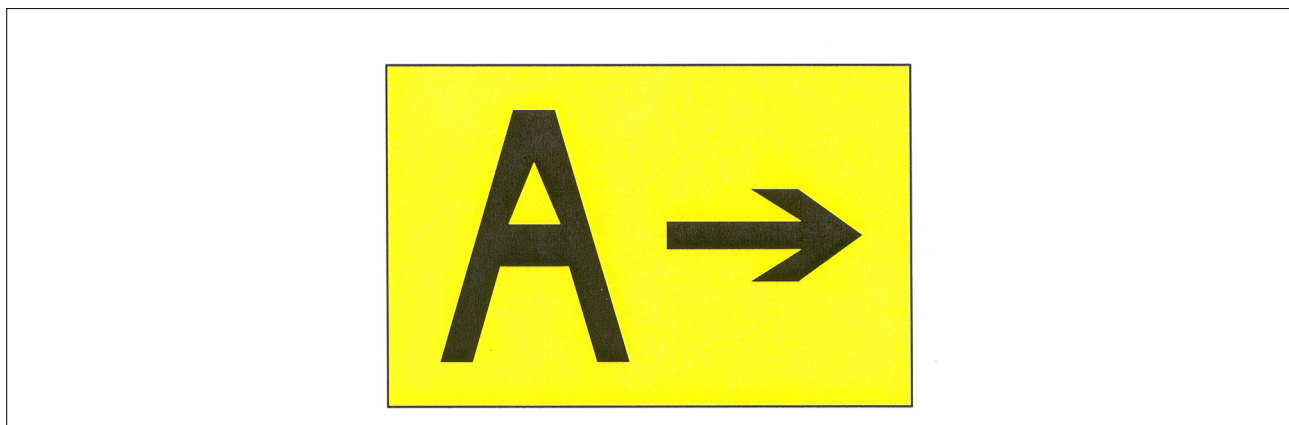
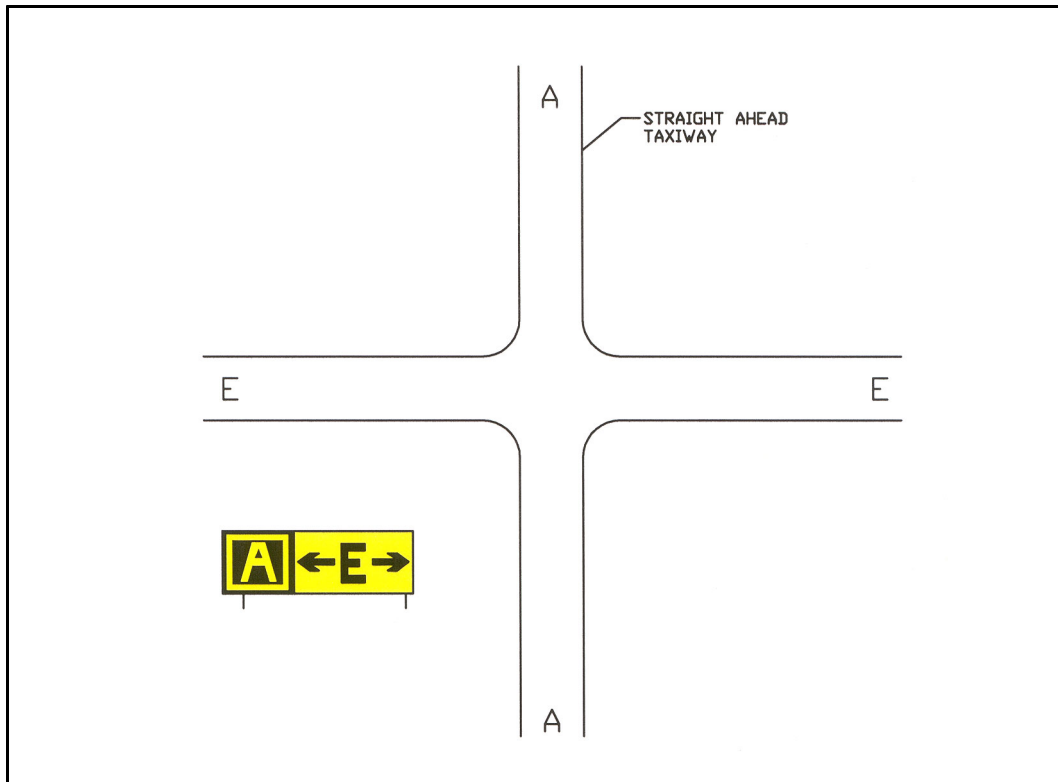
Direction Sign for Runway Exit

FIG 2-3-37
Direction Sign Array for Simple Intersection



2-3-11. Destination Signs

a. Destination signs have a yellow background with a black inscription indicating a taxi route to a destination on the airport. These signs supplement standard taxiway direction signs to optimize taxi paths to specific areas of the airport.

b. Destination signs always have an arrow showing the direction of the taxi route to the destination indicated on the sign. Where the destination sign arrow indicates a turn, the sign location is prior to the intersection. The sign may reside on the opposite side of an intersection for straight ahead paths and for ending taxiway intersections.

c. Inbound destination signs identify a taxi path to specific areas of the airport. Sign legends are typically short descriptions or abbreviations of the destination. FIG 2-3-38 shows examples of typical inbound destination signs. Common sign legends include:

1. APRON. General parking, servicing, and loading areas

(a) FBO Apron. An apron where itinerant general aviation operators can park their aircraft and expect to have access to traditional Fixed Base Operator services subject to terms and conditions.

(b) GA Transient Apron. An apron where itinerant general aviation operators can park their aircraft without FBO services and subject to terms and conditions.

(c) GA Tenant Apron. An area designated for parking of based general aviation aircraft, e.g., tie down area.

(d) North/South/East/West Apron. An apron designation describing relative location on the airport.

2. CARGO. Areas set aside for cargo handling.

- 3. CIVIL.** Areas set aside for civil aircraft.
- 4. FUEL.** Areas where aircraft receive fuel or related services.
- 5. INTL.** Areas set aside for handling international flights.
- 6. MIL.** Areas set aside for military aircraft.
 - (a) ANG.** Area reserved for Air National Guard
 - (b) USN.** Area reserved for U.S. Navy
- 7. PARKING.** Alternative name for apron area.
- 8. PAX.** Areas set aside for passenger handling.
- 9. RAMP.** Name synonymous with APRON.

10. TERM. Gate positions at which aircraft load or unload passengers and cargo.

d. Outbound destination signs identify the general direction to departure runways. The sign legend consists of direction arrow(s) and the applicable runway designations. FIG 2-3-39 is an example of a typical outbound destination sign.

e. When a sign indicates the inscription for two or more destinations having a common taxi route, a “dot” (•) separates the destinations and one arrow indicates the direction of the taxi path, as shown in FIG 2-3-39.

f. When a sign shows the inscription for two or more destinations having different taxiing routes, each destination will have its own arrow to indicate the taxi direction. A vertical black message divider separates each destination, as shown in FIG 2-3-40.

FIG 2-3-38
Inbound Destination Sign Example



FIG 2-3-39
Outbound Destination Sign for Common Taxi Route to Two Separate Runways



FIG 2-3-40

Destination Sign for Different Taxiing Routes to Two Runways**2-3-12. Information Signs**

Information signs have a yellow background with a black inscription. They are used to provide the pilot with information on such things as areas that cannot be seen from the control tower, applicable radio frequencies, and noise abatement procedures. The airport operator determines the need, size, and location for these signs.

2-3-13. Runway Distance Remaining Signs

Runway distance remaining signs have a black background with a white numeral inscription and may be installed along one or both side(s) of the runway. The number on the signs indicates the distance (in thousands of feet) of landing runway remaining. The last sign (i.e., the sign with the numeral “1”) will be located at least 950 feet from the runway end. FIG 2-3-41 shows an example of a runway distance remaining sign.

FIG 2-3-41

Runway Distance Remaining Sign Indicating 3,000 feet of Runway Remaining**2-3-14. Aircraft Arresting Systems**

a. Certain airports are equipped with a means of rapidly stopping military aircraft on a runway. This equipment, normally referred to as EMERGENCY ARRESTING GEAR, generally consists of pendant cables

supported over the runway surface by rubber “donuts.” Although most devices are located in the overrun areas, a few of these arresting systems have cables stretched over the operational areas near the ends of a runway.

b. Arresting cables which cross over a runway require special markings on the runway to identify the cable location. These markings consist of 10 feet diameter solid circles painted “identification yellow,” 30 feet on center, perpendicular to the runway centerline across the entire runway width. Additional details are contained in AC 150/5220–9, Aircraft Arresting Systems for Joint Civil/Military Airports.

NOTE–

Aircraft operations on the runway are not restricted by the installation of aircraft arresting devices.

c. Engineered Materials Arresting Systems (EMAS). EMAS, which is constructed of high energy-absorbing materials of selected strength, is located in the safety area beyond the end of the runway. EMAS will be marked with yellow chevrons. EMAS is designed to crush under the weight of commercial aircraft and will exert deceleration forces on the landing gear. These systems do not affect the normal landing and takeoff of airplanes. More information concerning EMAS is in AC 150/5220–22, Engineered Materials Arresting Systems (EMAS) for Aircraft Overruns.

NOTE–

EMAS may be located as close as 35 feet beyond the end of the runway. Aircraft and ground vehicles should never taxi or drive across the EMAS or beyond the end of the runway if EMAS is present.

FIG 2–3–42

Engineered Materials Arresting System (EMAS)



2–3–15. Security Identification Display Area (SIDA)

a. Security Identification Display Areas (SIDA) are limited access areas that require a badge issued in accordance with procedures in 49 CFR part 1542. A SIDA can include the Air Operations Area (AOA), e.g., aircraft movement area or parking area, or a Secured Area, such as where commercial passengers enplane. The AOA may not be a SIDA, but a Secured Area is always a SIDA. Movement through or into a SIDA is prohibited without authorization and proper identification being displayed. If you are unsure of the location of a SIDA, contact the airport authority for additional information. Airports that have a SIDA will have a description and map detailing boundaries and pertinent features available.

b. Pilots or passengers without proper identification that are observed entering a SIDA may be reported to the Transportation Security Administration (TSA) or airport security and may be subject to civil and criminal fines and prosecution. Pilots are advised to brief passengers accordingly. Report suspicious activity to the TSA by calling AOPA's Airport Watch Program, 866-427-3287. 49 CFR 1540 requires each individual who holds an airman certificate, medical certificate, authorization, or license issued by the FAA to present it for inspection upon a request from TSA.

FIG 2-3-43
Sample SIDA Warning Sign



of each Class D airspace area is individually tailored and when instrument procedures are published, the airspace will normally be designed to contain the procedures.

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

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

NOTE-

1. *The airport listing in the Chart Supplement will state the part-time surface area status (for example, “other times CLASS E” or “other times CLASS G”).*

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

b. Operating Rules and Pilot/Equipment Requirements:

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

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

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

NOTE-

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

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

EXAMPLE-

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

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

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

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

4. Departures from:

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

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

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

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

d. Surface area arrival extensions:

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

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

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

3-2-6. Class E Airspace

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

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

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

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

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

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

NOTE-

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

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

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

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

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

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

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

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

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

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

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

Center (AOC) operate weather reconnaissance/research aircraft missions, in support of the National Hurricane Operations Plan (NHOP), to gather meteorological data on hurricanes and tropical cyclones. 53rd WRS and NOAA AOC aircraft normally conduct these missions in airspace identified in a published WRA Notice to Airmen (NOTAM).

b. WRAs. Airspace with defined dimensions and published by a NOTAM, which is established to support weather reconnaissance/research flights. ATC services are not provided within WRAs. Only participating weather reconnaissance/research aircraft from the 53rd WRS and NOAA AOC are permitted to operate within a WRA. A WRA may only be established in airspace within U. S. Flight Information Regions (FIR) outside of U. S. territorial airspace.

c. A published WRA NOTAM describes the airspace dimensions of the WRA and the expected activities within the WRA. WRAs may border adjacent foreign FIRs, but are wholly contained within U.S. FIRs. As ATC services are not provided within a WRA, non-participating aircraft should avoid WRAs, and IFR aircraft should expect to be rerouted to avoid WRAs.

3-5-10. Other Non-Charted Airspace Areas

a. Stationary or Moving Altitude Reservation (ALTRV). A Stationary or Moving ALTRV is announced via an airspace NOTAM issued by the Central Altitude Reservation Facility (CARF) or ARTCC. These announcements will appear in CARF and/or ARTCC NOTAMS. This airspace ensures non-participating IFR aircraft remain separated from special activity. Non-participating VFR aircraft are permitted to fly through the area but should exercise vigilance.

b. 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. ATCAA locations and scheduled activation information can be found on the FAA SUA website; a NOTAM will not be issued to announce the activation of this airspace.

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, Para 5-4-3, Approach Control.

4-1-3. Flight Service Stations

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

4-1-4. Recording and Monitoring

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

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

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

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

REFERENCE-

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

NOTE–

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

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

(See TBL 4–1–1.)

a. Airport Operations Without Operating Control Tower

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

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

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

2. An airport may have a full or part-time tower or FSS located on the airport, a full or part-time UNICOM station or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain

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

4–1–15. Radar Traffic Information Service

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

a. Purpose of the Service

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

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

b. Provisions of the Service

1. Many factors, such as limitations of the radar, volume of traffic, controller workload and communications frequency congestion, could prevent the controller from providing this service. Controllers possess complete discretion for determining whether they are able to provide or continue to provide this service in a specific case.

The controller's reason against providing or continuing to provide the service in a particular case is not subject to question nor need it be communicated to the pilot. In other words, the provision of this service is entirely dependent upon whether controllers believe they are in a position to provide it. Traffic information is routinely provided to all aircraft operating on IFR flight plans except when the pilot declines the service, or the pilot is operating within Class A airspace. Traffic information may be provided to flights not operating on IFR flight plans when requested by pilots of such flights.

NOTE—

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

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

NOTE—

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

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

1. Radar identified

- (a) Azimuth from the aircraft in terms of the 12 hour clock, or
- (b) When rapidly maneuvering civil test or military aircraft prevent accurate issuance of traffic as in (a) above, specify the direction from an aircraft's position in terms of the eight cardinal compass points (N, NE, E, SE, S, SW, W, NW). This method must be terminated at the pilot's request.
- (c) Distance from the aircraft in nautical miles;
- (d) Direction in which the target is proceeding; and
- (e) Type of aircraft and altitude if known.

EXAMPLE—

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

2. Not radar identified

- (a) Distance and direction with respect to a fix;
- (b) Direction in which the target is proceeding; and

5. Transponder and ADS-B Operation Under Visual Flight Rules (VFR).

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

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

(c) When participating in a VFR standard formation flight that is not receiving ATC services, only the lead aircraft should operate its transponder and ADS-B Out and squawk code 1203. Once established in formation, all other aircraft should squawk standby and disable ADS-B transmissions.

NOTE-

1. If the formation flight is receiving ATC services, pilots can expect ATC to direct all non-lead aircraft to STOP Squawk, and should not do so until instructed.
2. Firefighting aircraft not in contact with ATC may squawk 1255 in lieu of 1200 while en route to, from, or within the designated firefighting area(s).
3. VFR aircraft flying authorized SAR missions for the USAF or USCG may be advised to squawk 1277 in lieu of 1200 while en route to, from, or within the designated search area.
4. VFR gliders should squawk 1202 in lieu of 1200.

REFERENCE-

FAA Order JO 7110.66, National Beacon Code Allocation Plan (NBCAP).

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

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

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

NOTE-

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

b. Transponder/ADS-B Code Designation

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

NOTE-

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

REFERENCE-

FAA Order JO 7110.66, National Beacon Code Allocation Plan (NBCAP).

c. Automatic Altitude Reporting

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

2. Adjust the transponder/ADS-B to reply on the Mode 3/A code specified by ATC and with altitude reporting enabled, unless otherwise directed by ATC or unless the altitude reporting equipment has not been tested and calibrated as required by 14 CFR section 91.217. If deactivation is required by ATC, turn off the

altitude reporting feature of your transponder/ADS-B. An instruction by ATC to “STOP ALTITUDE SQUAWK, ALTITUDE DIFFERS BY (number of feet) FEET,” may be an indication that the transmitted altitude information is incorrect, or that the aircraft’s altimeter setting is incorrect. While an incorrect altimeter setting has no effect on the transmitted altitude information, it will cause the aircraft to fly at a true altitude different from the assigned altitude. When a controller indicates that an altitude readout is invalid, the pilot should verify that the aircraft altimeter is set correctly.

NOTE—

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

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

d. IDENT Feature

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

e. Code Changes

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

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

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

f. Mode C Transponder and ADS-B Out Requirements

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

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

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

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

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

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

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

NOTE—

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

Section 3. Airport Operations

4-3-1. General

Increased traffic congestion, aircraft in climb and descent attitudes, and pilot preoccupation with cockpit duties are some factors that increase the hazardous accident potential near the airport. The situation is further compounded when the weather is marginal, that is, just meeting VFR requirements. Pilots must be particularly alert when operating in the vicinity of an airport. This section defines some rules, practices, and procedures that pilots should be familiar with and adhere to for safe airport operations.

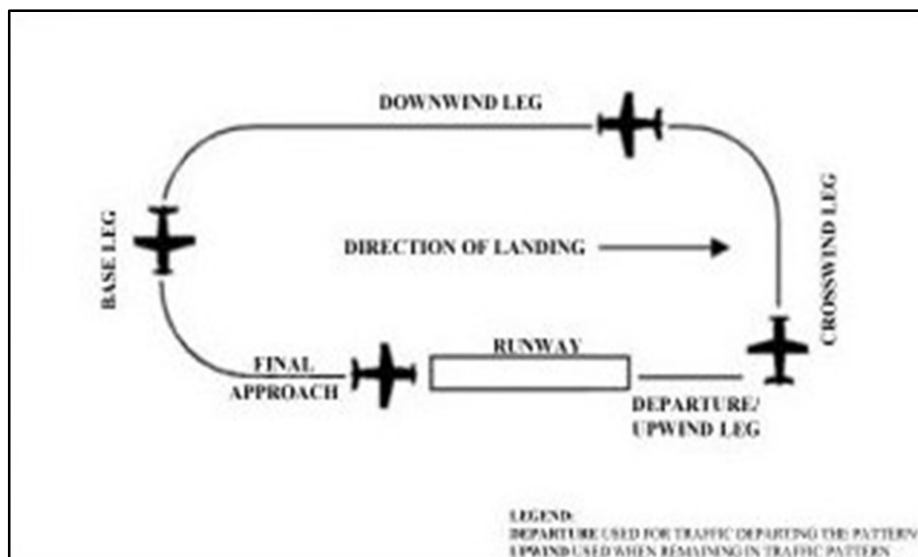
4-3-2. Airports with an Operating Control Tower

a. When operating at an airport where traffic control is being exercised by a control tower, pilots are required to maintain two-way radio contact with the tower while operating within the Class B, Class C, and Class D surface area unless the tower authorizes otherwise. Initial callup should be made about 15 miles from the airport. Unless there is a good reason to leave the tower frequency before exiting the Class B, Class C, and Class D surface areas, it is a good operating practice to remain on the tower frequency for the purpose of receiving traffic information. In the interest of reducing tower frequency congestion, pilots are reminded that it is not necessary to request permission to leave the tower frequency once outside of Class B, Class C, and Class D surface areas. Not all airports with an operating control tower will have Class D airspace. These airports do not have weather reporting which is a requirement for surface based controlled airspace, previously known as a control zone. The controlled airspace over these airports will normally begin at 700 feet or 1,200 feet above ground level and can be determined from the visual aeronautical charts. Pilots are expected to use good operating practices and communicate with the control tower as described in this section.

b. When necessary, the tower controller will issue clearances or other information for aircraft to generally follow the desired flight path (traffic patterns) when flying in Class B, Class C, and Class D surface areas and the proper taxi routes when operating on the ground. If not otherwise authorized or directed by the tower, pilots of fixed-wing aircraft approaching to land must circle the airport to the left. Pilots approaching to land in a helicopter must avoid the flow of fixed-wing traffic. However, in all instances, an appropriate clearance must be received from the tower before landing.

FIG 4-3-1

Components of a Traffic Pattern



NOTE—

This diagram is intended only to illustrate terminology used in identifying various components of a traffic pattern. It should not be used as a reference or guide on how to enter a traffic pattern.

c. The following terminology for the various components of a traffic pattern has been adopted as standard for use by control towers and pilots (See FIG 4–3–1):

1. Departure. The flight path that begins after takeoff and continues straight ahead along the extended runway centerline. The departure climb continues until reaching a point at least 1/2 mile beyond the departure end of the runway and within 300 feet of the traffic pattern altitude.

2. Upwind leg. A flight path that begins after departure and continues straight ahead along the extended runway centerline. Upwind leg is an extension of departure and is used when issuing control instructions for separation, spacing, or sequencing.

3. Crosswind leg. A flight path at right angles to the landing runway off its takeoff end.

4. Downwind leg. A flight path parallel to the landing runway in the opposite direction of landing.

5. Base leg. A flight path at right angles to the landing runway off its approach end and extending from the downwind leg to the intersection of the extended runway centerline.

6. Final approach. A flight path in the direction of landing along the extended runway centerline from the base leg to the runway.

d. Many towers are equipped with a tower radar display. The radar uses are intended to enhance the effectiveness and efficiency of the local control, or tower, position. They are not intended to provide radar services or benefits to pilots except as they may accrue through a more efficient tower operation. The four basic uses are:

1. To determine an aircraft's exact location. This is accomplished by radar identifying the VFR aircraft through any of the techniques available to a radar position, such as having the aircraft *squawk ident*. Once identified, the aircraft's position and spatial relationship to other aircraft can be quickly determined, and standard instructions regarding VFR operation in Class B, Class C, and Class D surface areas will be issued. Once initial radar identification of a VFR aircraft has been established and the appropriate instructions have been issued, radar monitoring may be discontinued; the reason being that the local controller's primary means of surveillance in VFR conditions is visually scanning the airport and local area.

2. To provide radar traffic advisories. Radar traffic advisories may be provided to the extent that the local controller is able to monitor the radar display. Local control has primary control responsibilities to the aircraft operating on the runways, which will normally supersede radar monitoring duties.

3. To provide a direction or suggested heading. The local controller may provide pilots flying VFR with generalized instructions which will facilitate operations; e.g., "PROCEED SOUTHWESTBOUND, ENTER A RIGHT DOWNWIND RUNWAY THREE ZERO," or provide a suggested heading to establish radar identification or as an advisory aid to navigation; e.g., "SUGGESTED HEADING TWO TWO ZERO, FOR RADAR IDENTIFICATION." In both cases, the instructions are advisory aids to the pilot flying VFR and are not radar vectors.

NOTE—

Pilots have complete discretion regarding acceptance of the suggested headings or directions and have sole responsibility for seeing and avoiding other aircraft.

4. To provide information and instructions to aircraft operating within Class B, Class C, and Class D surface areas. In an example of this situation, the local controller would use the radar to advise a pilot on an extended downwind when to turn base leg.

NOTE—

The above tower radar applications are intended to augment the standard functions of the local control position. There is no controller requirement to maintain constant radar identification. In fact, such a requirement could compromise the local

controller's ability to visually scan the airport and local area to meet FAA responsibilities to the aircraft operating on the runways and within the Class B, Class C, and Class D surface areas. Normally, pilots will not be advised of being in radar contact since that continued status cannot be guaranteed and since the purpose of the radar identification is not to establish a link for the provision of radar services.

e. A few of the radar equipped towers are authorized to use the radar to ensure separation between aircraft in specific situations, while still others may function as limited radar approach controls. The various radar uses are strictly a function of FAA operational need. The facilities may be indistinguishable to pilots since they are all referred to as tower and no publication lists the degree of radar use. Therefore, when in communication with a tower controller who may have radar available, do not assume that constant radar monitoring and complete ATC radar services are being provided.

4-3-3. Traffic Patterns

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

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

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

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

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

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

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

EXAMPLE—
RP 9, 18, 22R

NOTE—

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

REFERENCE—

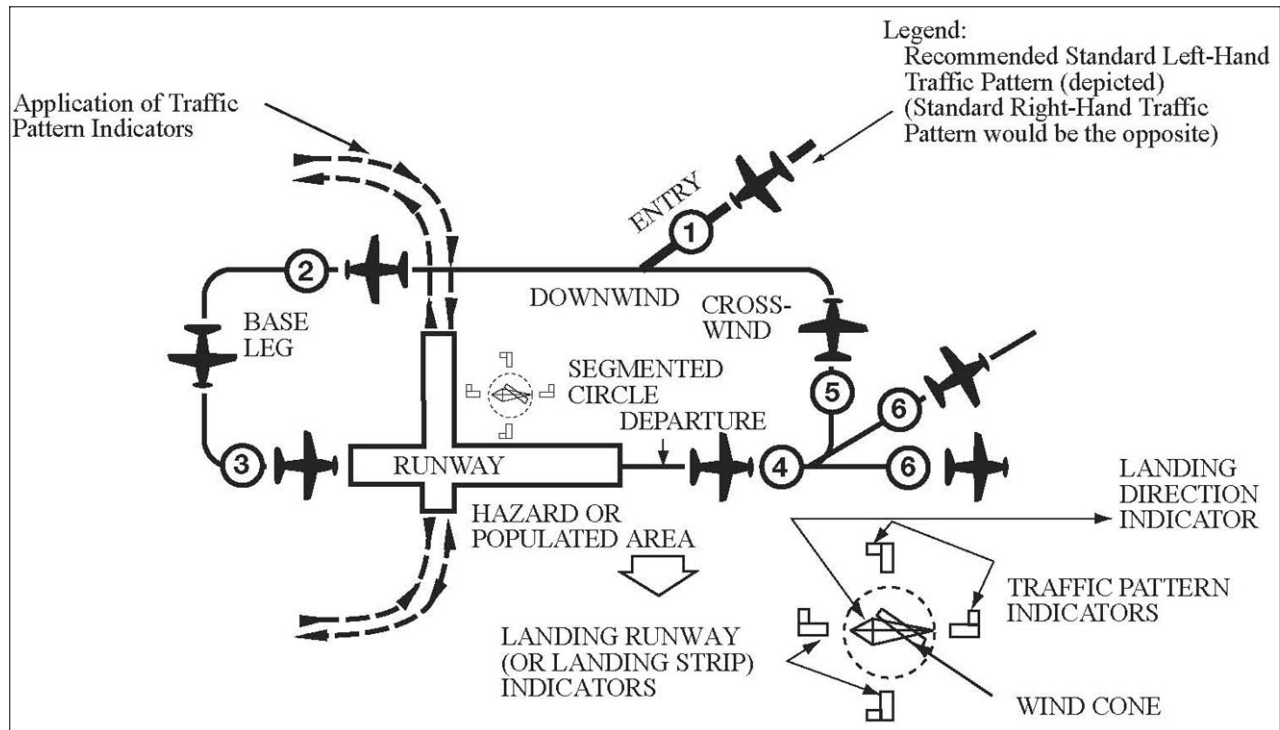
AC 90-66, Non-Towered Airport Flight Operations.

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

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

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

FIG 4-3-2
Traffic Pattern Operations
Single Runway



EXAMPLE—

Key to traffic pattern operations

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

EXAMPLE–

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

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

EXAMPLE–

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

REFERENCE–

AIM, Para 7–1–24, Microbursts.

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

d. The WSP provides weather processor enhancements to selected Airport Surveillance Radar (ASR)–9 facilities. The WSP provides Air Traffic with detection and alerting of hazardous weather such as wind shear, microbursts, and significant thunderstorm activity. The WSP displays terminal area 6 level weather, storm cell locations and movement, as well as the location and predicted future position and intensity of wind shifts that may affect airport operations. Controllers will receive and issue alerts based on Areas Noted for Attention (ARENA). An ARENA extends on the runway center line from a 3 mile final to the runway to a 2 mile departure.

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

4–3–8. Braking Action Reports and Advisories

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

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

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

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

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

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

4–3–9. Runway Condition Reports

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

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

NOTE–

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

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

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

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

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

NOTE–

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

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

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

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

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

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

REFERENCE–

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

NOTE–

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

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

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

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

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

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

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

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

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

2. Transponder. This airborne radar beacon transmitter-receiver automatically receives the signals from the interrogator and selectively replies with a specific pulse group (code) only to those interrogations being received on the mode to which it is set. These replies are independent of, and much stronger than a primary radar return.

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

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

1. Reinforcement of radar targets.
2. Rapid target identification.
3. Unique display of selected codes.

c. A part of the ATCRBS ground equipment is the decoder. This equipment enables a controller to assign discrete transponder codes to each aircraft under his/her control. Normally only one code will be assigned for

the entire flight. Assignments are made by the ARTCC computer on the basis of the National Beacon Code Allocation Plan. The equipment is also designed to receive Mode C altitude information from the aircraft.

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

REFERENCE—

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

4-5-3. Surveillance Radar

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

1. Condition observed;
2. Date and time of observation;
3. Altitude and location of observation;
4. Type and call sign of the aircraft; and
5. Type and software version of avionics system.

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

a. Introduction

TIS-B is the broadcast of ATC derived traffic information to ADS-B equipped (1090ES or UAT) aircraft from ground radio stations. The source of this traffic information is derived from ground-based air traffic surveillance sensors. TIS-B service will be available throughout the NAS where there are both adequate surveillance coverage from ground sensors and adequate broadcast coverage from ADS-B ground radio stations. The quality level of traffic information provided by TIS-B is dependent upon the number and type of ground sensors available as TIS-B sources and the timeliness of the reported data. (See FIG 4-5-7 and FIG 4-5-8.)

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, or by sending an email to the ADS-B help desk at adsb@faa.gov. Reports should include:

1. Condition observed;
2. Date and time of observation;
3. Altitude and location of observation;
4. Type and call sign of the aircraft; and
5. Type and software version of avionics system.

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

a. Introduction.

FIS-B is a ground broadcast service provided through the ADS-B Services network over the 978 MHz UAT data link. The FAA FIS-B system provides pilots and flight crews of properly equipped aircraft with a cockpit display of certain aviation weather and aeronautical information. FIS-B reception is line-of-sight within the service volume of the ground infrastructure. (See FIG 4–5–7 and FIG 4–5–8.)

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 (NOTAMs)/temporary flight restrictions (TFRs).

REFERENCE–

AIM, Para 7–1–9, Flight Information Services (FIS).

Advisory Circular (AC) 00–63, Use of Cockpit Displays of Digital Weather and Aeronautical Information.

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

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

a. Applicability. The policies, guidance and direction in this section apply to RVSM operations in the airspace over the lower 48 states, Alaska, Atlantic and Gulf of America High Offshore Airspace and airspace in the San Juan FIR where VHF or UHF voice direct controller-pilot communication (DCPC) is normally available. Policies, guidance and direction for RVSM operations in oceanic airspace where VHF or UHF voice DCPC is not available and the airspace of other countries can be found in the Aeronautical Information Publication (AIP), Part II- En Route, ENR 1. General Rules and Procedures, and ENR 7. Oceanic Operations.

b. Requirement. The FAA implemented RVSM between flight level (FL) 290-410 (inclusive) in the following airspace: the airspace of the lower 48 states of the United States, Alaska, Atlantic and Gulf of America High Offshore Airspace and the San Juan FIR. RVSM has been implemented worldwide and may be applied in all ICAO Flight Information Regions (FIR).

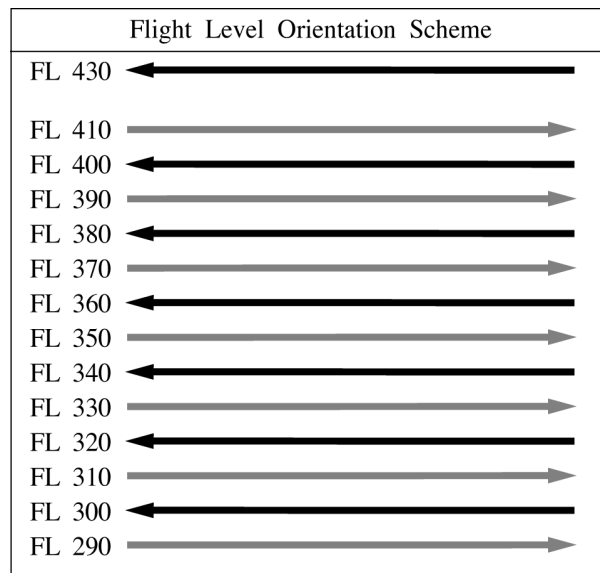
c. RVSM Authorization. In accordance with 14 CFR section 91.180, with only limited exceptions, prior to operating in RVSM airspace, operators must comply with the standards of part 91, Appendix G, and be authorized by the Administrator. If either the operator or the operator's aircraft have not met the applicable RVSM standards, the aircraft will be referred to as a "non-RVSM" aircraft. Paragraph 4-6-10 discusses ATC policies for accommodation of non-RVSM aircraft flown by the Department of Defense, Air Ambulance (MEDEVAC) operators, foreign State governments and aircraft flown for certification and development. Paragraph 4-6-11, Non-RVSM Aircraft Requesting Climb to and Descent from Flight Levels Above RVSM Airspace Without Intermediate Level Off, contains policies for non-RVSM aircraft climbing and descending through RVSM airspace to/from flight levels above RVSM airspace.

d. Benefits. RVSM enhances ATC flexibility, mitigates conflict points, enhances sector throughput, reduces controller workload and enables crossing traffic. Operators gain fuel savings and operating efficiency benefits by flying at more fuel efficient flight levels and on more user preferred routings.

4-6-2. Flight Level Orientation Scheme

Altitude assignments for direction of flight follow a scheme of odd altitude assignment for magnetic courses 000-179 degrees and even altitudes for magnetic courses 180-359 degrees for flights up to and including FL 410, as indicated in FIG 4-6-1.

FIG 4-6-1
Flight Level Orientation Scheme



NOTE—

Odd Flight Levels: Magnetic Course 000–179 Degrees Even Flight Levels: Magnetic Course 180–359 Degrees.

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

a. RVSM Authority. 14 CFR section 91.180 applies to RVSM operations within the U.S. 14 CFR section 91.706 applies to RVSM operations outside the U.S. Both sections require that the operator be authorized prior to operating in RVSM airspace. For Domestic RVSM operations, an operator may choose to operate under the provisions of part 91, Appendix G, section 9; or if intending to operate outside U.S. airspace, hold a specific approval (OpSpec/MSpec/LOA) under the provisions of section 3 of part 91, Appendix G.

b. Sources of Information. Advisory Circular (AC) 91-85, Authorization of Aircraft and Operators for Flight in Reduced Vertical Separation Minimum (RVSM) Airspace, and the FAA RVSM website.

c. TCAS Equipage. TCAS equipage requirements are contained in 14 CFR sections 121.356, 125.224, 129.18 and 135.189. part 91, Appendix G, does not contain TCAS equipage requirements specific to RVSM, however, Appendix G does require that aircraft equipped with TCAS II and flown in RVSM airspace be modified to incorporate TCAS II Version 7.0 or a later version.

d. Aircraft Monitoring. Operators are required to participate in the RVSM altitude-keeping performance monitoring program that is appropriate for the type of operation being conducted. The monitoring programs are described in AC 91-85. Monitoring is a quality control program that enables the FAA and other civil aviation authorities to assess the in-service altitude-keeping performance of aircraft and operators.

e. Purpose of RVSM Approvals Databases. All RVSM designated airspace is monitored airspace. ATC does not use RVSM approvals databases to determine whether or not a clearance can be issued into RVSM airspace. RVSM program managers do regularly review the operators and aircraft that operate in RVSM airspace to identify and investigate those aircraft and operators flying in RVSM airspace, but not listed on the RVSM approvals databases.

f. Registration of U.S. Operators. When U.S. operators and aircraft are granted specific RVSM authority, the Separation Standards Group at the FAA Technical Center obtains PTRS operator and aircraft information to update the FAA maintained U.S. Operator/Aircraft RVSM Approvals database. Basic database operator and aircraft information can be viewed on the RVSM Documentation web page in the “RVSM Approvals” section.

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

4-7-1. Introduction and General Policies

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

1. Houston Oceanic Control Area (CTA)/Flight Information Region (FIR).
2. Gulf of America portion of the Miami Oceanic CTA/FIR.
3. Monterrey CTA.
4. Merida High CTA within the Mexico FIR/UTA.

b. Within the Gulf of America airspace described above, pairs of airplanes whose flight plans indicate approval for PBN and either RNP 10 or RNP 4 may be spaced by ATC at lateral intervals of 50 NM. ATC will space any airplane without RNP 10 or RNP 4 capability such that at least 90 NM lateral separation is maintained with other airplanes in the Miami Oceanic CTA, and at least 100 NM separation is maintained in the Houston, Monterrey, and Merida CTAs.

c. The reduced lateral separation allows more airplanes to fly on optimum routes/altitudes over the Gulf of America.

d. 50 NM lateral separation is not applied on routes defined by ground navigation aids or on Gulf RNAV Routes Q100, Q102, or Q105.

e. Useful information for flight planning and operations over the Gulf of America, under this 50 NM lateral separation policy, as well as information on how to obtain RNP 10 or RNP 4 authorization, can be found in the West Atlantic, Gulf of America, and Caribbean Resource Guide for U.S. Operators located at: <https://www.faa.gov/headquartersoffices/avs/wat-gulf-and-caribbean-resource-guide>.

4-7-2. Accommodating Non-RNP 10 Aircraft

a. Operators not authorized for RNP 10 or RNP 4 may still file for any route and altitude within the Gulf of America CTAs. However, clearance on the operator's preferred route and/or altitude will be provided as traffic allows for 90 or 100 NM lateral separation between the non-RNP 10 aircraft and any others. Priority will be given to RNP 10 or RNP 4 aircraft.

b. Operators of aircraft not authorized RNP 10 or RNP 4 must include the annotation "RMK/NONRNP10" in Item 18 of their ATC flight plan.

c. Pilots of non-RNP 10 aircraft are to remind ATC of their RNP status; i.e., report "negative RNP 10" upon initial contact with ATC in each Gulf CTA.

d. Operators will likely benefit from the effort they invest to obtain RNP 10 or RNP 4 authorization, provided they are flying aircraft equipped to meet RNP 10 or RNP 4 standards.

4-7-3. Obtaining RNP 10 or RNP 4 Operational Authorization

a. For U.S. operators, AC 90-105, Approval Guidance for RNP Operations and Barometric Vertical Navigation in the U.S. National Airspace System and in Oceanic and Remote Continental Airspace, provides the aircraft and operator qualification criteria for RNP 10 or RNP 4 authorizations. FAA personnel at flight standards district offices (FSDO) and certificate management offices (CMO) will use the guidance contained

in AC 90–105 to evaluate an operator’s application for RNP 10 or RNP 4 authorization. Authorization to conduct RNP operations in oceanic airspace is provided to all U.S. operators through issuance of Operations Specification (OpSpec), Management Specification (MSpec), or Letter of Authorization (LOA) B036, as applicable to the nature of the operation; for example, part 121, part 91, etc. Operators may wish to review FAA Order 8900.1, Flight Standards Information Management System, volume 3, chapter 18, section 4, to understand the specific criteria for issuing OpSpec, MSpec, and/or LOA B036.

b. The operator’s RNP 10 or RNP 4 authorization should include any equipment requirements and RNP 10 time limits (if operating solely inertial–based navigation systems), which must be observed when conducting RNP operations. RNP 4 requires tighter navigation and track maintenance accuracy than RNP 10.

4–7–4. Authority for Operations with a Single Long–Range Navigation System

■ Operators may be authorized to take advantage of 50 NM lateral separation in the Gulf of America CTAs when equipped with only a single long–range navigation system. RNP 10 with a single long–range navigation system is authorized via OpSpec, MSpec, or LOA B054. Operators should contact their FSDO or CMO to obtain information on the specific requirements for obtaining B054. Volume 3, chapter 18, section 4 of FAA Order 8900.1 provides the qualification criteria to be used by FAA aviation safety inspectors in issuing B054.

4–7–5. Flight Plan Requirements

■ a. In order for an operator with RNP 10 or RNP 4 authorization to obtain 50 NM lateral separation in the Gulf of America CTAs, and therefore obtain preferred routing available to RNP authorized aircraft, the international flight plan form (FAA 7233–4) must be annotated as follows:

1. Item 10a (Equipment) must include the letter “R.”

2. Item 18 must include either “PBN/A1” for RNP 10 authorization or “PBN/L1” for RNP 4 authorization.

b. Indication of RNP 4 authorization implies the aircraft and pilots are also authorized RNP 10.

c. Chapter 5, Section 1, of this manual includes information on all flight plan codes. RNP 10 has the same meaning and application as RNAV 10. They share the same code.

4–7–6. Contingency Procedures

Pilots operating under reduced lateral separation must be particularly familiar with, and prepared to rapidly implement, the standard contingency procedures specifically written for operations when outside ATC surveillance and direct VHF communications (for example, the oceanic environment). Specific procedures have been developed for weather deviations. Operators should ensure all flight crews operating in this type of environment have been provided the standard contingency procedures in a readily accessible format. The margin for error when operating at reduced separation mandates correct and expeditious application of the standard contingency procedures. These internationally accepted procedures are published in ICAO Document 4444, chapter 15. The procedures are also reprinted in the U.S. Aeronautical Information Publication (AIP), En Route (ENR) Section 7.3, Special Procedures for In–flight Contingencies in Oceanic Airspace; and AC 91–70.

Chapter 5. Air Traffic Procedures

Section 1. Preflight

5-1-1. Preflight Preparation

a. Prior to every flight, pilots should gather all information vital to the nature of the flight, assess whether the flight would be safe, and then file a flight plan. Pilots can receive a regulatory compliant briefing without contacting Flight Service. Pilots are encouraged to use automated resources and review Advisory Circular AC 91-92, Pilot's Guide to a Preflight Briefing, for more information. Pilots who prefer to contact Flight Service are encouraged to conduct a self-brief prior to calling. Conducting a self-brief before contacting Flight Service provides familiarity of meteorological and aeronautical conditions applicable to the route of flight and promotes a better understanding of weather information. Pilots may access Flight Service through www.1800wxbrief.com or by calling 1-800-WX-BRIEF. Flight planning applications are also available for conducting a self-briefing and filing flight plans.

NOTE-

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

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

NOTE-

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

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

NOTE-

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

REFERENCE-

AIM, Para 5-1-3, Notice to Airmen (NOTAM) System.

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

REFERENCE-

AIM, Para 9-1-5, General Description of Each Chart Series.

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

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

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

REFERENCE—

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

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

REFERENCE—

Chart Supplement, Special Notices Section.

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

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

REFERENCE—

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

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

REFERENCE—

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

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

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

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

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

1. Obtain a complete preflight briefing and check NOTAMs. Prior to every flight, pilots should gather all information vital to the nature of the flight. Pilots can receive a regulatory compliant briefing without contacting Flight Service. Pilots are encouraged to use automated resources and review AC 91-92, Pilot's Guide to a Preflight Briefing, for more information. NOTAMs are available online from the Federal NOTAM System (FNS) NOTAM Search website (<https://notams.aim.faa.gov/notamSearch/>), private vendors, or on request from Flight Service.

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

3. Use current charts.

4. Use the navigation aids. Practice maintaining a good course—keep the needle centered.

5. Maintain a constant altitude which is appropriate for the direction of flight.

6. Estimate en route position times.

7. Make accurate and frequent position reports to the FSSs along your route of flight.

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

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

5-1-3. Notice to Airmen (NOTAM) System

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

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

1. Aerodromes.

2. Runways, taxiways, and ramp restrictions.

3. Obstructions.

4. Communications.

5. Airspace.

6. Status of navigational aids or radar service availability.

7. Other information essential to planned en route, terminal, or landing operations.

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

NOTE—

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

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

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

e. NAVAID NOTAMs. Pilots should check NOTAMs to ensure NAVAIDs required for the flight are in service. A NOTAM is published when a NAVAID is out of service or Unserviceable (U/S). Although a NAVAID is deemed U/S and planned for removal from service, it may be a long time before that NAVAID is officially decommissioned and removed from charts. A NOTAM is the primary method of alerting pilots to its unavailability. Pilots using VFR charts can also review the Aeronautical Information Services' (AIS) website concerning Safety Alerts, Charting Notices, and Digital Product Notices at https://www.faa.gov/air_traffic/flight_info/aeronav/safety_alerts/ for additional chart information.

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

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

NOTE—

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

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

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

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

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

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

(c) Visual and radio navigational aids.

(d) Communication and services.

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

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

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

EXAMPLE–

Delta 345 RNAV to MPASS, Runway26L, cleared for takeoff.

NOTE–

1. *The SID transition is not restated as it is contained in the ATC clearance.*

2. *Aircraft cleared via RNAV SIDs designed to begin with a vector to the initial waypoint are assigned a heading before departure.*

3. Pilots operating in a radar environment are expected to associate departure headings or an RNAV departure advisory with vectors or the flight path to their planned route or flight. When given a vector taking the aircraft off a previously assigned nonradar route, the pilot will be advised briefly what the vector is to achieve. Thereafter, radar service will be provided until the aircraft has been reestablished “on-course” using an appropriate navigation aid and the pilot has been advised of the aircraft’s position or a handoff is made to another radar controller with further surveillance capabilities.

c. Controllers will inform pilots of the departure control frequencies and, if appropriate, the transponder code before takeoff. Pilots must ensure their transponder/ADS-B is adjusted to the “on” or normal operating position as soon as practical and remain on during all operations unless otherwise requested to change to “standby” by ATC. Pilots should not change to the departure control frequency until requested. Controllers may omit the departure control frequency if a DP has or will be assigned and the departure control frequency is published on the DP.

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

a. Instrument departure procedures are 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 (ODP), printed either textually or graphically, and Standard Instrument Departures (SID), always printed graphically. All DPs, either textual or graphic may be designed using either conventional or RNAV criteria. RNAV procedures will have RNAV printed in the title; for example, SHEAD TWO DEPARTURE (RNAV). ODPs provide obstruction clearance via the least onerous route from the terminal area to the appropriate en route structure. ODPs are recommended for obstruction clearance and may be flown without ATC clearance unless an alternate departure procedure (SID or radar vector) has been specifically assigned by ATC. Graphic ODPs will have (OBSTACLE) printed in the procedure title; for example, GEYSR THREE DEPARTURE (OBSTACLE), or, CROWN ONE DEPARTURE (RNAV) (OBSTACLE). Standard Instrument Departures are air traffic control (ATC) procedures printed for pilot/controller use in graphic form to provide obstruction clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement and to reduce pilot/controller workload. ATC clearance must be received prior to flying a SID. All DPs provide the pilot with a way to depart the airport and transition to the en route structure safely.

b. A Diverse Vector Area (DVA) is an area in which ATC may provide random radar vectors during an uninterrupted climb from the departure runway until above the MVA/MIA, established in accordance with the TERPS criteria for diverse departures. The DVA provides obstacle and terrain avoidance in lieu of taking off from the runway under IFR using an ODP or SID.

c. Pilots operating under 14 CFR part 91 are strongly encouraged to file and fly a DP at night, during marginal Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC), when one is available. The following paragraphs will provide an overview of the DP program, why DPs are developed, what criteria are used, where to find them, how they are to be flown, and finally pilot and ATC responsibilities.

d. Why are DPs necessary? The primary reason is to provide obstacle clearance protection information to pilots. A secondary reason, at busier airports, is to increase efficiency and reduce communications and departure delays through the use of SIDs. When an instrument approach is initially developed for an airport, the need for DPs is assessed. The procedure designer conducts an obstacle analysis to support departure operations. If an

aircraft may turn in any direction from a runway within the limits of the assessment area (see paragraph 5–2–9e3) and remain clear of obstacles, that runway passes what is called a diverse departure assessment and no ODP will be published. A SID may be published if needed for air traffic control purposes. However, if an obstacle penetrates what is called the 40:1 obstacle identification surface, then the procedure designer chooses whether to:

1. Establish a steeper than normal climb gradient; or
 2. Establish a steeper than normal climb gradient with an alternative that increases takeoff minima to allow the pilot to visually remain clear of the obstacle(s); or
 3. Design and publish a specific departure route; or
 4. A combination or all of the above.
- e. What criteria is used to provide obstruction clearance during departure?

1. Unless specified otherwise, required obstacle clearance for all departures, including diverse, is based on the pilot crossing the departure end of the runway at least 35 feet above the departure end of runway elevation, climbing to 400 feet above the departure end of runway elevation before making the initial turn, and maintaining a minimum climb gradient of 200 feet per nautical mile (FPNM), unless required to level off by a crossing restriction, until the minimum IFR altitude. A greater climb gradient may be specified in the DP to clear obstacles or to achieve an ATC crossing restriction. If an initial turn higher than 400 feet above the departure end of runway elevation is specified in the DP, the turn should be commenced at the higher altitude. If a turn is specified at a fix, the turn must be made at that fix. Fixes may have minimum and/or maximum crossing altitudes that must be adhered to prior to passing the fix. In rare instances, obstacles that exist on the extended runway centerline may make an “early turn” more desirable than proceeding straight ahead. In these cases, the published departure instructions will include the language “turn left(right) as soon as practicable.” These departures will also include a ceiling and visibility minimum of at least 300 and 1. Pilots encountering one of these DPs should preplan the climb out to gain altitude and begin the turn as quickly as possible within the bounds of safe operating practices and operating limitations. This type of departure procedure is being phased out.

NOTE–

“Practical” or “feasible” may exist in some existing departure text instead of “practicable.”

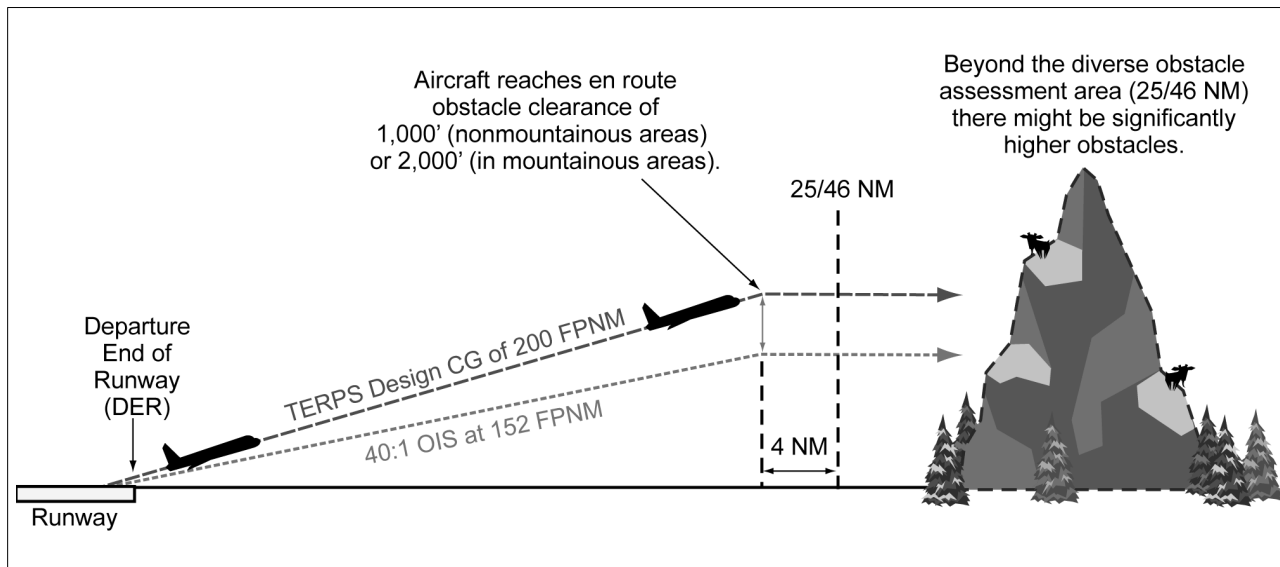
2. ODPs, SIDs, and DVAs assume normal aircraft performance, and that all engines are operating. Development of contingency procedures, required to cover the case of an engine failure or other emergency in flight that may occur after liftoff, is the responsibility of the operator. (More detailed information on this subject is available in Advisory Circular AC 120–91, Airport Obstacle Analysis, and in the “Departure Procedures” section of chapter 2 in the Instrument Procedures Handbook, FAA–H–8083–16.)

3. The 40:1 obstacle identification surface (OIS) begins at the departure end of runway (DER) and slopes upward at 152 FPNM until reaching the minimum IFR altitude or entering the en route structure. This assessment area is limited to 25 NM from the airport in nonmountainous areas and 46 NM in designated mountainous areas. Beyond this distance, the pilot is responsible for obstacle clearance if not operating on a published route, if below (having not reached) the MEA or MOCA of a published route, or an ATC assigned altitude. See FIG 5–2–1. (Ref 14 CFR 91.177 for further information on en route altitudes.)

NOTE–

ODPs are normally designed to terminate within these distance limitations, however, some ODPs will contain routes that may exceed 25/46 NM; these routes will ensure obstacle protection until reaching the end of the ODP.

FIG 5-2-1
Diverse Departure Obstacle Assessment to 25/46 NM



4. Takeoff Obstacles. Takeoff Obstacles Notes in the “Takeoff Minimums and (OBSTACLE) Departure Procedures” section of the Terminal Procedures Publication (TPP) identifies obstacle(s) that penetrate the 40:1 OCS. The obstacle notes alert the pilot to the height and location of the obstacles relative to the DER so they can be avoided. This can be accomplished in a variety of ways: the pilot may be able to see and avoid the obstruction; 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, the takeoff should be delayed or another runway selected for the IFR departure.

(a) Takeoff obstacles will be published as low, close-in and/or takeoff minimums obstacle notes.

(1) Low, close-in obstacles require a higher than standard climb gradient (within 1 NM or less from DER) to an altitude of 200 feet or less above DER elevation and do not require increased takeoff minimums.

(2) Takeoff minimums obstacles require a higher than standard climb gradient (within 2.6 NM from DER) to an altitude greater than 200 feet above the DER elevation and require increased takeoff minimums. These obstacles are published with higher than standard ceiling and visibility takeoff minimums and are published in the same obstacle listing.

(b) Obstacle notes are not required to be charted on SIDs. When a pilot is assigned a SID for departure refer to the airport entry in the TPP or the graphic ODP to obtain information on the takeoff obstacles.

(c) The FAA redefined the initial climb area criteria that are used to evaluate and identify the obstacles that penetrate the 40:1 OCS. The takeoff obstacle notes are published in a different manner and an additional minimums option is added for the departure. To ensure the pilot knows which evaluation was accomplished, the charting will be different by bolding certain headers and runway information. Until the FAA can amend all departures the legacy obstacle notes will still be published.

(1) For textual departures, the headers Takeoff Minimums, Departure Procedures, and Takeoff Obstacle Notes will be bolded and underlined. The specific runway entries under each header will continue to be bolded.

(2) For graphic departure procedures, the headers Takeoff Minimums and Takeoff Obstacle Notes will be bolded and continue to be underlined. The specific runway entries for these headers will be bolded. In the Departure Route Description section of the graphic departure, the heading will be bolded and underlined and the runway information will just be bolded.

(3) Legacy takeoff obstacle notes combine low, close-in and takeoff obstacles for each runway.

(4) New takeoff obstacle notes separate low, close-in and takeoff minimums obstacle notes. There is also a DER crossing altitude included in the notes section, providing the pilot with a DER crossing height that clears all obstacles that penetrate the 40:1 OCS.

(5) The obstacles are described with an inner limit from the DER, using the word “beginning,” expressed in 1/4 SM increments rounded down and an outer limit, using the words “extending to” expressed in 1/4 SM increments rounded up. They will also be described in relation to the extended runway centerline as “left, right, or crossing.” Crossing means they are within 100ft of the centerline. Left or right means they are greater than 100 ft from centerline. Both an MSL altitude and height above DER elevation will be provided for the obstacle that penetrates the 40:1 OCS the most. This allows the pilot to determine when the reported weather conditions are adequate to see and avoid the low, close-in obstacle(s) if aircraft performance does not permit the aircraft to climb over them. It also allows the pilot to correlate the position of the obstacles and the MSL elevation and height above DER for the controlling obstacle for the published higher than standard takeoff minimums.

(6) A DER crossing height using standard ceiling/visibility is provided as a new takeoff minimums option for pilots in addition to the current options (higher than standard ceiling/visibility or standard ceiling/visibility with a higher than standard climb gradient, or a reduced takeoff runway length with a standard climb gradient and standard ceiling/visibility).

EXAMPLE–

Legacy takeoff minimums and obstacle notes

TAKEOFF MINIMUMS:

Rwy12 L/R, 400–2 1/2 or std. w/min. climb of 261’ per NM to 500.

TAKEOFF OBSTACLE NOTES:

Rwy 14, trees 2011’ from DER, 29’ left of centerline, 100’ AGL/3829’ MSL.

Rwy 32, trees 1009’ from DER, 697’ left of centerline, 100’ AGL/3839’ MSL.

Tower 4448’ from DER, 1036’ left of centerline, 165’ AGL/3886’ MSL.

EXAMPLE–

New takeoff minimums and obstacle notes

TAKEOFF MINIMUMS:

Rwy12 L/R: 400–2 1/2 or std. w/min. climb of 261’ per NM to 500 or standard and crossing DER 66’ above DER Elev clears takeoff minimums obstacles.

TAKEOFF OBSTACLE NOTES:

Rwy 12L LOW, CLOSE-IN OBSTACLES: trees beginning 600’ from DER, extending to 1/2 SM, crossing centerline, up to 156’ MSL, 86’ above DER, crossing DER 49’ above DER Elev clears low, close-in obstacles.

Rwy 12L TAKEOFF MINIMUMS OBSTACLES: buildings, crane, tower beginning 1 1/2 SM from DER, extending to 3/4 SM, left, right, and crossing centerline, up to 373’ MSL, 284’ above DER, crossing DER at 66’ above DER Elev clears takeoff minimums obstacles.

Rwy 12R LOW, CLOSE-IN OBSTACLES: obstacles 35’ and below.

Rwy 12R TAKEOFF MINIMUMS OBSTACLES: buildings, crane, tower beginning 1 1/2 SM from DER, extending to 3/4 SM, left, right, and crossing centerline, up to 373’ MSL, 284’ above DER, crossing DER at 66’ above DER Elev clears takeoff minimums obstacles.

Rwy 30L/R LOW, CLOSE-IN OBSTACLES: obstacles 35’ and below.

(d) Compliance with 14 CFR part 121 or 135 one-engine-inoperative (OEI) departure performance requirements, or similar ICAO/State rules, cannot be assured by the sole use of takeoff obstacle note data as published in the TPP. Operators conducting these operations should refer to precise data sources (GIS database, etc.) specifically intended for OEI departure planning (see AC 120-91).

5. Climb gradients greater than 200 FPNM are specified when required to support procedure design constraints, obstacle clearance, and/or airspace restrictions. Compliance with a climb gradient for these purposes is mandatory when the procedure is part of the ATC clearance, unless increased takeoff minimums are provided and weather conditions allow compliance with these minimums.

NOTE—

Climb gradients for ATC purposes are being phased out on SIDs.

EXAMPLE—

“Cross ALPHA intersection at or below 4000; maintain 6000.” The pilot climbs at least 200 FPNM to 6000. If 4000 is reached before ALPHA, the pilot levels off at 4000 until passing ALPHA; then immediately resumes at least 200 FPNM climb.

EXAMPLE—

“TAKEOFF MINIMUMS: RWY 27, Standard with a minimum climb of 280’ per NM to 2500.” A climb of at least 280 FPNM is required to 2500 and is mandatory when the departure procedure is included in the ATC clearance.

NOTE—

Some SIDs still retain labeled “ATC” climb gradients published or have climb gradients that are established to meet a published altitude restriction that is not required for obstacle clearance or procedure design criteria. These procedures will be revised in the course of the normal procedure amendment process.

6. Climb gradients may be specified only to an altitude/fix, above which the normal gradient applies. An ATC-required altitude restriction published at a fix, will not have an associated climb gradient published with that restriction. Pilots are expected to determine if crossing altitudes can be met, based on the performance capability of the aircraft they are operating.

EXAMPLE—

“Minimum climb 340 FPNM to ALPHA.” The pilot climbs at least 340 FPNM to ALPHA, then at least 200 FPNM to MIA.

7. A Visual Climb Over Airport (VCOA) procedure is a departure option for an IFR aircraft, operating in visual meteorological conditions equal to or greater than the specified visibility and ceiling, to visually conduct climbing turns over the airport to the published “at or above” altitude. At this point, the pilot may proceed in instrument meteorological conditions to the first en route fix using a diverse departure, or to proceed via a published routing to a fix from where the aircraft may join the IFR en route structure, while maintaining a climb gradient of at least 200 feet per nautical mile. 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. Pilots are expected to remain within the distance prescribed in the published visibility minimums during the climb over the airport until reaching the “at or above” altitude for the VCOA procedure. If no additional routing is published, then the pilot may proceed in accordance with their IFR clearance. If additional routing is published after the “at-or-above” altitude, the pilot must comply with the route to a fix that may include a climb-in-holding pattern to reach the MEA/MIA for the en route portion of their IFR flight. These textual procedures are published in the Takeoff Minimums and (Obstacle) Departure Procedures section of the TPP and/or appear as an option on a Graphic ODP.

EXAMPLE—

TAKEOFF MINIMUMS: Rwy 32, standard with minimum climb of 410’ per NM to 3000’ or 1100–3 for VCOA.

VCOA: Rwy 32, obtain ATC approval for VCOA when requesting IFR clearance. Climb in visual conditions to cross Broken Bow Muni/Keith Glaze Field at or above 3500’ before proceeding on course.

f. Obstacle Clearance Responsibilities. DPs are designed so that the pilot’s adherence to the procedure’s lateral path and vertical climb requirements will ensure obstacle protection.

1. Obstacle clearance responsibility rests with the pilot when he/she chooses to depart IFR under 14 CFR part 91 and has not filed or been cleared for an ODP or an ATC-assigned SID or assigned headings for a DVA from the departure runway. Standard takeoff minimums are one statute mile for aircraft having two engines or less and one-half statute mile for aircraft having more than two engines. Higher than standard ceiling and visibility minimums will allow visual avoidance of the obstacles during the initial climb at the standard climb gradient.

2. When cleared to depart IFR using the ODP, SID, VCOA, or assigned headings for DVA, pilots must reference the published takeoff minimums and takeoff obstacle notes.

(a) Since the presence of low, close-in obstacles do not require publishing increased takeoff minimums the pilot should consider, if necessary to see and avoid these obstacles, the weather at time of takeoff. Based on the position of low, close-in obstacles, weather no less than 300 ft and 1 NM may be necessary to visually avoid obstacles.

(b) Takeoff minimums 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. When departing IFR using the higher than standard takeoff minimums option, pilots are responsible for visually avoiding takeoff minimums obstacles. Pilots should also consider drift following lift-off to ensure sufficient clearance from these obstacles. The segment of the procedure that requires the pilot to see and avoid obstacles ends when the aircraft is beyond or above the ceiling and visibility published to avoid these obstacles.

3. When departing using the VCOA, obstacle avoidance is not guaranteed if the pilot maneuvers farther from the airport than the published visibility minimum for the VCOA prior to reaching the published VCOA altitude. Pilots are responsible for maintaining clearance from low, close-in obstacles.

4. When departing using a DVA, pilots are responsible for maintaining clearance from low, close-in obstacles. DVAs may also require a higher than standard climb gradient. Standard takeoff minimums apply when departing a runway under IFR when using the DVA. The existence of a DVA will be noted in the Takeoff Minimums and "(OBSTACLE)" Departure Procedure section of the TPP.

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.

5. 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 feet per nautical mile during the departure until reaching the minimum en route altitude, unless higher than standard climb gradient is published. When a higher than standard climb gradient is published and used, that climb gradient is maintained, until reaching the climb gradient termination altitude, after which the standard 200 feet per nautical mile is maintained until reaching the minimum en route altitude.

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.

g. Where are DPs located? DPs and DVAs will be listed by airport in the IFR Takeoff Minimums and "(OBSTACLE)" Departure Procedures Section, Section L, of the TPP. If the DP is textual, it will be described in TPP Section L. SIDs and complex ODPs will be published graphically and named. The name will be listed by airport name and runway in Section L. Graphic ODPs will also have the term "(OBSTACLE)" printed in the charted procedure title, differentiating them from SIDs.

1. An ODP that has been developed solely for obstacle avoidance will be indicated with the symbol "T" on appropriate Instrument Approach Procedure (IAP) charts and DP charts for that airport. The "T" symbol will continue to refer users to TPP Section C. In the case of a graphic ODP, the TPP Section C will only contain the

name of the ODP. Since there may be both a textual and a graphic DP, Section C should still be checked for additional information. The nonstandard takeoff minimums and minimum climb gradients found in TPP Section C also apply to charted DPs and radar vector departures unless different minimums are specified on the charted DP. Takeoff minimums and departure procedures apply to all runways unless otherwise specified. New graphic DPs will have all the information printed on the graphic depiction. As a general rule, ATC will only assign an ODP from a non-towered airport when compliance with the ODP is necessary for aircraft to aircraft separation. Pilots may use the ODP to help ensure separation from terrain and obstacles.

h. Responsibilities

1. Each pilot, prior to departing an airport on an IFR flight should:

- (a)** Consider the type of terrain and other obstacles on or in the vicinity of the departure airport;
- (b)** Determine whether an ODP is available;
- (c)** Determine if obstacle avoidance can be maintained visually or if the ODP should be flown; and
- (d)** Consider the effect of degraded climb performance and the actions to take in the event of an engine loss during the departure. Pilots should notify ATC as soon as possible of reduced climb capability in that circumstance.

NOTE—

Guidance concerning contingency procedures that address an engine failure on takeoff after V_1 speed on a large or turbine-powered transport category airplane may be found in AC 120-91, Airport Obstacle Analysis.

(e) Determine if a DVA is published and whether the aircraft is capable of meeting the published climb gradient. Advise ATC when requesting the IFR clearance, or as soon as possible, if unable to meet the DVA climb gradient.

(f) Check for Takeoff Obstacle Notes published in the TPP for the takeoff runway.

2. Pilots should not exceed a published speed restriction associated with a SID waypoint until passing that waypoint.

3. After an aircraft is established on a SID and subsequently vectored or cleared to deviate off of the SID or SID transition, pilots must consider the SID canceled, unless the controller adds “expect to resume SID;” pilots should then be prepared to rejoin the SID at a subsequent fix or procedure leg. If the SID contains published altitude and/or speed restrictions, those restrictions are canceled and pilots will receive an altitude to maintain and, if necessary, a speed. ATC may also interrupt the vertical navigation of a SID and provide alternate altitude instructions while the aircraft remains established on the published lateral path. Aircraft may be vectored off of an ODP, or issued an altitude lower than a published altitude on an ODP, at which time the ODP is canceled. In these cases, ATC assumes responsibility for terrain and obstacle clearance. In all cases, the minimum 200 FPNM climb gradient is assumed.

4. Aircraft instructed to resume a SID procedure such as a DP or SID which contains speed and/or altitude restrictions, must be:

- (a)** Issued/reissued all applicable restrictions, or
- (b)** Advised to “Climb via SID” or resume published speed.

EXAMPLE—

“Resume the Solar One departure, Climb via SID.”

“Proceed direct CIROS, resume the Solar One departure, Climb via SID.”

5. A clearance for a SID which does not contain published crossing restrictions, and/or is a SID with a Radar Vector segment or a Radar Vector SID, will be issued using the phraseology “Maintain (*altitude*).”

6. A clearance for a SID which contains published altitude restrictions may be issued using the phraseology “climb via.” Climb via is an abbreviated clearance that requires compliance with the procedure lateral path, associated speed and altitude restrictions along the cleared route or procedure. Clearance to “climb via” authorizes the pilot to:

(a) When used in the IFR departure clearance, in a PDC, DCL or when cleared to a waypoint depicted on a SID, to join the procedure after departure or to resume the procedure.

(b) When vertical navigation is interrupted and an altitude is assigned to maintain which is not contained on the published procedure, to climb from that previously-assigned altitude at pilot's discretion to the altitude depicted for the next waypoint.

(c) Once established on the depicted departure, to navigate laterally and climb to meet all published or assigned altitude and speed restrictions.

NOTE—

1. When otherwise cleared along a route or procedure that contains published speed restrictions, the pilot must comply with those speed restrictions independent of a climb via clearance.

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

3. If ATC interrupts lateral/vertical navigation while an aircraft is flying a SID, ATC must ensure obstacle clearance. When issuing a "climb via" clearance to join or resume a procedure ATC must ensure obstacle clearance until the aircraft is established on the lateral and vertical path of the SID.

4. ATC will assign an altitude to cross if no altitude is depicted at a waypoint/fix or when otherwise necessary/ required, for an aircraft on a direct route to a waypoint/fix where the SID will be joined or resumed.

5. SIDs will have a "top altitude;" the "top altitude" is the charted "maintain" altitude contained in the procedure description or assigned by ATC.

REFERENCE—

FAA Order JO 7110.65, Para 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 Bizze 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 Bizze Two departure.”

NOTE–

In Example 8, the aircraft will join the Bizze Two SID at Rockr at or above 10,000 and then comply with the published lateral path and any published speed or altitude restrictions while climbing to the SID top altitude.

9. (An aircraft was issued the Suzan Two departure, “climb via SID” in the IFR departure clearance. After departure ATC vectors the aircraft off of the SID, and then clears the aircraft to rejoin the SID at Dvine waypoint, which has a published crossing restriction). The clearance will read:

“Proceed direct Dvine, Climb via the Suzan Two departure.”

NOTE–

In Example 9, the aircraft will join the Suzan Two departure at Dvine, at the published altitude, and then comply with the published lateral path and any published speed or altitude restrictions.

7. Pilots cleared for vertical navigation using the phraseology “climb via” must inform ATC, upon initial contact, of the altitude leaving and any assigned restrictions not published on the procedure.

EXAMPLE–

1. (Cactus 711 is cleared to climb via the Laura Two departure. The Laura Two has a top altitude of FL190):

“Cactus Seven Eleven leaving two thousand, climbing via the Laura Two departure.”

2. (Cactus 711 is cleared to climb via the Laura Two departure, but ATC changed the top altitude to 16,000):

“Cactus Seven Eleven leaving two thousand for one-six thousand, climbing via the Laura Two departure.”

8. If prior to or after takeoff an altitude restriction is issued by ATC, all previously issued “ATC” altitude restrictions are canceled including those published on a SID. Pilots must still comply with all speed restrictions and lateral path requirements published on the SID unless canceled by ATC.

EXAMPLE–

Prior to takeoff or after departure ATC issues an altitude change clearance to an aircraft cleared to climb via a SID but ATC no longer requires compliance with published altitude restrictions:

“Climb and maintain flight level two four zero.”

NOTE—

The published SID altitude restrictions are canceled; The aircraft should comply with the SID lateral path and begin an unrestricted climb to FL240. Compliance with published speed restrictions is still required unless specifically deleted by ATC.

9. Altitude restrictions published on an ODP are necessary for obstacle clearance and/or design constraints. Crossing altitudes and speed restrictions on ODPs cannot be canceled or amended by ATC.

i. PBN Departure Procedures

1. All public PBN SIDs and graphic ODPs are normally designed using RNAV 1, RNP 1, or A-RNP NavSpecs. These procedures generally start with an initial track or heading leg near the departure end of runway (DER). In addition, these procedures require system performance currently met by GPS or DME/DME/IRU PBN systems that satisfy the criteria discussed in the latest AC 90–100, U.S. Terminal and En Route Area Navigation (RNAV) Operations. RNAV 1 and RNP 1 procedures must maintain a total system error of not more than 1 NM for 95 percent of the total flight time. Minimum values for A-RNP procedures will be charted in the PBN box (for example, 1.00 or 0.30).

2. In the U.S., a specific procedure's PBN requirements will be prominently displayed in separate, standardized notes boxes. For procedures with PBN elements, the "PBN box" will contain the procedure's NavSpec(s); and, if required: specific sensors or infrastructure needed for the navigation solution, any additional or advanced functional requirements, the minimum RNP value, and any amplifying remarks. Items listed in this PBN box are REQUIRED for the procedure's PBN elements.

Section 3. En Route Procedures

5-3-1. ARTCC Communications

a. Direct Communications, Controllers and Pilots.

1. ARTCCs are capable of direct communications with IFR air traffic on certain frequencies. Maximum communications coverage is possible through the use of Remote Center Air/Ground (RCAG) sites comprised of both VHF and UHF transmitters and receivers. These sites are located throughout the U.S. Although they may be several hundred miles away from the ARTCC, they are remoted to the various ARTCCs by land lines or microwave links. Since IFR operations are expedited through the use of direct communications, pilots are requested to use these frequencies strictly for communications pertinent to the control of IFR aircraft. Flight plan filing, en route weather, weather forecasts, and similar data should be requested through FSSs, company radio, or appropriate military facilities capable of performing these services.

2. An ARTCC is divided into sectors. Each sector is handled by one or a team of controllers and has its own sector discrete frequency. As a flight progresses from one sector to another, the pilot is requested to change to the appropriate sector discrete frequency.

3. Controller Pilot Data Link Communications (CPDLC) is a system that supplements air/ground voice communications. The CPDLC's principal operating criteria are:

(a) Voice remains the primary and controlling air/ground communications means.

(b) Participating aircraft will need to have the appropriate CPDLC avionics equipment in order to receive uplink or transmit downlink messages.

(c) En Route CPDLC Initial Services offer the following services: Altimeter Setting (AS), Transfer of Communications (TOC), Initial Contact (IC), and limited route assignments, including airborne reroutes (ABRR), limited altitude assignments, and emergency messages.

(1) Altimeter settings will be uplinked automatically when appropriate after a Monitor TOC. Altimeter settings will also be uplinked automatically when an aircraft receives an uplinked altitude assignment below FL 180. A controller may also manually send an altimeter setting message.

NOTE—

When conducting instrument approach procedures, pilots are responsible to obtain and use the appropriate altimeter setting in accordance with 14 CFR section 97.20. CPDLC issued altimeter settings are excluded for this purpose.

(2) Initial contact is a safety validation transaction that compares a pilot's initiated altitude downlink message with an aircraft's stored altitude in the ATC automation system. When an IC mismatch or Confirm Assigned Altitude (CAA) downlink time-out indicator is displayed in the Full Data Block (FDB) and Aircraft List (ACL), the controller who has track control of the aircraft must use voice communication to verify the assigned altitude of the aircraft, and acknowledge the IC mismatch/time-out indicator.

(3) Transfer of communications automatically establishes data link contact with a succeeding sector.

(4) Menu text transmissions are scripted nontrajectory altering uplink messages.

(5) The CPDLC Message Elements for the Initial Capabilities rollout are contained in TBL 5-3-1 through TBL 5-3-19, CPDLC Message Elements, below.

NOTE—

The FAA is not implementing ATN B1; the ATN B1 column in the tables is there for informational purposes only

TBL 5-3-1
Route Uplink Message Elements (RTEU)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
UM74 PROCEED DIRECT TO (<i>position</i>)	UM74 PROCEED DIRECT TO (<i>position</i>)	W/U	RTEU-2	Instruction to proceed directly to the specified position.	PROCEED DIRECT TO (<i>position</i>)
UM79 CLEARED TO (<i>position</i>) via (<i>route clearance</i>)	UM79 CLEARED TO (<i>position</i>) via (<i>route clearance</i>)	W/U	RTEU-6	Instruction to proceed to the specified position via the specified route.	CLEARED TO (<i>position</i>) VIA (<i>departure data[O]</i>) (<i>en-route data</i>)
UM80 CLEARED (<i>route clearance</i>)	UM80 CLEARED (<i>route clearance</i>)	W/U	RTEU-7	Instruction to proceed via the specified route.	CLEARED (<i>departure data[O]</i>) (<i>en-route data</i>) (<i>arrival approach data</i>)
UM83 AT (<i>position</i>) CLEARED (<i>route clearance</i>)	N/A	W/U	RTEU-9	Instruction to proceed from the specified position via the specified route.	AT (<i>position</i>) CLEARED (<i>en-route data</i>) (<i>arrival approach data</i>)

TBL 5-3-2
Route Downlink Message Elements (RTED)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
DM22 REQUEST DIRECT TO (<i>position</i>)	DM22 REQUEST DIRECT TO (<i>position</i>)	Y	RTED-1	Request for a direct clearance to the specified position.	REQUEST DIRECT TO (<i>position</i>)

TBL 5-3-17

Free Text Downlink Message Elements (TXTD)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
DM68 (<i>free text</i>) <i>Note 1. – Urgency or Distress Alr (M)</i> <i>Note 2. – Selecting any of the emergency message elements will result in this message element being enabled for the flight crew to include in the emergency message at their discretion.</i>	N/A	Y	TXTD-1		(<i>free text</i>) <i>Note – M alert attribute.</i>

TBL 5-3-18

System Management Uplink Message Elements (SYSU)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
UM159 ERROR (<i>error information</i>)	UM159 ERROR (<i>error information</i>)	N	SYSU-1	System-generated notification of an error.	ERROR (<i>error information</i>)
UM160 NEXT DATA AUTHORITY (<i>ICAO facility designation</i>) <i>Note – The facility designation is required.</i>	UM160 NEXT DATA AUTHORITY (<i>facility</i>) <i>Note – Facility parameter can specify a facility designation or no facility.</i>	N	SYSU-2	System-generated notification of the next data authority or the cancellation thereof.	NEXT DATA AUTHORITY (<i>facility designation [O]</i>)

TBL 5-3-19

System Management Downlink Message Elements (SYSD)

CPDLC Message Sets			Operational Definition in PANS-ATM (Doc 4444)		
FANS 1/A	ATN B1	Response	Message Element Identifier	Message Element Intended Use	Format for Message Element Display
DM62 ERROR (<i>error information</i>)	DM62 ERROR (<i>error information</i>)	N	SYSD-1	System-generated notification of an error.	SYSD-1
DM63 NOT CURRENT DATA AUTHORITY	DM63 NOT CURRENT DATA AUTHORITY	N	SYSD-3	System-generated rejection of any CPDLC message sent from a ground facility that is not the current data authority.	SYSD-3
DM64 (<i>ICAO facility designation</i>) <i>Note – Use by FANS 1/A aircraft in B1 environments.</i>	DM107 NOT AUTHORIZED NEXT DATA AUTHORITY <i>Note – CDA and NDA cannot be provided.</i>	N	SYSD-5	System-generated notification that the ground system is not designated as the next data authority (NDA), indicating the identity of the current data authority (CDA). Identity of the NDA, if any, is also reported.	SYSD-5

b. ATC Frequency Change Procedures.

1. The following phraseology will be used by controllers to effect a frequency change:

EXAMPLE–

(Aircraft identification) contact (facility name or location name and terminal function) (frequency) at (time, fix, or altitude).

NOTE–

Pilots are expected to maintain a listening watch on the transferring controller's frequency until the time, fix, or altitude specified. ATC will omit frequency change restrictions whenever pilot compliance is expected upon receipt.

2. The following phraseology should be utilized by pilots for establishing contact with the designated facility:

(a) When operating in a radar environment: On initial contact, the pilot should inform the controller of the aircraft's assigned altitude preceded by the words "level," or "climbing to," or "descending to," as appropriate; and the aircraft's present vacating altitude, if applicable.

EXAMPLE–

1. (Name) CENTER, (aircraft identification), LEVEL (altitude or flight level).

2. (Name) CENTER, (aircraft identification), LEAVING (exact altitude or flight level), CLIMBING TO OR DESCENDING TO (altitude of flight level).

NOTE–

Exact altitude or flight level means to the nearest 100 foot increment. Exact altitude or flight level reports on initial contact provide ATC with information required prior to using Mode C altitude information for separation purposes.

- (b) When operating in a nonradar environment:

(1) On initial contact, the pilot should inform the controller of the aircraft's present position, altitude and time estimate for the next reporting point.

EXAMPLE–

(Name) CENTER, (aircraft identification), (position), (altitude), ESTIMATING (reporting point) AT (time).

(2) After initial contact, when a position report will be made, the pilot should give the controller a complete position report.

EXAMPLE–

(Name) CENTER, (aircraft identification), (position), (time), (altitude), (type of flight plan), (ETA and name of next reporting point), (the name of the next succeeding reporting point), AND (remarks).

REFERENCE–

AIM, Para 5–3–2, Position Reporting.

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

CAUTION–

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

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

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

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

NOTE–

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

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

e. New York Oceanic FIR. The use of CPDLC and ADS–C in the New York Oceanic FIR (KZWY) is only permitted by Inmarsat and Iridium customers. All other forms of data link connectivity are not authorized. Users



must ensure that the proper data link code is filed in Item 10a of the ICAO FPL in order to indicate which satellite medium(s) the aircraft is equipped with. The identifier for Inmarsat is J5 and the identifier for Iridium is J7. If J5 or J7 is not included in the ICAO FPL, then the LOGON will be rejected by KZWW and the aircraft will not be able to connect.

5-3-2. Position Reporting

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

a. Position Identification.

1. When a position report is to be made passing a VOR radio facility, the time reported should be the time at which the first complete reversal of the “to/from” indicator is accomplished.
2. When a position report is made passing a facility by means of an airborne ADF, the time reported should be the time at which the indicator makes a complete reversal.
3. When an aural or a light panel indication is used to determine the time passing a reporting point, such as a fan marker, Z marker, cone of silence or intersection of range courses, the time should be noted when the signal is first received and again when it ceases. The mean of these two times should then be taken as the actual time over the fix.
4. If a position is given with respect to distance and direction from a reporting point, the distance and direction should be computed as accurately as possible.
5. Except for terminal area transition purposes, position reports or navigation with reference to aids not established for use in the structure in which flight is being conducted will not normally be required by ATC.

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

c. Position Reporting Requirements.

1. **Flights Along Airways or Routes.** A position report is required by all flights regardless of altitude, including those operating in accordance with an ATC clearance specifying “*VFR-on-top*,” over each designated compulsory reporting point along the route being flown.
2. **Flights Along a Direct Route.** Regardless of the altitude or flight level being flown, including flights operating in accordance with an ATC clearance specifying “*VFR-on-top*,” pilots must report over each reporting point used in the flight plan to define the route of flight.
3. **Flights in a Radar Environment.** When informed by ATC that their aircraft are in “Radar Contact,” pilots should discontinue position reports over designated reporting points. They should resume normal position reporting when ATC advises “*RADAR CONTACT LOST*” or “*RADAR SERVICE TERMINATED*.”
4. **Flights in an Oceanic (Nonradar) Environment.** Pilots must report over each point used in the flight plan to define the route of flight, even if the point is depicted on aeronautical charts as an “on request” (non-compulsory) reporting point. For aircraft providing automatic position reporting via an Automatic Dependent Surveillance-Contract (ADS-C) logon, pilots should discontinue voice position reports.

NOTE—

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

- (a) when their aircraft is initially identified in the ATC system; and
- (b) when radar identification is reestablished after radar service has been terminated or radar contact lost.

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

d. Position Report Items:

1. Position reports should include the following items:

- (a) Identification;
- (b) Position;
- (c) Time;
- (d) Altitude or flight level (include actual altitude or flight level when operating on a clearance specifying VFR-on-top);
- (e) Type of flight plan (not required in IFR position reports made directly to ARTCCs or approach control);
- (f) ETA and name of next reporting point;
- (g) The name only of the next succeeding reporting point along the route of flight; and
- (h) Pertinent remarks.

5-3-3. Additional Reports

a. The following reports should be made to ATC or FSS facilities without a specific ATC request:

1. At all times.

- (a) When vacating any previously assigned altitude or flight level for a newly assigned altitude or flight level.
- (b) When an altitude change will be made if operating on a clearance specifying VFR-on-top.
- (c) When *unable* to climb/descend at a rate of at least 500 feet per minute.
- (d) When approach has been missed. (Request clearance for specific action; i.e., to alternative airport, another approach, etc.)
- (e) Change in the average true airspeed (at cruising altitude) when it varies by 5 percent or 10 knots (whichever is greater) from that filed in the flight plan.
- (f) The time and altitude or flight level upon reaching a holding fix or point to which cleared.
- (g) When leaving any assigned holding fix or point.

NOTE—

The reports in subparagraphs (f) and (g) may be omitted by pilots of aircraft involved in instrument training at military terminal area facilities when radar service is being provided.

(h) Any loss, in controlled airspace, of VOR, TACAN, ADF, low frequency navigation receiver capability, GPS anomalies while using installed IFR-certified GPS/GNSS receivers, complete or partial loss of ILS receiver capability or impairment of air/ground communications capability. Reports should include aircraft identification, equipment affected, degree to which the capability to operate under IFR in the ATC system is impaired, and the nature and extent of assistance desired from ATC.

NOTE—

1. Other equipment installed in an aircraft may effectively impair safety and/or the ability to operate under IFR. If such

equipment (e.g., airborne weather radar) malfunctions and in the pilot's judgment either safety or IFR capabilities are affected, reports should be made as above.

2. When reporting GPS anomalies, include the location and altitude of the anomaly. Be specific when describing the location and include duration of the anomaly if necessary.

(i) Any information relating to the safety of flight.

2. When not in radar contact.

(a) When leaving final approach fix inbound on final approach (nonprecision approach) or when leaving the outer marker or fix used in lieu of the outer marker inbound on final approach (precision approach).

(b) A corrected estimate at anytime it becomes apparent that an estimate as previously submitted is in error in excess of 2 minutes. For flights in the North Atlantic (NAT), a revised estimate is required if the error is 3 minutes or more.

b. Pilots encountering weather conditions which have not been forecast, or hazardous conditions which have been forecast, are expected to forward a report of such weather to ATC.

REFERENCE—

*AIM, Para 7–1–18, Pilot Weather Reports (PIREPs).
14 CFR Section 91.183(B) and (C).*

5–3–4. Airways and Route Systems

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

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

NOTE—

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

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

NOTE—

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

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

NOTE—

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

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

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

(c) The use of TSO-C145 (as revised) or TSO-C146 (as revised) GPS/WAAS navigation systems is allowed in Alaska as the only means of navigation on published air traffic service (ATS) routes, including those Victor, T-Routes, and colored airway segments designated with a second minimum en route altitude (MEA) depicted in blue and followed by the letter G at those lower altitudes. The altitudes so depicted are below the minimum reception altitude (MRA) of the land-based navigation facility defining the route segment, and guarantee standard en route obstacle clearance and two-way communications. Air carrier operators requiring operations specifications are authorized to conduct operations on those routes in accordance with FAA operations specifications.

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

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

NOTE—

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

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

3. Area Navigation (RNAV) Routes.

(a) Published RNAV routes, including Q-routes, T-routes, and Y-routes, can be flight planned for use by aircraft with RNAV capability, subject to any limitations or requirements noted on en route charts, in applicable Advisory Circulars, NOTAMs, etc. RNAV routes are normally depicted in blue on aeronautical charts and are identified by the letter “Q,” “T,” or “Y” followed by the airway number (for example, Q13, T205, and Y280). Published RNAV routes are RNAV 2 except when specifically charted as RNAV 1. Unless otherwise specified, these routes require system performance currently met by GPS, GPS/WAAS, 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.

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

NOTE—

Aircraft in Alaska may only operate on GNSS Q-routes with GPS (TSO-C129 (as revised) or TSO-C196 (as revised)) equipment while the aircraft remains in Air Traffic Control (ATC) radar surveillance or with GPS/WAAS which does not require ATC radar surveillance.

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

NOTE—

Aircraft in Alaska may only operate on GNSS T-routes with GPS/WAAS (TSO-C145 (as revised) or TSO-C146 (as revised)) equipment.

(3) Y-routes generally run in U.S. offshore airspace, however operators can find some Y-routes over southern Florida. Pilots must use GPS for navigation and meet RNAV 2 performance requirements for all flights on Y-routes. Operators can find additional Y-route requirements in the U.S. Aeronautical Information Publication (AIP), ENR 7.10, available on the FAA website.

(b) Unpublished RNAV routes are direct routes, based on area navigation capability, between waypoints defined in terms of latitude/longitude coordinates, degree-distance fixes, or offsets from established

routes/airways at a specified distance and direction. Radar monitoring by ATC is required on all unpublished RNAV routes, except for GNSS-equipped aircraft cleared via filed published waypoints recallable from the aircraft's navigation database.

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

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

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

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

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

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

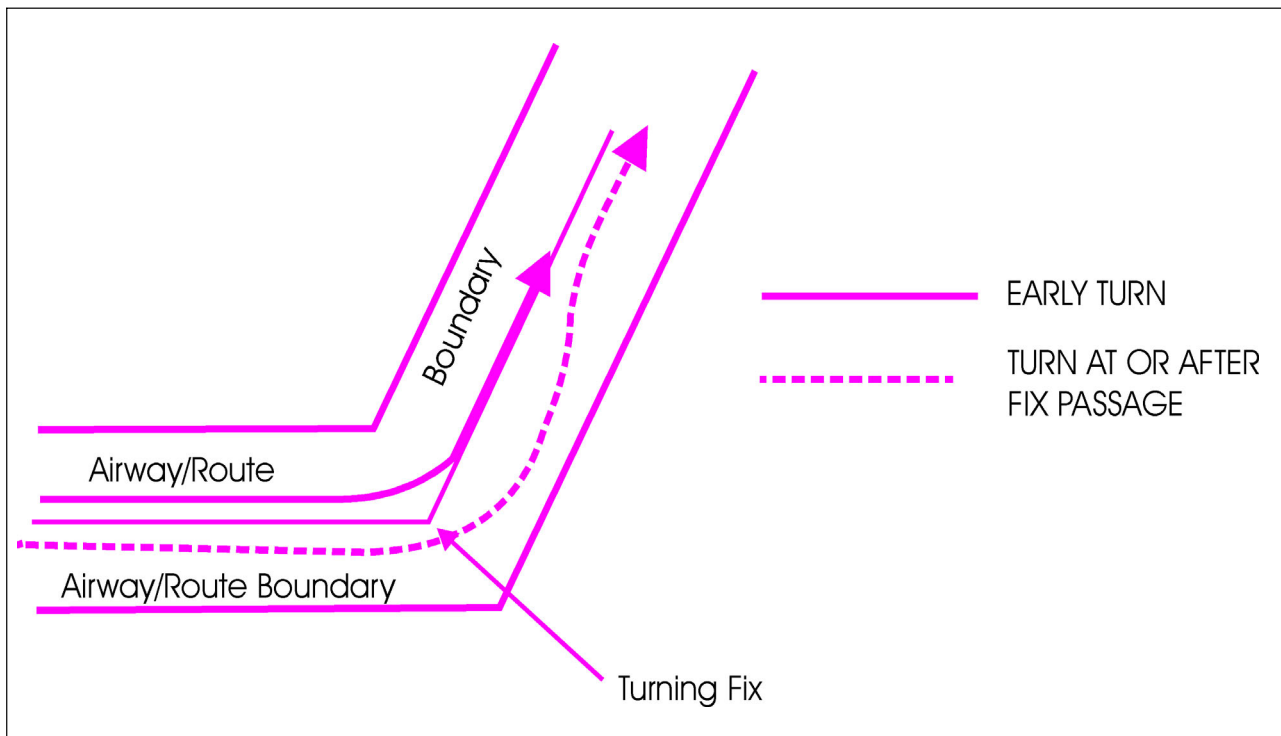
(b) Unless issued a VFR flight clearance by ATC, regardless of the weather conditions or the height of the terrain, no person may operate an aircraft under VMC within Class B airspace.

(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.

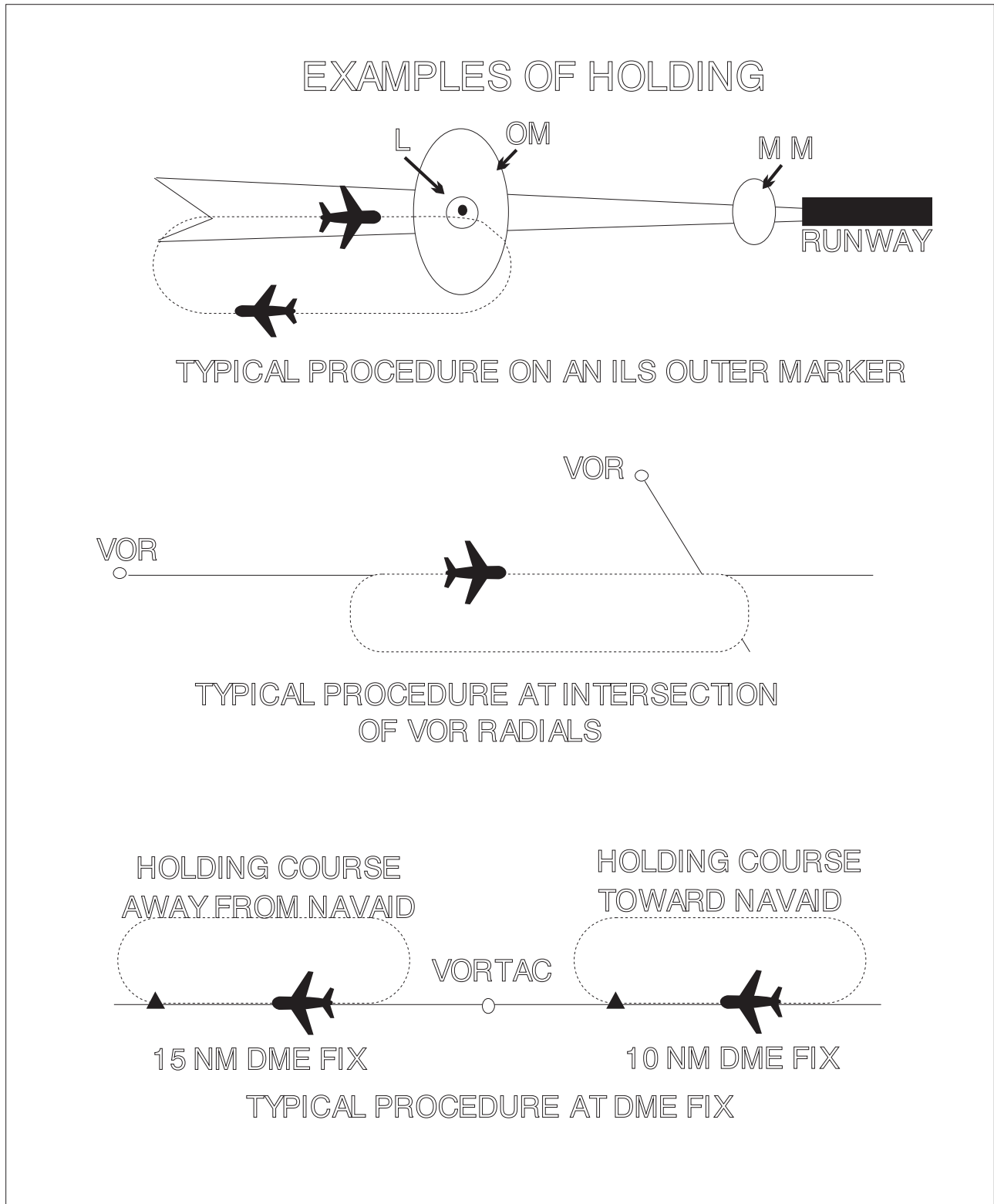
REFERENCE—

AIM, Para 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



(e) The naming of multiple approaches of the same type to the same runway is also changing. Multiple approaches with the same guidance will be annotated with an alphabetical suffix beginning at the end of the alphabet and working backwards for subsequent procedures (e.g., ILS Z RWY 28, ILS Y RWY 28, etc.). The existing annotations such as ILS 2 RWY 28 or Silver ILS RWY 28 will be phased out and replaced with the new designation. The Cat II and Cat III designations are used to differentiate between multiple ILSs to the same runway unless there are multiples of the same type.

(f) RNAV (GPS) approaches to LNAV, LP, LNAV/VNAV and LPV lines of minima using WAAS and RNAV (GPS) approaches to LNAV and LNAV/VNAV lines of minima using GPS are charted as RNAV (GPS) RWY (Number) (e.g., RNAV (GPS) RWY 21).

(g) Performance-Based Navigation (PBN) Box. As charts are updated, a procedure's PBN requirements and conventional equipment requirements will be prominently displayed in separate, standardized notes boxes. For procedures with PBN elements, the PBN box will contain the procedure's navigation specification(s); and, if required: specific sensors or infrastructure needed for the navigation solution, any additional or advanced functional requirements, the minimum Required Navigation Performance (RNP) value, and any amplifying remarks. Items listed in this PBN box are REQUIRED for the procedure's PBN elements. For example, an ILS with an RNAV missed approach would require a specific capability to fly the missed approach portion of the procedure. That required capability will be listed in the PBN box. The separate Equipment Requirements box will list ground-based equipment requirements. On procedures with both PBN elements and equipment requirements, the PBN requirements box will be listed first. The publication of these notes will continue incrementally until all charts have been amended to comply with the new standard.

4. Approach minimums are based on the local altimeter setting for that airport, unless annotated otherwise; e.g., Oklahoma City/Will Rogers World approaches are based on having a Will Rogers World altimeter setting. When a different altimeter source is required, or more than one source is authorized, it will be annotated on the approach chart; e.g., use Sidney altimeter setting, if not received, use Scottsbluff altimeter setting. Approach minimums may be raised when a nonlocal altimeter source is authorized. When more than one altimeter source is authorized, and the minima are different, they will be shown by separate lines in the approach minima box or a note; e.g., use MHK altimeter setting; when not available use SLN altimeter setting and increase all MDAs 40 feet. The altimeter source location may be referenced by city name, city and state, airport name, or the FAA location identifier. When using the location identifier, an airport outside the contiguous U.S. will use both the FAA and ICAO identifiers. New approach procedures and future amendments of existing procedures will use airport identifiers as the standard reference. When the altimeter must be obtained from a source other than air traffic a note will indicate the source; e.g., Obtain local altimeter setting on CTAF. When the altimeter setting(s) on which the approach is based is not available, the approach is not authorized. Baro-VNAV must be flown using the local altimeter setting only. Where no local altimeter is available, the LNAV/VNAV line will still be published for use by WAAS receivers with a note that Baro-VNAV is not authorized. When a local and at least one other altimeter setting source is authorized and the local altimeter is not available Baro-VNAV is not authorized; however, the LNAV/VNAV minima can still be used by WAAS receivers using the alternate altimeter setting source.

NOTE—

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

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

6. IAPs are designed to provide an IFR descent from the en route environment to a point where a safe landing can be made. They are prescribed and approved by appropriate civil or military authority to ensure a safe descent

during instrument flight conditions at a specific airport. It is important that pilots understand these procedures and their use prior to attempting to fly instrument approaches.

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

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

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

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

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

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

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

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

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

NOTE—

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

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

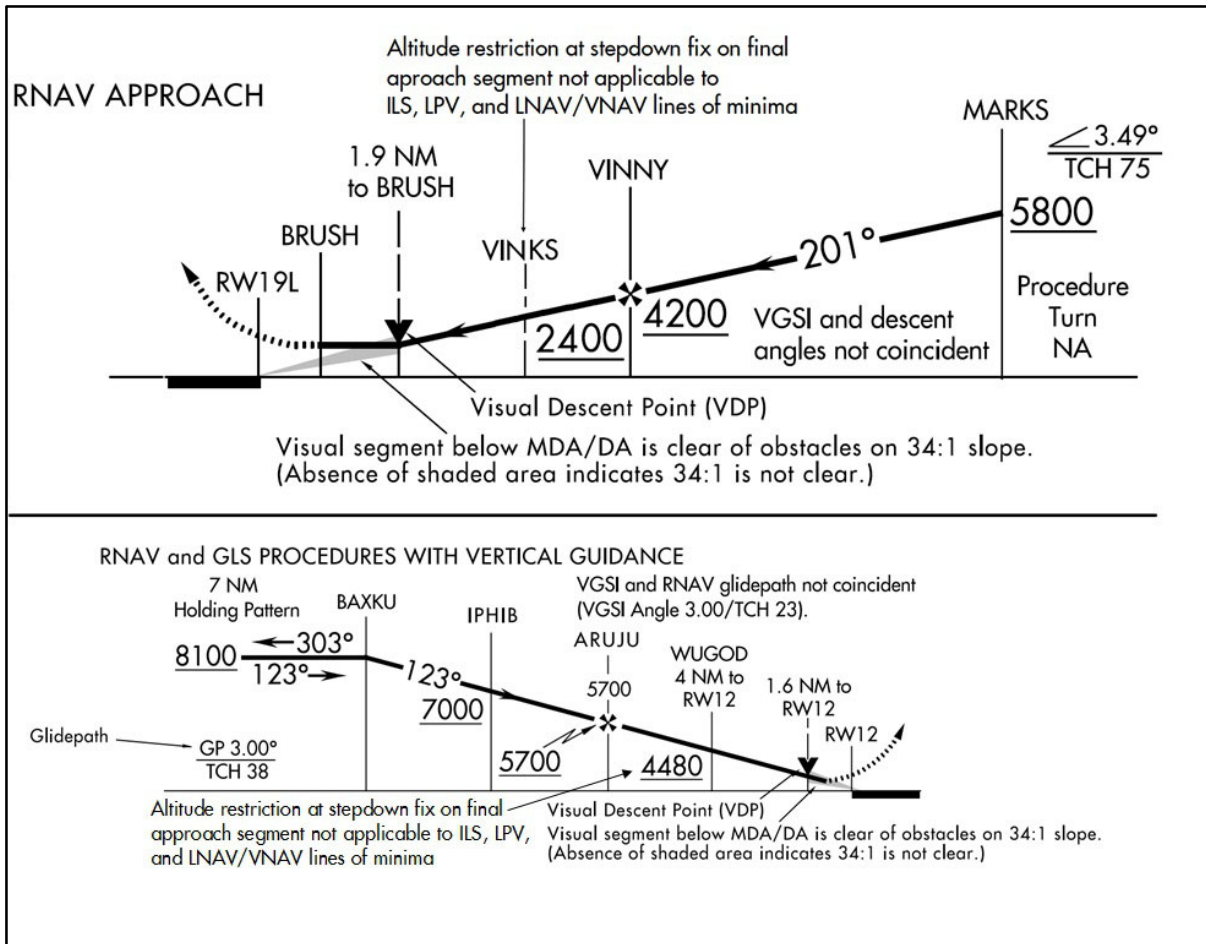
3. *Approaches used for simultaneous (parallel) independent and simultaneous close parallel operations procedurally require descending on the glideslope from the altitude at which the approach clearance is issued (refer to 5-4-15 and 5-4-16). For simultaneous close parallel (PRM) approaches, the Attention All Users Page (AAUP) may publish a note which indicates that descending on the glideslope/glidepath meets all crossing restrictions. However, if no such note is published, and for simultaneous independent approaches (4300 and greater runway separation) where an AAUP is not published, pilots are cautioned to monitor their descent on the glideslope/path outside of the PFAF to ensure compliance with published crossing restrictions during simultaneous operations.*

4. *When parallel approach courses are less than 2500 feet apart and reduced in-trail spacing is authorized for simultaneous dependent operations, a chart note will indicate that simultaneous operations require use of vertical guidance and that the pilot should maintain last assigned altitude until established on glide slope. These approaches procedurally require utilization of the ILS glide slope for wake turbulence mitigation. Pilots should not confuse these simultaneous dependent operations with (SOIA) simultaneous close parallel PRM approaches, where PRM appears in the approach title.*

5. Altitude restrictions depicted at stepdown fixes within the final approach segment are applicable only when flying a Non-Precision Approach to a straight-in or circling line of minima identified as an MDA (H). These altitude restrictions may be annotated with a note “LOC only” or “LNAV only.” Stepdown fix altitude restrictions within the final approach segment do not apply to pilots using Precision Approach (ILS) or Approach with Vertical Guidance (LPV, LNAV/VNAV) lines of minima identified as a DA(H), since obstacle clearance on these approaches is based on the aircraft following the applicable vertical guidance. Pilots are responsible for adherence to stepdown fix altitude restrictions when outside the final approach segment (i.e., initial or intermediate segment), regardless of which type of procedure the pilot is flying. (See FIG 5-4-1.)

c. The **Minimum Safe Altitudes (MSA)** is published for emergency use on IAP or departure procedure (DP) graphic charts. MSAs provide 1,000 feet of clearance over all obstacles, but do not necessarily assure acceptable navigation signal coverage. The MSA depiction on the plan view of an approach chart or on a DP graphic chart contains the identifier of the center point of the MSA, the applicable radius of the MSA, a depiction of the sector(s), and the minimum altitudes above mean sea level which provide obstacle clearance. For conventional navigation systems, the MSA is normally based on the primary omnidirectional facility on which the IAP or DP graphic chart is predicated, but may be based on the airport reference point (ARP) if no suitable facility is available. For RNAV approaches or DP graphic charts, the MSA is based on an RNAV waypoint. MSAs normally have a 25 NM radius; however, for conventional navigation systems, this radius may be expanded to 30 NM if necessary to encompass the airport landing surfaces. A single sector altitude is normally established, however when the MSA is based on a facility and it is necessary to obtain relief from obstacles, an MSA with up to four sectors may be established.

FIG 5-4-1
Instrument Approach Procedure Stepdown Fixes



d. Terminal Arrival Area (TAA)

1. The TAA provides a transition from the en route structure to the terminal environment with little required pilot/air traffic control interface for aircraft equipped with Area Navigation (RNAV) systems. A TAA provides minimum altitudes with standard obstacle clearance when operating within the TAA boundaries. TAAs are primarily used on RNAV approaches but may be used on an ILS approach when RNAV is the sole means for navigation to the IF; however, they are not normally used in areas of heavy concentration of air traffic.

2. The basic design of the RNAV procedure underlying the TAA is normally the “T” design (also called the “Basic T”). The “T” design incorporates two IAFs plus a dual purpose IF/IAF that functions as both an intermediate fix and an initial approach fix. The T configuration continues from the IF/IAF to the final approach fix (FAF) and then to the missed approach point (MAP). The two base leg IAFs are typically aligned in a straight-line perpendicular to the intermediate course connecting at the IF/IAF. A Hold-in-Lieu-of Procedure Turn (HILPT) is anchored at the IF/IAF and depicted on U.S. Government publications using the “hold-in-lieu-of-PT” holding pattern symbol. When the HILPT is necessary for course alignment and/or descent, the dual purpose IF/IAF serves as an IAF during the entry into the pattern. Following entry into the HILPT pattern and when flying a route or sector labeled “NoPT,” the dual-purpose fix serves as an IF, marking the beginning of the Intermediate Segment. See FIG 5-4-2 and FIG 5-4-3 for the Basic “T” TAA configuration.

use of quick reference icons. Due to limited space in the profile area, only four or fewer icons can be shown. However, the icons may not provide representation of the entire missed approach procedure. The entire set of textual missed approach instructions are provided at the top of the approach chart in the pilot briefing. (See FIG 5-4-6).

(d) Waypoints. All RNAV or GPS stand-alone IAPs are flown using data pertaining to the particular IAP obtained from an onboard database, including the sequence of all WPs used for the approach and missed approach, except that step down waypoints may not be included in some TSO-C129 receiver databases. Included in the database, in most receivers, is coding that informs the navigation system of which WPs are fly-over (FO) or fly-by (FB). The navigation system may provide guidance appropriately – including leading the turn prior to a fly-by WP; or causing overflight of a fly-over WP. Where the navigation system does not provide such guidance, the pilot must accomplish the turn lead or waypoint overflight manually. Chart symbology for the FB WP provides pilot awareness of expected actions. Refer to the legend of the U.S. Terminal Procedures books.

(e) TAAs are described in paragraph 5-4-5d, Terminal Arrival Area (TAA). When published, the RNAV chart depicts the TAA areas through the use of “icons” representing each TAA area associated with the RNAV procedure (See FIG 5-4-6). These icons are depicted in the plan view of the approach chart, generally arranged on the chart in accordance with their position relative to the aircraft’s arrival from the en route structure. The WP, to which navigation is appropriate and expected within each specific TAA area, will be named and depicted on the associated TAA icon. Each depicted named WP is the IAF for arrivals from within that area. TAAs may not be used on all RNAV procedures because of airspace congestion or other reasons.

(f) Published Temperature Limitations. There are currently two temperature limitations that may be published in the notes box of the middle briefing strip on an instrument approach procedure (IAP). The two published temperature limitations are:

(1) A temperature range limitation associated with the use of baro-VNAV that may be published on a United States PBN IAP titled RNAV (GPS) or RNAV (RNP); and/or

(2) A Cold Temperature Airport (CTA) limitation designated by a snowflake ICON and temperature in Celsius (C) that is published on every IAP for the airfield.

REFERENCE-

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

(g) WAAS Channel Number/Approach ID. The WAAS Channel Number is an optional equipment capability that allows the use of a 5-digit number to select a specific final approach segment without using the menu method. The Approach ID is an airport unique 4-character combination for verifying the selection and extraction of the correct final approach segment information from the aircraft database. It is similar to the ILS ident, but displayed visually rather than aurally. The Approach ID consists of the letter W for WAAS, the runway number, and a letter other than L, C or R, which could be confused with Left, Center and Right, e.g., W35A. Approach IDs are assigned in the order that WAAS approaches are built to that runway number at that airport. The WAAS Channel Number and Approach ID are displayed in the upper left corner of the approach procedure pilot briefing.

(h) At locations where outages of WAAS vertical guidance may occur daily due to initial system limitations, a negative W symbol (**W**) will be placed on RNAV (GPS) approach charts. Many of these outages will be very short in duration, but may result in the disruption of the vertical portion of the approach. The **W** symbol indicates that NOTAMs or Air Traffic advisories are not provided for outages which occur in the WAAS LNAV/VNAV or LPV vertical service. Use LNAV or circling minima for flight planning at these locations, whether as a destination or alternate. For flight operations at these locations, when the WAAS avionics indicate that LNAV/VNAV or LPV service is available, then vertical guidance may be used to complete the approach using the displayed level of service. Should an outage occur during the procedure, reversion to LNAV minima may be required. As the WAAS coverage is expanded, the **W** will be removed.

NOTE-

Properly trained and approved, as required, TSO-C145() and TSO-C146() equipped users (WAAS users) with and using

approved baro-VNAV equipment may plan for LNAV/VNAV DA at an alternate airport. Specifically authorized WAAS users with and using approved baro-VNAV equipment may also plan for RNP 0.3 DA at the alternate airport as long as the pilot has verified RNP availability through an approved prediction program.

5-4-6. Approach Clearance

a. An aircraft which has been cleared to a holding fix and subsequently “cleared . . . approach” has not received new routing. Even though clearance for the approach may have been issued prior to the aircraft reaching the holding fix, ATC would expect the pilot to proceed via the holding fix (his/her last assigned route), and the feeder route associated with that fix (if a feeder route is published on the approach chart) to the initial approach fix (IAF) to commence the approach. *WHEN CLEARED FOR THE APPROACH, THE PUBLISHED OFF AIRWAY (FEEDER) ROUTES THAT LEAD FROM THE EN ROUTE STRUCTURE TO THE IAF ARE PART OF THE APPROACH CLEARANCE.*

b. If a feeder route to an IAF begins at a fix located along the route of flight prior to reaching the holding fix, and clearance for an approach is issued, a pilot should commence the approach via the published feeder route; i.e., the aircraft would not be expected to overfly the feeder route and return to it. The pilot is expected to commence the approach in a similar manner at the IAF, if the IAF for the procedure is located along the route of flight to the holding fix.

c. If a route of flight directly to the initial approach fix is desired, it should be so stated by the controller with phraseology to include the words “direct . . .,” “proceed direct” or a similar phrase which the pilot can interpret without question. When uncertain of the clearance, immediately query ATC as to what route of flight is desired.

d. The name of an instrument approach, as published, is used to identify the approach, even though a component of the approach aid, such as the glideslope on an Instrument Landing System, is inoperative or unreliable. The controller will use the name of the approach as published, but must advise the aircraft at the time an approach clearance is issued that the inoperative or unreliable approach aid component is unusable, except when the title of the published approach procedures otherwise allows; for example, ILS Rwy 05 or LOC Rwy 05.

e. At times ATC may not specify a particular approach procedure in the clearance, but will state “CLEARED APPROACH.”

1. This clearance indicates the pilot may execute any one of the authorized IAPs for that airport.

2. The clearance may be issued in conjunction with the route to or over an IAF or feeder fix.

3. This clearance does not constitute approval for the pilot to execute a contact approach or a visual approach to the airport or runway.

f. Except when being vectored to the final approach course, pilots cleared for an IAP are expected to execute the entire procedure commencing at an IAF or an associated feeder fix as described on the IAP chart. Pilots are not required to execute the entire procedure if:

1. An appropriate new or revised ATC clearance is received, or

2. The IFR flight plan is canceled.

g. STAR to Approach Connectivity. A STAR may terminate at a fix that is also the IAF or IF for an approach. When the arrival route instructions as published on the STAR state the pilot can expect the instrument approach from the STAR terminus fix or approach IAF or IF, pilots are expected to ensure that the RNAV system is loaded with the approach beginning at that IAF or IF so that the STAR and approach are connected. ATC will clear the aircraft for the instrument approach by stating the IAF fix/waypoint by name with the approach clearance. This procedure also applies to aircraft arriving to an airport via other air traffic services (ATS) routes.

EXAMPLE-

“At RDFSH, Cleared ILS Runway 27 Approach”

NOTE-

The fix “RDFSH” is the STAR terminus fix and an IAF for the ILS runway 27 approach at KIAH. Pilots are expected to ensure

that the ILS Runway 27 approach is loaded in the RNAV system with the RDFSH IAF selected. Pilots are not to select vectors or vectors to final option when loading the ILS runway 27 approach.

h. The following applies to aircraft on radar vectors and/or cleared “direct to” in conjunction with an approach clearance:

1. Maintain the last altitude assigned by ATC until the aircraft is established on a published segment of a transition route, or approach procedure segment, or other published route, for which a lower altitude is published on the chart. If already on an established route, or approach or arrival segment, you may descend to whatever minimum altitude is listed for that route or segment.

2. Continue on the vector heading until intercepting the next published ground track applicable to the approach clearance.

3. Once reaching the final approach fix via the published segments, the pilot may continue on approach to a landing.

4. If proceeding to an IAF with a published course reversal (procedure turn or hold-in-lieu of PT pattern), except when cleared for a straight in approach by ATC, the pilot must execute the procedure turn/hold-in-lieu of PT, and complete the approach.

5. If cleared to an IAF/IF via a NoPT route, or no procedure turn/hold-in-lieu of PT is published, continue with the published approach.

6. In addition to the above, RNAV aircraft may be issued a clearance direct to the IAF/IF at intercept angles not greater than 90 degrees for both conventional and RNAV instrument approaches. Controllers may issue a heading or a course direct to a fix between the IF and FAF at intercept angles not greater than 30 degrees for both conventional and RNAV instrument approaches. In all cases, controllers will assign altitudes that ensure obstacle clearance and will permit a normal descent to the FAF. When clearing aircraft direct to the IF, ATC will radar monitor the aircraft until the IF and will advise the pilot to expect clearance direct to the IF at least 5 miles from the fix. ATC must issue a straight-in approach clearance when clearing an aircraft direct to an IAF/IF with a procedure turn or hold-in-lieu of a procedure turn, and ATC does not want the aircraft to execute the course reversal.

NOTE—

Refer to 14 CFR 91.175 (i).

7. RNAV aircraft may be issued a clearance direct to the FAF that is also charted as an IAF, in which case the pilot is expected to execute the depicted procedure turn or hold-in-lieu of procedure turn. ATC will not issue a straight-in approach clearance. If the pilot desires a straight-in approach, they must request vectors to the final approach course outside of the FAF or fly a published “NoPT” route. When visual approaches are in use, ATC may clear an aircraft direct to the FAF.

NOTE—

1. *In anticipation of a clearance by ATC to any fix published on an instrument approach procedure, pilots of RNAV aircraft are advised to select an appropriate IAF or feeder fix when loading an instrument approach procedure into the RNAV system.*

2. *Selection of “Vectors-to-Final” or “Vectors” option for an instrument approach may prevent approach fixes located outside of the FAF from being loaded into an RNAV system. Therefore, the selection of these options is discouraged due to increased workload for pilots to reprogram the navigation system.*

8. **Arrival Holding.** Some approach charts have an arrival holding pattern depicted at an IAF or at a feeder fix located along an airway. The arrival hold is depicted using a “thin line” since it is not always a mandatory part of the instrument procedure.

(a) Arrival holding is charted where holding is frequently required prior to starting the approach procedure so that detailed holding instructions are not required. The arrival holding pattern is not authorized unless assigned by ATC. Holding at the same fix may also be depicted on the en route chart.

(b) Arrival holding is also charted where it is necessary to use a holding pattern to align the aircraft for procedure entry from an airway due to turn angle limitations imposed by procedure design standards. When the

turn angle from an airway into the approach procedure exceeds the permissible limits, an arrival holding pattern may be published along with a note on the procedure specifying the fix, the airway, and arrival direction where use of the arrival hold is required for procedure entry. Unlike a hold-in-lieu of procedure turn, use of the arrival holding pattern is not authorized until assigned by ATC. If ATC does not assign the arrival hold before reaching the holding fix, the pilot should request the hold for procedure entry. Once established on the inbound holding course and an approach clearance has been received, the published procedure can commence. Alternatively, if using the holding pattern for procedure entry is not desired, the pilot may ask ATC for maneuvering airspace to align the aircraft with the feeder course.

EXAMPLE–

Planview Chart Note: “Proc NA via V343 northeast bound without holding at JOXIT. ATC CLNC REQD.”

i. An RF leg is defined as a constant radius circular path around a defined turn center that starts and terminates at a fix. An RF leg may be published as part of a procedure. Since not all aircraft have the capability to fly these leg types, pilots are responsible for knowing if they can conduct an RNAV approach with an RF leg. Requirements for RF legs will be indicated on the approach chart in the notes section or at the applicable initial approach fix. Controllers will clear RNAV-equipped aircraft for instrument approach procedures containing RF legs:

1. Via published transitions, or
2. In accordance with paragraph e6 above, and
3. ATC will not clear aircraft direct to any waypoint beginning or within an RF leg, and will not assign fix/waypoint crossing speeds in excess of charted speed restrictions.

EXAMPLE–

Controllers will not clear aircraft direct to THIRD because that waypoint begins the RF leg, and aircraft cannot be vectored or cleared to TURNN or vectored to intercept the approach segment at any point between THIRD and FORTH because this is the RF leg. (See FIG 5–4–15.)

j. When necessary to cancel a previously issued approach clearance, the controller will advise the pilot “Cancel Approach Clearance” followed by any additional instructions when applicable.

5–4–7. Instrument Approach Procedures

a. Aircraft approach category means a grouping of aircraft based on a speed of V_{REF} at the maximum certified landing weight, if specified, or if V_{REF} is not specified, $1.3V_{SO}$ at the maximum certified landing weight. V_{REF} , V_{SO} , and the maximum certified landing weight are those values as established for the aircraft by the certification authority of the country of registry. A pilot must maneuver the aircraft within the circling approach protected area (see FIG 5–4–27) to achieve the obstacle and terrain clearances provided by procedure design criteria.

b. In addition to pilot techniques for maneuvering, one acceptable method to reduce the risk of flying out of the circling approach protected area is to use either the minima corresponding to the category determined during certification or minima associated with a higher category. Helicopters may use Category A minima. If it is necessary to operate at a speed in excess of the upper limit of the speed range for an aircraft’s category, the minimums for the higher category should be used. This may occur with certain aircraft types operating in heavy/gusty wind, icing, or non-normal conditions. For example, an airplane which fits into Category B, but is circling to land at a speed of 145 knots, should use the approach Category D minimums. As an additional example, a Category A airplane (or helicopter) which is operating at 130 knots on a straight-in approach should use the approach Category C minimums.

c. A pilot who chooses an alternative method when it is necessary to maneuver at a speed that exceeds the category speed limit (for example, where higher category minimums are not published) should consider the following factors that can significantly affect the actual ground track flown:

1. Bank angle. For example, at 165 knots groundspeed, the radius of turn increases from 4,194 feet using 30 degrees of bank to 6,654 feet when using 20 degrees of bank. When using a shallower bank angle, it may be

necessary to modify the flightpath or indicated airspeed to remain within the circling approach protected area. Pilots should be aware that excessive bank angle can lead to a loss of aircraft control.

2. Indicated airspeed. Procedure design criteria typically utilize the highest speed for a particular category. If a pilot chooses to operate at a higher speed, other factors should be modified to ensure that the aircraft remains within the circling approach protected area.

3. Wind speed and direction. For example, it is not uncommon to maneuver the aircraft to a downwind leg where the groundspeed will be considerably higher than the indicated airspeed. Pilots must carefully plan the initiation of all turns to ensure that the aircraft remains within the circling approach protected area.

4. Pilot technique. Pilots frequently have many options with regard to flightpath when conducting circling approaches. Sound planning and judgment are vital to proper execution. The lateral and vertical path to be flown should be carefully considered using current weather and terrain information to ensure that the aircraft remains within the circling approach protected area.

d. It is important to remember that 14 CFR section 91.175(c) requires that “where a DA/DH or MDA is applicable, no pilot may operate an aircraft below the authorized MDA or continue an approach below the authorized DA/DH unless the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers, and for operations conducted under part 121 or part 135 unless that descent rate will allow touchdown to occur within the touchdown zone of the runway of intended landing.”

e. See the following category limits:

- 1.** Category A: Speed less than 91 knots.
- 2.** Category B: Speed 91 knots or more but less than 121 knots.
- 3.** Category C: Speed 121 knots or more but less than 141 knots.
- 4.** Category D: Speed 141 knots or more but less than 166 knots.
- 5.** Category E: Speed 166 knots or more.

NOTE—

V_{REF} in the above definition refers to the speed used in establishing the approved landing distance under the airworthiness regulations constituting the type certification basis of the airplane, regardless of whether that speed for a particular airplane is 1.3 V_{SO}, 1.23 V_{SR}, or some higher speed required for airplane controllability. This speed, at the maximum certificated landing weight, determines the lowest applicable approach category for all approaches regardless of actual landing weight.

f. When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, must, in addition to complying with the minimum altitudes for IFR operations (14 CFR section 91.177), maintain the last assigned altitude unless a different altitude is assigned by ATC, or until the aircraft is established on a segment of a published route or IAP. After the aircraft is so established, published altitudes apply to descent within each succeeding route or approach segment unless a different altitude is assigned by ATC. Notwithstanding this pilot responsibility, for aircraft operating on unpublished routes or while being radar vectored, ATC will, except when conducting a radar approach, issue an IFR approach clearance only after the aircraft is established on a segment of a published route or IAP, or assign an altitude to maintain until the aircraft is established on a segment of a published route or instrument approach procedure. For this purpose, the procedure turn of a published IAP must not be considered a segment of that IAP until the aircraft reaches the initial fix or navigation facility upon which the procedure turn is predicated.

EXAMPLE—

Cross Redding VOR at or above five thousand, cleared VOR runway three four approach.

or

Five miles from outer marker, turn right heading three three zero, maintain two thousand until established on the localizer, cleared ILS runway three six approach.

NOTE—

1. The altitude assigned will assure IFR obstruction clearance from the point at which the approach clearance is issued until

established on a segment of a published route or IAP. If uncertain of the meaning of the clearance, immediately request clarification from ATC.

2. *An aircraft is not established on an approach while below published approach altitudes. If the MVA/MIA allows, and ATC assigns an altitude below an IF or IAF altitude, the pilot will be issued an altitude to maintain until past a point that the aircraft is established on the approach.*

g. Several IAPs, using various navigation and approach aids may be authorized for an airport. ATC may advise that a particular approach procedure is being used, primarily to expedite traffic. If issued a clearance that specifies a particular approach procedure, notify ATC immediately if a different one is desired. In this event it may be necessary for ATC to withhold clearance for the different approach until such time as traffic conditions permit. However, a pilot involved in an emergency situation will be given priority. If the pilot is not familiar with the specific approach procedure, ATC should be advised and they will provide detailed information on the execution of the procedure.

REFERENCE—

AIM, Para 5–4–4, Advance Information on Instrument Approach.

h. The name of an instrument approach, as published, is used to identify the approach, even though a component of the approach aid, such as the glideslope on an Instrument Landing System, is inoperative or unreliable. The controller will use the name of the approach as published, but must advise the aircraft at the time an approach clearance is issued that the inoperative or unreliable approach aid component is unusable, except when the title of the published approach procedures otherwise allows, for example, ILS or LOC.

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

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

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

REFERENCE—

AIM, Para 5–4–21, Missed Approach.

AIM, Para 5–5–5, Missed Approach.

5–4–8. Special Instrument Approach Procedures

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

safety-of-flight information relating to Specials provided the location has a valid landing area identifier and is serviced by the United States NOTAM system. Pilots may access NOTAMs online or through an FAA Flight Service Station (FSS). FSS specialists will not automatically provide NOTAM information to pilots for special IAPs during telephone pre-flight briefings. Pilots who are authorized by the FAA to use special IAPs must specifically request FDC NOTAM information for the particular special IAP they plan to use.

5-4-9. Procedure Turn and Hold-in-lieu of Procedure Turn

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

NOTE—

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

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

2. Descent to the procedure turn (PT) completion altitude from the PT fix altitude (when one has been published or assigned by ATC) must not begin until crossing over the PT fix or abeam and proceeding outbound. Some procedures contain a note in the chart profile view that says “Maintain (altitude) or above until established outbound for procedure turn” (See FIG 5-4-16). Newer procedures will simply depict an “at or above” altitude at the PT fix without a chart note (See FIG 5-4-17). Both are there to ensure required obstacle clearance is provided in the procedure turn entry zone (See FIG 5-4-18). Absence of a chart note or specified minimum altitude adjacent to the PT fix is an indication that descent to the procedure turn altitude can commence immediately upon crossing over the PT fix, regardless of the direction of flight. This is because the minimum altitudes in the PT entry zone and the PT maneuvering zone are the same.

FIG 5-4-15
Example of an RNAV Approach with RF Leg

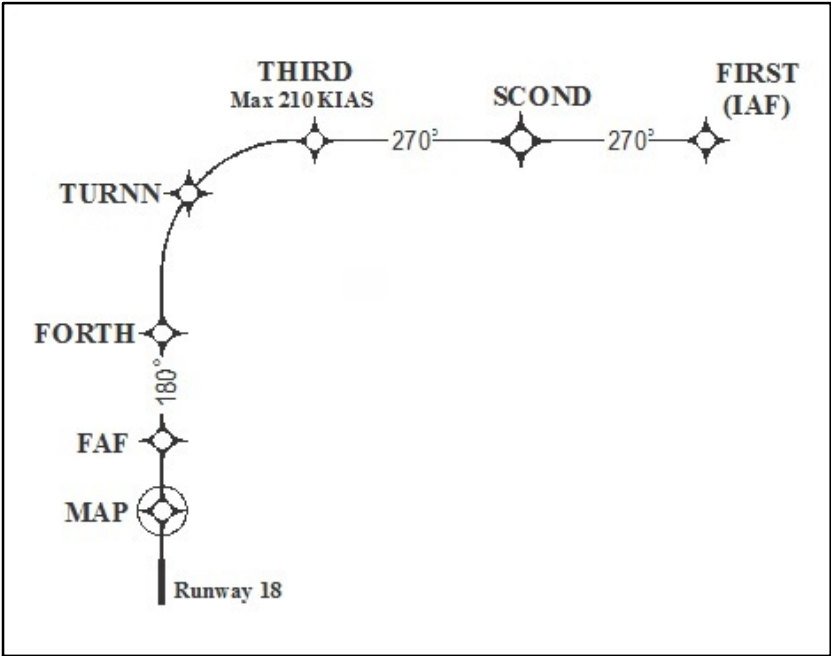


FIG 5-4-16

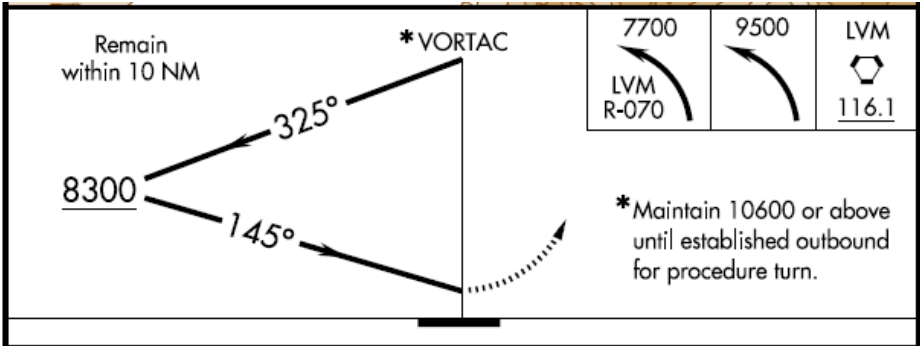
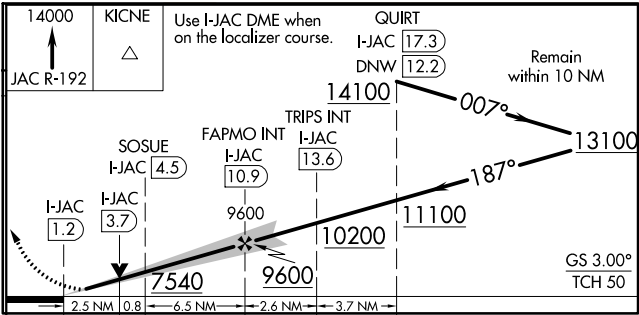


FIG 5-4-17



Altitude and subsequently to the prescribed MDA. In addition, the pilot will be advised of the location of the Missed Approach Point (MAP) prescribed for the procedure and the aircraft's position each mile on final from the runway, airport or heliport or MAP, as appropriate. If requested by the pilot, recommended altitudes will be issued at each mile, based on the descent gradient established for the procedure, down to the last mile that is at or above the MDA. Normally, navigational guidance will be provided until the aircraft reaches the MAP. Controllers will terminate guidance and instruct the pilot to execute a missed approach unless at the MAP the pilot has the runway, airport or heliport in sight or, for a helicopter point-in-space approach, the prescribed visual reference with the surface is established. Also, if, at any time during the approach the controller considers that safe guidance for the remainder of the approach cannot be provided, the controller will terminate guidance and instruct the pilot to execute a missed approach. Similarly, guidance termination and missed approach will be effected upon pilot request and, for civil aircraft only, controllers may terminate guidance when the pilot reports the runway, airport/heliport or visual surface route (point-in-space approach) in sight or otherwise indicates that continued guidance is not required. Radar service is automatically terminated at the completion of a radar approach.

NOTE—

The published MDA for straight-in approaches will be issued to the pilot before beginning descent. When a surveillance approach will terminate in a circle-to-land maneuver, the pilot must furnish the aircraft approach category to the controller. The controller will then provide the pilot with the appropriate MDA.

3. NO-GYRO Approach. This approach is available to a pilot under radar control who experiences circumstances wherein the directional gyro or other stabilized compass is inoperative or inaccurate. When this occurs, the pilot should so advise ATC and request a No-Gyro vector or approach. Pilots of aircraft not equipped with a directional gyro or other stabilized compass who desire radar handling may also request a No-Gyro vector or approach. The pilot should make all turns at standard rate and should execute the turn immediately upon receipt of instructions. For example, "TURN RIGHT," "STOP TURN." When a surveillance or precision approach is made, the pilot will be advised after the aircraft has been turned onto final approach to make turns at half standard rate.

5-4-12. Radar Monitoring of Instrument Approaches

a. PAR facilities operated by the FAA and the military services at some joint-use (civil and military) and military installations monitor aircraft on instrument approaches and issue radar advisories to the pilot when weather is below VFR minimums (1,000 and 3), at night, or when requested by a pilot. This service is provided only when the PAR Final Approach Course coincides with the final approach of the navigational aid and only during the operational hours of the PAR. The radar advisories serve only as a secondary aid since the pilot has selected the navigational aid as the primary aid for the approach.

b. Prior to starting final approach, the pilot will be advised of the frequency on which the advisories will be transmitted. If, for any reason, radar advisories cannot be furnished, the pilot will be so advised.

c. Advisory information, derived from radar observations, includes information on:

1. Passing the final approach fix inbound (nonprecision approach) or passing the outer marker or fix used in lieu of the outer marker inbound (precision approach).

NOTE—

At this point, the pilot may be requested to report sighting the approach lights or the runway.

2. Trend advisories with respect to elevation and/or azimuth radar position and movement will be provided.

NOTE—

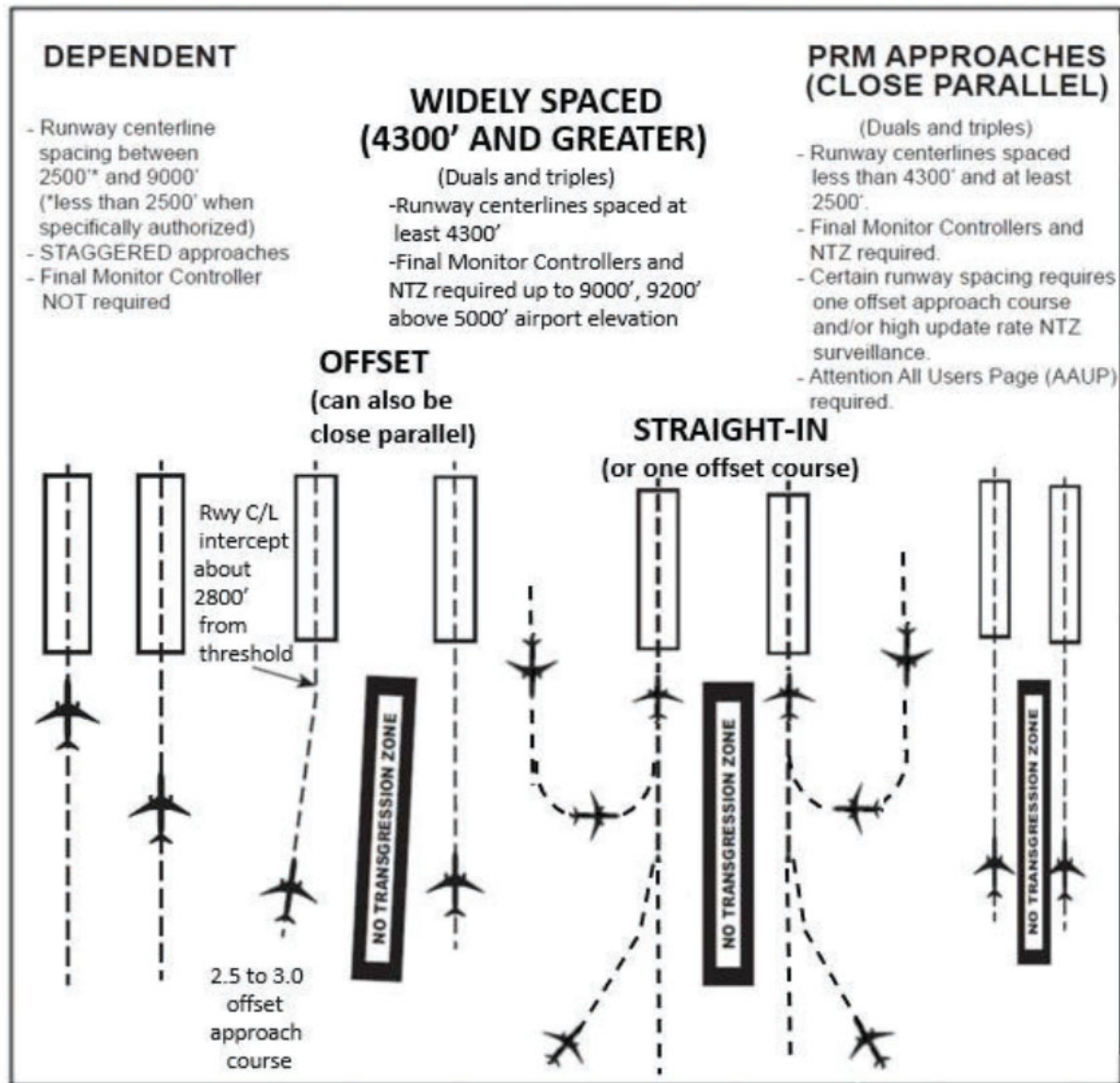
Whenever the aircraft nears the PAR safety limit, the pilot will be advised that the aircraft is well above or below the glidepath or well left or right of course. Glidepath information is given only to those aircraft executing a precision approach, such as ILS. Altitude information is not transmitted to aircraft executing other than precision approaches because the descent portions of these approaches generally do not coincide with the depicted PAR glidepath.

3. If, after repeated advisories, the aircraft proceeds outside the PAR safety limit or if a radical deviation is observed, the pilot will be advised to execute a missed approach unless the prescribed visual reference with the surface is established.

- d. Radar service is automatically terminated upon completion of the approach.

5-4-13. Simultaneous Approaches to Parallel Runways

FIG 5-4-20
Simultaneous Approaches
(Approach Courses Parallel and Offset between 2.5 and 3.0 degrees)



- a. ATC procedures permit ILS/RNAV/GLS instrument approach operations to dual or triple parallel runway configurations. ILS/RNAV/GLS approaches to parallel runways are grouped into three classes: Simultaneous Dependent Approaches; Simultaneous Independent Approaches; and Simultaneous Close Parallel PRM Approaches. RNAV approach procedures that are approved for simultaneous operations require GPS as the sensor for position updating. VOR/DME, DME/DME and IRU RNAV updating is not authorized. The classification of a parallel runway approach procedure is dependent on adjacent parallel runway centerline separation, ATC procedures, and airport ATC final approach radar monitoring and communications capabilities. At some airports, one or more approach courses may be offset up to 3 degrees. ILS approaches with offset localizer configurations result in loss of Category II/III capabilities and an increase in decision altitude/height (50').

b. Depending on weather conditions, traffic volume, and the specific combination of runways being utilized for arrival operations, a runway may be used for different types of simultaneous operations, including closely spaced dependent or independent approaches. Pilots should ensure that they understand the type of operation that is being conducted, and ask ATC for clarification if necessary.

c. Parallel approach operations demand heightened pilot situational awareness. Once cleared for an approach procedure, each pilot must maintain the lateral and vertical path of the procedure unless otherwise instructed by ATC. Instrument approach procedures using a curved or straight path to transition to the final segment may be used in conjunction with simultaneous operations. Pilots may notice nearby aircraft on adjacent approaches. As each aircraft nears the final approach fix, it may appear to the pilots involved that these aircraft are on converging or intercepting flight tracks. The procedures provide safe separation between aircraft. Each pilot should maintain close adherence to the approach procedure. Each pilot should be prepared to take appropriate action should adjacent aircraft deviate in a manner that creates a collision hazard to their aircraft and notify ATC. Pilots are informed by ATC or through the ATIS that simultaneous approaches are in use.

d. The close proximity of adjacent aircraft conducting simultaneous independent approaches, especially simultaneous close parallel PRM approaches mandates strict pilot compliance with all ATC clearances. ATC assigned airspeeds, altitudes, and headings must be complied with in a timely manner. Autopilot coupled approaches require pilot knowledge of procedures necessary to comply with ATC instructions. Simultaneous independent approaches, particularly simultaneous close parallel PRM approaches necessitate precise approach course tracking to minimize final monitor controller intervention, and unwanted No Transgression Zone (NTZ) penetration. In the unlikely event of a breakout, ATC will not assign altitudes lower than the minimum vectoring altitude. Pilots should notify ATC immediately if there is a degradation of aircraft or navigation systems.

e. Strict radio discipline is mandatory during simultaneous independent and simultaneous close parallel PRM approach operations. This includes an alert listening watch and the avoidance of lengthy, unnecessary radio transmissions. Attention must be given to proper call sign usage to prevent the inadvertent execution of clearances intended for another aircraft. Use of abbreviated call signs must be avoided to preclude confusion of aircraft with similar sounding call signs. Pilots must be alert to unusually long periods of silence or any unusual background sounds in their radio receiver. A stuck microphone may block the issuance of ATC instructions on the tower frequency by the final monitor controller during simultaneous independent and simultaneous close parallel PRM approaches. In the case of PRM approaches, the use of a second frequency by the monitor controller mitigates the “stuck mike” or other blockage on the tower frequency.

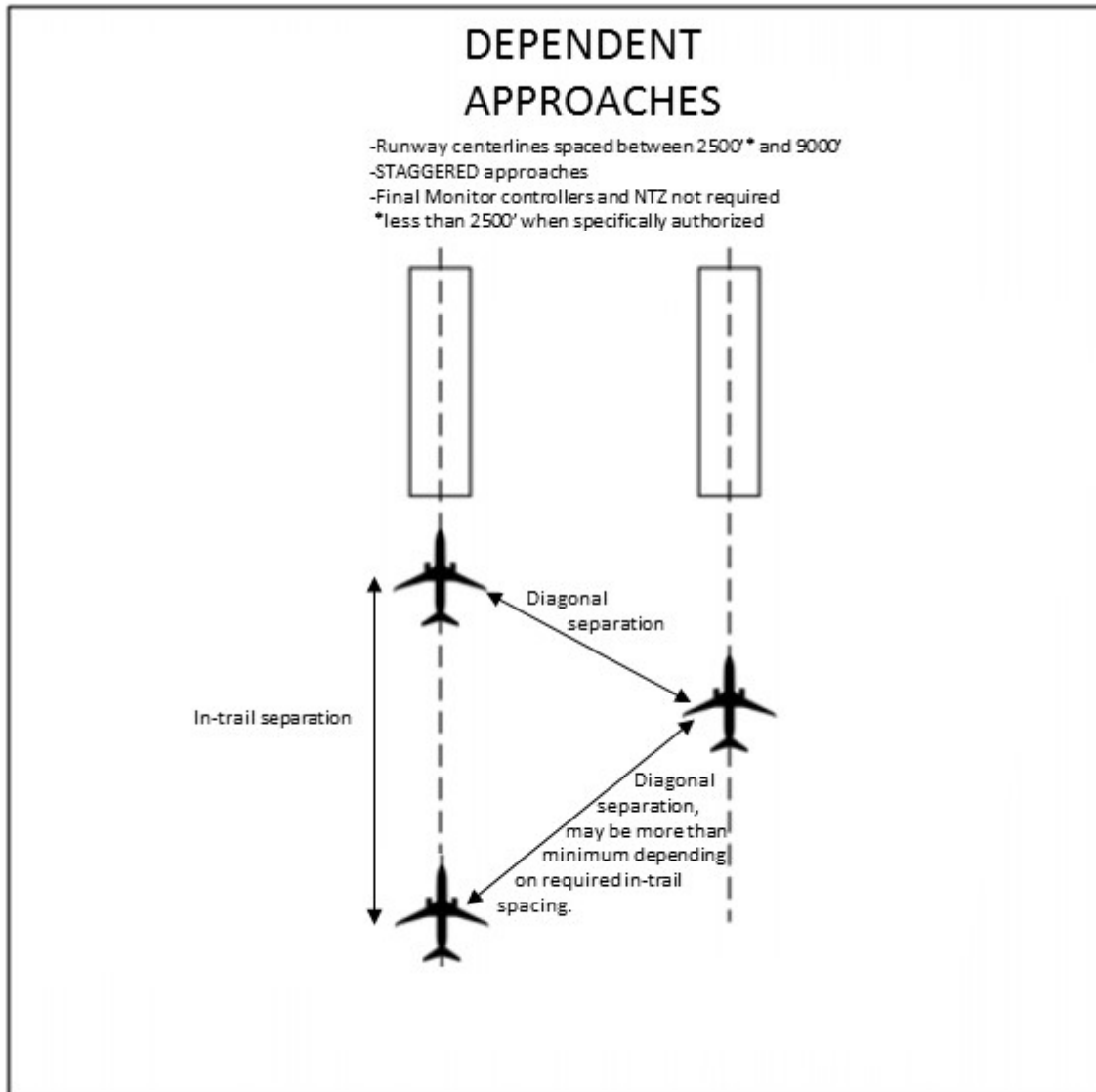
REFERENCE—

AIM, Chapter 4, Section 2, Radio Communications Phraseology and Techniques, gives additional communications information.

f. Use of Traffic Collision Avoidance Systems (TCAS) provides an additional element of safety to parallel approach operations. Pilots should follow recommended TCAS operating procedures presented in approved flight manuals, original equipment manufacturer recommendations, professional newsletters, and FAA publications.

5-4-14. Simultaneous Dependent Approaches

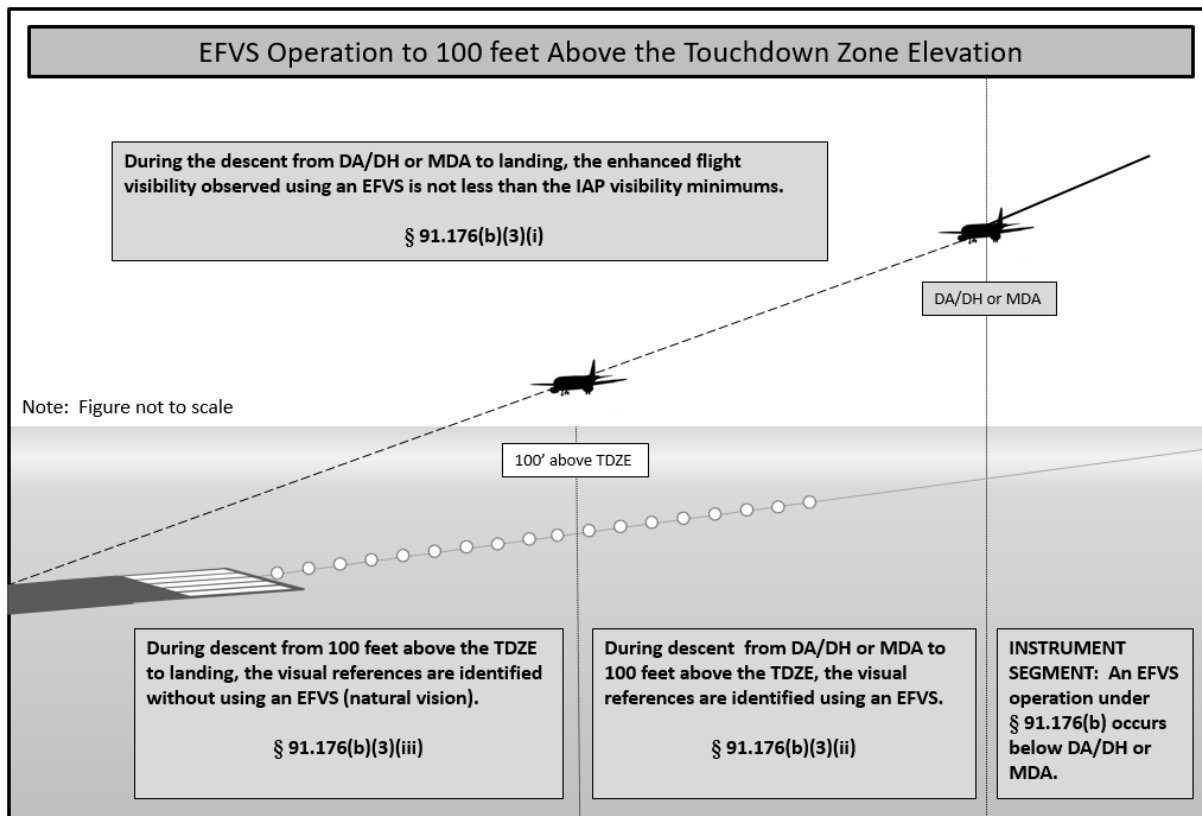
FIG 5-4-21
Simultaneous Approaches
(Parallel Runways and Approach Courses)



a. Simultaneous dependent approaches are an ATC procedure permitting approaches to airports having parallel runway centerlines separated by at least 2,500 feet up to 9,000 feet. Integral parts of a total system are ILS or other system providing approach navigation, radar, communications, ATC procedures, and required airborne equipment. RNAV equipment in the aircraft or GLS equipment on the ground and in the aircraft may replace the required airborne and ground based ILS equipment. Although non-precision minimums may be published, pilots must only use those procedures specifically authorized by chart note. For example, the chart note "LNAV NA during simultaneous operations," requires vertical guidance. When given a choice, pilots should always fly a precision approach whenever possible.

b. A simultaneous dependent approach differs from a simultaneous independent approach in that, the minimum distance between parallel runway centerlines may be reduced; there is no requirement for radar monitoring or advisories; and a staggered separation of aircraft on the adjacent final course is required.

FIG 5-4-33
EFVS Operation to 100 ft Above the TDZE



d. EFVS Equipment Requirements. An EFVS that is installed on a U.S.-registered aircraft and is used to conduct EFVS operations must conform to an FAA-type design approval (i.e., a type certificate (TC), amended TC, or supplemental type certificate (STC)). A foreign-registered aircraft used to conduct EFVS operations that does not have an FAA-type design approval must be equipped with an EFVS that has been approved by either the State of the Operator or the State of Registry to meet the requirements of ICAO Annex 6. Equipment requirements for an EFVS operation to touchdown and rollout can be found in 14 CFR § 91.176(a)(1), and the equipment requirements for an EFVS operation to 100 feet above the TDZE can be found in 14 CFR § 91.176(b)(1). An operator can determine the eligibility of their aircraft to conduct EFVS operations by referring to the Airplane Flight Manual, Airplane Flight Manual Supplement, Rotorcraft Flight Manual, or Rotorcraft Flight Manual Supplement as applicable.

e. Operating Requirements. Any operator who conducts EFVS operations to touchdown and rollout (14 CFR § 91.176(a)) must have an OpSpec, MSpec, or LOA that specifically authorizes those operations. Parts 91K, 121, 125, 129, and 135 operators who conduct EFVS operations to 100 feet above the TDZE (14 CFR § 91.176(b)) must have an OpSpec, MSpec, or LOA that specifically authorizes the operation. Part 91 operators (other than 91K operators) are not required to have an LOA to conduct EFVS operations to 100 feet above the TDZE in the United States. However, an optional LOA is available to facilitate operational approval from foreign Civil Aviation Authorities (CAA). To conduct an EFVS operation to touchdown and rollout during an authorized Category II or III operation, the operator must have:

1. An OpSpec, MSpec, or LOA authorizing EFVS operations to touchdown and rollout (14 CFR § 91.176(a)); and
2. An OpSpec, MSpec, or LOA authorizing Category II or Category III operations.

f. EFVS Operations in Rotorcraft. Currently, EFVS operations in rotorcraft can only be conducted on IAPs that are flown to a runway. Instrument approach criteria, procedures, and appropriate visual references have not

yet been developed for straight-in landing operations below DA/DH or MDA under IFR to heliports or platforms. An EFVS cannot be used in lieu of natural vision to descend below published minimums on copter approaches to a point in space (PinS) followed by a “proceed visual flight rules (VFR)” visual segment, or on approaches designed to a specific landing site using a “proceed visually” visual segment.

g. EFVS Pilot Requirements. A pilot who conducts EFVS operations must receive ground and flight training specific to the EFVS operation to be conducted. The training must be obtained from an authorized training provider under a training program approved by the FAA. Additionally, recent flight experience and proficiency or competency check requirements apply to EFVS operations. These requirements are addressed in 14 CFR §§ 61.66, 91.1065, 121.441, Appendix F to part 121, 125.287, and 135.293.

h. Enhanced Flight Visibility and Visual Reference Requirements. To descend below DA/DH or MDA during EFVS operations under 14 CFR § 91.176(a) or (b), a pilot must make a determination that the enhanced flight visibility observed by using an EFVS is not less than what is prescribed by the IAP being flown. In addition, the visual references required in 14 CFR § 91.176(a) or (b) must be distinctly visible and identifiable to the pilot using the EFVS. The determination of enhanced flight visibility is a separate action from that of identifying required visual references, and is different from ground-reported visibility. Even though the reported visibility or the visibility observed using natural vision may be less, as long as the EFVS provides the required enhanced flight visibility and a pilot meets all of the other requirements, the pilot can continue descending below DA/DH or MDA using the EFVS. Suitable enhanced flight visibility is necessary to ensure the aircraft is in a position to continue the approach and land. It is important to understand that using an EFVS does not result in obtaining lower minima with respect to the visibility or the DA/DH or MDA specified in the IAP. An EFVS simply provides another means of operating in the visual segment of an IAP. The DA/DH or MDA and the visibility value specified in the IAP to be flown do not change.

i. Flight Planning and Beginning or Continuing an Approach Under IFR. A part 121, 125, or 135 operator’s OpSpec or LOA for EFVS operations may authorize an EFVS operational credit dispatching or releasing a flight and for beginning or continuing an instrument approach procedure. When a pilot reaches DA/DH or MDA, the pilot conducts the EFVS operation in accordance with 14 CFR § 91.176(a) or (b) and their authorization to conduct EFVS operations.

j. Missed Approach Considerations. In order to conduct an EFVS operation, the EFVS must be operable. In the event of a failure of any required component of an EFVS at any point in the approach to touchdown, a missed approach is required. However, this provision does not preclude a pilot’s authority to continue an approach if continuation of an approach is considered by the pilot to be a safer course of action.

k. Light Emitting Diode (LED) Airport Lighting Impact on EFVS Operations. Incandescent lamps are being replaced with LEDs at some airports in threshold lights, taxiway edge lights, taxiway centerline lights, low intensity runway edge lights, wind cone lights, beacons, and some obstruction lighting. Additionally, there are plans to replace incandescent lamps with LEDs in approach lighting systems. Pilots should be aware that LED lights cannot be sensed by infrared-based EFVSs. Airports with LED approach lights will be identified in the Airport Remarks paragraph of the Charting Supplement with the remarks: “Pilots conducting EFVS ops; be aware LED ALS in use.” More information may be found at the FAA Flight Standards EFVS webpage at https://www.faa.gov/about/office_org/headquarters_offices/avs/offices/afx/afs/afs400/afs410/efvs.

l. Other Vision Systems. Unlike an EFVS that meets the equipment requirements of 14 CFR § 91.176, a Synthetic Vision System (SVS) or Synthetic Vision Guidance System (SVGS) does not provide a real-time sensor image of the outside scene and also does not meet the equipment requirements for EFVS operations. A pilot cannot use a synthetic vision image on a head-up or a head-down display in lieu of natural vision to descend below DA/DH or MDA. An EFVS can, however, be integrated with an SVS, also known as a Combined Vision System (CVS). A CVS can be used to conduct EFVS operations if all of the requirements for an EFVS are satisfied and the SVS image does not interfere with the pilot’s ability to see the external scene, to identify the required visual references, or to see the sensor image.

m. Additional Information. Operational criteria for EFVS can be found in Advisory Circular (AC) 90–106, Enhanced Flight Vision System Operations, and airworthiness criteria for EFVS can be found in AC 20–167,

Airworthiness Approval of Enhanced Vision System, Synthetic Vision System, Combined Vision System, and Enhanced Flight Vision System Equipment.

5-4-23. Visual Approach

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

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

c. Operating to an Airport With an Operating Control Tower. Aircraft may be authorized to conduct a visual approach to one runway while other aircraft are conducting IFR or VFR approaches to another parallel, intersecting, or converging runway. ATC may authorize a visual approach after advising all aircraft involved that other aircraft are conducting operations to the other runway. This may be accomplished through use of the ATIS.

1. When operating to parallel runways separated by less than 2,500 feet, ATC will ensure approved separation is provided unless the succeeding aircraft reports sighting the preceding aircraft to the adjacent parallel and visual separation is applied.

2. When operating to parallel runways separated by at least 2,500 feet but less than 4,300 feet, ATC will ensure approved separation is provided until the aircraft are issued an approach clearance and one pilot has acknowledged receipt of a visual approach clearance, and the other pilot has acknowledged receipt of a visual or instrument approach clearance, and aircraft are established on a heading or established on a direct course to a fix or cleared on an RNAV/instrument approach procedure which will intercept the extended centerline of the runway at an angle not greater than 30 degrees.

3. When operating to parallel runways separated by 4,300 feet or more, ATC will ensure approved separation is provided until one of the aircraft has been issued and the pilot has acknowledged receipt of the visual approach clearance, and each aircraft is assigned a heading, or established on a direct course to a fix, or cleared on an RNAV/instrument approach procedure which will allow the aircraft to intercept the extended centerline of the runway at an angle not greater than 30 degrees.

NOTE—

The intent of the 30 degree intercept angle is to reduce the potential for overshoots of the final and to preclude side-by-side operations with one or both aircraft in a belly-up configuration during the turn-on.

d. Clearance for Visual Approach. At locations with an operating control tower, ATC will issue approach clearances that will include an assigned runway. At locations without an operating control tower or where a part-time tower is closed, ATC will issue a visual approach clearance to the airport only.

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

f. A visual approach is not an IAP and therefore has no missed approach segment. If a go-around is necessary for any reason, aircraft operating at controlled airports will be issued an appropriate clearance or instruction by

the tower to enter the traffic pattern for landing or proceed as otherwise instructed. In either case, the pilot is responsible to maintain terrain and obstruction avoidance until reaching an ATC assigned altitude if issued, and ATC will provide approved separation or visual separation from other IFR aircraft. At uncontrolled airports, aircraft are expected to remain clear of clouds and complete a landing as soon as possible. If a landing cannot be accomplished, the aircraft is expected to remain clear of clouds and contact ATC as soon as possible for further clearance. Separation from other IFR aircraft will be maintained under these circumstances.

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

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

REFERENCE—

AIM, Para 5-1-15, Canceling IFR Flight Plan.

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

5-4-24. Charted Visual Flight Procedure (CVFP)

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

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

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

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

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

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

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

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

i. ATC will not issue clearances for CVFPs when the weather is less than the published minimum.

j. ATC will clear aircraft for a CVFP after the pilot reports sighting a charted landmark or a preceding aircraft. If instructed to follow a preceding aircraft, pilots are responsible for maintaining a safe approach interval and wake turbulence separation.

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

l. When conducting visual approaches, pilots are encouraged to use other available navigational aids to assist in positive lateral and vertical alignment with the assigned runway.

5-4-25. Contact Approach

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

b. Controllers may authorize a contact approach provided:

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

EXAMPLE–

Request contact approach.

2. The reported ground visibility at the destination airport is at least 1 statute mile.
3. The contact approach will be made to an airport having a standard or special instrument approach procedure.
4. Approved separation is applied between aircraft so cleared and between these aircraft and other IFR or special VFR aircraft.

EXAMPLE–

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

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

5–4–26. Landing Priority

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

5–4–27. Overhead Approach Maneuver

a. Pilots operating in accordance with an IFR flight plan in Visual Meteorological Conditions (VMC) may request ATC authorization for an overhead maneuver. An overhead maneuver is not an instrument approach procedure. Overhead maneuver patterns are developed at airports where aircraft have an operational need to conduct the maneuver. An aircraft conducting an overhead maneuver is considered to be VFR and the IFR flight plan is canceled when the aircraft reaches the initial point on the initial approach portion of the maneuver. (See FIG 5–4–34.) The existence of a standard overhead maneuver pattern does not eliminate the possible requirement for an aircraft to conform to conventional rectangular patterns if an overhead maneuver cannot be approved. Aircraft operating to an airport without a functioning control tower must initiate cancellation of an IFR flight plan prior to executing the overhead maneuver. Cancellation of the IFR flight plan must be accomplished after crossing the landing threshold on the initial portion of the maneuver or after landing. Controllers may authorize an overhead maneuver and issue the following to arriving aircraft:

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

PHRASEOLOGY–

PATTERN ALTITUDE (altitude). RIGHT TURNS.

2. Request for a report on initial approach.

PHRASEOLOGY–

REPORT INITIAL.

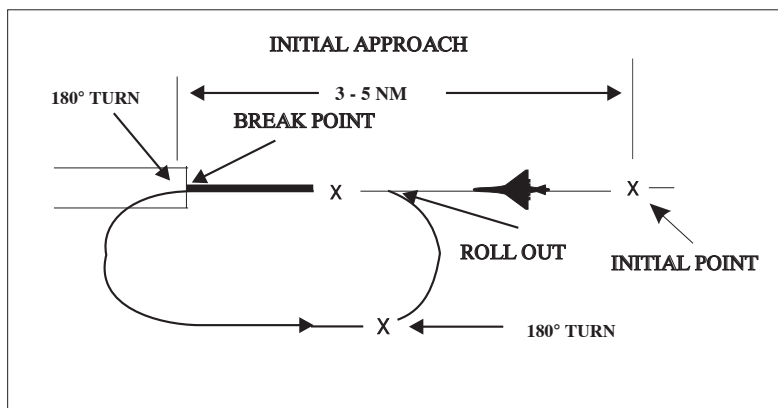
3. “Break” information and a request for the pilot to report. The “Break Point” will be specified if nonstandard. Pilots may be requested to report “break” if required for traffic or other reasons.

PHRASEOLOGY–

BREAK AT (specified point).

REPORT BREAK.

FIG 5-4-34
Overhead Maneuver



Section 5. Pilot/Controller Roles and Responsibilities

5-5-1. General

a. The roles and responsibilities of the pilot and controller for effective participation in the ATC system are contained in several documents. Pilot responsibilities are in the CFRs and the air traffic controllers' are in the FAA Order JO 7110.65, Air Traffic Control, and supplemental FAA directives. Additional and supplemental information for pilots can be found in the current Aeronautical Information Manual (AIM), Notices to Airmen, Advisory Circulars and aeronautical charts. Since there are many other excellent publications produced by nongovernment organizations, as well as other government organizations, with various updating cycles, questions concerning the latest or most current material can be resolved by cross-checking with the above mentioned documents.

b. The pilot-in-command of an aircraft is directly responsible for, and is the final authority as to the safe operation of that aircraft. In an emergency requiring immediate action, the pilot-in-command may deviate from any rule in the General Subpart A and Flight Rules Subpart B in accordance with 14 CFR section 91.3.

c. The air traffic controller is responsible to give first priority to the separation of aircraft and to the issuance of radar safety alerts, second priority to other services that are required, but do not involve separation of aircraft and third priority to additional services to the extent possible.

d. In order to maintain a safe and efficient air traffic system, it is necessary that each party fulfill their responsibilities to the fullest.

e. The responsibilities of the pilot and the controller intentionally overlap in many areas providing a degree of redundancy. Should one or the other fail in any manner, this overlapping responsibility is expected to compensate, in many cases, for failures that may affect safety.

f. The following, while not intended to be all inclusive, is a brief listing of pilot and controller responsibilities for some commonly used procedures or phases of flight. More detailed explanations are contained in other portions of this publication, the appropriate CFRs, ACs and similar publications. The information provided is an overview of the principles involved and is not meant as an interpretation of the rules nor is it intended to extend or diminish responsibilities.

5-5-2. Air Traffic Clearance

a. Pilot.

1. Acknowledges receipt and understanding of an ATC clearance.
2. Reads back any hold short of runway instructions issued by ATC.
3. Requests clarification or amendment, as appropriate, any time a clearance is not fully understood or considered unacceptable from a safety standpoint.
4. Promptly complies with an air traffic clearance upon receipt except as necessary to cope with an emergency. Advises ATC as soon as possible and obtains an amended clearance, if deviation is necessary.

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 altitude crossing restriction.

b. Controller.

1. Issues appropriate clearances for the operation to be conducted, or being conducted, in accordance with established criteria.
2. Assigns altitudes in IFR clearances that are at or above the minimum IFR altitudes in controlled airspace.

3. Ensures acknowledgement by the pilot for issued information, clearances, or instructions.
4. Ensures that readbacks by the pilot of altitude, heading, or other items are correct. If incorrect, distorted, or incomplete, makes corrections as appropriate.

5-5-3. Contact Approach

a. Pilot.

1. Must request a contact approach and makes it in lieu of a standard or special instrument approach.
2. By requesting the contact approach, indicates that the flight is operating clear of clouds, has at least one mile flight visibility, and reasonably expects to continue to the destination airport in those conditions.
3. Assumes responsibility for obstruction clearance while conducting a contact approach.
4. Advises ATC immediately if unable to continue the contact approach or if encounters less than 1 mile flight visibility.
5. Is aware that if radar service is being received, it may be automatically terminated when told to contact the tower.

REFERENCE-

Pilot/Controller Glossary Term – Radar Service Terminated.

b. Controller.

1. Issues clearance for a contact approach only when requested by the pilot. Does not solicit the use of this procedure.
2. Before issuing the clearance, ascertains that reported ground visibility at destination airport is at least 1 mile.
3. Provides approved separation between the aircraft cleared for a contact approach and other IFR or special VFR aircraft. When using vertical separation, does not assign a fixed altitude, but clears the aircraft at or below an altitude which is at least 1,000 feet below any IFR traffic but not below Minimum Safe Altitudes prescribed in 14 CFR section 91.119.
4. Issues alternative instructions if, in their judgment, weather conditions may make completion of the approach impracticable.

5-5-4. Instrument Approach

a. Pilot.

1. Be aware that the controller issues clearance for approach based only on known traffic.
2. Follows the procedure as shown on the IAP, including all restrictive notations, such as:
 - (a) Procedure not authorized at night;
 - (b) Approach not authorized when local area altimeter not available;
 - (c) Procedure not authorized when control tower not in operation;
 - (d) Procedure not authorized when glide slope not used;
 - (e) Straight-in minimums not authorized at night; etc.
 - (f) Radar required; or
 - (g) The circling minimums published on the instrument approach chart provide adequate obstruction clearance and pilots should not descend below the circling altitude until the aircraft is in a position to make final descent for landing. Sound judgment and knowledge of the pilot's and the aircraft's capabilities are the criteria

Chapter 7. Safety of Flight

Section 1. Meteorology

7-1-1. National Weather Service Aviation Weather Service Program

a. Weather service to aviation is a joint effort of the National Oceanic and Atmospheric Administration (NOAA), the National Weather Service (NWS), the Federal Aviation Administration (FAA), Department of Defense, and various private sector aviation weather service providers. Requirements for all aviation weather products originate from the FAA, which is the Meteorological Authority for the U.S.

b. NWS meteorologists are assigned to all air route traffic control centers (ARTCC) as part of the Center Weather Service Units (CWSU) as well as the Air Traffic Control System Command Center (ATCSCC). These meteorologists provide specialized briefings as well as tailored forecasts to support the needs of the FAA and other users of the NAS.

c. Aviation Products

1. The NWS maintains an extensive surface, upper air, and radar weather observing program; and a nationwide aviation weather forecasting service.

2. Airport observations (METAR and SPECI) supported by the NWS are provided by automated observing systems.

3. Terminal Aerodrome Forecasts (TAF) are prepared by 123 NWS Weather Forecast Offices (WFOs) for over 700 airports. These forecasts are valid for 24 or 30 hours and amended as required.

4. Inflight aviation advisories (for example, Significant Meteorological Information (SIGMETs) and Airmen's Meteorological Information (AIRMETs)) are issued by three NWS Meteorological Watch Offices (MWOs); the Aviation Weather Center (AWC) in Kansas City, MO, the Alaska Aviation Weather Unit (AAWU) in Anchorage, AK, and the Weather Service Forecast Office (WFO) in Honolulu, HI. The AWC, the AAWU, and WSFO Honolulu issue area forecasts for selected areas. In addition, NWS meteorologists assigned to most ARTCCs as part of the Center Weather Service Unit (CWSU) provide Center Weather Advisories (CWAs) and gather weather information to support the needs of the FAA and other users of the system.

5. Several NWS National Centers for Environmental Prediction (NCEP) provide aviation specific weather forecasts, or select public forecasts which are of interest to pilots and operators.

(a) The Aviation Weather Center (AWC) displays a variety of domestic and international aviation forecast products over the Internet at aviationweather.gov.

(b) The NCEP Central Operations (NCO) is responsible for the operation of many numerical weather prediction models, including those which produce the many wind and temperature aloft forecasts.

(c) The Storm Prediction Center (SPC) issues tornado and severe weather watches along with other guidance forecasts.

(d) The National Hurricane Center (NHC) issues forecasts on tropical weather systems (for example, hurricanes).

(e) The Space Weather Prediction Center (SWPC) provides alerts, watches, warnings and forecasts for space weather events (for example, solar storms) affecting or expected to affect Earth's environment.

(f) The Weather Prediction Center (WPC) provides analysis and forecast products on a national scale including surface pressure and frontal analyses.

6. NOAA operates two Volcanic Ash Advisory Centers (VAAC) which issue forecasts of ash clouds following a volcanic eruption in their area of responsibility.

7. Details on the products provided by the above listed offices and centers is available in FAA-H-8083-28, Aviation Weather Handbook.

d. Weather element values may be expressed by using different measurement systems depending on several factors, such as whether the weather products will be used by the general public, aviation interests, international services, or a combination of these users. FIG 7-1-1 provides conversion tables for the most used weather elements that will be encountered by pilots.

7-1-2. FAA Weather Services

a. The FAA provides the Flight Service program, which serves the weather needs of pilots through its flight service stations (FSS) (both government and contract via 1-800-WX-BRIEF) and via the Internet, through Leidos Flight Service.

b. The FAA maintains an extensive surface weather observing program. Airport observations (METAR and SPECI) in the U.S. are provided by automated observing systems. Various levels of human oversight of the METAR and SPECI reports and augmentation may be provided at select larger airports by either government or contract personnel qualified to report specified weather elements that cannot be detected by the automated observing system. The requirements to issue SPECI reports are detailed in TBL 7-1-1.

TBL 7-1-1

SPECI Issuance Table		
1	Wind Shift	Wind direction changes by 45° or more, in less than 15 minutes, and the wind speed is 10 kt or more throughout the wind shift.
2	Visibility	<p>The surface visibility (as reported in the body of the report):</p> <ul style="list-style-type: none"> Decreases to less than 3 sm, 2 sm, 1 sm, ½ sm, ¼ sm or the lowest standard instrument approach procedure (IAP) minimum.¹ Increases to equal to or exceed 3 sm, 2 sm, 1 sm, ½ sm, ¼ sm or the lowest standard IAP minimum.¹ <p>¹ As published in the U.S. Terminal Procedures. If none published, use ½ sm.</p>
3	RVR	The highest value from the designated RVR runway decreases to less than 2,400 ft during the preceding 10 minutes; or, if the RVR is below 2,400 ft, increases to equal to or exceed 2,400 ft during the preceding 10 minutes. U.S. military stations may not report a SPECI based on RVR.
4	Tornado, Funnel Cloud, or Waterspout	<ul style="list-style-type: none"> Is observed. Disappears from sight or ends.
5	Thunderstorm	<ul style="list-style-type: none"> Begins (a SPECI is not required to report the beginning of a new thunderstorm if one is currently reported). Ends.
6	Precipitation	<ul style="list-style-type: none"> Hail begins or ends. Freezing precipitation begins, ends, or changes intensity. Ice pellets begin, end, or change intensity. Snow begins, ends, or changes intensity.
7	Squalls	When a squall occurs. (Wind speed suddenly increases by at least 16 knots and is sustained at 22 knots or more for at least one minute.)

2. R & D and controlled testing.
3. Experimental application.
4. Operational application.

f. Pilots and operators should be aware that weather services provided by entities other than FAA, NWS, or their contractors may not meet FAA/NWS quality control standards. Hence, operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (that is, product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar products, or products not supported by FAA/NWS technical specifications.

NOTE–

When in doubt, consult with a FAA Flight Service Station Specialist.

g. In addition, pilots and operators should be aware there are weather services and products available from government organizations beyond the scope of the AWRP process mentioned earlier in this section. For example, governmental agencies such as the NWS and the Aviation Weather Center (AWC), or research organizations such as the National Center for Atmospheric Research (NCAR) display weather “model data” and “experimental” products which require training and/or expertise to properly interpret and use. These products are developmental prototypes that are subject to ongoing research and can change without notice. Therefore, some data on display by government organizations, or government data on display by independent organizations may be unsuitable for flight planning purposes. Operators and pilots contemplating using such services should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar weather products.

NOTE–

When in doubt, consult with a FAA Flight Service Station Specialist.

h. With increased access to weather products via the public Internet, the aviation community has access to an overwhelming amount of weather information and data that support self-briefing. the *Aviation Weather Handbook*, FAA-H-8083-28 (current edition), describes the weather products distributed by the NWS. Pilots and operators using the public Internet to access weather from a third party vendor should request and/or review an appropriate description of services and provider disclosure. This should include, but is not limited to, the type of weather product (for example, current weather or forecast weather), the currency of the product (i.e., product issue and valid times), and the relevance of the product. Pilots and operators should be cautious when using unfamiliar weather products and when in doubt, consult with a Flight Service Specialist.

i. The development of new weather products, coupled with the termination of some legacy textual and graphical products may create confusion between regulatory requirements and the new products. All flight-related, aviation weather decisions must be based on all available pertinent weather products. As every flight is unique and the weather conditions for that flight vary hour by hour, day to day, multiple weather products may be necessary to meet aviation weather regulatory requirements. Many new weather products now have a Precautionary Use Statement that details the proper use or application of the specific product.

j. The FAA has identified three distinct types of weather information available to pilots and operators.

1. Observations. Raw weather data collected by some type of sensor suite including surface and airborne observations, radar, lightning, satellite imagery, and profilers.

2. Analysis. Enhanced depiction and/or interpretation of observed weather data.

3. Forecasts. Predictions of the development and/or movement of weather phenomena based on meteorological observations and various mathematical models.

k. Not all sources of aviation weather information are able to provide all three types of weather information. The FAA has determined that operators and pilots may utilize the following approved sources of aviation weather information:

1. Federal Government. The FAA and NWS collect raw weather data, analyze the observations, and produce forecasts. The FAA and NWS disseminate meteorological observations, analyses, and forecasts through a variety of systems. In addition, the Federal Government is the only approval authority for sources of weather observations; for example, contract towers and airport operators may be approved by the Federal Government to provide weather observations.

2. Enhanced Weather Information System (EWINS). An EWINS is an FAA authorized, proprietary system for tracking, evaluating, reporting, and forecasting the presence or lack of adverse weather phenomena. The FAA authorizes a certificate holder to use an EWINS to produce flight movement forecasts, adverse weather phenomena forecasts, and other meteorological advisories. For more detailed information regarding EWINS, see FAA-H-8083-28, Aviation Weather Handbook, and the Flight Standards Information Management System 8900.1.

3. Commercial Weather Information Providers. In general, commercial providers produce proprietary weather products based on NWS/FAA products with formatting and layout modifications but no material changes to the weather information itself. This is also referred to as “repackaging.” In addition, commercial providers may produce analyses, forecasts, and other proprietary weather products that substantially alter the information contained in government-produced products. However, those proprietary weather products that substantially alter government-produced weather products or information, may only be approved for use by 14 CFR part 121 and part 135 certificate holders if the commercial provider is EWINS qualified.

NOTE—

Commercial weather information providers contracted by FAA to provide weather observations, analyses, and forecasts (e.g., contract towers) are included in the Federal Government category of approved sources by virtue of maintaining required technical and quality assurance standards under Federal Government oversight.

7-1-4. Graphical Forecasts for Aviation (GFA)

a. The GFA website is intended to provide the necessary aviation weather information to give users a complete picture of the weather that may affect flight in the continental United States (CONUS). The website includes observational data, forecasts, and warnings that can be viewed from 14 hours in the past to 15 hours in the future, including thunderstorms, clouds, flight category, precipitation, icing, turbulence, and wind. Hourly model data and forecasts, including information on clouds, flight category, precipitation, icing, turbulence, wind, and graphical output from the National Weather Service’s (NWS) National Digital Forecast Data (NDFD) are available. Wind, icing, and turbulence forecasts are available in 3,000 ft increments from the surface up to 30,000 ft MSL, and in 6,000 ft increments from 30,000 ft MSL to 48,000 ft MSL. Turbulence forecasts are also broken into low (below 18,000 ft MSL) and high (at or above 18,000 ft MSL) graphics. A maximum icing graphic and maximum wind velocity graphic (regardless of altitude) are also available. Built with modern geospatial information tools, users can pan and zoom to focus on areas of greatest interest. Target users are commercial and general aviation pilots, operators, briefers, and dispatchers.

b. Weather Products.

1. The Aviation Forecasts include gridded displays of various weather parameters as well as NWS textual weather observations, forecasts, and warnings. Icing, turbulence, and wind gridded products are three-dimensional. Other gridded products are two-dimensional and may represent a “composite” of a three-dimensional weather phenomenon or a surface weather variable, such as horizontal visibility. The following are examples of aviation forecasts depicted on the GFA:

(a) Terminal Aerodrome Forecast (TAF)

(b) Ceiling & Visibility (CIG/VIS)

They are not authorized to make original forecasts, but are authorized to translate and interpret available forecasts and reports directly into terms describing the weather conditions which you can expect along your flight route and at your destination. Prior to every flight, pilots should gather all information vital to the nature of the flight. Pilots can receive a regulatory compliant briefing without contacting Flight Service. Pilots are encouraged to use automated resources and review AC 91–92, Pilot’s Guide to a Preflight Briefing, for more information. Pilots who prefer to contact Flight Service are encouraged to conduct a self–brief prior to calling. Conducting a self–brief before contacting Flight Service provides familiarity of meteorological and aeronautical conditions applicable to the route of flight and promotes a better understanding of weather information. Three basic types of preflight briefings (Standard, Abbreviated, and Outlook) are available to serve the pilot’s specific needs. Pilots should specify to the briefer the type of briefing they want, along with their appropriate background information. This will enable the briefer to tailor the information to the pilot’s intended flight. The following paragraphs describe the types of briefings available and the information provided in each briefing.

REFERENCE–

AIM, Para 5–1–1, Preflight Preparation, for items that are required.

b. Standard Briefing. You should request a Standard Briefing any time you are planning a flight and you have not received a previous briefing or have not received preliminary information through online resources. International data may be inaccurate or incomplete. If you are planning a flight outside of U.S. controlled airspace, the briefer will advise you to check data as soon as practical after entering foreign airspace, unless you advise that you have the international cautionary advisory. The briefer will automatically provide the following information in the sequence listed, except as noted, when it is applicable to your proposed flight.

1. Adverse Conditions. Significant meteorological and/or aeronautical information that might influence the pilot to alter or cancel the proposed flight; for example, hazardous weather conditions, airport closures, air traffic delays, etc. Pilots should be especially alert for current or forecast weather that could reduce flight minimums below VFR or IFR conditions. Pilots should also be alert for any reported or forecast icing if the aircraft is not certified for operating in icing conditions. Flying into areas of icing or weather below minimums could have disastrous results.

2. VFR Flight Not Recommended. When VFR flight is proposed and sky conditions or visibilities are present or forecast, surface or aloft, that, in the briefer’s judgment, would make flight under VFR doubtful, the briefer will describe the conditions, describe the affected locations, and use the phrase “*VFR flight not recommended.*” This recommendation is advisory in nature. The final decision as to whether the flight can be conducted safely rests solely with the pilot. Upon receiving a “*VFR flight not recommended*” statement, the non–IFR rated pilot will need to make a “go or no go” decision. This decision should be based on weighing the current and forecast weather conditions against the pilot’s experience and ratings. The aircraft’s equipment, capabilities and limitations should also be considered.

NOTE–

Pilots flying into areas of minimal VFR weather could encounter unforecasted lowering conditions that place the aircraft outside the pilot’s ratings and experience level. This could result in spatial disorientation and/or loss of control of the aircraft.

3. Synopsis. A brief statement describing the type, location and movement of weather systems and/or air masses which might affect the proposed flight.

NOTE–

These first 3 elements of a briefing may be combined in any order when the briefer believes it will help to more clearly describe conditions.

4. Current Conditions. Reported weather conditions applicable to the flight will be summarized from all available sources; e.g., METARs/ SPECIs, PIREPs, RAREPs. This element will be omitted if the proposed time of departure is beyond 2 hours, unless the information is specifically requested by the pilot.

5. En Route Forecast. Forecast en route conditions for the proposed route are summarized in logical order; i.e., departure/climbout, en route, and descent. (Heights are MSL, unless the contractions “AGL” or “CIG” are denoted indicating that heights are above ground.)

6. Destination Forecast. The destination forecast for the planned ETA. Any significant changes within 1 hour before and after the planned arrival are included.

7. Winds Aloft. Forecast winds aloft will be provided in knots and degrees, referenced to true north. The briefer will interpolate wind directions and speeds between levels and stations as necessary to provide expected conditions at planned altitudes. (Heights are MSL.) Temperature information will be provided on request.

8. Notices to Airmen (NOTAMs).

(a) Available NOTAM (D) information pertinent to the proposed flight, including special use airspace (SUA) NOTAMs for restricted areas, aerial refueling, and night vision goggles (NVG).

NOTE—

Other SUA NOTAMs (D), such as military operations area (MOA), military training route (MTR), and warning area NOTAMs, are considered “upon request” briefing items as indicated in paragraph 7–1–4b10(a).

(b) Prohibited Areas P–40, P–49, P–56, and the special flight rules area (SFRA) for Washington, DC.

(c) FSS briefers do not provide FDC NOTAM information for special instrument approach procedures unless specifically asked. Pilots authorized by the FAA to use special instrument approach procedures must specifically request FDC NOTAM information for these procedures.

NOTE—

1. NOTAM information may be combined with current conditions when the briefer believes it is logical to do so.

2. Airway NOTAMs, procedural NOTAMs, and NOTAMs that are general in nature and not tied to a specific airport/facility (for example, flight advisories and restrictions, open duration special security instructions, and special flight rules areas) are briefed solely by pilot request. For complete flight information, pilots are urged to review the Domestic Notices and International Notices found in the External Links section of the Federal NOTAM System (FNS) NOTAM Search System and the Chart Supplement in addition to obtaining a briefing.

9. ATC Delays. Any known ATC delays and flow control advisories which might affect the proposed flight.

10. Pilots may obtain the following from flight service station briefers upon request:

(a) Information on SUA and SUA–related airspace, except those listed in paragraph 7–1–4b8.

NOTE—

1. For the purpose of this paragraph, SUA and related airspace includes the following types of airspace: alert area, military operations area (MOA), warning area, and air traffic control assigned airspace (ATCAA). MTR data includes the following types of airspace: IFR training routes (IR), VFR training routes (VR), and slow training routes (SR).

2. Pilots are encouraged to request updated information from ATC facilities while in flight.

(b) A review of airway NOTAMs, procedural NOTAMs, and NOTAMs that are general in nature and not tied to a specific airport/facility (for example, flight advisories and restrictions, open duration special security instructions, and special flight rules areas), Domestic Notices and International Notices. Domestic Notices and International Notices are found in the External Links section of the Federal NOTAM System (FNS) NOTAM Search System.

(c) Approximate density altitude data.

(d) Information regarding such items as air traffic services and rules, customs/immigration procedures, ADIZ rules, search and rescue, etc.

(e) GPS RAIM availability for 1 hour before to 1 hour after ETA or a time specified by the pilot.

(f) Other assistance as required.

c. Abbreviated Briefing. Request an Abbreviated Briefing when you need information to supplement mass disseminated data, update a previous briefing, or when you need only one or two specific items. Provide the briefer with appropriate background information, the time you received the previous information, and/or the specific items needed. You should indicate the source of the information already received so that the briefer can

limit the briefing to the information that you have not received, and/or appreciable changes in meteorological/aeronautical conditions since your previous briefing. To the extent possible, the briefer will provide the information in the sequence shown for a Standard Briefing. If you request only one or two specific items, the briefer will advise you if adverse conditions are present or forecast. (Adverse conditions contain both meteorological and/or aeronautical information.) Details on these conditions will be provided at your request. International data may be inaccurate or incomplete. If you are planning a flight outside of U.S. controlled airspace, the briefer will advise you to check data as soon as practical after entering foreign airspace, unless you advise that you have the international cautionary advisory.

d. Outlook Briefing. You should request an Outlook Briefing whenever your proposed time of departure is six or more hours from the time of the briefing. The briefer will provide available forecast data applicable to the proposed flight. This type of briefing is provided for planning purposes only. You should obtain a Standard or Abbreviated Briefing prior to departure in order to obtain such items as adverse conditions, current conditions, updated forecasts, winds aloft and NOTAMs, etc.

e. When filing a flight plan only, you will be asked if you require the latest information on adverse conditions pertinent to the route of flight.

f. Inflight Briefing. You are encouraged to conduct a self-briefing using online resources or obtain your preflight briefing by telephone or in person (Alaska only) before departure. In those cases where you need to obtain a preflight briefing or an update to a previous briefing by radio, you should contact the nearest FSS to obtain this information. After communications have been established, advise the specialist of the type briefing you require and provide appropriate background information. You will be provided information as specified in the above paragraphs, depending on the type of briefing requested. En Route advisories tailored to the phase of flight that begins after climb-out and ends with descent to land are provided upon pilot request. Besides Flight Service, there are other resources available to the pilot in flight, including:

Automatic Dependent Surveillance–Broadcast (ADS–B). Free traffic, weather, and flight information are available on ADS–B In receivers that can receive data over 978 MHz (UAT) broadcasts. These services are available across the nation to aircraft owners who equip with ADS–B In, with further advances coming from airborne and runway traffic awareness. Even search-and-rescue operations benefit from accurate ADS–B tracking.

Flight Information Services–Broadcast (FIS–B). FIS–B is a free service; but is only available to aircraft that can receive data over 978 MHz (UAT). FIS–B automatically transmits a wide range of weather products with national and regional focus to all equipped aircraft. Having current weather and aeronautical information in the cockpit helps pilots plan more safe and efficient flight paths, as well as make strategic decisions during flight to avoid potentially hazardous weather.

Pilots are encouraged to provide a continuous exchange of information on weather, winds, turbulence, flight visibility, icing, etc., between pilots and inflight specialists. Pilots should report good weather as well as bad, and confirm expected conditions as well as unexpected. Remember that weather conditions can change rapidly and that a “go or no go” decision, as mentioned in paragraph 7–1–4b2, should be assessed at all phases of flight.

g. Following any briefing, feel free to ask for any information that you or the briefer may have missed or are not understood. This way, the briefer is able to present the information in a logical sequence, and lessens the chance of important items being overlooked.

7–1–6. Inflight Aviation Weather Advisories

a. Inflight Aviation Weather Advisories are forecasts to advise en route aircraft of development of potentially hazardous weather. Inflight aviation weather advisories in the conterminous U.S. are issued by the Aviation Weather Center (AWC) in Kansas City, MO, as well as 20 Center Weather Service Units (CWSU) associated with ARTCCs. AWC also issues advisories for portions of the Gulf of America, Atlantic and Pacific Oceans, which

are under the control of ARTCCs with Oceanic flight information regions (FIRs). The Weather Forecast Office (WFO) in Honolulu issues advisories for the Hawaiian Islands and a large portion of the Pacific Ocean. In Alaska, the Alaska Aviation Weather Unit (AAWU) issues inflight aviation weather advisories along with the Anchorage CWSU. All heights are referenced MSL, except in the case of ceilings (CIG) which indicate AGL.

b. There are four types of inflight aviation weather advisories: the SIGMET, the Convective SIGMET, the AIRMET, and the Center Weather Advisory (CWA). All of these advisories use VORs, airports, or well-known geographic areas to describe the hazardous weather areas.

c. The Severe Weather Watch Bulletins (WWs), (with associated Alert Messages) (AWW) supplements these Inflight Aviation Weather Advisories.

d. SIGMET. A SIGMET is a concise description of the occurrence or expected occurrence of specified en route weather phenomena which is expected to affect the safety of aircraft operations.

1. SIGMETs:

(a) Are intended for dissemination to all pilots in flight to enhance safety.

(b) Are issued by the responsible MWO as soon as it is practical to alert operators and aircrews of hazardous en route conditions.

(c) Are unscheduled products that are valid for 4 hours; except SIGMETs associated with tropical cyclones and volcanic ash clouds are valid for 6 hours. Unscheduled updates and corrections are issued as necessary.

(d) Use geographical points to describe the hazardous weather areas. These points can reference either VORs, airports, or latitude–longitude, depending on SIGMET location. If the total area to be affected during the forecast period is very large, it could be that, in actuality, only a small portion of this total area would be affected at any one time.

EXAMPLE–

Example of a SIGMET:

BOSR WS 050600

SIGMET ROMEO 2 VALID UNTIL 051000

ME NH VT

FROM CAR TO YSJ TO CON TO MPV TO CAR

OCNL SEV TURB BLW 080 EXP DUE TO STG NWLY FLOW. CONDS CONTG BYD 1000Z.

2. SIGMETs over the contiguous U.S.:

(a) Are issued corresponding to the areas described in FIG 7–1–5. and are only for non-convective weather. The U.S. issues a special category of SIGMETs for convective weather called Convective SIGMETs.

(b) Are identified by an alphabetic designator from November through Yankee, excluding Sierra and Tango. Issuance for the same phenomenon will be sequentially numbered, using the original designator until the phenomenon ends. For example, the first issuance in the Chicago (CHI) area (reference FIG 7–1–5) for phenomenon moving from the Salt Lake City (SLC) area will be SIGMET Papa 3, if the previous two issuances, Papa 1 and Papa 2, had been in the SLC area. Note that no two different phenomena across the country can have the same alphabetic designator at the same time.

(c) Use location identifiers (either VORs or airports) to describe the hazardous weather areas.

(d) Are issued when the following phenomena occur or are expected to occur:

(1) Severe icing not associated with thunderstorms.

(2) Severe or extreme turbulence or clear air turbulence (CAT) not associated with thunderstorms.

(3) Widespread dust storms or sandstorms lowering surface visibilities to below 3 miles.

(4) Volcanic ash.

FIG 7-1-5
SIGMET Locations – Contiguous U.S.

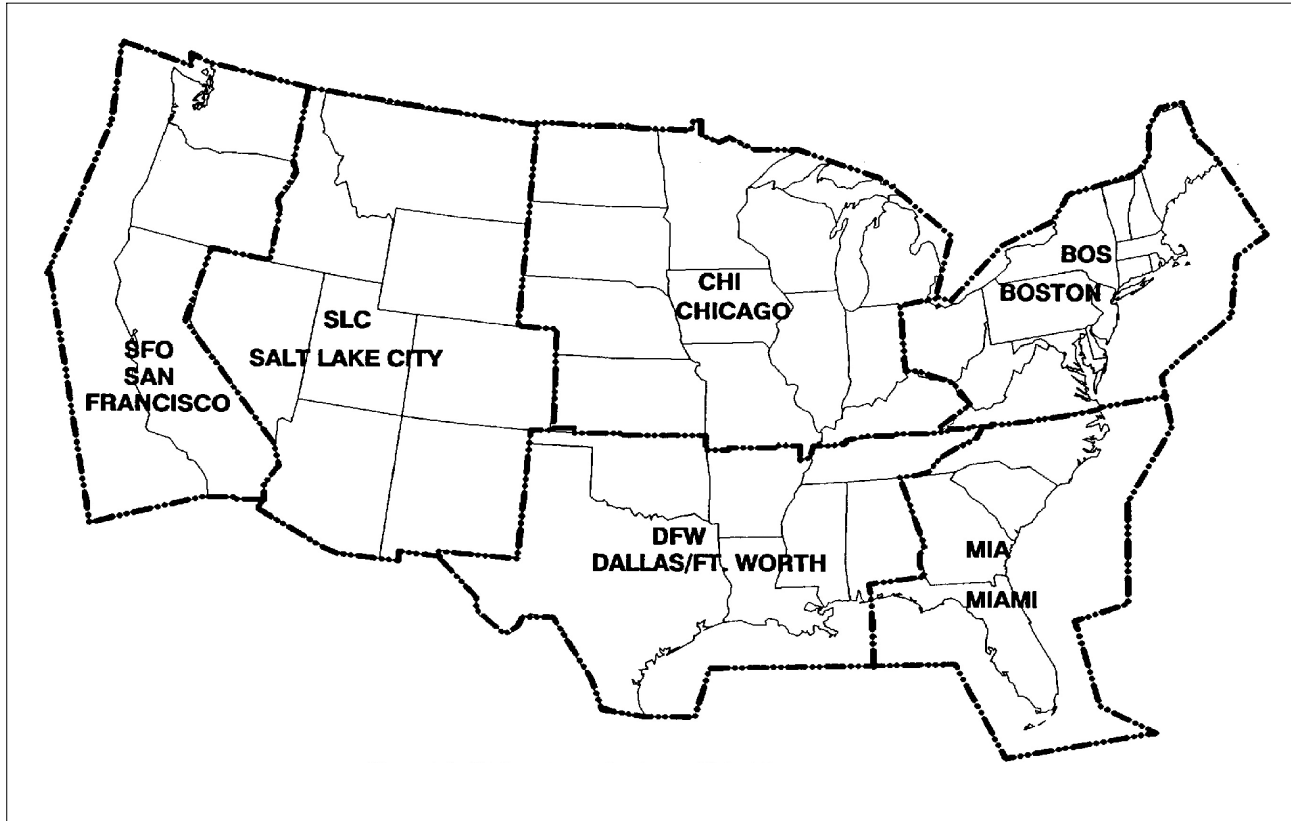
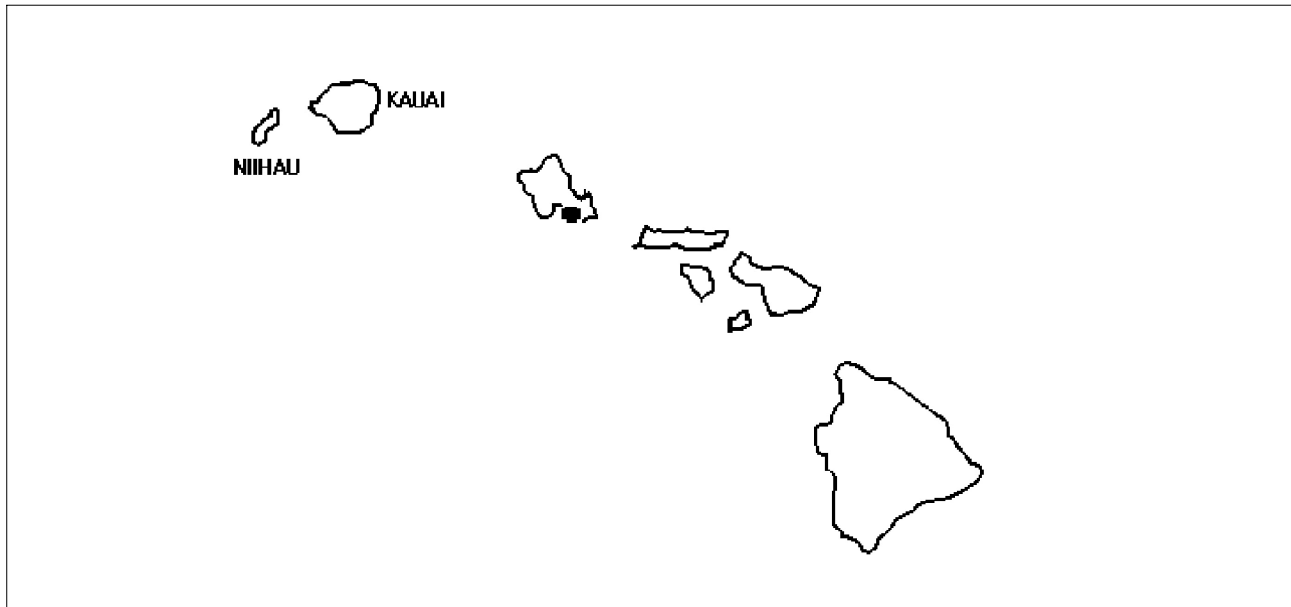


FIG 7-1-6
Hawaii Area Forecast Locations



f. AIRMET. AIRMETs are a concise description of the occurrence or expected occurrence of specified en route weather phenomena that may affect the safety of aircraft operations, but at intensities lower than those which require the issuance of a SIGMET.

1. AIRMETs contain details about IFR conditions, extensive mountain obscuration, turbulence, strong surface winds, icing, and freezing levels. Unscheduled updates and corrections are issued as necessary.

2. AIRMETs:

(a) Are intended to inform all pilots, but especially Visual Flight Rules pilots and operators of sensitive aircraft, of potentially hazardous weather phenomena.

(b) Are issued on a scheduled basis every 6 hours, except every 8 hours in Alaska. Unscheduled updates and corrections are issued as necessary.

(c) Are intended for dissemination to all pilots in the preflight and en route phase of flight to enhance safety. En route AIRMETs are available over flight service frequencies. Over the contiguous U.S., AIRMETs are also available on equipment intended to display weather and other non-air traffic control-related flight information to pilots using the Flight Information Service–Broadcast (FIS–B). In Alaska and Hawaii, AIRMETs are broadcast on air traffic frequencies.

(d) Are issued for the contiguous U.S., Alaska, and Hawaii. No AIRMETs are issued for U.S. Oceanic FIRs in the Gulf of America, Caribbean, Western Atlantic, and Pacific Oceans.

TBL 7-1-2

U. S. AIRMET Issuance Time and Frequency

Product Type	Issuance Time	Issuance Frequency
AIRMETs over the Contiguous U.S.	0245, 0845, 1445, 2045 UTC	Every 6 hours
AIRMETs over Alaska	0515, 1315, 2115 UTC (standard time) 0415, 1215, 2015 UTC (Daylight savings time)	Every 8 hours
AIRMETs over Hawaii	0400, 1000, 1600, 2200 UTC	Every 6 hours

3. AIRMETs over the Contiguous U.S.:

(a) Are displayed graphically on websites, such as, aviationweather.gov and 1800wxbrief.com, and equipment receiving FIS–B information.

(b) Provide a higher forecast resolution than AIRMETs issued in text format.

(c) Are valid at discrete times no more than 3 hours apart for a period of up to 12 hours into the future (for example, 00, 03, 06, 09, and 12 hours). Additional forecasts may be inserted during the first 6 hours (for example; 01, 02, 04, and 05). 00-hour represents the initial conditions, and the subsequent graphics depict the area affected by the particular hazard at that valid time. Forecasts valid at 00 through 06 hours correspond to the text AIRMET bulletin.

(d) Depict the following en route aviation weather hazards:

- (1) Instrument flight rule conditions (ceiling < 1000' and/or surface visibility < 3 miles).
- (2) Widespread mountain obscuration.
- (3) Moderate icing.
- (4) Freezing levels.
- (5) Moderate turbulence.
- (6) Non-convective low-level wind shear potential below 2,000 feet AGL.
- (7) Sustained surface winds greater than 30 knots.

meteorological reasoning and technical information for the aviation community. SPC may enhance a Public Tornado Watch Notification Message by using the words “THIS IS A PARTICULARLY DANGEROUS SITUATION” when there is a likelihood of multiple strong (damage of EF2 or EF3) or violent (damage of EF4 or EF5) tornadoes.

4. Public severe thunderstorm and tornado watch notification messages were formerly known as the Severe Weather Watch Bulletins (WW). The NWS no longer uses that title or acronym for this product but retains WW in the product header for processing by weather data systems.

EXAMPLE–

Example of a Public Tornado Watch Notification Message:

WWUS20 KWNS 050550

SEL2

SPC WW 051750

URGENT - IMMEDIATE BROADCAST REQUESTED

TORNADO WATCH NUMBER 243

NWS STORM PREDICTION CENTER NORMAN OK

1250 AM CDT MON MAY 5 2011

THE NWS STORM PREDICTION CENTER HAS ISSUED A

*TORNADO WATCH FOR PORTIONS OF

WESTERN AND CENTRAL ARKANSAS

SOUTHERN MISSOURI

FAR EASTERN OKLAHOMA

*EFFECTIVE THIS MONDAY MORNING FROM 1250 AM UNTIL 600 AM CDT.

...THIS IS A PARTICULARLY DANGEROUS SITUATION...

*PRIMARY THREATS INCLUDE

NUMEROUS INTENSE TORNADOES LIKELY

NUMEROUS SIGNIFICANT DAMAGING WIND GUSTS TO 80 MPH LIKELY

NUMEROUS VERY LARGE HAIL TO 4 INCHES IN DIAMETER LIKELY

THE TORNADO WATCH AREA IS APPROXIMATELY ALONG AND 100 STATUTE MILES EAST AND WEST OF A LINE FROM 15 MILES WEST NORTHWEST OF FORT LEONARD WOOD MISSOURI TO 45 MILES SOUTHWEST OF HOT SPRINGS ARKANSAS. FOR A COMPLETE DEPICTION OF THE WATCH SEE THE ASSOCIATED WATCH OUTLINE UPDATE (WOUS64 KWNS WOU2).

REMEMBER...A TORNADO WATCH MEANS CONDITIONS ARE FAVORABLE FOR TORNADOES AND SEVERE THUNDERSTORMS IN AND CLOSE TO THE WATCH AREA. PERSONS IN THESE AREAS SHOULD BE ON THE LOOKOUT FOR THREATENING WEATHER CONDITIONS AND LISTEN FOR LATER STATEMENTS AND POSSIBLE WARNINGS.

OTHER WATCH INFORMATION...THIS TORNADO WATCH REPLACES TORNADO WATCH NUMBER 237. WATCH NUMBER 237 WILL NOT BE IN EFFECT AFTER

1250 AM CDT. CONTINUE... WW 239... WW 240... WW 241... WW 242...

DISCUSSION...SRN MO SQUALL LINE EXPECTED TO CONTINUE EWD...WHERE LONG/HOOKED HODOGRAPHS SUGGEST THREAT FOR EMBEDDED SUPERCELLS/POSSIBLE TORNADOES. FARTHER S...MORE WIDELY SCATTERED

SUPERCELLS WITH A THREAT FOR TORNADOES WILL PERSIST IN VERY STRONGLY DEEP SHEARED/LCL ENVIRONMENT IN AR.

AVIATION...TORNADOES AND A FEW SEVERE THUNDERSTORMS WITH HAIL SURFACE AND ALOFT TO 4 INCHES. EXTREME TURBULENCE AND SURFACE WIND GUSTS TO 70 KNOTS. A FEW CUMULONIMBI WITH MAXIMUM TOPS TO 500. MEAN STORM MOTION VECTOR 26045.

5. Status reports are issued as needed to show progress of storms and to delineate areas no longer under the threat of severe storm activity. Cancellation bulletins are issued when it becomes evident that no severe weather will develop or that storms have subsided and are no longer severe.

h. Center Weather Advisories (CWAs)

1. CWAs are unscheduled inflight, flow control, air traffic, and air crew advisory. By nature of its short lead time, the CWA is not a flight planning product. It is generally a nowcast for conditions beginning within the next two hours. CWAs will be issued:

- (a) As a supplement to an existing SIGMET, Convective SIGMET or AIRMET.
- (b) When an Inflight Advisory has not been issued but observed or expected weather conditions meet SIGMET/AIRMET criteria based on current pilot reports and reinforced by other sources of information about existing meteorological conditions.
- (c) When observed or developing weather conditions do not meet SIGMET, Convective SIGMET, or AIRMET criteria; e.g., in terms of intensity or area coverage, but current pilot reports or other weather information sources indicate that existing or anticipated meteorological phenomena will adversely affect the safe flow of air traffic within the ARTCC area of responsibility.

2. The following example is a CWA issued from the Kansas City, Missouri, ARTCC. The “3” after ZKC in the first line denotes this CWA has been issued for the third weather phenomena to occur for the day. The “301” in the second line denotes the phenomena number again (3) and the issuance number (01) for this phenomena. The CWA was issued at 2140Z and is valid until 2340Z.

EXAMPLE–

ZKC3 CWA 032140

ZKC CWA 301 VALID UNTIL 032340

ISOLD SVR TSTM over KCOU MOVG SWWD 10 KTS ETC.

7-1-7. Categorical Ceiling and Visibility Conditions

a. Categorical terms, describing either reported or forecast general ceiling and visibility conditions, are defined as follows:

1. **LIFR (Low IFR).** Ceiling less than 500 feet and/or visibility less than 1 mile.
2. **IFR.** Ceiling 500 to less than 1,000 feet and/or visibility 1 to less than 3 miles.
3. **MVFR (Marginal VFR).** Ceiling 1,000 to 3,000 feet and/or visibility 3 to 5 miles inclusive.
4. **VFR.** Ceiling greater than 3,000 feet and visibility greater than 5 miles; includes sky clear.

b. The cause of LIFR, IFR, or MVFR is indicated by either ceiling or visibility restrictions or both. The contraction “CIG” and/or weather and obstruction to vision symbols are used. If winds or gusts of 25 knots or greater are forecast for the outlook period, the word “WIND” is also included for all categories including VFR.

EXAMPLE–

1. *LIFR CIG–low IFR due to low ceiling.*

2. *IFR FG–IFR due to visibility restricted by fog.*

3. *MVFR CIG HZ FU–marginal VFR due to both ceiling and visibility restricted by haze and smoke.*

4. *IFR CIG RA WIND–IFR due to both low ceiling and visibility restricted by rain; wind expected to be 25 knots or greater.*

7-1-8. Inflight Weather Advisory Broadcasts

a. ARTCCs broadcast a Convective SIGMET, SIGMET, AIRMET (except in the contiguous U.S.), Urgent Pilot Report, or CWA alert once on all frequencies, except emergency frequencies, when any part of the area described is within 150 miles of the airspace under their jurisdiction. These broadcasts advise pilots of the availability of hazardous weather advisories and to contact the nearest flight service facility for additional details.

EXAMPLE–

1. *Attention all aircraft, SIGMET Delta Three, from Myton to Tuba City to Milford, severe turbulence and severe clear icing below one zero thousand feet. Expected to continue beyond zero three zero zero zulu.*

2. *Attention all aircraft, convective SIGMET Two Seven Eastern. From the vicinity of Elmira to Phillipsburg. Scattered embedded thunderstorms moving east at one zero knots. A few intense level five cells, maximum tops four five zero.*

3. *Attention all aircraft, Kansas City Center weather advisory one zero three. Numerous reports of moderate to severe icing from eight to nine thousand feet in a three zero mile radius of St. Louis. Light or negative icing reported from four thousand to one two thousand feet remainder of Kansas City Center area.*

2. TBL 7-1-3 lists the text and graphical products available through FIS-B and provided free-of-charge. Detailed information concerning FIS-B meteorological products can be found in FAA-H-8083-28, Aviation Weather Handbook, and AC 00-63, Use of Cockpit Displays of Digital Weather and Aeronautical Information. Information on Special Use Airspace (SUA), Temporary Flight Restriction (TFR), and Notice to Airmen (NOTAM) products can be found in Chapters 3, 4, and 5 of this manual.

3. Users of FIS-B should familiarize themselves with the operational characteristics and limitations of the system, including: system architecture; service environment; product lifecycles; modes of operation; and indications of system failure.

NOTE-

The NOTAM-D and NOTAM-FDC products broadcast via FIS-B are limited to those issued or effective within the past 30 days. Except for TFRs, NOTAMs older than 30 days are not provided. The pilot in command is responsible for reviewing all necessary information prior to flight.

4. FIS-B products are updated and transmitted at specific intervals based primarily on product issuance criteria. Update intervals are defined as the rate at which the product data is available from the source for transmission. Transmission intervals are defined as the amount of time within which a new or updated product transmission must be completed and/or the rate or repetition interval at which the product is rebroadcast. Update and transmission intervals for each product are provided in TBL 7-1-3.

5. Where applicable, FIS-B products include a look-ahead range expressed in nautical miles (NM) for three service domains: Airport Surface; Terminal Airspace; and En Route/Gulf of America. TBL 7-1-4 provides service domain availability and look-ahead ranging for each FIS-B product.

6. Prior to using this capability, users should familiarize themselves with the operation of FIS-B avionics by referencing the applicable User's Guides. Guidance concerning the interpretation of information displayed should be obtained from the appropriate avionics manufacturer.

7. FIS-B malfunctions not attributed to aircraft system failures or covered by active NOTAM should be reported by radio or telephone to the nearest FSS facility, or by sending an email to the ADS-B help desk at adsb@faa.gov. Reports should include:

- (a) Condition observed;
- (b) Date and time of observation;
- (c) Altitude and location of observation;
- (d) Type and call sign of the aircraft; and
- (e) Type and software version of avionics system.

f. Non-FAA FIS Systems. Several commercial vendors also provide customers with FIS data over both the aeronautical spectrum and on other frequencies using a variety of data link protocols. In some cases, the vendors provide only the communications system that carries customer messages, such as the Aircraft Communications Addressing and Reporting System (ACARS) used by many air carrier and other operators.

1. Operators using non-FAA FIS data for inflight weather and other operational information should ensure that the products used conform to FAA/NWS standards. Specifically, aviation weather and NAS status information should meet the following criteria:

(a) The products should be either FAA/NWS "accepted" aviation weather reports or products, or based on FAA/NWS accepted aviation weather reports or products. If products are used which do not meet this criteria, they should be so identified. The operator must determine the applicability of such products to their particular flight operations.

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

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

TBL 7-1-3
FIS-B Over UAT Product Update and Transmission Intervals

Product	Update Interval¹	Transmission Interval (95%)²	Basic Product
AIRMET	As Available	5 minutes	Yes
AWW/WW	As Available, then at 15 minute intervals for 1 hour	5 minutes	No
Ceiling	As Available	10 minutes	No
Convective SIGMET	As Available, then at 15 minute intervals for 1 hour	5 minutes	Yes
D-ATIS	As Available	1 minute	No
Echo Top	5 minutes	5 minutes	No
METAR/SPECI	1 minute (where available), As Available otherwise	5 minutes	Yes
MRMS NEXRAD (CONUS)	2 minutes	15 minutes	Yes
MRMS NEXRAD (Regional)	2 minutes	2.5 minutes	Yes
NOTAMs-D/FDC	As Available	10 minutes	Yes
NOTAMs-TFR	As Available	10 minutes	Yes
PIREP	As Available	10 minutes	Yes
SIGMET	As Available, then at 15 minute intervals for 1 hour	5 minutes	Yes
SUA Status	As Available	10 minutes	Yes
TAF/AMEND	6 Hours (±15 minutes)	10 minutes	Yes
Temperature Aloft	12 Hours (±15 minutes)	10 minutes	Yes
TWIP	As Available	1 minute	No
Winds aloft	12 Hours (±15 minutes)	10 minutes	Yes
Lightning strikes ³	5 minutes	5 minutes	Yes
Turbulence ³	1 minute	15 minutes	Yes
Icing, Forecast Potential (FIP) ³	60 minutes	15 minutes	Yes
Cloud tops ³	30 minutes	15 minutes	Yes
1 Minute AWOS ³	1 minute	10 minutes	No
Graphical-AIRMET ³	As Available	5 minutes	Yes
Center Weather Advisory (CWA) ³	As Available	10 minutes	Yes
Temporary Restricted Areas (TRA)	As Available	10 minutes	Yes
Temporary Military Operations Areas (TMOA)	As Available	10 minutes	Yes

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

200 feet and visibility 1/2 mile (200–1/2). Subtract 31.00 “Hg. from 31.21 “Hg. to get .21 “Hg. .21 “Hg rounds up to .30 “Hg. Calculate the increased requirement: 100 feet per 1/10 equates to a 300 feet increase for .30 “Hg. 1/4 statute mile per 1/10 equates to a 3/4 statute mile increase for .30 “Hg. The destination weather requirement is determined by adding the 300–3/4 increase to 200–1/2. The destination weather requirement is now 500–1 1/4.

[b] 31.00 “Hg. will remain set during the complete instrument approach. The aircraft has arrived at the DA or minimum descent altitude (MDA) when the published DA or MDA is displayed on the barometric altimeter.

NOTE–

The aircraft will be approximately 300 feet higher than the indicated barometric altitude using this method.

[c] These restrictions do not apply to authorized Category II/III ILS operations and certificate holders using approved atmospheric pressure at aerodrome elevation (QFE) altimetry systems.

(7) Air Traffic Organization (ATO) Service Center Directors, in their area of jurisdiction, may authorize temporary waivers to high barometric pressure flying NOTAM requirements to permit emergency supply, transport, or medical services, per 14 CFR § 91.144 (b). ATO Service Center contact information can be found at: https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/mission_support/sc.

2. At or above 18,000 feet MSL. All operators will set 29.92 “Hg. (standard setting) in the barometric altimeter. The lowest usable flight level is determined by the atmospheric pressure in the area of operation as shown in TBL 7–2–1. Air Traffic Control (ATC) will assign this flight level.

**TBL 7–2–1
Lowest Usable Flight Level**

Altimeter Setting (Current Reported)	Lowest Usable Flight Level
29.92 or higher	180
29.91 to 28.92	190
28.91 to 27.92	200

3. When the minimum altitude per 14 CFR section 91.159 and 14 CFR section 91.177 is above 18,000 feet MSL, the lowest usable flight level must be the flight level equivalent of the minimum altitude plus the number of feet specified in TBL 7–2–2. ATC will accomplish this calculation.

**TBL 7–2–2
Lowest Flight Level Correction Factor**

Altimeter Factor	Correction Factor
29.92 or higher	None
29.91 to 29.42	500 feet
29.41 to 28.92	1000 feet
28.91 to 28.42	1500 feet
28.41 to 27.92	2000 feet
27.91 to 27.42	2500 feet

EXAMPLE–

The minimum safe altitude of a route is 19,000 feet MSL and the altimeter setting is reported between 29.92 and 29.43 “Hg, the lowest usable flight level will be 195, which is the flight level equivalent of 19,500 feet MSL (minimum altitude (TBL 7–2–1) plus 500 feet).

Section 6. Potential Flight Hazards

7-6-1. Accident Causal Factors

a. The 10 most frequent causal factors for general aviation accidents that involve the pilot-in-command are:

1. Inadequate preflight preparation and/or planning.
2. Failure to obtain and/or maintain flying speed.
3. Failure to maintain direction control.
4. Improper level off.
5. Failure to see and avoid objects or obstructions.
6. Mismanagement of fuel.
7. Improper inflight decisions or planning.
8. Misjudgment of distance and speed.
9. Selection of unsuitable terrain.
10. Improper operation of flight controls.

b. This list remains relatively stable and points out the need for continued refresher training to establish a higher level of flight proficiency for all pilots. A part of the FAA's continuing effort to promote increased aviation safety is the Aviation Safety Program. For information on Aviation Safety Program activities contact your nearest Flight Standards District Office.

c. **Alertness.** Be alert at all times, especially when the weather is good. Most pilots pay attention to business when they are operating in full IFR weather conditions, but strangely, air collisions almost invariably have occurred under ideal weather conditions. Unlimited visibility appears to encourage a sense of security which is not at all justified. Considerable information of value may be obtained by listening to advisories being issued in the terminal area, even though controller workload may prevent a pilot from obtaining individual service.

d. **Giving Way.** If you think another aircraft is too close to you, give way instead of waiting for the other pilot to respect the right-of-way to which you may be entitled. It is a lot safer to pursue the right-of-way angle after you have completed your flight.

7-6-2. Reporting Radio/Radar Altimeter Anomalies

a. Background.

1. The radio altimeter (also known as radar altimeter or RADALT) is a safety-critical aircraft system used to determine an aircraft's height above terrain. It is the only sensor onboard the aircraft capable of providing a direct measurement of the clearance height above the terrain and obstacles. Information from radio altimeters is essential for flight operations as a main enabler of several safety-critical functions and systems on the aircraft. The receiver on the radio altimeter is highly accurate because it is extremely sensitive, making it susceptible to radio frequency interference (RFI). RFI in the C-band portion of the spectrum could impact the functions of the radio altimeter during any phase of flight—most critically during takeoff, approach, and landing phases. This could pose a serious risk to flight safety.

2. Installed radio altimeters normally supply critical height data to a wide range of automated safety systems, navigation systems, and cockpit displays. Harmful RFI affecting the radio altimeter can cause these safety and navigation systems to operate in unexpected ways and display erroneous information to the pilot. RFI can interrupt, or significantly degrade, radio altimeter functions—precluding radio altimeter-based terrain alerts

and low-visibility approach and landing operations. Systems of concern include Terrain Awareness Warning Systems (TAWS), Enhanced Ground Proximity Warning Systems (EGPWS), and Traffic Collision Avoidance Systems (TCAS), to name a few. Pilots of radio altimeter equipped aircraft should become familiar with the radio altimeter's interdependence with the other aircraft systems and expected failure modes and indications that may be associated with harmful interference.

b. Actions. Recognizing interference/anomalies in the radio altimeter can be difficult, as it may present as inoperative or erroneous data. Pilots need to monitor their automation, as well as their radio altimeters for discrepancies, and be prepared to take action. Pilots encountering radio altimeter interference/anomalies should transition to procedures that do not require the radio altimeter, and inform Air Traffic Control (ATC).

c. Inflight Reporting. Pilots should report any radio altimeter anomaly to ATC as soon as practical.

d. Post Flight Reporting.

1. Pilots are encouraged to submit detailed reports of radio altimeter interference/anomalies post flight as soon as practical, by internet via the Radio Altimeter Anomaly Reporting Form at https://www.faa.gov/air_traffic/nas/RADALT_reports/.

2. The post flight pilot reports of radio altimeter anomalies should contain as much of the following information as applicable:

- (a) Date and time the anomaly was observed;
- (b) Location of the aircraft at the time the anomaly started and ended (e.g., latitude, longitude or bearing/distance from a reference point or navigational aid);
- (c) Magnetic heading;
- (d) Altitude (MSL/AGL);
- (e) Aircraft Type (make/model);
- (f) Flight Number or Aircraft Registration Number;
- (g) Meteorological conditions;
- (h) Type of radio altimeter in use (e.g., make/model/software series or version), if known;
- (i) Event overview;
- (j) Consequences/operational impact (e.g., impacted equipment, actions taken to mitigate the disruption and/or remedy provided by ATC, required post flight pilot and maintenance actions).

7-6-3. VFR in Congested Areas

A high percentage of near midair collisions occur below 8,000 feet AGL and within 30 miles of an airport. When operating VFR in these highly congested areas, whether you intend to land at an airport within the area or are just flying through, it is recommended that extra vigilance be maintained and that you monitor an appropriate control frequency. Normally the appropriate frequency is an approach control frequency. By such monitoring action you can "get the picture" of the traffic in your area. When the approach controller has radar, radar traffic advisories may be given to VFR pilots upon request.

REFERENCE-

AIM, Para 4-1-15, Radar Traffic Information Service.

7-6-4. Obstructions To Flight

a. General. Many structures exist that could significantly affect the safety of your flight when operating below 500 feet above ground level (AGL), and particularly below 200 feet AGL. While 14 CFR part 91.119 allows flight below 500 feet AGL when over sparsely populated areas or open water, such operations involve increased

safety risks. At and below 200 feet AGL there are numerous power lines, antenna towers, etc., that are not marked and lighted and/or charted as obstructions and, therefore, may not be seen in time to avoid a collision. Notices to Airmen NOTAM are issued on those lighted structures experiencing temporary light outages. However, some time may pass before the FAA is notified of these outages, and the NOTAM issued, thus pilot vigilance is imperative. Additionally, new obstructions may not be on current charts because the information was not received prior to the FAA publishing the chart.

b. Antenna Towers. Extreme caution should be exercised when flying less than 2,000 feet AGL because of numerous skeletal structures, such as radio and television antenna towers, that exceed 1,000 feet AGL with some extending higher than 2,000 feet AGL. Most skeletal structures are supported by guy wires which are very difficult to see in good weather and can be invisible at dusk or during periods of reduced visibility. These wires can extend about 1,500 feet horizontally from a structure; therefore, all skeletal structures should be avoided horizontally by at least 2,000 feet.

c. Overhead Wires. Overhead transmission and utility lines often span approaches to runways, natural flyways such as lakes, rivers, gorges, and canyons, and cross other landmarks pilots frequently follow such as highways, railroad tracks, etc. As with antenna towers, these power transmission and/or utility lines and the supporting structures of these lines may not always be readily visible. The wires may be virtually impossible to see under certain conditions. Spherical markers may be used to identify overhead wires and catenary transmission lines and may be lighted. In some locations, the supporting structures of overhead transmission lines are equipped with unique sequence flashing white strobe light systems to indicate that there are wires between the structures. The flash sequence for the wire support structures will be middle, top, and bottom with all lights on the same level flashing simultaneously. However, not all power transmission and/or utility lines require notice to the FAA as they do not exceed 200 feet AGL or meet the obstruction standard of 14 CFR part 77 and, therefore, are not marked and/or lighted. All pilots are cautioned to remain extremely vigilant for power transmission and/or utility lines and their supporting structures when following natural flyways or during the approach and landing phase. This is particularly important for seaplane and/or float equipped aircraft when landing on, or departing from, unfamiliar lakes or rivers.

d. Wind Turbines. The number, size, and height of individual wind turbines and wind turbine farms have increased over time. The locations of wind turbine farms have also expanded to areas more commonly flown by VFR pilots and to all regions of the United States. VFR pilots should be aware that many wind turbines are exceeding 499 feet AGL in height, which may affect minimum safe VFR altitudes in uncontrolled airspace. In addition, many wind turbines are encroaching on the 700 foot AGL floor of controlled airspace (Class E). Pilots are cautioned to maintain appropriate safe distance (laterally, vertically, or both). Wind turbines are typically charted on Visual Flight Rules (VFR) Sectional Charts and/or Terminal Area Charts. For a description of how wind turbines and wind turbine farms are charted, refer to the [FAA Aeronautical Chart User's Guide](#). Wind turbines are normally painted white or light gray to improve daytime conspicuity. They are typically lit with medium-intensity, flashing red lights, placed as high as possible on the turbine nacelle (not the blade tips), that should be synchronized to flash together; however, not all wind turbine units within a farm need to be lighted, depending on their location and height. Sometimes, only the perimeter of the wind turbine farm and an arrangement of interior wind turbines are lit. Some wind turbine farms use Aircraft Detection Lighting Systems (ADLS), which are proximity sensor-based systems designed to detect aircraft as they approach the obstruction. This system automatically activates the appropriate obstruction lights until they are no longer needed based on the position of the transiting aircraft. This technology reduces the impact of nighttime lighting on nearby communities and migratory birds and extends the life expectancy of the obstruction lights. For more information on how obstructions such as wind turbines are marked and lighted, refer to Advisory Circular 70/7460-1, Obstruction Marking and Lighting. Pilots should be aware that wind turbines in motion could result in limitations of air traffic services in the vicinity of the wind turbine farms.

REFERENCE—

AIM, Para 4-5-1, Radar.

e. Meteorological (MET) Evaluation Towers. MET towers are used by wind energy companies to determine feasible sites for wind turbines. Some of these towers are less than 200 feet AGL. These structures are portable,

erected in a matter of hours, installed with guyed wires, and constructed from a galvanized material often making them difficult to see in certain atmospheric conditions. Markings for these towers include alternating bands of aviation orange and white paint, and high-visibility sleeves installed on the outer guy wires. However, not all MET towers follow these guidelines, and pilots should be vigilant when flying at low altitude in remote or rural areas.

f. Other Objects/Structures. There are other objects or structures that could adversely affect your flight such as temporary construction cranes near an airport, newly constructed buildings, new towers, etc. Many of these structures do not meet charting requirements or may not yet be charted because of the charting cycle. Some structures do not require obstruction marking and/or lighting, and some may not be marked and lighted even though the FAA recommended it. VFR pilots should carefully review NOTAMs for temporary or permanent obstructions along the planned route of flight during their preflight preparations. Particular emphasis should be given to obstructions in the vicinity of the approach and departure ends of the runway complex or any other areas where flight below 500 feet AGL is planned or likely to occur.

7-6-5. Avoid Flight Beneath Unmanned Balloons

a. The majority of unmanned free balloons currently being operated have, extending below them, either a suspension device to which the payload or instrument package is attached, or a trailing wire antenna, or both. In many instances these balloon subsystems may be invisible to the pilot until the aircraft is close to the balloon, thereby creating a potentially dangerous situation. Therefore, good judgment on the part of the pilot dictates that aircraft should remain well clear of all unmanned free balloons and flight below them should be avoided at all times.

b. Pilots are urged to report any unmanned free balloons sighted to the nearest FAA ground facility with which communication is established. Such information will assist FAA ATC facilities to identify and flight follow unmanned free balloons operating in the airspace.

7-6-6. Unmanned Aircraft Systems

a. Unmanned Aircraft Systems (UAS), formerly referred to as “Unmanned Aerial Vehicles” (UAVs) or “drones,” are having an increasing operational presence in the NAS. Once the exclusive domain of the military, UAS are now being operated by various entities. Although these aircraft are “unmanned,” UAS are flown by a remotely located pilot and crew. Physical and performance characteristics of unmanned aircraft (UA) vary greatly and unlike model aircraft that typically operate lower than 400 feet AGL, UA may be found operating at virtually any altitude and any speed. Sizes of UA can be as small as several pounds to as large as a commercial transport aircraft. UAS come in various categories including airplane, rotorcraft, powered-lift (tilt-rotor), and lighter-than-air. Propulsion systems of UAS include a broad range of alternatives from piston powered and turbojet engines to battery and solar-powered electric motors.

b. To ensure segregation of UAS operations from other aircraft, the military typically conducts UAS operations within restricted or other special use airspace. However, UAS operations are now being approved in the NAS outside of special use airspace through the use of FAA-issued Certificates of Waiver or Authorization (COA) or through the issuance of a special airworthiness certificate. COA and special airworthiness approvals authorize UAS flight operations to be contained within specific geographic boundaries and altitudes, usually require coordination with an ATC facility, and typically require the issuance of a NOTAM describing the operation to be conducted. UAS approvals also require observers to provide “see-and-avoid” capability to the UAS crew and to provide the necessary compliance with 14 CFR section 91.113. For UAS operations approved at or above FL180, UAS operate under the same requirements as that of manned aircraft (i.e., flights are operated under instrument flight rules, are in communication with ATC, and are appropriately equipped).

c. UAS operations may be approved at either controlled or uncontrolled airports and are typically disseminated by NOTAM. In all cases, approved UAS operations must comply with all applicable regulations and/or special provisions specified in the COA or in the operating limitations of the special airworthiness

2. Call Sign or Aircraft Registration Number.
3. Type Aircraft.
4. Nearest Major City.
5. Altitude.
6. Location of Event (Latitude/Longitude and/or Fixed Radial Distance (FRD)).
7. Brief Description of the Event and any other Pertinent Information.

f. Pilots are also encouraged to complete the Laser Beam Exposure Questionnaire located on the FAA Laser Safety Initiative website at <http://www.faa.gov/about/initiatives/lasers/> and submit electronically per the directions on the questionnaire, as soon as possible after landing.

g. When a laser event is reported to an air traffic facility, a general caution warning will be broadcasted on all appropriate frequencies every five minutes for 20 minutes and broadcasted on the ATIS for one hour following the report.

PHRASEOLOGY–

UNAUTHORIZED LASER ILLUMINATION EVENT, (UTC time), (location), (altitude), (color), (direction).

EXAMPLE–

“Unauthorized laser illumination event, at 0100z, 8 mile final runway 18R at 3,000 feet, green laser from the southwest.”

REFERENCE–

FAA Order JO 7110.65, Para 10–2–14, Unauthorized Laser Illumination of Aircraft.

FAA Order JO 7210.3, Para 2–1–27, Reporting Unauthorized Laser Illumination of Aircraft.

h. When these activities become known to the FAA, Notices to Airmen (NOTAMs) are issued to inform the aviation community of the events. Pilots should consult NOTAMs or the Chart Supplement for information regarding these activities.

7–6–14. Flying in Flat Light, Brown Out Conditions, and White Out Conditions

a. Flat Light. Flat light is an optical illusion, also known as “**sector or partial white out.**” It is not as severe as “white out” but the condition causes pilots to lose their depth-of-field and contrast in vision. Flat light conditions are usually accompanied by overcast skies inhibiting any visual clues. Such conditions can occur anywhere in the world, primarily in snow covered areas but can occur in dust, sand, mud flats, or on glassy water. Flat light can completely obscure features of the terrain, creating an inability to distinguish distances and closure rates. As a result of this reflected light, it can give pilots the illusion that they are ascending or descending when they may actually be flying level. However, with good judgment and proper training and planning, it is possible to safely operate an aircraft in flat light conditions.

b. Brown Out. A brownout (or *brown-out*) is an in-flight visibility restriction due to dust or sand in the air. In a brownout, the pilot cannot see nearby objects which provide the outside visual references necessary to control the aircraft near the ground. This can cause spatial disorientation and loss of situational awareness leading to an accident.

1. The following factors will affect the probability and severity of brownout: rotor disk loading, rotor configuration, soil composition, wind, approach speed, and approach angle.

2. The brownout phenomenon causes accidents during helicopter landing and take-off operations in dust, fine dirt, sand, or arid desert terrain. Intense, blinding dust clouds stirred up by the helicopter rotor downwash during near-ground flight causes significant flight safety risks from aircraft and ground obstacle collisions, and dynamic rollover due to sloped and uneven terrain.

3. This is a dangerous phenomenon experienced by many helicopters when making landing approaches in dusty environments, whereby sand or dust particles become swept up in the rotor outwash and obscure the pilot’s vision of the terrain. This is particularly dangerous because the pilot needs those visual cues from their surroundings in order to make a safe landing.

4. Blowing sand and dust can cause an illusion of a tilted horizon. A pilot not using the flight instruments for reference may instinctively try to level the aircraft with respect to the false horizon, resulting in an accident. Helicopter rotor wash also causes sand to blow around outside the cockpit windows, possibly leading the pilot to experience an illusion where the helicopter appears to be turning when it is actually in a level hover. This can also cause the pilot to make incorrect control inputs which can quickly lead to disaster when hovering near the ground. In night landings, aircraft lighting can enhance the visual illusions by illuminating the brownout cloud.

c. White Out. As defined in meteorological terms, white out occurs when a person becomes engulfed in a uniformly white glow. The glow is a result of being surrounded by blowing snow, dust, sand, mud or water. There are no shadows, no horizon or clouds and all depth-of-field and orientation are lost. A white out situation is severe in that there are no visual references. Flying is not recommended in any white out situation. Flat light conditions can lead to a white out environment quite rapidly, and both atmospheric conditions are insidious; they sneak up on you as your visual references slowly begin to disappear. White out has been the cause of several aviation accidents.

d. Self Induced White Out. This effect typically occurs when a helicopter takes off or lands on a snow-covered area. The rotor down wash picks up particles and re-circulates them through the rotor down wash. The effect can vary in intensity depending upon the amount of light on the surface. This can happen on the sunniest, brightest day with good contrast everywhere. However, when it happens, there can be a complete loss of visual clues. If the pilot has not prepared for this immediate loss of visibility, the results can be disastrous. Good planning does not prevent one from encountering flat light or white out conditions.

e. Never take off in a white out situation.

1. Realize that in flat light conditions it may be possible to depart but not to return to that site. During takeoff, make sure you have a reference point. Do not lose sight of it until you have a departure reference point in view. Be prepared to return to the takeoff reference if the departure reference does not come into view.

2. Flat light is common to snow skiers. One way to compensate for the lack of visual contrast and depth-of-field loss is by wearing amber tinted lenses (also known as blue blockers). Special note of caution: Eyewear is not ideal for every pilot. Take into consideration personal factors—age, light sensitivity, and ambient lighting conditions.

3. So what should a pilot do when all visual references are lost?

- (a) Trust the cockpit instruments.
- (b) Execute a 180 degree turnaround and start looking for outside references.
- (c) Above all – fly the aircraft.

f. Landing in Low Light Conditions. When landing in a low light condition – use extreme caution. Look for intermediate reference points, in addition to checkpoints along each leg of the route for course confirmation and timing. The lower the ambient light becomes, the more reference points a pilot should use.

g. Airport Landings.

1. Look for features around the airport or approach path that can be used in determining depth perception. Buildings, towers, vehicles or other aircraft serve well for this measurement. Use something that will provide you with a sense of height above the ground, in addition to orienting you to the runway.

2. Be cautious of snowdrifts and snow banks – anything that can distinguish the edge of the runway. Look for subtle changes in snow texture or shading to identify ridges or changes in snow depth.

h. Off-Airport Landings.

1. In the event of an off-airport landing, pilots have used a number of different visual cues to gain reference. Use whatever you must to create the contrast you need. Natural references seem to work best (trees, rocks, snow ribs, etc.)

and/or engine damage/failure. These hazards are most critical during low altitude flight in calm and cold air, especially in and around approach and departure corridors or airport traffic areas.

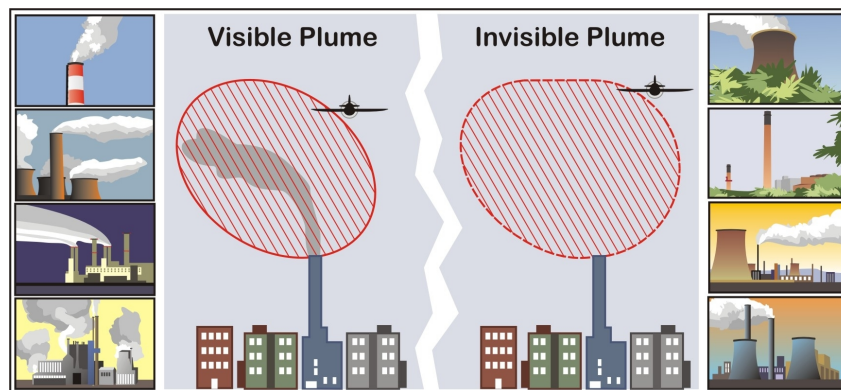
Whether plumes are visible or invisible, the total extent of their turbulent affect is difficult to predict. Some studies do predict that the significant turbulent effects of an exhaust plume can extend to heights of over 1,000 feet above the height of the top of the stack or cooling tower. Any effects will be more pronounced in calm stable air where the plume is very hot and the surrounding area is still and cold. Fortunately, studies also predict that any amount of crosswind will help to dissipate the effects. However, the size of the tower or stack is not a good indicator of the predicted effect the plume may produce. The major effects are related to the heat or size of the plume effluent, the ambient air temperature, and the wind speed affecting the plume. Smaller aircraft can expect to feel an effect at a higher altitude than heavier aircraft.

b. When able, a pilot should steer clear of exhaust plumes by flying on the upwind side of smokestacks or cooling towers. When a plume is visible via smoke or a condensation cloud, remain clear and realize a plume may have both visible and invisible characteristics. Exhaust stacks without visible plumes may still be in full operation, and airspace in the vicinity should be treated with caution. As with mountain wave turbulence or clear air turbulence, an invisible plume may be encountered unexpectedly. Cooling towers, power plant stacks, exhaust fans, and other similar structures are depicted in FIG 7-6-2.

Pilots are encouraged to exercise caution when flying in the vicinity of exhaust plumes. Pilots are also encouraged to reference the Chart Supplement where amplifying notes may caution pilots and identify the location of structure(s) emitting exhaust plumes.

The best available information on this phenomenon must come from pilots via the PIREP reporting procedures. All pilots encountering hazardous plume conditions are urgently requested to report time, location, and intensity (light, moderate, severe, or extreme) of the element to the FAA facility with which they are maintaining radio contact. If time and conditions permit, elements should be reported according to the standards for other PIREPs and position reports (AIM paragraph 7-1-21, PIREPS Relating to Turbulence).

FIG 7-6-2
Plumes



7-6-17. Space Launch and Reentry Area

Locations where commercial space launch and/or reentry operations occur. Hazardous operations occur in space launch and reentry areas, and for pilot awareness, a rocket-shaped symbol is used to depict them on sectional aeronautical charts. These locations may have vertical launches from launch pads, horizontal launches from runways, and/or reentering vehicles coming back to land. Because of the wide range of hazards associated with space launch and reentry areas, pilots are expected to check NOTAMs for the specific area prior to flight to determine the location and lateral boundaries of the associated hazard area, and the active time. NOTAMs may include terms such as “rocket launch activity,” “space launch,” or “space reentry,” depending upon the type of

operation. Space launch and reentry areas are not established for amateur rocket operations conducted per 14 CFR part 101.

FIG 7-6-3

Space Launch and Reentry Area Depicted on a Sectional Chart



7-6-18. Automatic Landing Operations

Prior to conducting automatic landing operations, pilots are expected to determine that the flight control and instrument approach guidance systems being used permit safe, automatically flown landings to be conducted at that runway. The analysis should include, but not be limited to, ILS classification code where applicable, suitable threshold crossing height, runway slope, and pre-threshold terrain. The FAA only evaluates runways and other ground infrastructure for suitability to support automatic landing operations for those facilities associated with published CAT II, SA CAT II, and CAT III instrument approach procedures. When conducting automatic landing operations, pilots must ensure that the runway, associated procedure, navigation source, and other infrastructure have no outstanding NOTAMs or chart notes that would preclude automatic landing operations (e.g., “Localizer unusable inside the threshold,” or “Glide slope unusable below xxx feet”). Pilots should advise ATC of their intent to conduct an automatic landing, remain alert to any unsuitable system performance, and be prepared to disengage the automatic landing system when necessary. During automatic landing operations using an ILS facility, pilots should understand and observe the provisions of AIM, subparagraph 1-1-9k, ILS Course and Glideslope Distortion.

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), https://www.faa.gov/air_traffic/flight_info/aeronav/safety_alerts/ which is part of FAA's Air Traffic Organization, Mission Support Services.

9-1-2. Obtaining Aeronautical Charts

Public sales of charts and publications are available through a network of FAA approved print providers. A listing of products, dates of latest editions and agents is available on the AIS website at: https://www.faa.gov/air_traffic/flight_info/aeronav/safety_alerts/.

9-1-3. Safety Alerts, Charting Notices, and Data Product Notices

a. Safety Alerts (SAs) are published to notify users of an error that was reported or discovered in one of our digital products. The specific product and effective date(s) are provided.

b. Charting Notices (CNs) are published to notify users of a planned chart/publication enhancement and the effective date on which the enhancement will be implemented.

c. Data Product Notices (DPNs) are published to notify users of a system outage. DPNs may also be used to notify users of a developmental upgrade to one of our digital products and the effective date on which the upgrade will be implemented.

d. A listing of these notices is found on the AIS website at: https://www.faa.gov/air_traffic/flight_info/aeronav/safety_alerts/.

9-1-4. Selected Charts and Products Available

VFR Navigation Charts

IFR Navigation Charts

Planning Charts

Supplementary Charts and Publications

Digital Products

9-1-5. General Description of Each Chart Series

a. VFR Navigation Charts.

1. Sectional Aeronautical Charts. Sectional Charts are designed for visual navigation of slow to medium speed aircraft. The topographic information consists of contour lines, shaded relief, drainage patterns, and an extensive selection of visual checkpoints and landmarks used for flight under VFR. Cultural features include cities and towns, roads, railroads, and other distinct landmarks. The aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, special-use airspace, obstructions, and related data. Scale 1 inch = 6.86 nm/1:500,000. 60 x 20 inches folded to 5 x 10 inches. Revised every 56 days. (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. VFR Transition Routes may be depicted and/or described on this chart. Scale 1 inch = 3.43 nm/1:250,000. Revised every 56 days. (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 America area. Information depicted includes offshore mineral leasing areas and blocks, oil drilling platforms, and high density helicopter activity areas. Scale 1 inch = 13.7 nm/1:1,000,000. 55 x 27 inches folded to 5 x 10 inches. Revised every 56 days.

4. Grand Canyon VFR Aeronautical Chart. Covers the Grand Canyon National Park area and is designed to promote aviation safety, flight free zones, and facilitate VFR navigation in this popular area. The chart contains aeronautical information for general aviation VFR pilots on one side and commercial VFR air tour operators on the other side. Revised every 56 days.

FIG 9-1-1

Sectional and VFR Terminal Area Charts for the Conterminous U.S., Hawaii, Puerto Rico, and Virgin Islands

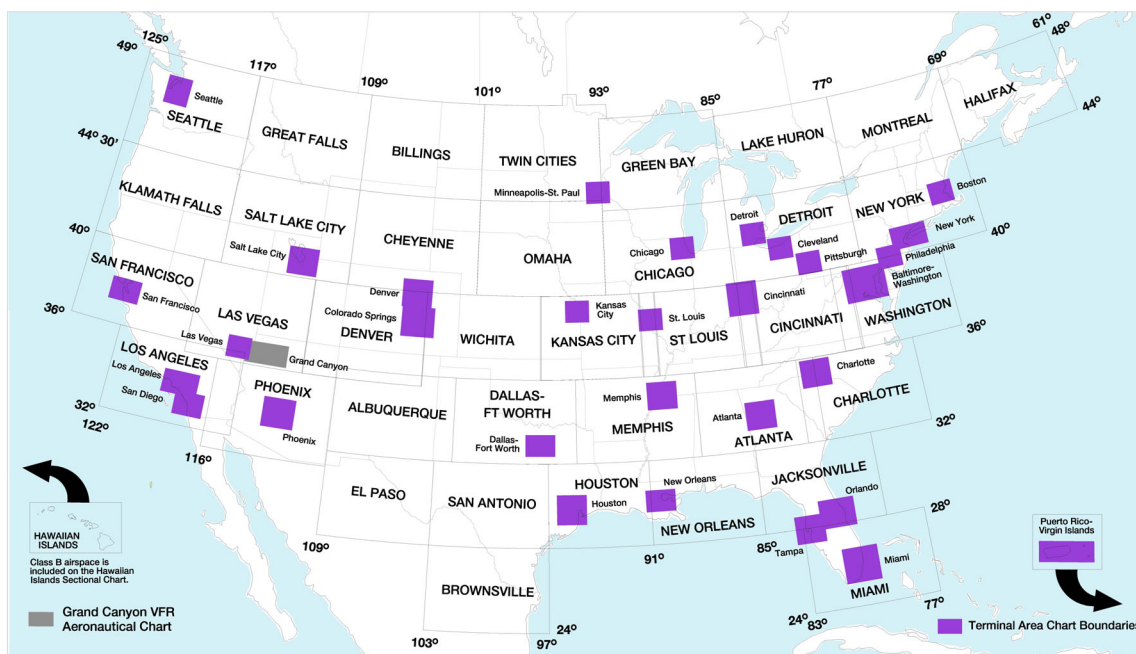
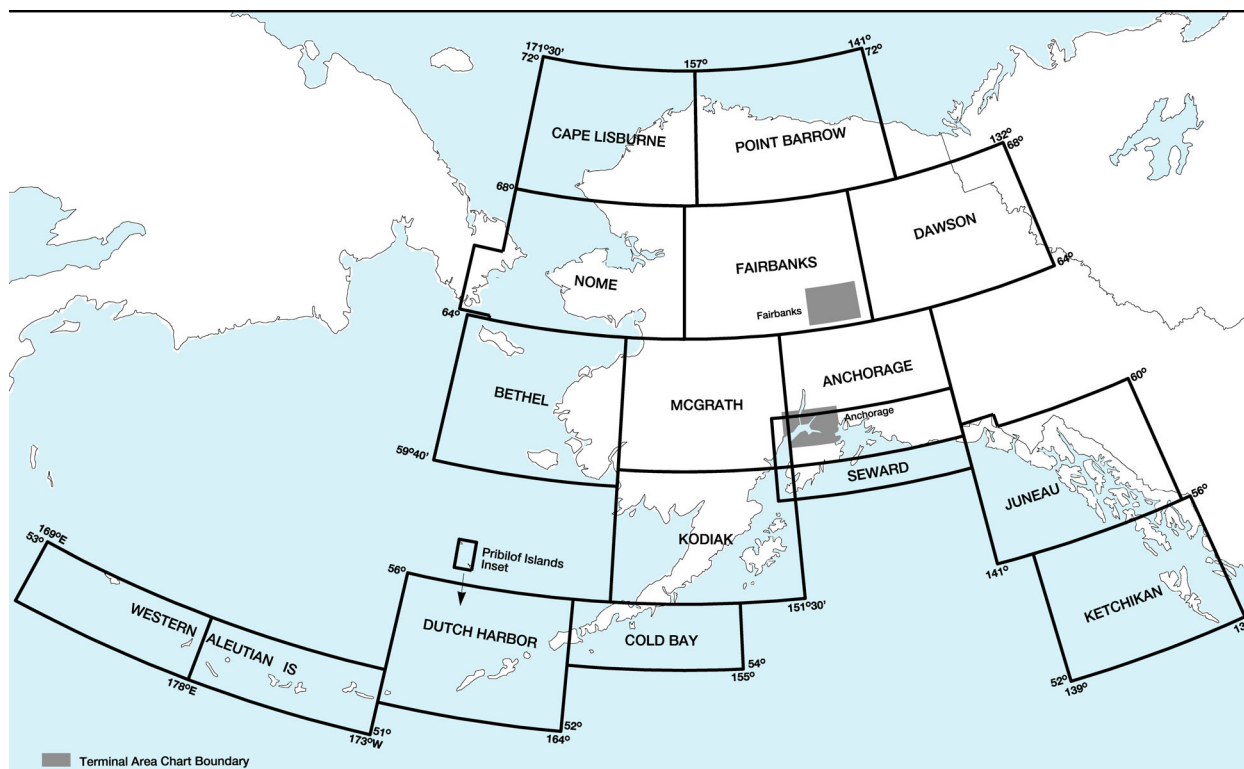
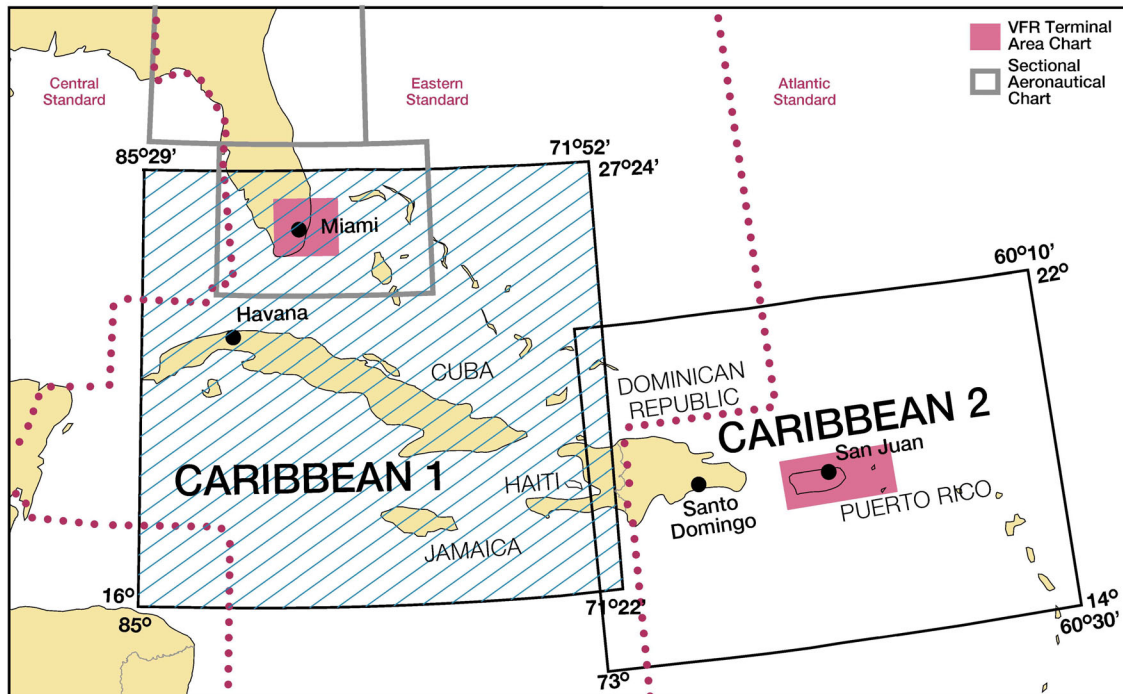


FIG 9-1-2
Sectional and VFR Terminal Area Charts for Alaska



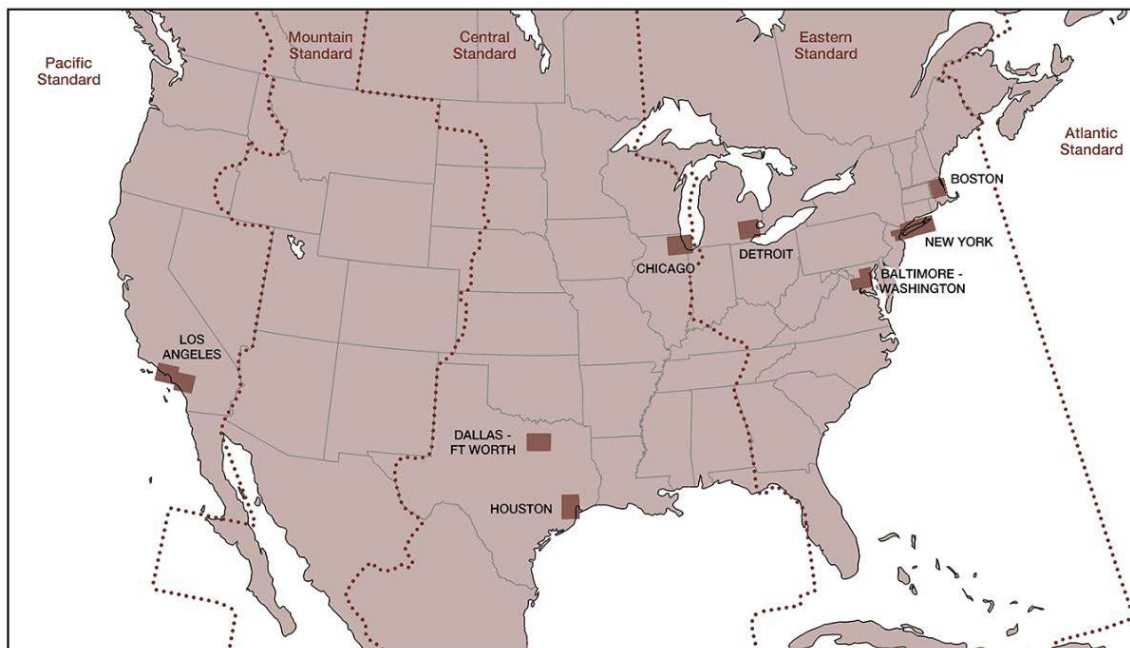
5. Caribbean VFR Aeronautical Charts. Caribbean 1 and 2 (CAC-1 and CAC-2) are designed for visual navigation to assist familiarization of foreign aeronautical and topographic information. The aeronautical information includes visual and radio aids to navigation, airports, controlled airspace, special-use airspace, obstructions, and related data. The topographic information consists of contour lines, shaded relief, drainage patterns, and a selection of landmarks used for flight under VFR. Cultural features include cities and towns, roads, railroads, and other distinct landmarks. Scale 1 inch = 13.7 nm/1:1,000,000. CAC-1 consists of two sides measuring 30" x 60" each. CAC-2 consists of two sides measuring 20" x 60" each. Revised every 56 days. (See FIG 9-1-3.)

FIG 9-1-3
Caribbean VFR Aeronautical Charts



6. Helicopter Route Charts. A three-color chart series which shows current aeronautical information useful to helicopter pilots navigating in areas with high concentrations of helicopter activity. Information depicted includes helicopter routes, four classes of heliports with associated frequency and lighting capabilities, NAVAIDs, and obstructions. In addition, pictorial symbols, roads, and easily identified geographical features are portrayed. Scale 1 inch = 1.71 nm/1:125,000. 34 x 30 inches folded to 5 x 10 inches. Revised every 56 days. (See FIG 9-1-4.)

FIG 9-1-4
Helicopter Route Charts



b. IFR Navigation Charts.

1. IFR En Route Low Altitude Charts (Conterminous U.S. and Alaska). En route low altitude charts provide aeronautical information for navigation under IFR conditions below 18,000 feet MSL. This four-color chart series includes airways; limits of controlled airspace; VHF NAVAIDs with frequency, identification, channel, geographic coordinates; airports with terminal air/ground communications; minimum en route and obstruction clearance altitudes; airway distances; reporting points; special use airspace; and military training routes. Scales vary from 1 inch = 5nm to 1 inch = 20 nm. 50 x 20 inches folded to 5 x 10 inches. Charts revised every 56 days. *Area charts* show congested terminal areas at a large scale. They are included with subscriptions to any conterminous U.S. Set Low (Full set, East or West sets). (See FIG 9-1-5 and FIG 9-1-6.)

FIG 9-1-5
En Route Low Altitude Instrument Charts for the Conterminous U.S. (Includes Area Charts)

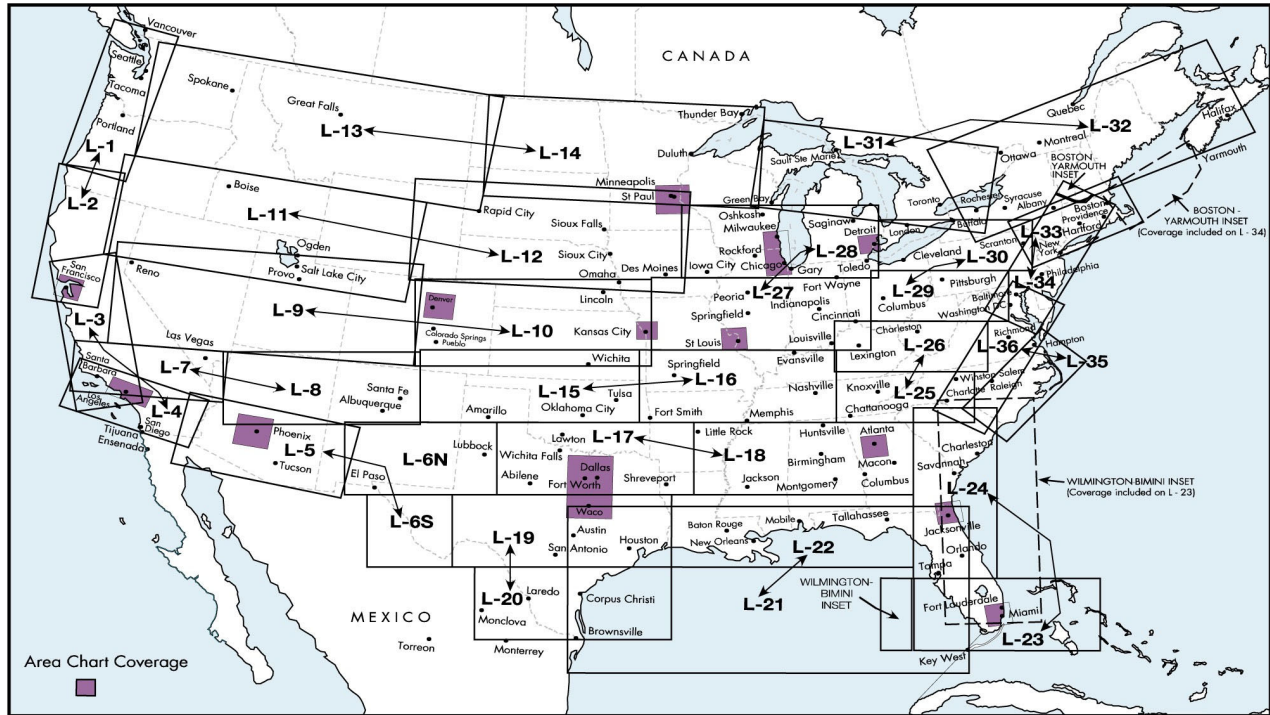
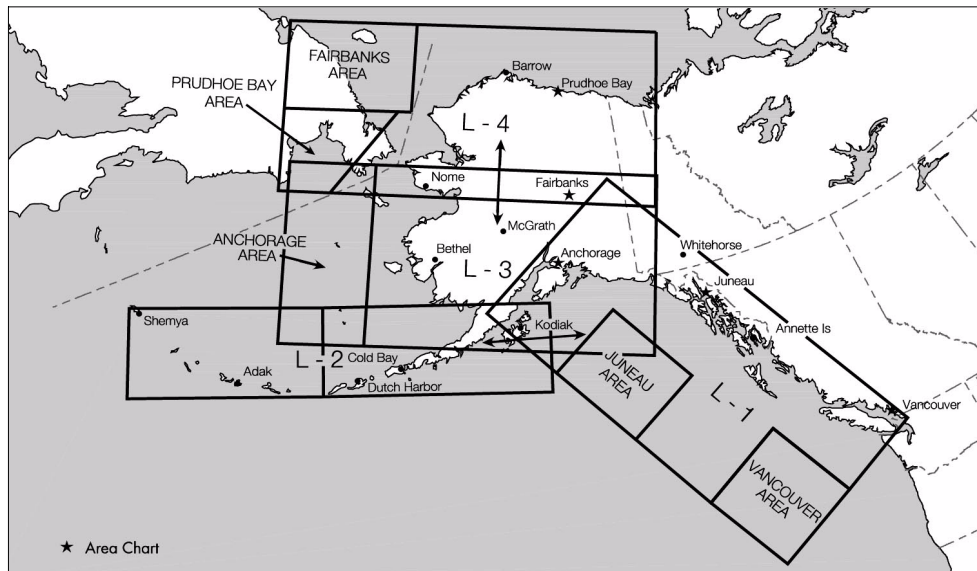


FIG 9-1-6
Alaska En Route Low Altitude Chart



2. IFR En Route High Altitude Charts (Conterminous U.S. and Alaska). En route high altitude charts are designed for navigation at or above 18,000 feet MSL. This four-color chart series includes the jet route structure; VHF NAVAIDs with frequency, identification, channel, geographic coordinates; selected airports; reporting points. Scales vary from 1 inch = 45 nm to 1 inch = 18 nm. 55 x 20 inches folded to 5 x 10 inches. Revised every 56 days. (See FIG 9-1-7 and FIG 9-1-8.)

FIG 9-1-7
En Route High Altitude Charts for the Conterminous U.S.

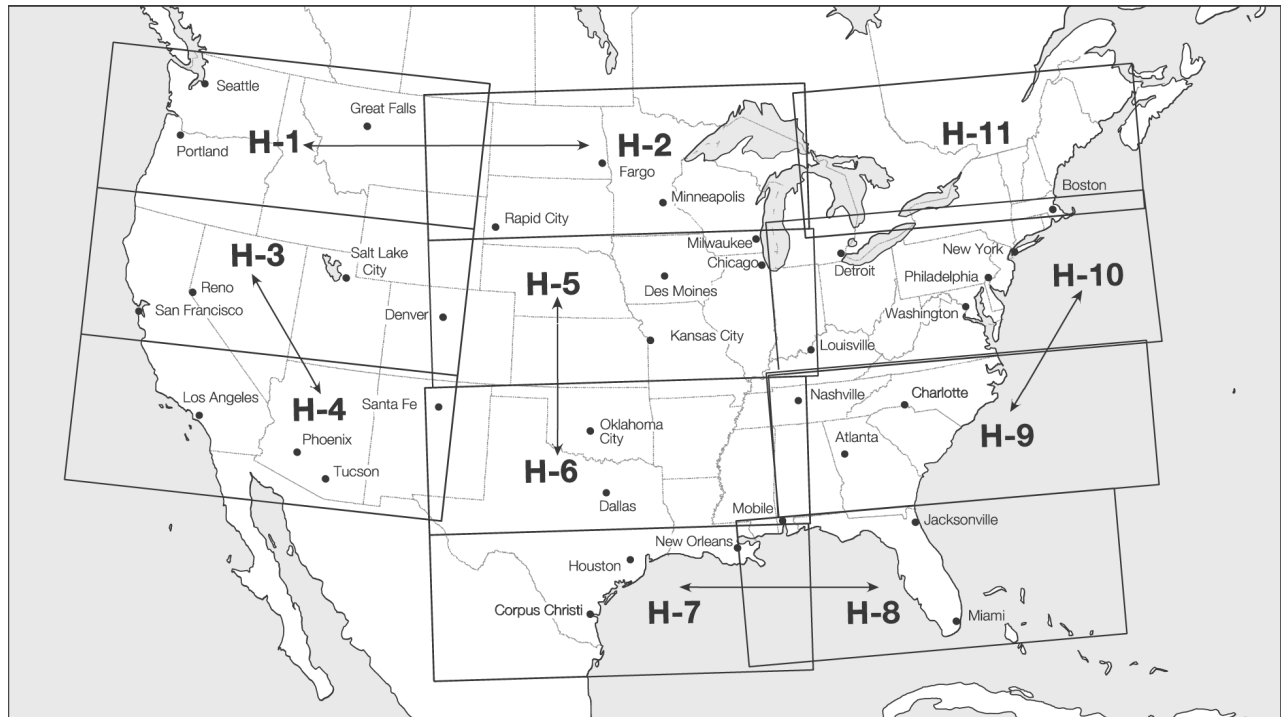
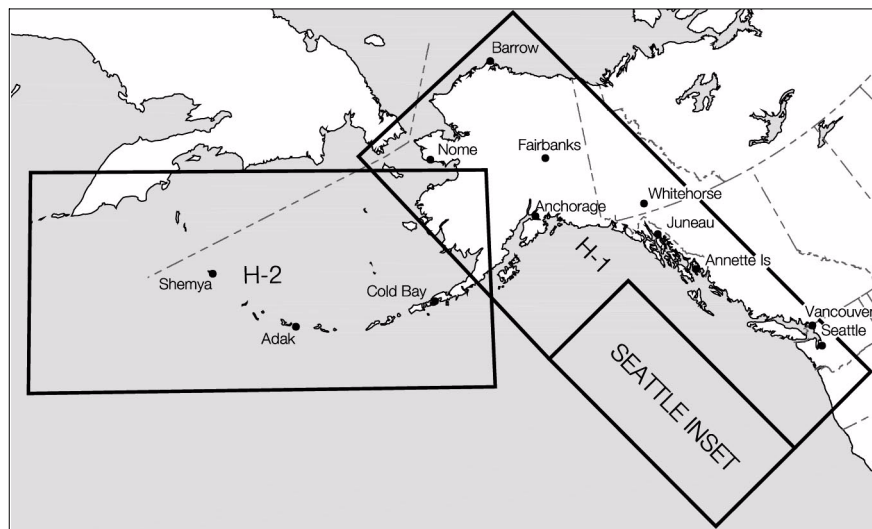


FIG 9-1-8
Alaskan En Route High Altitude Chart



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 website. (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 website.

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 America 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. Revised every 56 days. (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 = 27.4 nm/1:2,000,000. The one sided chart is 58.5 x 40.75 inches and is designed for wall mounting. Revised annually. (See FIG 9-1-9.)

FIG 9-1-9
Alaska VFR Wall Planning Chart

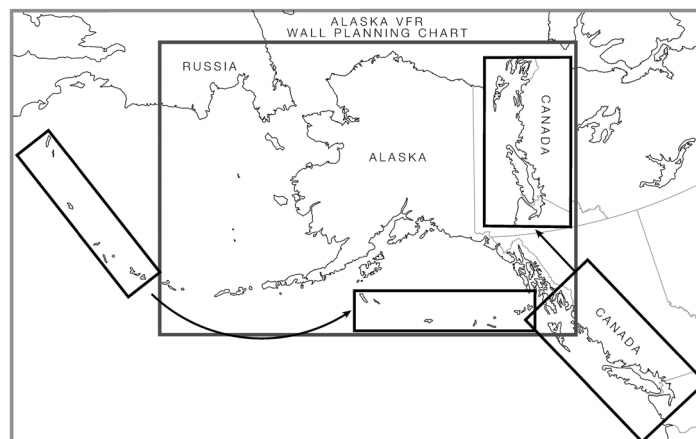
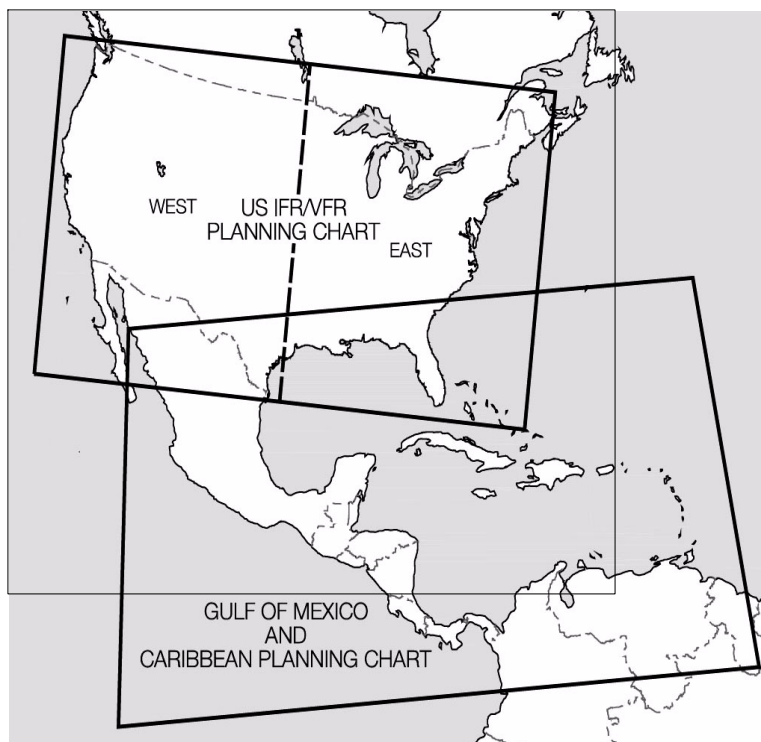
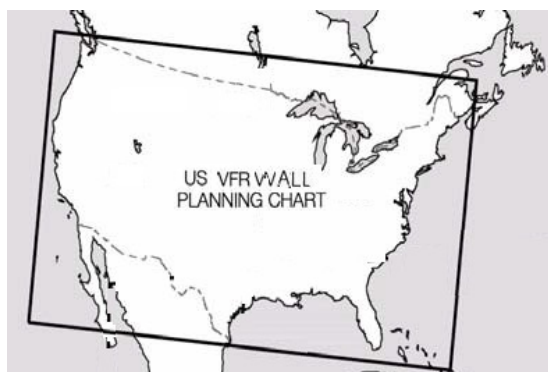


FIG 9-1-10
Planning Charts



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. Revised annually. (See FIG 9-1-11.)

FIG 9-1-11
U.S. VFR Wall Planning Chart



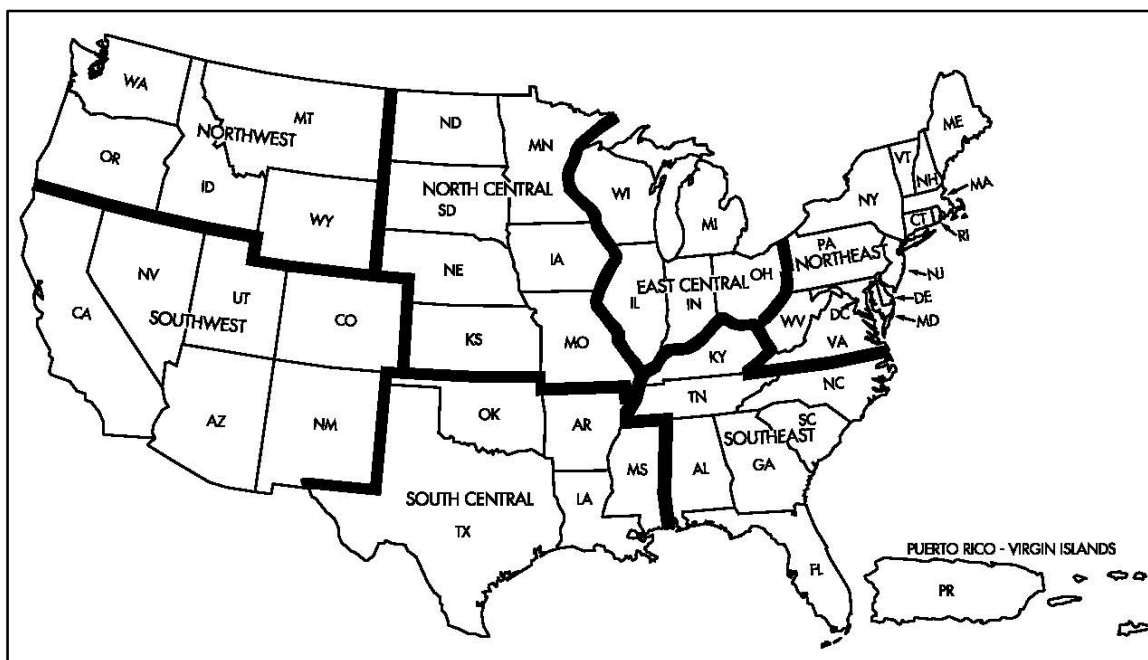
5. VFR Flyway Planning Charts. This chart is printed on the reverse side of selected TAC charts. The coverage is the same as the associated TAC. Flyway planning charts depict flight paths and altitudes recommended for use to bypass high traffic areas. Ground references are provided as a guide for visual orientation. Flyway planning charts are designed for use in conjunction with TACs and sectional charts and are not to be used for navigation. VFR Transition Routes may be depicted and/or described on this chart. Chart scale 1 inch = 3.43 nm/1:250,000.

d. Supplementary Charts and Publications.

1. Chart Supplement refers to a series of civil/military flight information publications issued by FAA every 56 days consisting of the Chart Supplement U.S., Chart Supplement Alaska, and Chart Supplement Pacific.

2. **Chart Supplement U.S.** This is a civil/military flight information publication. This 7-volume book series is designed for use with appropriate IFR or VFR charts and contains data including, but not limited to, airports, NAVAIDs, communications data, weather data sources, special notices, non-regulatory operational procedures, and airport diagrams. 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, run widths, and lighting codes. (See FIG 9-1-12.)

FIG 9-1-12
Chart Supplement U.S. Geographic Areas

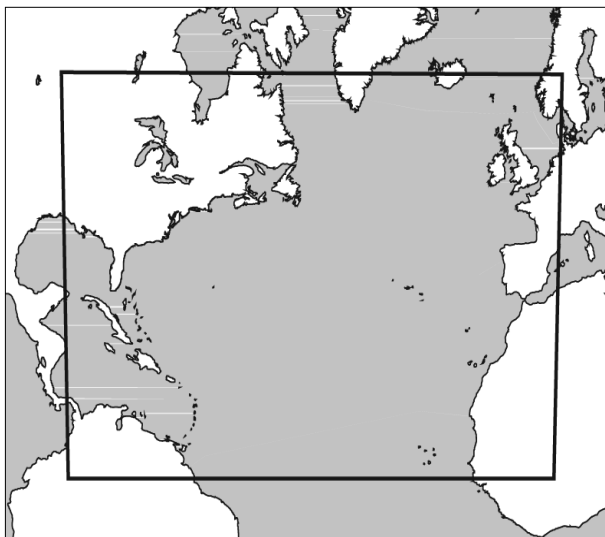


3. **Chart Supplement Alaska.** This is a civil/military flight information publication. This single-volume book is designed for use with appropriate IFR or VFR charts. The Chart Supplement Alaska contains data including, but not limited to, airports, NAVAIDs, communications data, weather data sources, special notices, non-regulatory operational procedures, and airport diagrams. The publication also includes uniquely geographical operational requirements as area notices and emergency procedures.

4. **Chart Supplement Pacific.** This is a civil/military flight information publication. This single volume book is designed for use with appropriate IFR or VFR charts. The Chart Supplement Pacific contains data including, but not limited to, airports, NAVAIDs, communications data, weather data sources, special notices, non-regulatory operational procedures, and airport diagrams. The publication also includes airspace, navigational facilities, non-regulatory Pacific area procedures, Instrument Approach Procedures (IAP), Departure Procedures (DP), Standard Terminal Arrival (STAR) charts, radar minimums, supporting data for the Hawaiian and Pacific Islands, and uniquely geographical operational requirements as area notices and emergency procedures.

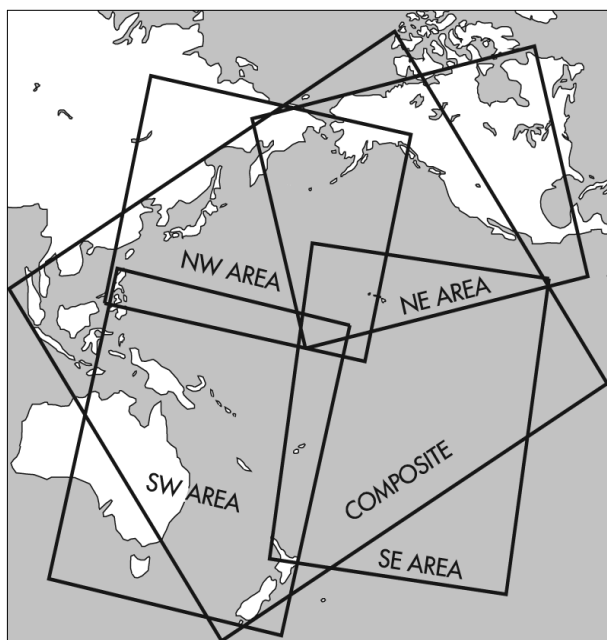
5. **North Atlantic Route Chart.** Designed for FAA controllers to monitor transatlantic flights, this 5-color chart shows oceanic control areas, coastal navigation aids, oceanic reporting points, and NAVAID geographic coordinates. Full Size Chart: Scale 1 inch = 113.1 nm/1:8,250,000. Chart is shipped flat only. Half Size Chart: Scale 1 inch = 150.8 nm/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 days. (See FIG 9-1-13.)

FIG 9-1-13
North Atlantic Route Charts



6. North Pacific Route Charts. These charts are designed for FAA controllers to monitor transoceanic flights. They show established intercontinental air routes, including reporting points with geographic positions. Composite Chart: Scale 1 inch = 164 nm/1:12,000,000. 48 x 41-1/2 inches. Area Charts: Scale 1 inch = 95.9 nm/1:7,000,000. 52 x 40-1/2 inches. All charts shipped unfolded. Charts revised every 56 days. (See FIG 9-1-14.)

FIG 9-1-14
North Pacific Oceanic Route Charts



7. Airport Obstruction Charts (OC). The OC is a 1:12,000 scale graphic depicting 14 CFR part 77, Objects Affecting Navigable Airspace, surfaces, a representation of objects that penetrate these surfaces, aircraft movement and apron areas, navigational aids, prominent airport buildings, and a selection of roads and other planimetric detail in the airport vicinity. Also included are tabulations of runway and other operational data.

8. FAA Aeronautical Chart User's Guide. A booklet designed to be used as a teaching aid and reference document. It describes the substantial amount of information provided on FAA's aeronautical charts and publications. It includes explanations and illustrations of chart terms and symbols organized by chart type. The users guide is available for free download at the AIS website.

e. Digital Products.

1. The Digital Aeronautical Information CD (DAICD). The DAICD is a combination of the NAVAID Digital Data File, the Digital Chart Supplement, and the Digital Obstacle File on one Compact Disk. These three digital products are no longer sold separately. The files are updated every 56 days and are available by subscription only.

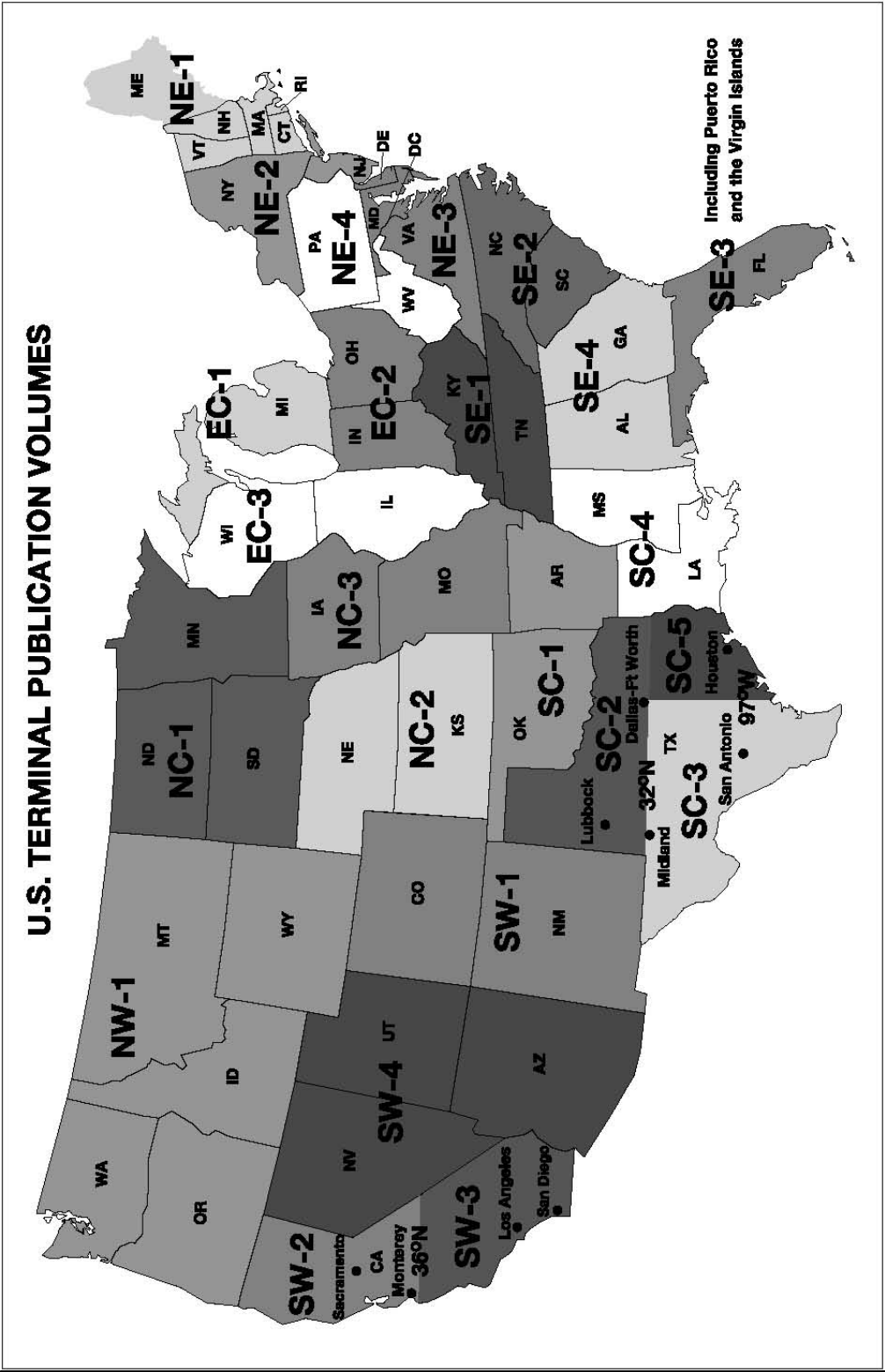
(a) The NAVAID Digital Data File. This file contains a current listing of NAVAIDs that are compatible with the National Airspace System. This file contains all NAVAIDs including ILS and its components, in the U.S., Puerto Rico, and the Virgin Islands plus bordering facilities in Canada, Mexico, and the Atlantic and Pacific areas.

(b) The Digital Obstacle File. This file describes all obstacles of interest to aviation users in the U.S., with limited coverage of the Pacific, Caribbean, Canada, and Mexico. The obstacles are assigned unique numerical identifiers, accuracy codes, and listed in order of ascending latitude within each state or area.

2. The Coded Instrument Flight Procedures (CIFP) (ARINC 424 [Ver 13 & 15]). The CIFP is a basic digital dataset, modeled to an international standard, which can be used as a basis to support GPS navigation. Initial data elements included are: Airport and Helicopter Records, VHF and NDB Navigation aids, en route waypoints and airways. Additional data elements will be added in subsequent releases to include: departure procedures, standard terminal arrivals, and GPS/RNAV instrument approach procedures. The database is updated every 28 days. The data is available by subscription only and is distributed on CD-ROM or by ftp download.

3. digital-Visual Charts (d-VC). These digital VFR charts are geo-referenced images of FAA Sectional Aeronautical, TAC, and Helicopter Route charts. Additional digital data may easily be overlaid on the raster image using commonly available Geographic Information System software. Data such as weather, temporary flight restrictions, obstacles, or other geospatial data can be combined with d-VC data to support a variety of needs. The file resolution is 300 dots per inch and the data is 8-bit color. The data is provided as a GeoTIFF and distributed on DVD-R media and on the AIS website. The root mean square error of the transformation will not exceed two pixels. Digital-VCs are updated every 56 days and are available by subscription only.

FIG 9-1-15
U.S. Terminal Publication Volumes



■ 9–1–6. 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 website: <https://www.nga.mil/ProductsServices/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 Aéreo
Blvd. Puerto Aéreo 485
Zona Federal Del Aeropuerto Int'l
15620 Mexico D.F.
Mexico

d. International Civil Aviation Organization (ICAO). A list of free ICAO publications and catalogs is available at the following website: <https://www.icao.int/publications/Pages/default.aspx>.

(d) Upon reaching the published MAP, or as soon as practicable thereafter, the pilot should advise ATC whether proceeding visually and canceling IFR or complying with the missed approach instructions. See paragraph 5–1–15, Canceling IFR Flight Plan.

(e) Where any necessary visual reference requirements are specified by the FAA, at least one of the following visual references for the intended heliport is visible and identifiable before the pilot may proceed visually:

- (1) FATO or FATO lights.
- (2) TLOF or TLOF lights.
- (3) Heliport Instrument Lighting System (HILS).
- (4) Heliport Approach Lighting System (HALS).
- (5) Visual Glideslope Indicator (VGSI).
- (6) Windsock or windsock light.
- (7) Heliport beacon.

(8) Other facilities or systems approved by the Flight Technologies and Procedures Division (AFS–400).

2. Approach to a Point-in-Space (PinS). At locations where the MAP is located more than 2 SM from the landing area, or the path from the MAP to the landing area is populated with obstructions which require avoidance actions or requires turn greater than 30 degrees, a PinS Proceed VFR procedure may be developed. These approaches are annotated “PROCEED VFR FROM (named MAP) OR CONDUCT THE SPECIFIED MISSED APPROACH.”

(a) These procedures require the pilot, at or prior to the MAP, to determine if the published minimum visibility, or the weather minimums required by the operating rule (e.g., part 91, part 135, etc.), or operations specifications (whichever is higher) is available to safely transition from IFR to VFR flight. If not, the pilot must execute a missed approach. For part 135 operations, pilots may not begin the instrument approach unless the latest weather report indicates that the weather conditions are at or above the authorized IFR minimums or the VFR weather minimums (as required by the class of airspace, operating rule and/or Operations Specifications) whichever is higher.

(b) Visual contact with the landing site is not required; however, the pilot must have the appropriate VFR weather minimums throughout the visual segment. The visibility is limited to no lower than that published in the procedure, until canceling IFR.

(c) IFR obstruction clearance areas are not applied to the VFR segment between the MAP and the landing site. Pilots are responsible for obstacle or terrain avoidance from the MAP to the landing area.

(d) Upon reaching the MAP defined on the approach procedure, or as soon as practicable thereafter, the pilot should advise ATC whether proceeding VFR and canceling IFR, or complying with the missed approach instructions. See paragraph 5–1–15, Canceling IFR Flight Plan.

(e) If the visual segment penetrates Class B, C, or D airspace, pilots are responsible for obtaining a Special VFR clearance, when required.

10–1–4. The Gulf of America Grid System

a. On October 8, 1998, the Southwest Regional Office of the FAA, with assistance from the Helicopter Safety Advisory Conference (HSAC), implemented the world’s first Instrument Flight Rules (IFR) Grid System in the Gulf of America. This navigational route structure is completely independent of ground-based navigation aids (NAVAIDs) and was designed to facilitate helicopter IFR operations to offshore destinations. The Grid System is defined by over 300 offshore waypoints located 20 minutes apart (latitude and longitude). Flight plan

routes are routinely defined by just 4 segments: departure point (lat/long), first en route grid waypoint, last en route grid waypoint prior to approach procedure, and destination point (lat/long). There are over 4,000 possible offshore landing sites. Upon reaching the waypoint prior to the destination, the pilot may execute an Offshore Standard Approach Procedure (OSAP), a Helicopter En Route Descent Areas (HEDA) approach, or an Airborne Radar Approach (ARA). For more information on these helicopter instrument procedures, refer to FAA AC 90-80B, Approval of Offshore Standard Approach Procedures, Airborne Radar Approaches, and Helicopter En Route Descent Areas, on the FAA website <http://www.faa.gov> under Advisory Circulars. The return flight plan is just the reverse with the requested stand-alone GPS approach contained in the remarks section.

1. The large number (over 300) of waypoints in the grid system makes it difficult to assign phonetically pronounceable names to the waypoints that would be meaningful to pilots and controllers. A unique naming system was adopted that enables pilots and controllers to derive the fix position from the name. The five-letter names are derived as follows:

(a) The waypoints are divided into sets of 3 columns each. A three-letter identifier, identifying a geographical area or a NAVAID to the north, represents each set.

(b) Each column in a set is named after its position, i.e., left (L), center (C), and right (R).

(c) The rows of the grid are named alphabetically from north to south, starting with A for the northern most row.

EXAMPLE-

LCHRC would be pronounced "Lake Charles Romeo Charlie." The waypoint is in the right-hand column of the Lake Charles VOR set, in row C (third south from the northern most row).

2. In December 2009, significant improvements to the Gulf of America grid system were realized with the introduction of ATC separation services using ADS-B. In cooperation with the oil and gas services industry, HSAC and Helicopter Association International (HAI), the FAA installed an infrastructure of ADS-B ground stations, weather stations (AWOS) and VHF remote communication outlets (RCO) throughout a large area of the Gulf of America. This infrastructure allows the FAA's Houston ARTCC to provide "domestic-like" air traffic control service in the offshore area beyond 12nm from the coastline to hundreds of miles offshore to aircraft equipped with ADS-B. Properly equipped aircraft can now be authorized to receive more direct routing, domestic en route separation minima and real time flight following. Operators who do not have authorization to receive ATC separation services using ADS-B, will continue to use the low altitude grid system and receive procedural separation from Houston ARTCC. Non-ADS-B equipped aircraft also benefit from improved VHF communication and expanded weather information coverage.

3. Three requirements must be met for operators to file IFR flight plans utilizing the grid:

(a) The helicopter must be equipped for IFR operations and equipped with IFR approved GPS navigational units.

(b) The operator must obtain prior written approval from the appropriate Flight Standards District Office through a Letter of Authorization or Operations Specification, as appropriate.

(c) The operator must be a signatory to the Houston ARTCC Letter of Agreement.

4. Operators who wish to benefit from ADS-B based ATC separation services must meet the following additional requirements:

(a) The Operator's installed ADS-B Out equipment must meet the performance requirements of one of the following FAA Technical Standard Orders (TSO), or later revisions: TSO-C154c, Universal Access Transceiver (UAT) Automatic Dependent Surveillance-Broadcast (ADS-B) Equipment, or TSO-C166b, Extended Squitter Automatic Dependent Surveillance-Broadcast (ADS-B) and Traffic Information.

(b) Flight crews must comply with the procedures prescribed in the Houston ARTCC Letter of Agreement dated December 17, 2009, or later.

NOTE—

The unique ADS-B architecture in the Gulf of America 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 America 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, website address: http://www.faa.gov/air_traffic/flight_info/aeronav.

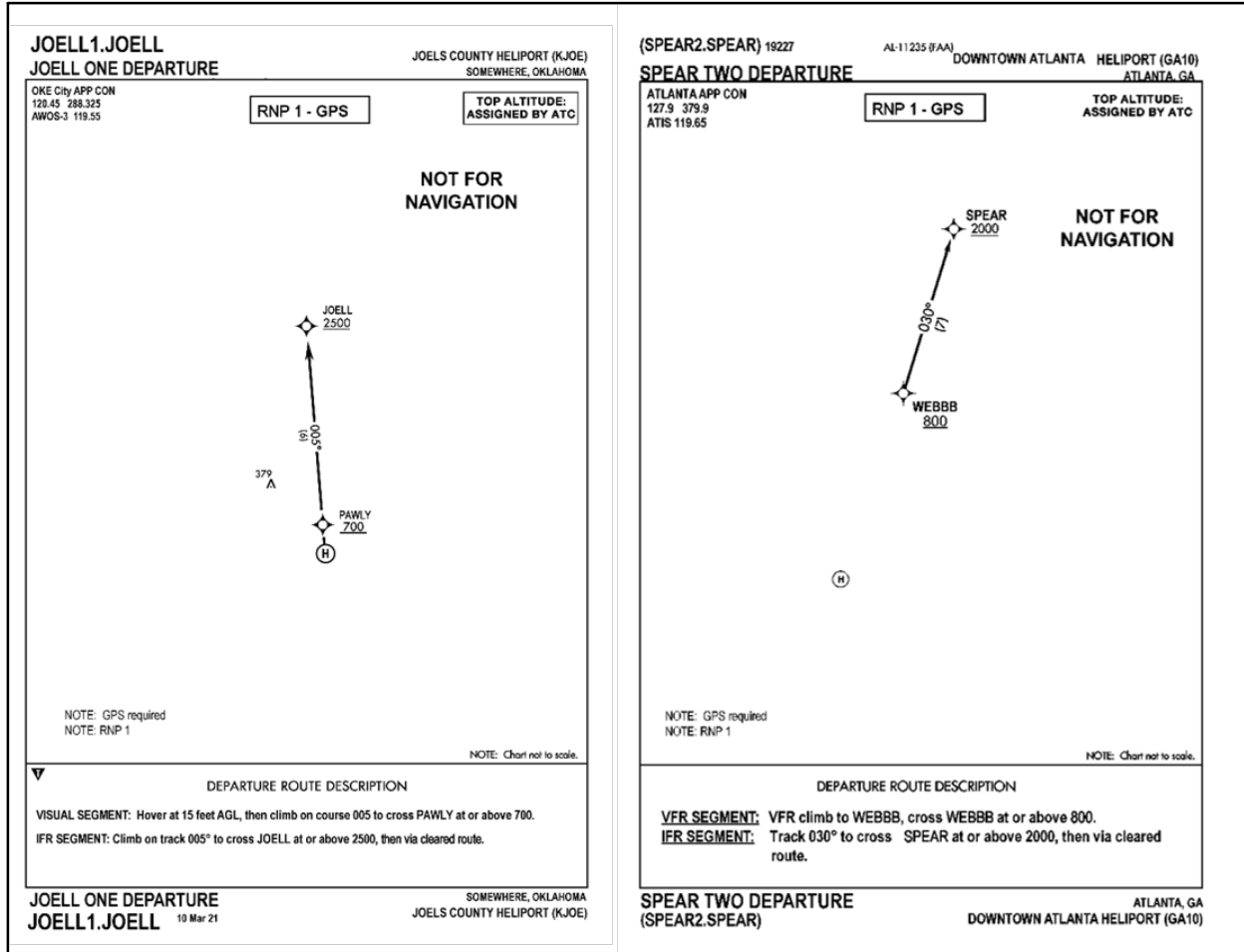
10-1-5. Departure Procedures

a. When departing from a location on a point-in-space (PinS) SID with a visual segment indicated and the departure instruction describes the visual segment the aircraft must cross the initial departure fix (IDF) outbound at-or-above the altitude depicted on the chart. The helicopter will initially establish a hover at or above the heliport crossing height (HCH) specified on the chart. The HCH specifies a minimum hover height to begin the climb to assist in avoiding obstacles. The helicopter will leave the departure location on the published outbound heading/course specified, climbing at least 400 ft/per NM (or as depicted on the chart), remaining clear of clouds, crossing at or above the IDF altitude specified, prior to proceeding outbound on the procedure. For example the chart may include these instructions: "Hover at 15 ft AGL, then climb on track 005, remaining clear of clouds, to cross PAWLY at or above 700."

b. When flying a PinS SID procedure containing a segment with instructions to "proceed VFR," the pilot must keep the aircraft clear of the clouds and cross the IDF outbound at or above the altitude depicted. Departure procedures that support multiple departure locations will have a Proceed VFR segment leading to the IDF. The chart will provide a bearing and distance to the IDF from the heliport. That bearing and distance are for pilot orientation purposes only and are not a required procedure track. The helicopter will leave the departure location via pilot navigation in order to align with the departure route and comply with the altitude specified at the IDF. For example, the chart may include these instructions: "VFR Climb to WEBBB, Cross WEBBB at or above 800."

c. Once the aircraft reaches the IDF, the aircraft should proceed out the described route as specified on the chart, crossing each consecutive fix at or above the indicated altitude(s) until reaching the end of the departure or as directed by ATC.

FIG 10-1-1
Departure Charts



Section 2. Special Operations

10-2-1. Offshore Helicopter Operations

a. Introduction

The offshore environment offers unique applications and challenges for helicopter pilots. The mission demands, the nature of oil and gas exploration and production facilities, and the flight environment (weather, terrain, obstacles, traffic), demand special practices, techniques and procedures not found in other flight operations. Several industry organizations have risen to the task of reducing risks in offshore operations, including the Helicopter Safety Advisory Conference (HSAC) (<http://www.hsac.org>), and the Offshore Committee of the Helicopter Association International (HAI) (<https://rotor.org/>). The following recommended practices for offshore helicopter operations are based on guidance developed by HSAC for use in the Gulf of America, and provided here with their permission. While not regulatory, these recommended practices provide aviation and oil and gas industry operators with useful information in developing procedures to avoid certain hazards of offshore helicopter operations.

NOTE—

Like all aviation practices, these recommended practices are under constant review. In addition to normal procedures for comments, suggested changes, or corrections to the AIM (contained in the Preface), any questions or feedback concerning these recommended procedures may also be directed to the HSAC through the feedback feature of the HSAC website (<http://www.hsac.org>).

b. Passenger Management on and about Heliport Facilities

1. Background. Several incidents involving offshore helicopter passengers have highlighted the potential for incidents and accidents on and about the heliport area. The following practices will minimize risks to passengers and others involved in heliport operations.

2. Recommended Practices

(a) Heliport facilities should have a designated and posted passenger waiting area which is clear of the heliport, heliport access points, and stairways.

(b) Arriving passengers and cargo should be unloaded and cleared from the heliport and access route prior to loading departing passengers and cargo.

(c) Where a flight crew consists of more than one pilot, one crewmember should supervise the unloading/loading process from outside the aircraft.

(d) Where practical, a designated facility employee should assist with loading/unloading, etc.

c. Crane-Helicopter Operational Procedures

1. Background. Historical experience has shown that catastrophic consequences can occur when industry safe practices for crane/helicopter operations are not observed. The following recommended practices are designed to minimize risks during crane and helicopter operations.

2. Recommended Practices

(a) Personnel awareness

(1) Crane operators and pilots should develop a mutual understanding and respect of the others' operational limitations and cooperate in the spirit of safety;

(2) Pilots need to be aware that crane operators sometimes cannot release the load to cradle the crane boom, such as when attached to wire line lubricators or supporting diving bells; and

(3) Crane operators need to be aware that helicopters require warm up before takeoff, a two-minute cool down before shutdown, and cannot circle for extended lengths of time because of fuel consumption.

(b) It is recommended that when helicopters are approaching, maneuvering, taking off, or running on the heliport, cranes be shutdown and the operator leave the cab. Cranes not in use must have their booms cradled, if feasible. If in use, the crane's boom(s) are to be pointed away from the heliport and the crane shutdown for helicopter operations.

(c) Pilots will not approach, land on, takeoff, or have rotor blades turning on heliports of structures not complying with the above practice.

(d) It is recommended that cranes on offshore platforms, rigs, vessels, or any other facility, which could interfere with helicopter operations (including approach/departure paths):

(1) Be equipped with a red rotating beacon or red high intensity strobe light connected to the system powering the crane, indicating the crane is under power;

(2) Be designed to allow the operator a maximum view of the helideck area and should be equipped with wide-angle mirrors to eliminate blind spots; and

(3) Have their boom tips, headache balls, and hooks painted with high visibility international orange.

d. Helicopter/Tanker Operations

1. Background. The interface of helicopters and tankers during shipboard helicopter operations is complex and may be hazardous unless appropriate procedures are coordinated among all parties. The following recommended practices are designed to minimize risks during helicopter/tanker operations:

2. Recommended Practices

(a) Management, flight operations personnel, and pilots should be familiar with and apply the operating safety standards set forth in "Guide to Helicopter/Ship Operations", International Chamber of Shipping, Third Edition, 5-89 (as amended), establishing operational guidelines/standards and safe practices sufficient to safeguard helicopter/tanker operations.

(b) Appropriate plans, approvals, and communications must be accomplished prior to reaching the vessel, allowing tanker crews sufficient time to perform required safety preparations and position crew members to receive or dispatch a helicopter safely.

(c) Appropriate approvals and direct communications with the bridge of the tanker must be maintained throughout all helicopter/tanker operations.

(d) Helicopter/tanker operations, including landings/departures, must not be conducted until the helicopter pilot-in-command has received and acknowledged permission from the bridge of the tanker.

(e) Helicopter/tanker operations must not be conducted during product/cargo transfer.

(f) Generally, permission will not be granted to land on tankers during mooring operations or while maneuvering alongside another tanker.

e. Helideck/Heliport Operational Hazard Warning(s) Procedures

1. Background

(a) A number of operational hazards can develop on or near offshore helidecks or onshore heliports that can be minimized through procedures for proper notification or visual warning to pilots. Examples of hazards include but are not limited to:

(1) Perforating operations: subparagraph f.

(2) H₂S gas presence: subparagraph g.

(3) Gas venting: subparagraph h; or,

(4) Closed helidecks or heliports: subparagraph i (unspecified cause).

(b) These and other operational hazards are currently minimized through timely dissemination of a written Notice to Airmen (NOTAM) for pilots by helicopter companies and operators. A NOTAM provides a

written description of the hazard, time and duration of occurrence, and other pertinent information. ANY POTENTIAL HAZARD should be communicated to helicopter operators or company aviation departments as early as possible to allow the NOTAM to be activated.

(c) To supplement the existing NOTAM procedure and further assist in reducing these hazards, a standardized visual signal(s) on the helideck/heliport will provide a positive indication to an approaching helicopter of the status of the landing area. Recommended Practice(s) have been developed to reinforce the NOTAM procedures and standardize visual signals.

f. Drilling Rig Perforating Operations: Helideck/Heliport Operational Hazard Warning(s)/Procedure(s)

1. Background. A critical step in the oil well completion process is perforation, which involves the use of explosive charges in the drill pipe to open the pipe to oil or gas deposits. Explosive charges used in conjunction with perforation operations offshore can potentially be prematurely detonated by radio transmissions, including those from helicopters. The following practices are recommended.

2. Recommended Practices

(a) Personnel Conducting Perforating Operations. Whenever perforating operations are scheduled and operators are concerned that radio transmissions from helicopters in the vicinity may jeopardize the operation, personnel conducting perforating operations should take the following precautionary measures:

(1) Notify company aviation departments, helicopter operators or bases, and nearby manned platforms of the pending perforation operation so the Notice to Airmen (NOTAM) system can be activated for the perforation operation and the temporary helideck closure.

(2) Close the deck and make the radio warning clearly visible to passing pilots, install a temporary marking (described in subparagraph 10-2-1i1(b)) with the words “NO RADIO” stenciled in red on the legs of the diagonals. The letters should be 24 inches high and 12 inches wide. (See FIG 10-2-1.)

(3) The marker should be installed during the time that charges may be affected by radio transmissions.

(b) Pilots

(1) When operating within 1,000 feet of a known perforation operation or observing the white X with red “NO RADIO” warning indicating perforation operations are underway, pilots will avoid radio transmissions from or near the helideck (within 1,000 feet) and will not land on the deck if the X is present. In addition to communications radios, radio transmissions are also emitted by aircraft radar, transponders, ADS-B equipment, radar altimeters, and DME equipment, and ELTs.

(2) Whenever possible, make radio calls to the platform being approached or to the Flight Following Communications Center at least one mile out on approach. Ensure all communications are complete outside the 1,000 foot hazard distance. If no response is received, or if the platform is not radio equipped, further radio transmissions should not be made until visual contact with the deck indicates it is open for operation (no white “X”).

g. Hydrogen Sulfide Gas Helideck/Heliport Operational Hazard Warning(s)/Procedures

1. Background. Hydrogen sulfide (H₂S) gas: Hydrogen sulfide gas in higher concentrations (300–500 ppm) can cause loss of consciousness within a few seconds and presents a hazard to pilots on/near offshore helidecks. When operating in offshore areas that have been identified to have concentrations of hydrogen sulfide gas, the following practices are recommended.

2. Recommended Practices

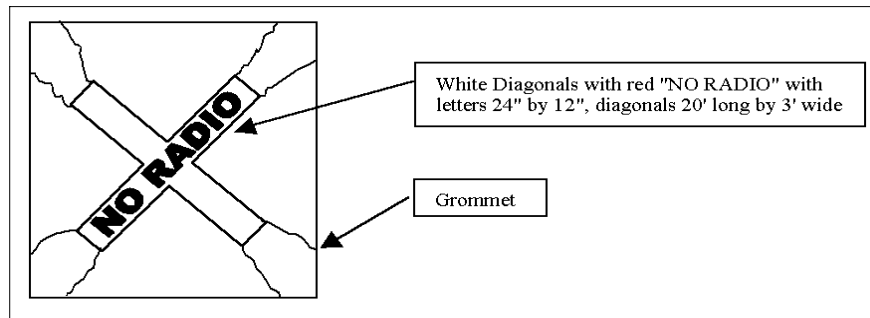
(a) Pilots

(1) Ensure approved protective air packs are available for emergency use by the crew on the helicopter.

(2) If shutdown on a helideck, request the supervisor in charge provide a briefing on location of protective equipment and safety procedures.

(3) If while flying near a helideck and the visual red beacon alarm is observed or an unusually strong odor of “rotten eggs” is detected, immediately don the protective air pack, exit to an area upwind, and notify the suspected source field of the hazard.

FIG 10-2-1
Closed Helideck Marking – No Radio



(b) Oil Field Supervisors

(1) If presence of hydrogen sulfide is detected, a red rotating beacon or red high intensity strobe light adjacent to the primary helideck stairwell or wind indicator on the structure should be turned on to provide visual warning of hazard. If the beacon is to be located near the stairwell, the State of Louisiana “Offshore Heliport Design Guide” and FAA Advisory Circular (AC) 150/5390-2A, Heliport Design Guide, should be reviewed to ensure proper clearance on the helideck.

(2) Notify nearby helicopter operators and bases of the hazard and advise when hazard is cleared.

(3) Provide a safety briefing to include location of protective equipment to all arriving personnel.

(4) Wind socks or indicator should be clearly visible to provide upwind indication for the pilot.

h. Gas Venting Helideck/Heliport Operational Hazard Warning(s)/Procedures – Operations Near Gas Vent Booms

1. Background. Ignited flare booms can release a large volume of natural gas and create a hot fire and intense heat with little time for the pilot to react. Likewise, unignited gas vents can release reasonably large volumes of methane gas under certain conditions. Thus, operations conducted very near unignited gas vents require precautions to prevent inadvertent ingestion of combustible gases by the helicopter engine(s). The following practices are recommended.

2. Pilots

(a) Gas will drift upwards and downwind of the vent. Plan the approach and takeoff to observe and avoid the area downwind of the vent, remaining as far away as practicable from the open end of the vent boom.

(b) Do not attempt to start or land on an offshore helideck when the deck is downwind of a gas vent unless properly trained personnel verify conditions are safe.

3. Oil Field Supervisors

(a) During venting of large amounts of unignited raw gas, a red rotating beacon or red high intensity strobe light adjacent to the primary helideck stairwell or wind indicator should be turned on to provide visible warning of hazard. If the beacon is to be located near the stairwell, the State of Louisiana “Offshore Heliport Design Guide” and FAA AC 150/5390-2A, Heliport Design Guide, should be reviewed to ensure proper clearance from the helideck.

(b) Notify nearby helicopter operators and bases of the hazard for planned operations.

11–8–5. Emergency UAS Authorizations Through Special Government Interest (SGI) Airspace Waivers

a. Background. UAS are used by public safety agencies to respond to emergencies. The SGI process is for any part 107 or part 91 operator that either due to time limitations, airspace restrictions or emergency situations that requires expedited authorization by contacting the system operations support center (SOSC) at 9–ATOR–HQ–SOSC@faa.gov.

b. The SGI process, depending on the nature of the operation, can be completed in a matter of minutes. This process enables response to an emergency with UAS in an expeditious manner.

c. Public Safety organizations may apply for expedited airspace authorizations through the SGI process. The SGI process is defined in FAA Order JO 7210.3, Facility Operation and Administration.

REFERENCE–

FAA Order JO 7210.3, Facility Operation and Administration.

d. Additional information regarding SGI authorizations can be located at the FAA’s Emergency Situations webpage.

NOTE–

The FAA’s Emergency Situations website may be reviewed at:

https://www.faa.gov/uas/advanced_operations/emergency_situations/.

11–8–6. Environmental Best Practices

a. Unmanned aircraft operate in a similar environment to manned aircraft. Since most UAS operations are conducted at low altitude, hazards, risks and potential environment factors may be encountered on a more frequent basis. In addition to the Bird Hazards, Flight over National Refuges, Parks, and Forests, the following factors must also be considered:

1. Flight Near Protected Conservation Areas. UAS, if misused, can have devastating impacts on protected wildlife. UAS operators may check for conservation area airspace restrictions on the B4UFLY mobile app.

2. Flight(s) Near Noise Sensitive Areas. Consider the following:

(a) UAS operations and flight paths should be planned to avoid prolonged or repetitive flight at low altitude near noise sensitive areas.

(b) As described in FAA Order 1050.1, Environmental Impact: Policies and Procedures, an area is “noise sensitive” if noise interferes with any normal activities associated with the area’s use.

REFERENCE–

FAA Order 1050.1, Environmental Impact: Policies and Procedures.

(c) To the extent consistent with FAA safety requirements, operators should observe best practices developed by the National Park Service, U.S. Fish and Wildlife Service, U.S. Forest Service, and National Oceanic and Atmospheric Administration when operating above areas administered by those agencies. The National Park Service provides additional guidance at their Unmanned Aircraft Systems website.

NOTE–

The National Park Service, Unmanned Aircraft Systems website may be viewed at: <https://www.nps.gov/subjects/sound/uas.htm>.

b. Some bird species have shown the potential to attack UAS that approach their nesting and hunting areas too closely. The type of birds that are most likely to attack sUAS are raptors such as hawks, eagles, and falcons. However, gulls, geese, and crows have also been known to attack UAS. Aggressive bird attacks may damage UAS propellers or other critical equipment, and may result in sudden loss of power or engine failure. Remote pilots and recreational flyers should consider reviewing engine–out procedures, especially when operating near high bird concentrations.

11–8–7. Resources for UAS Operators

a. FAA.GOV/UAS. The FAA UAS website, www.faa.gov/uas, is the central point for information about FAA UAS rules, regulations, and safety best practices.

b. FAA DroneZone. The FAA DroneZone is the Agency’s portal for registering drones, requesting part 107 airspace authorizations and waivers, registering as a CBO, requesting fixed flying sites, and other tasks.

c. Local FAA offices (Flight Standards District Offices/FSDOs). FSDOs can be the best in–person source for UAS information. A list of FSDOs in the United States is at https://www.faa.gov/about/office_org/field_offices/fsdo/all_fsdo/.

d. Aeronautical Information. The FAA provides aeronautical information to NAS users, including UAS pilots, through a variety of methods, including publications like this manual, other publications, Advisory Circulars (ACs), charts, website and mobile applications, etc. Check https://www.faa.gov/air_traffic/flight_info/aeronav/safety_alerts/ for these items.

e. The UAS Support Center. For general question or comment about UAS or drones, the FAA’s Support Center is available at 844–FLY–MY–UA or UASHelp@faa.gov.

f. Clubs and Associations. Local UAS recreational clubs, CBO organizations, and business associations are excellent resources for information and updates on flying in the local region.

g. LAANC. LAANC is the Low Altitude Authorization and Notification Capability, a collaboration between FAA and industry. It automates the application and approval process for airspace authorizations. Using applications developed by an FAA–approved UAS service supplier (USS) you can apply for an airspace authorization at over 600 airports. Download the free LAANC app at https://www.faa.gov/uas/programs_partnerships/data_exchange/.

h. B4UFLY. The B4UFLY mobile application is a partnership between the FAA and Kittyhawk. The app helps recreational flyers know whether it is safe to fly their drone, as well as increases their situational awareness. Download the free B4UFLY app at https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/b4ufly/.

i. Weather Sources. Aviation weather services (such as <https://www.aviationweather.gov/>) are generally targeted towards manned aviation, the FAA is currently working on UAS–specific weather applications.

j. NOTAMs. The Notice to Airmen (NOTAM) system, like aviation weather sources, remains primarily predicated on manned aviation needs. However, the system provides continual updates on all aviation activity (to include UAS flight activities which have been input to the FAA), as well as airport status. The NOTAM system will be of greatest use to larger UAS activities, UAS en route operations in controlled airspace, and those flying to or from airports. NOTAMs, temporary flight restrictions (TFRs), and aircraft safety alerts can be accessed at https://www.faa.gov/pilots/safety/notams_tfr/.

TBL 4-13

Filing for Performance Based Navigation (PBN) Routes

Type of Routing	Capability Required	Item 10a	Item 18 PBN/ See NOTE 2	Item 18 NAV/ See NOTE 3	Notes
RNAV SID or STAR (See NOTE 1)	RNAV 1	GR	D2		If GNSS
		DIR	D4		If DME/DME/IRU
RNP SID or STAR (See NOTE 2)	RNP 1 GNSS	GR	O2		If GNSS only
	RNP 1 GNSS	DGIR	O1		If GNSS primary and DME/DME/IRU backup
RNP SID or STAR with RF required (See NOTE 2)	RNP 1 GNSS	GRZ	O2	Z1	If GNSS only
	RNP 1 GNSS	DGIRZ	O1	Z1	If GNSS primary and DME/DME/IRU backup
Domestic Q-Route (see separate requirements for Gulf of America Q-Routes)	RNAV 2	GR	C2		If GNSS
		DIR	C4		If DME/DME/IRU
T-Route	RNAV 2	GR	C2		GNSS is required for T-Routes
RNAV (GPS) Approach	RNP Approach, GPS	GR	S1		<i>Domestic arrivals do not need to file PBN approach capabilities to request the approach.</i>
RNAV (GPS) Approach	RNP Approach, GPS Baro-VNAV	GR	S2		
RNAV (GPS) Approach with RF required	RNP Approach, GPS RF Capability	GRZ	S2	Z1	
RNP AR Approach with RF	RNP (Special Autho- rization Required) RF Leg Capability	GR	T1		
RNP AR Approach with- out RF	RNP (Special Autho- rization Required)	GR	T2		

NOTE-

1. If the flight is requesting an RNAV SID only (no RNAV STAR) or RNAV STAR only (no RNAV SID) then consult guidance on the FAA website at

https://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/air_traffic_services/flight_plan_filing.

2. PBN descriptor D1 includes the capabilities of D2, D3, and D4. PBN descriptor B1 includes the capabilities of B2, B3, B4, and B5. PBN descriptor C1 includes the capabilities of C2, C3, and C4.

3. In NAV/, descriptors for advanced capabilities (Z1, P1, R1, M1, and M2) should be entered as a single character string with no intervening spaces, and separated from any other entries in NAV/ by a space.

EXAMPLE-

NAV/Z1P1M2 SBAS

7. Automated Departure Clearance Delivery (DCL or PDC). When planning to use automated pre-departure clearance delivery capability, file as indicated below.

(a) PDC provides pre-departure clearances from the FAA to the operator's designated flight operations center, which then delivers the clearance to the pilot by various means. Use of PDC does not require any special flight plan entry.

(b) DCL provides pre-departure clearances from the FAA directly to the cockpit/FMS via Controller Pilot Datalink Communications (CPDLC). Use of DCL requires flight plan entries as follows:

- Include CPDLC codes in Item 10a only if the flight is capable of en route/oceanic CPDLC, the codes are not required for DCL.
- Include Z in Item 10a to indicate there is information provided in Item 18 DAT/.
- Include the clearance delivery methods of which the flight is capable, and order of preference in Item 18 DAT/. (See AIM 5–2–2)
 - VOICE – deliver clearance via Voice
 - PDC – deliver clearance via PDC
 - FANS – deliver clearance via FANS 1/A
 - FANSP – deliver clearance via FANS 1/A+

EXAMPLE–*DAT/1FANS2PDC**DAT/1FANSP2VOICE*

8. Operating in Reduced Vertical Separation Minima (RVSM) Airspace (Item 10a). When planning to fly in RVSM airspace (FL 290 up to and including FL 410) then file as indicated below.

(a) If capable and approved for RVSM operations, per AIM 4–6–1, Applicability and RVSM Mandate (Date/Time and Area), file a W in Item 10a. Include the aircraft registration mark in Item 18 REG/, which is used to post–operationally monitor the safety of RVSM operations.

- Do not file a “W” in Item 10a if the aircraft is capable of RVSM operations, but is not approved to operate in RVSM airspace.
- If RVSM capability is lost after the flight plan is filed, request that ATC remove the ‘W’ from Item 10a.

(b) When requesting to operate non–RVSM in RVSM airspace, using one of the exceptions identified in AIM 4–6–10, do not include a “W” in Item 10a. Include STS/NONRVSM in Item 18. STS/NONRVSM is used only as part of a request to operate non–RVSM in RVSM airspace.

9. Eligibility for Reduced Oceanic Separation. Indicate eligibility for the listed reduced separation minima as indicated in the tables below. Full Operational Requirements for these services are found in the U.S. Aeronautical Information Publication (AIP) ENR 7, Oceanic Operations, available at http://www.faa.gov/air_traffic/publications/atpubs/aip_html/index.html.

*TBL 4–14***Filing for Gulf of America CTA**

Dimension of Separation	Separation Minima	ADS–C Surveillance Requirements	Comm. Requirement	PBN Requirement	Flight Plan Entries			
					ADS–C in Item 10b	CPDLC in Item 10a	PBN in Item 18 PBN/ (also File ‘R’ in Item 10a)	PBN in Item 18 NAV/
Lateral	50 NM	N/A (ADS–C not required)	Voice comm–HF or VHF as required to maintain contact over the entire route to be flown.	RNP10 or RNP4	N/A	N/A	A1 or L1	N/A

NOTE–

If not RNAV10/RNP10 capable and planning to operate in the Gulf of America CTA, then put the notation NON–RNP10 in Item 18 RMK/, preferably first.

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. Terms used in this glossary that apply to flight service station (FSS) roles are included when they differ from air traffic control functions. These terms are followed by "[FSS]."

d. This Glossary will be revised, as necessary, to maintain a common understanding of the system.

EXPLANATION OF CHANGES

e. Terms Added:

AIRPLANE
POWERED LIFT
ROTORCRAFT
VERTIPAD
VERTIPORT

f. Terms Deleted:

LAHSO-DRY
LAHSO-WET
SIMPLIFIED DIRECTIONAL FACILITY (SDF)

g. Terms Modified:

AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER (ATCSCC)
AIRCRAFT
AUTOMATED SERVICES
FLIGHT SERVICE STATION
HELICOPTER
LAHSO
LAND AND HOLD SHORT OPERATIONS
NATIONAL FLIGHT DATA DIGEST (NFDD)
NOTAM
NOTICE TO AIR MISSIONS (NOTAM)
TRAFFIC MANAGEMENT PROGRAM ALERT
TRAFFIC PATTERN
WEATHER RECONNAISSANCE AREA (WRA)

h. Editorial/format changes were made where necessary. Revision bars were not used due to the insignificant nature of the changes.

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.)

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.

e. Air Traffic Organization (ATO) Space Operations and Unmanned Aircraft System (UAS); the Office of Primary Responsibility (OPR) for all space and upper class E tactical operations in the National Airspace System (NAS).

AIR TRAFFIC SERVICE– A generic term meaning:

- a. Flight Information Service.**
- b. Alerting Service.**
- c. Air Traffic Advisory Service.**
- d. Air Traffic Control Service:**
 - 1. Area Control Service,**
 - 2. Approach Control Service, or**
 - 3. Airport Control Service.**

AIR TRAFFIC ORGANIZATION (ATO) – The FAA line of business responsible for providing safe and efficient air navigation services in the national airspace system.

AIR TRAFFIC SERVICE (ATS) ROUTES – The term “ATS Route” is a generic term that includes “VOR Federal airways,” “colored Federal airways,” “jet routes,” and “RNAV routes.” The term “ATS route” does not replace these more familiar route names, but serves only as an overall title when listing the types of routes that comprise the United States route structure.

AIRBORNE– An aircraft is considered airborne when all parts of the aircraft are off the ground.

AIRBORNE DELAY– Amount of delay to be encountered in airborne holding.

AIRBORNE REROUTE (ABRR)– A capability within the Traffic Flow Management System used for the timely development and implementation of tactical reroutes for airborne aircraft. This capability defines a set of aircraft-specific reroutes that address a certain traffic flow problem and then electronically transmits them to En Route Automation Modernization (ERAM) for execution by the appropriate sector controllers.

AIRCRAFT– Device(s) that are used or intended to be used for flight in the air, and when used in air traffic control terminology, may include the flight crew. The term is inclusive of all types, including but not limited to, airplane, glider, lighter-than-air, powered-lift, and rotorcraft.

(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 HAZARD AREA (AHA)– Used by ATC to segregate air traffic from a launch vehicle, reentry vehicle, amateur rocket, jettisoned stages, hardware, or falling debris generated by failures associated with any of these activities. An AHA is designated via NOTAM as either a TFR or stationary ALTRV. Unless otherwise specified, the vertical limits of an AHA are from the surface to unlimited.

(See CONTINGENCY HAZARD AREA.)

(See REFINED HAZARD AREA.)

(See TRANSITIONAL HAZARD AREA.)

AIRCRAFT LIST (ACL)– A view available with EDST that lists aircraft currently in or predicted to be in a particular sector's airspace. The view contains textual flight data information in line format and may be sorted into various orders based on the specific needs of the sector team.

(See EN ROUTE DECISION SUPPORT TOOL.)

AIRCRAFT SURGE LAUNCH AND RECOVERY– Procedures used at USAF bases to provide increased launch and recovery rates in instrument flight rules conditions. ASLAR is based on:

- a. Reduced separation between aircraft which is based on time or distance. Standard arrival separation applies between participants including multiple flights until the DRAG point. The DRAG point is a published location on an ASLAR approach where aircraft landing second in a formation slows to a predetermined airspeed. The DRAG point is the reference point at which MARSAs apply as expanding elements effect separation within a flight or between subsequent participating flights.

b. ASLAR procedures must be covered in a Letter of Agreement between the responsible USAF military ATC facility and the concerned Federal Aviation Administration facility. Initial Approach Fix spacing requirements are normally addressed as a minimum.

AIRCRAFT WAKE TURBULENCE CATEGORIES– For the purpose of Wake Turbulence Recategorization (RECAT) Separation Minima, ATC groups aircraft into categories ranging from Category A through Category I, dependent upon the version of RECAT that is applied. Specific category assignments vary and are listed in the RECAT Orders.

AIRMEN'S METEOROLOGICAL INFORMATION (AIRMET)– A concise description of an occurrence or expected occurrence of specified en route weather phenomena that may affect the safety of aircraft operations, but at intensities lower than those that require the issuance of a SIGMET. An AIRMET may be issued when any of the following weather phenomena are occurring or expected to occur:

- a.** Moderate turbulence
 - b.** Low-level windshear
 - c.** Strong surface winds greater than 30 knots
 - d.** Moderate icing
 - e.** Freezing level
 - f.** Mountain obscuration
 - g.** IFR
- (See CONVECTIVE SIGMET.)
 (See CWA.)
 (See GRAPHICAL AIRMEN'S METEOROLOGICAL INFORMATION.)
 (See SAW.)
 (See SIGMET.)
 (Refer to AIM.)

AIRPLANE– An engine-driven fixed-wing aircraft heavier than air that is supported in flight by the dynamic reaction of the air against its wings.

AIRPORT– An area on land or water that is used or intended to be used for the landing and takeoff of aircraft and includes its buildings and facilities, if any.

AIRPORT ADVISORY AREA– The area within ten miles of an airport without a control tower or where the tower is not in operation, and on which a Flight Service Station is located.

(See LOCAL AIRPORT ADVISORY.)
 (Refer to AIM.)

AIRPORT ARRIVAL RATE (AAR)– A dynamic input parameter specifying the number of arriving aircraft which an airport or airspace can accept from the ARTCC per hour. The AAR is used to calculate the desired interval between successive arrival aircraft.

AIRPORT DEPARTURE RATE (ADR)– A dynamic parameter specifying the number of aircraft which can depart an airport and the airspace can accept per hour.

AIRPORT ELEVATION– The highest point of an airport's usable runways measured in feet from mean sea level.
 (See TOUCHDOWN ZONE ELEVATION.)
 (See ICAO term AERODROME ELEVATION.)

AIRPORT LIGHTING– Various lighting aids that may be installed on an airport. Types of airport lighting include:

a. Approach Light System (ALS)– An airport lighting facility which provides visual guidance to landing aircraft by radiating light beams in a directional pattern by which the pilot aligns the aircraft with the extended centerline of the runway on his/her final approach for landing. Condenser-Discharge Sequential Flashing

Lights/Sequenced Flashing Lights may be installed in conjunction with the ALS at some airports. Types of Approach Light Systems are:

1. ALSF-1– Approach Light System with Sequenced Flashing Lights in ILS Cat-I configuration.
2. ALSF-2– Approach Light System with Sequenced Flashing Lights in ILS Cat-II configuration. The ALSF-2 may operate as an SSALR when weather conditions permit.
3. SSALF– Simplified Short Approach Light System with Sequenced Flashing Lights.
4. SSALR– Simplified Short Approach Light System with Runway Alignment Indicator Lights.
5. MALSF– Medium Intensity Approach Light System with Sequenced Flashing Lights.
6. MALSR– Medium Intensity Approach Light System with Runway Alignment Indicator Lights.
7. RLLS– Runway Lead-in Light System Consists of one or more series of flashing lights installed at or near ground level that provides positive visual guidance along an approach path, either curving or straight, where special problems exist with hazardous terrain, obstructions, or noise abatement procedures.
8. RAIL– Runway Alignment Indicator Lights– Sequenced Flashing Lights which are installed only in combination with other light systems.
9. ODALS– Omnidirectional Approach Lighting System consists of seven omnidirectional flashing lights located in the approach area of a nonprecision runway. Five lights are located on the runway centerline extended with the first light located 300 feet from the threshold and extending at equal intervals up to 1,500 feet from the threshold. The other two lights are located, one on each side of the runway threshold, at a lateral distance of 40 feet from the runway edge, or 75 feet from the runway edge when installed on a runway equipped with a VASI. (Refer to FAA Order JO 6850.2, Visual Guidance Lighting Systems.)
 - b. Runway Lights/Runway Edge Lights– Lights having a prescribed angle of emission used to define the lateral limits of a runway. Runway lights are uniformly spaced at intervals of approximately 200 feet, and the intensity may be controlled or preset.
 - c. Touchdown Zone Lighting– Two rows of transverse light bars located symmetrically about the runway centerline normally at 100 foot intervals. The basic system extends 3,000 feet along the runway.
 - d. Runway Centerline Lighting– Flush centerline lights spaced at 50-foot intervals beginning 75 feet from the landing threshold and extending to within 75 feet of the opposite end of the runway.
 - e. Threshold Lights– Fixed green lights arranged symmetrically left and right of the runway centerline, identifying the runway threshold.
 - f. Runway End Identifier Lights (REIL)– Two synchronized flashing lights, one on each side of the runway threshold, which provide rapid and positive identification of the approach end of a particular runway.
 - g. Visual Approach Slope Indicator (VASI)– An airport lighting facility providing vertical visual approach slope guidance to aircraft during approach to landing by radiating a directional pattern of high intensity red and white focused light beams which indicate to the pilot that he/she is “on path” if he/she sees red/white, “above path” if white/white, and “below path” if red/red. Some airports serving large aircraft have three-bar VASIs which provide two visual glide paths to the same runway.
 - h. Precision Approach Path Indicator (PAPI)– An airport lighting facility, similar to VASI, providing vertical approach slope guidance to aircraft during approach to landing. PAPIs consist of a single row of either two or four lights, normally installed on the left side of the runway, and have an effective visual range of about 5 miles during the day and up to 20 miles at night. PAPIs radiate a directional pattern of high intensity red and white focused light beams which indicate that the pilot is “on path” if the pilot sees an equal number of white lights and red lights, with white to the left of the red; “above path” if the pilot sees more white than red lights; and “below path” if the pilot sees more red than white lights.
 - i. Boundary Lights– Lights defining the perimeter of an airport or landing area.
(Refer to AIM.)

AIRPORT MARKING AIDS– Markings used on runway and taxiway surfaces to identify a specific runway, a runway threshold, a centerline, a hold line, etc. A runway should be marked in accordance with its present usage such as:

- a. Visual.
 - b. Nonprecision instrument.
 - c. Precision instrument.
- (Refer to AIM.)

AIRPORT REFERENCE POINT (ARP)– The approximate geometric center of all usable runway surfaces.

AIRPORT RESERVATION OFFICE– Office responsible for monitoring the operation of slot controlled airports. It receives and processes requests for unscheduled operations at slot controlled airports.

AIRPORT ROTATING BEACON– A visual NAVAID operated at many airports. At civil airports, alternating white and green flashes indicate the location of the airport. At military airports, the beacons flash alternately white and green, but are differentiated from civil beacons by dualpeaked (two quick) white flashes between the green flashes.

(See INSTRUMENT FLIGHT RULES.)

(See SPECIAL VFR OPERATIONS.)

(See ICAO term AERODROME BEACON.)

(Refer to AIM.)

AIRPORT SURFACE DETECTION EQUIPMENT (ASDE)– Surveillance equipment specifically designed to detect aircraft, vehicular traffic, and other objects, on the surface of an airport, and to present the image on a tower display. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways. There are three ASDE systems deployed in the NAS:

- a. ASDE–3– a Surface Movement Radar.
- b. ASDE–X– a system that uses an X–band Surface Movement Radar, multilateration, and ADS–B.
- c. Airport Surface Surveillance Capability (ASSC)– A system that uses Surface Movement Radar, multilateration, and ADS–B.

AIRPORT SURVEILLANCE RADAR– Approach control radar used to detect and display an aircraft’s position in the terminal area. ASR provides range and azimuth information but does not provide elevation data. Coverage of the ASR can extend up to 60 miles.

AIRPORT TAXI CHARTS–

(See AERONAUTICAL CHART.)

AIRPORT TRAFFIC CONTROL SERVICE– A service provided by a control tower for aircraft operating on the movement area and in the vicinity of an airport.

(See MOVEMENT AREA.)

(See TOWER.)

(See ICAO term AERODROME CONTROL SERVICE.)

AIRPORT TRAFFIC CONTROL TOWER–

(See TOWER.)

AIRSPACE CONFLICT– Predicted conflict of an aircraft and active Special Activity Airspace (SAA).

AIRSPACE FLOW PROGRAM (AFP)– AFP is a Traffic Management (TM) process administered by the Air Traffic Control System Command Center (ATCSCC) where aircraft are assigned an Expect Departure Clearance Time (EDCT) in order to manage capacity and demand for a specific area of the National Airspace System (NAS). The purpose of the program is to mitigate the effects of en route constraints. It is a flexible program and may be implemented in various forms depending upon the needs of the air traffic system.

AIRSPACE HIERARCHY– Within the airspace classes, there is a hierarchy and, in the event of an overlap of airspace: Class A preempts Class B, Class B preempts Class C, Class C preempts Class D, Class D preempts Class E, and Class E preempts Class G.

AIRSPEED– The speed of an aircraft relative to its surrounding air mass. The unqualified term “airspeed” means one of the following:

a. Indicated Airspeed– The speed shown on the aircraft airspeed indicator. This is the speed used in pilot/controller communications under the general term “airspeed.”

(Refer to 14 CFR part 1.)

b. True Airspeed– The airspeed of an aircraft relative to undisturbed air. Used primarily in flight planning and en route portion of flight. When used in pilot/controller communications, it is referred to as “true airspeed” and not shortened to “airspeed.”

AIRSPACE RESERVATION– The term used in oceanic ATC for airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. Airspace reservations must be classified as either “moving” or “stationary.”

(See MOVING AIRSPACE RESERVATION)

(See STATIONARY AIRSPACE RESERVATION.)

(See ALTITUDE RESERVATION.)

AIRSTART– The starting of an aircraft engine while the aircraft is airborne, preceded by engine shutdown during training flights or by actual engine failure.

AIRWAY– A Class E airspace area established in the form of a corridor, the centerline of which is defined by radio navigational aids.

(See FEDERAL AIRWAYS.)

(See ICAO term AIRWAY.)

(Refer to 14 CFR part 71.)

(Refer to AIM.)

AIRWAY [ICAO]– A control area or portion thereof established in the form of corridor equipped with radio navigational aids.

AIRWAY BEACON– Used to mark airway segments in remote mountain areas. The light flashes Morse Code to identify the beacon site.

(Refer to AIM.)

AIS–

(See AERONAUTICAL INFORMATION SERVICES.)

AIT–

(See AUTOMATED INFORMATION TRANSFER.)

ALERFA (Alert Phase) [ICAO]– A situation wherein apprehension exists as to the safety of an aircraft and its occupants.

ALERT– A notification to a position that there is an aircraft-to-aircraft or aircraft-to-airspace conflict, as detected by Automated Problem Detection (APD).

ALERT AREA–

(See SPECIAL USE AIRSPACE.)

ALERT NOTICE (ALNOT)– A request originated by a flight service station (FSS) or an air route traffic control center (ARTCC) for an extensive communication search for overdue, unreported, or missing aircraft.

ALERTING SERVICE– A service provided to notify appropriate organizations regarding aircraft in need of search and rescue aid and assist such organizations as required.

ALNOT–

(See ALERT NOTICE.)

ALONG-TRACK DISTANCE (ATD)– The horizontal distance between the aircraft’s current position and a fix measured by an area navigation system that is not subject to slant range errors.

ALPHANUMERIC DISPLAY– Letters and numerals used to show identification, altitude, beacon code, and other information concerning a target on a radar display.

ALTERNATE AERODROME [ICAO]– An aerodrome to which an aircraft may proceed when it becomes either impossible or inadvisable to proceed to or to land at the aerodrome of intended landing.

Note: The aerodrome from which a flight departs may also be an en-route or a destination alternate aerodrome for the flight.

ALTERNATE AIRPORT– An airport at which an aircraft may land if a landing at the intended airport becomes inadvisable.

(See ICAO term ALTERNATE AERODROME.)

ALTIMETER SETTING– The barometric pressure reading used to adjust a pressure altimeter for variations in existing atmospheric pressure or to the standard altimeter setting (29.92).

(Refer to 14 CFR part 91.)

(Refer to AIM.)

ALTITUDE– The height of a level, point, or object measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL).

(See FLIGHT LEVEL.)

a. MSL Altitude– Altitude expressed in feet measured from mean sea level.

b. AGL Altitude– Altitude expressed in feet measured above ground level.

c. Indicated Altitude– The altitude as shown by an altimeter. On a pressure or barometric altimeter it is altitude as shown uncorrected for instrument error and uncompensated for variation from standard atmospheric conditions.

(See ICAO term ALTITUDE.)

ALTITUDE [ICAO]– The vertical distance of a level, a point or an object considered as a point, measured from mean sea level (MSL).

ALTITUDE READOUT– An aircraft's altitude, transmitted via the Mode C transponder feature, that is visually displayed in 100-foot increments on a radar scope having readout capability.

(See ALPHANUMERIC DISPLAY.)

(Refer to AIM.)

ALTITUDE RESERVATION (ALTRV)– Airspace utilization under prescribed conditions normally employed for the mass movement of aircraft or other special user requirements which cannot otherwise be accomplished. ALTRVs are approved by the appropriate FAA facility. ALTRVs must be classified as either “moving” or “stationary.”

(See MOVING ALTITUDE RESERVATION.)

(See STATIONARY ALTITUDE RESERVATION.)

(See AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER.)

ALTITUDE RESTRICTION– An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

ALTITUDE RESTRICTIONS ARE CANCELED– Adherence to previously imposed altitude restrictions is no longer required during a climb or descent.

ALTRV–

(See ALTITUDE RESERVATION.)

AMVER–

(See AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM.)

APB–

(See AUTOMATED PROBLEM DETECTION BOUNDARY.)

APD–

(See AUTOMATED PROBLEM DETECTION.)

APDIA–

(See AUTOMATED PROBLEM DETECTION INHIBITED AREA.)

APPROACH CLEARANCE– Authorization by ATC for a pilot to conduct an instrument approach. The type of instrument approach for which a clearance and other pertinent information is provided in the approach clearance when required.

(See CLEARED APPROACH.)

(See INSTRUMENT APPROACH PROCEDURE.)

(Refer to AIM.)

(Refer to 14 CFR part 91.)

APPROACH CONTROL FACILITY– A terminal ATC facility that provides approach control service in a terminal area.

(See APPROACH CONTROL SERVICE.)

(See RADAR APPROACH CONTROL FACILITY.)

APPROACH CONTROL SERVICE– Air traffic control service provided by an approach control facility for arriving and departing VFR/IFR aircraft and, on occasion, en route aircraft. At some airports not served by an approach control facility, the ARTCC provides limited approach control service.

(See ICAO term APPROACH CONTROL SERVICE.)

(Refer to AIM.)

APPROACH CONTROL SERVICE [ICAO]– Air traffic control service for arriving or departing controlled flights.

APPROACH GATE– An imaginary point used within ATC as a basis for vectoring aircraft to the final approach course. The gate will be established along the final approach course 1 mile from the final approach fix on the side away from the airport and will be no closer than 5 miles from the landing threshold.

APPROACH/DEPARTURE HOLD AREA– The locations on taxiways in the approach or departure areas of a runway designated to protect landing or departing aircraft. These locations are identified by signs and markings.

APPROACH LIGHT SYSTEM–

(See AIRPORT LIGHTING.)

APPROACH SEQUENCE– The order in which aircraft are positioned while on approach or awaiting approach clearance.

(See LANDING SEQUENCE.)

(See ICAO term APPROACH SEQUENCE.)

APPROACH SEQUENCE [ICAO]– The order in which two or more aircraft are cleared to approach to land at the aerodrome.

APPROACH SPEED– The recommended speed contained in aircraft manuals used by pilots when making an approach to landing. This speed will vary for different segments of an approach as well as for aircraft weight and configuration.

APPROACH WITH VERTICAL GUIDANCE (APV)– A term used to describe RNAV approach procedures that provide lateral and vertical guidance but do not meet the requirements to be considered a precision approach.

APPROPRIATE ATS AUTHORITY [ICAO]– The relevant authority designated by the State responsible for providing air traffic services in the airspace concerned. In the United States, the “appropriate ATS authority” is the Program Director for Air Traffic Planning and Procedures, ATP-1.

APPROPRIATE AUTHORITY–

- a. Regarding flight over the high seas: the relevant authority is the State of Registry.
- b. Regarding flight over other than the high seas: the relevant authority is the State having sovereignty over the territory being overflown.

APPROPRIATE OBSTACLE CLEARANCE MINIMUM ALTITUDE– Any of the following:

- (See MINIMUM EN ROUTE IFR ALTITUDE.)
- (See MINIMUM IFR ALTITUDE.)
- (See MINIMUM OBSTRUCTION CLEARANCE ALTITUDE.)
- (See MINIMUM VECTORING ALTITUDE.)

APPROPRIATE TERRAIN CLEARANCE MINIMUM ALTITUDE– Any of the following:

- (See MINIMUM EN ROUTE IFR ALTITUDE.)
- (See MINIMUM IFR ALTITUDE.)
- (See MINIMUM OBSTRUCTION CLEARANCE ALTITUDE.)
- (See MINIMUM VECTORING ALTITUDE.)

APRON– A defined area on an airport or heliport intended to accommodate aircraft for purposes of loading or unloading passengers or cargo, refueling, parking, or maintenance. With regard to seaplanes, a ramp is used for access to the apron from the water.

(See ICAO term APRON.)

APRON [ICAO]– A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, refueling, parking or maintenance.

ARC– The track over the ground of an aircraft flying at a constant distance from a navigational aid by reference to distance measuring equipment (DME).

AREA CONTROL CENTER [ICAO]– An air traffic control facility primarily responsible for ATC services being provided IFR aircraft during the en route phase of flight. The U.S. equivalent facility is an air route traffic control center (ARTCC).

AREA NAVIGATION (RNAV)– A method of navigation which permits aircraft operation on any desired flight path within the coverage of ground– or space–based navigation aids or within the limits of the capability of self-contained aids, or a combination of these.

Note: Area navigation includes performance–based navigation as well as other operations that do not meet the definition of performance–based navigation.

AREA NAVIGATION (RNAV) APPROACH CONFIGURATION:

a. STANDARD T– An RNAV approach whose design allows direct flight to any one of three initial approach fixes (IAF) and eliminates the need for procedure turns. The standard design is to align the procedure on the extended centerline with the missed approach point (MAP) at the runway threshold, the final approach fix (FAF), and the initial approach/intermediate fix (IAF/IF). The other two IAFs will be established perpendicular to the IF.

b. MODIFIED T– An RNAV approach design for single or multiple runways where terrain or operational constraints do not allow for the standard T. The “T” may be modified by increasing or decreasing the angle from the corner IAF(s) to the IF or by eliminating one or both corner IAFs.

c. STANDARD I– An RNAV approach design for a single runway with both corner IAFs eliminated. Course reversal or radar vectoring may be required at busy terminals with multiple runways.

d. TERMINAL ARRIVAL AREA (TAA)– The TAA is controlled airspace established in conjunction with the Standard or Modified T and I RNAV approach configurations. In the standard TAA, there are three areas: straight-in, left base, and right base. The arc boundaries of the three areas of the TAA are published portions of the approach and allow aircraft to transition from the en route structure direct to the nearest IAF. TAAs will also eliminate or reduce feeder routes, departure extensions, and procedure turns or course reversal.

1. STRAIGHT-IN AREA– A 30 NM arc centered on the IF bounded by a straight line extending through the IF perpendicular to the intermediate course.

2. LEFT BASE AREA– A 30 NM arc centered on the right corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30 NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

3. RIGHT BASE AREA– A 30 NM arc centered on the left corner IAF. The area shares a boundary with the straight-in area except that it extends out for 30 NM from the IAF and is bounded on the other side by a line extending from the IF through the FAF to the arc.

AREA NAVIGATION (RNAV) GLOBAL POSITIONING SYSTEM (GPS) PRECISION RUNWAY MONITORING (PRM) APPROACH–

A GPS approach, which requires vertical guidance, used in lieu of another type of PRM approach to conduct approaches to parallel runways whose extended centerlines are separated by less than 4,300 feet and at least 3,000 feet, where simultaneous close parallel approaches are permitted. Also used in lieu of an ILS PRM and/or LDA PRM approach to conduct Simultaneous Offset Instrument Approach (SOIA) operations.

ARMY AVIATION FLIGHT INFORMATION BULLETIN– A bulletin that provides air operation data covering Army, National Guard, and Army Reserve aviation activities.

ARO–

(See AIRPORT RESERVATION OFFICE.)

ARRESTING SYSTEM– A safety device consisting of two major components, namely, engaging or catching devices and energy absorption devices for the purpose of arresting both tailhook and/or nontailhook-equipped aircraft. It is used to prevent aircraft from overrunning runways when the aircraft cannot be stopped after landing or during aborted takeoff. Arresting systems have various names; e.g., arresting gear, hook device, wire barrier cable.

(See ABORT.)

(Refer to AIM.)

ARRIVAL CENTER– The ARTCC having jurisdiction for the impacted airport.

ARRIVAL DELAY– A parameter which specifies a period of time in which no aircraft will be metered for arrival at the specified airport.

ARRIVAL/DEPARTURE WINDOW (ADW)– A depiction presented on an air traffic control display, used by the controller to prevent possible conflicts between arrivals to, and departures from, a runway. The ADW identifies that point on the final approach course by which a departing aircraft must have begun takeoff.

ARRIVAL SECTOR (En Route)– An operational control sector containing one or more meter fixes on or near the TRACON boundary.

ARRIVAL TIME– The time an aircraft touches down on arrival.

ARSR–

(See AIR ROUTE SURVEILLANCE RADAR.)

ARTCC–

(See AIR ROUTE TRAFFIC CONTROL CENTER.)

ASDA–

(See ACCELERATE-STOP DISTANCE AVAILABLE.)

ASDA [ICAO]–

(See ICAO Term ACCELERATE-STOP DISTANCE AVAILABLE.)

ASDE–

(See AIRPORT SURFACE DETECTION EQUIPMENT.)

ASLAR–

(See AIRCRAFT SURGE LAUNCH AND RECOVERY.)

ASR–

(See AIRPORT SURVEILLANCE RADAR.)

ASR APPROACH–

(See SURVEILLANCE APPROACH.)

ASSOCIATED– A radar target displaying a data block with flight identification and altitude information.

(See UNASSOCIATED.)

ATC–

(See AIR TRAFFIC CONTROL.)

ATC ADVISES– Used to prefix a message of noncontrol information when it is relayed to an aircraft by other than an air traffic controller.

(See ADVISORY.)

ATC ASSIGNED AIRSPACE– Airspace of defined vertical/lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic.

(See SPECIAL USE AIRSPACE.)

ATC CLEARANCE–

(See AIR TRAFFIC CLEARANCE.)

ATC CLEARS– Used to prefix an ATC clearance when it is relayed to an aircraft by other than an air traffic controller.

ATC INSTRUCTIONS– Directives issued by air traffic control for the purpose of requiring a pilot to take specific actions; e.g., “Turn left heading two five zero,” “Go around,” “Clear the runway.”

(Refer to 14 CFR part 91.)

ATC PREFERRED ROUTE NOTIFICATION– EDST notification to the appropriate controller of the need to determine if an ATC preferred route needs to be applied, based on destination airport.

(See ROUTE ACTION NOTIFICATION.)

(See EN ROUTE DECISION SUPPORT TOOL.)

ATC PREFERRED ROUTES– Preferred routes that are not automatically applied by Host.

ATC REQUESTS– Used to prefix an ATC request when it is relayed to an aircraft by other than an air traffic controller.

ATC SECURITY SERVICES– Communications and security tracking provided by an ATC facility in support of the DHS, the DoD, or other Federal security elements in the interest of national security. Such security services are only applicable within designated areas. ATC security services do not include ATC basic radar services or flight following.

ATC SECURITY SERVICES POSITION– The position responsible for providing ATC security services as defined. This position does not provide ATC, IFR separation, or VFR flight following services, but is responsible for providing security services in an area comprising airspace assigned to one or more ATC operating sectors. This position may be combined with control positions.

ATC SECURITY TRACKING– The continuous tracking of aircraft movement by an ATC facility in support of the DHS, the DoD, or other security elements for national security using radar (i.e., radar tracking) or other means (e.g., manual tracking) without providing basic radar services (including traffic advisories) or other ATC services not defined in this section.

ATS SURVEILLANCE SERVICE [ICAO]– A term used to indicate a service provided directly by means of an ATS surveillance system.

ATC SURVEILLANCE SOURCE– Used by ATC for establishing identification, control and separation using a target depicted on an air traffic control facility’s video display that has met the relevant safety standards for operational use and received from one, or a combination, of the following surveillance sources:

- a. Radar (See RADAR.)
- b. ADS-B (See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST.)

c. WAM (See WIDE AREA MULTILATERATION.)

(See INTERROGATOR.)

(See TRANSPONDER.)

(See ICAO term RADAR.)

(Refer to AIM.)

ATS SURVEILLANCE SYSTEM [ICAO]– A generic term meaning variously, ADS-B, PSR, SSR or any comparable ground-based system that enables the identification of aircraft.

Note: A comparable ground-based system is one that has been demonstrated, by comparative assessment or other methodology, to have a level of safety and performance equal to or better than monopulse SSR.

ATCAA–

(See ATC ASSIGNED AIRSPACE.)

ATCRBS–

(See RADAR.)

ATCSCC–

(See AIR TRAFFIC CONTROL SYSTEM COMMAND CENTER.)

ATCT–

(See TOWER.)

ATD–

(See ALONG-TRACK DISTANCE.)

ATIS–

(See AUTOMATIC TERMINAL INFORMATION SERVICE.)

ATIS [ICAO]–

(See ICAO Term AUTOMATIC TERMINAL INFORMATION SERVICE.)

ATO–

(See AIR TRAFFIC ORGANIZATION.)

ATPA–

(See AUTOMATED TERMINAL PROXIMITY ALERT.)

ATS ROUTE [ICAO]– A specified route designed for channeling the flow of traffic as necessary for the provision of air traffic services.

Note: The term “ATS Route” is used to mean variously, airway, advisory route, controlled or uncontrolled route, arrival or departure, etc.

ATTENTION ALL USERS PAGE (AAUP)– The AAUP provides the pilot with additional information relative to conducting a specific operation, for example, PRM approaches and RNAV departures.

AUTOLAND APPROACH–An autoland system aids by providing control of aircraft systems during a precision instrument approach to at least decision altitude and possibly all the way to touchdown, as well as in some cases, through the landing rollout. The autoland system is a sub-system of the autopilot system from which control surface management occurs. The aircraft autopilot sends instructions to the autoland system and monitors the autoland system performance and integrity during its execution.

AUTOMATED EMERGENCY DESCENT–

(See EMERGENCY DESCENT MODE.)

AUTOMATED INFORMATION TRANSFER (AIT)– A precoordinated process, specifically defined in facility directives, during which a transfer of altitude control and/or radar identification is accomplished without verbal coordination between controllers using information communicated in a full data block.

AUTOMATED MUTUAL-ASSISTANCE VESSEL RESCUE SYSTEM– A facility which can deliver, in a matter of minutes, a surface picture (SURPIC) of vessels in the area of a potential or actual search and rescue incident, including their predicted positions and their characteristics.

(See FAA Order JO 7110.65, Para 10–6–4, INFLIGHT CONTINGENCIES.)

AUTOMATED PROBLEM DETECTION (APD)– An Automation Processing capability that compares trajectories in order to predict conflicts.

AUTOMATED PROBLEM DETECTION BOUNDARY (APB)– The adapted distance beyond a facilities boundary defining the airspace within which EDST performs conflict detection.

(See EN ROUTE DECISION SUPPORT TOOL.)

AUTOMATED PROBLEM DETECTION INHIBITED AREA (APDIA)– Airspace surrounding a terminal area within which APD is inhibited for all flights within that airspace.

AUTOMATED SERVICES–Services delivered via an automated system (that is, without human interaction). For example, flight plans, Notices to Airmen (NOTAMs), interactive maps, computer-generated text-to-speech messages, short message service, or email.

AUTOMATED TERMINAL PROXIMITY ALERT (ATPA)– Monitors the separation of aircraft on the Final Approach Course (FAC), displaying a graphical notification (cone and/or mileage) when a potential loss of separation is detected. The warning cone (Yellow) will display at 45 seconds and the alert cone (Red) will display at 24 seconds prior to predicted loss of separation. Current distance between two aircraft on final will be displayed in line 3 of the full data block of the trailing aircraft in corresponding colors.

AUTOMATED WEATHER SYSTEM– Any of the automated weather sensor platforms that collect weather data at airports and disseminate the weather information via radio and/or landline. The systems currently consist of the Automated Surface Observing System (ASOS) and Automated Weather Observation System (AWOS).

AUTOMATED UNICOM– Provides completely automated weather, radio check capability and airport advisory information on an Automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the UNICOM frequency. Availability will be published in the Chart Supplement and approach charts.

AUTOMATIC ALTITUDE REPORT–

(See ALTITUDE READOUT.)

AUTOMATIC ALTITUDE REPORTING– That function of a transponder which responds to Mode C interrogations by transmitting the aircraft's altitude in 100-foot increments.

AUTOMATIC CARRIER LANDING SYSTEM– U.S. Navy final approach equipment consisting of precision tracking radar coupled to a computer data link to provide continuous information to the aircraft, monitoring capability to the pilot, and a backup approach system.

AUTOMATIC DEPENDENT SURVEILLANCE (ADS) [ICAO]– A surveillance technique in which aircraft automatically provide, via a data link, data derived from on-board navigation and position fixing systems, including aircraft identification, four dimensional position and additional data as appropriate.

AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST (ADS-B)– A surveillance system in which an aircraft or vehicle to be detected is fitted with cooperative equipment in the form of a data link transmitter. The aircraft or vehicle periodically broadcasts its GNSS-derived position and other required information such as identity and velocity, which is then received by a ground-based or space-based receiver for processing and display at an air traffic control facility, as well as by suitably equipped aircraft.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT.)

(See COOPERATIVE SURVEILLANCE.)

(See GLOBAL POSITIONING SYSTEM.)

(See SPACE–BASED ADS–B.)

AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN (ADS–B In)– Aircraft avionics capable of receiving ADS–B Out transmissions directly from other aircraft, as well as traffic or weather information transmitted from ground stations.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–REBROADCAST.)

(See FLIGHT INFORMATION SERVICE–BROADCAST.)

(See TRAFFIC INFORMATION SERVICE–BROADCAST.)

AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST OUT (ADS–B Out)– The transmitter onboard an aircraft or ground vehicle that periodically broadcasts its GNSS–derived position along with other required information, such as identity, altitude, and velocity.

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST.)

(See AUTOMATIC DEPENDENT SURVEILLANCE–BROADCAST IN.)

AUTOMATIC DEPENDENT SURVEILLANCE–CONTRACT (ADS–C)– A data link position reporting system, controlled by a ground station, that establishes contracts with an aircraft’s avionics that occur automatically whenever specific events occur, or specific time intervals are reached.

AUTOMATIC DEPENDENT SURVEILLANCE- REBROADCAST (ADS–R)– A datalink translation function of the ADS–B ground system required to accommodate the two separate operating frequencies (978 MHz and 1090 MHz). The ADS–B system receives the ADS–B messages transmitted on one frequency and ADS–R translates and reformats the information for rebroadcast and use on the other frequency. This allows ADS–B In equipped aircraft to see nearby ADS–B Out traffic regardless of the operating link of the other aircraft. Aircraft operating on the same ADS–B frequency exchange information directly and do not require the ADS–R translation function.

AUTOMATIC DIRECTION FINDER– An aircraft radio navigation system which senses and indicates the direction to a L/MF nondirectional radio beacon (NDB) ground transmitter. Direction is indicated to the pilot as a magnetic bearing or as a relative bearing to the longitudinal axis of the aircraft depending on the type of indicator installed in the aircraft. In certain applications, such as military, ADF operations may be based on airborne and ground transmitters in the VHF/UHF frequency spectrum.

(See BEARING.)

(See NONDIRECTIONAL BEACON.)

AUTOMATIC FLIGHT INFORMATION SERVICE (AFIS) – ALASKA FSSs ONLY– The continuous broadcast of recorded non–control information at airports in Alaska where a FSS provides local airport advisory service. The AFIS broadcast automates the repetitive transmission of essential but routine information such as weather, wind, altimeter, favored runway, braking action, airport NOTAMs, and other applicable information. The information is continuously broadcast over a discrete VHF radio frequency (usually the ASOS/AWOS frequency).

AUTOMATIC TERMINAL INFORMATION SERVICE– The continuous broadcast of recorded noncontrol information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information; e.g., “Los Angeles information Alfa. One three zero zero Coordinated Universal Time. Weather, measured ceiling two thousand overcast, visibility three, haze, smoke, temperature seven one, dew point five seven, wind two five zero at five, altimeter two niner niner six. I-L-S Runway Two Five Left approach in use, Runway Two Five Right closed, advise you have Alfa.”

(See ICAO term AUTOMATIC TERMINAL INFORMATION SERVICE.)

(Refer to AIM.)

AUTOMATIC TERMINAL INFORMATION SERVICE [ICAO]– The provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts throughout the day or a specified portion of the day.

AUTOROTATION– A rotorcraft flight condition in which the lifting rotor is driven entirely by action of the air when the rotorcraft is in motion.

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, and broadcast aviation weather and aeronautical information. 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-BY WAYPOINT– A fly-by waypoint requires the use of turn anticipation to avoid overshoot of the next flight segment.

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-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.)

FLYAWAY– When the pilot is unable to effect control of the aircraft and, as a result, the UA is not operating in a predictable or planned manner.

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 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.

FRIA–

(See FAA–RECOGNIZED IDENTIFICATION AREA.)

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]– 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

H

HAA–

(See HEIGHT ABOVE AIRPORT.)

HAL–

(See HEIGHT ABOVE LANDING.)

HANDOFF– An action taken to transfer the radar identification of an aircraft from one controller to another if the aircraft will enter the receiving controller's airspace and radio communications with the aircraft will be transferred.

HAT–

(See HEIGHT ABOVE TOUCHDOWN.)

HAVE NUMBERS– Used by pilots to inform ATC that they have received runway, wind, and altimeter information only.

HAZARDOUS MATERIALS (HAZMAT)– Hazardous materials as defined by 49 Code of Federal Regulations (CFR) §171.8.

(Refer to 49 CFR part 171.8)

(Refer to AIM)

HAZARDOUS WEATHER INFORMATION–Summary of significant meteorological information (SIGMET/WS), convective significant meteorological information (convective SIGMET/WST), urgent pilot weather reports (urgent PIREP/UUA), center weather advisories (CWA), airmen's meteorological information (AIRMET/WA), graphical airmen's meteorological information (G-AIRMET) and any other weather such as isolated thunderstorms that are rapidly developing and increasing in intensity, or low ceilings and visibilities that are becoming widespread which is considered significant and are not included in a current hazardous weather advisory.

HAZMAT–

(See HAZARDOUS MATERIALS.)

HEAVY (AIRCRAFT)–

(See AIRCRAFT CLASSES.)

HEIGHT ABOVE AIRPORT (HAA)– The height of the Minimum Descent Altitude above the published airport elevation. This is published in conjunction with circling minimums.

(See MINIMUM DESCENT ALTITUDE.)

HEIGHT ABOVE LANDING (HAL)– The height above a designated helicopter landing area used for helicopter instrument approach procedures.

(Refer to 14 CFR part 97.)

HEIGHT ABOVE TOUCHDOWN (HAT)– The height of the Decision Height or Minimum Descent Altitude above the highest runway elevation in the touchdown zone (first 3,000 feet of the runway). HAT is published on instrument approach charts in conjunction with all straight-in minimums.

(See DECISION HEIGHT.)

(See MINIMUM DESCENT ALTITUDE.)

HELICOPTER– A rotorcraft that, for its horizontal motion, depends principally on its engine-driven rotors.

(See ROTORCRAFT.)

HELIPAD– A small, designated area, usually with a prepared surface, on a heliport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of helicopters.

HELIPORT– An area of land, water, or structure used or intended to be used for the landing and takeoff of helicopters and includes its buildings and facilities if any.

HELIPORT REFERENCE POINT (HRP)– The geographic center of a heliport.

HERTZ– The standard radio equivalent of frequency in cycles per second of an electromagnetic wave. Kiloherertz (kHz) is a frequency of one thousand cycles per second. Megahertz (MHz) is a frequency of one million cycles per second.

HF–

(See HIGH FREQUENCY.)

HF COMMUNICATIONS–

(See HIGH FREQUENCY COMMUNICATIONS.)

HIGH FREQUENCY– The frequency band between 3 and 30 MHz.

(See HIGH FREQUENCY COMMUNICATIONS.)

HIGH FREQUENCY COMMUNICATIONS– High radio frequencies (HF) between 3 and 30 MHz used for air-to-ground voice communication in overseas operations.

HIGH SPEED EXIT–

(See HIGH SPEED TAXIWAY.)

HIGH SPEED TAXIWAY– A long radius taxiway designed and provided with lighting or marking to define the path of aircraft, traveling at high speed (up to 60 knots), from the runway center to a point on the center of a taxiway. Also referred to as long radius exit or turn-off taxiway. The high speed taxiway is designed to expedite aircraft turning off the runway after landing, thus reducing runway occupancy time.

HIGH SPEED TURNOFF–

(See HIGH SPEED TAXIWAY.)

HIGH UPDATE RATE SURVEILLANCE– A surveillance system that provides a sensor update rate of less than 4.8 seconds.

HOLD FOR RELEASE– Used by ATC to delay an aircraft for traffic management reasons; i.e., weather, traffic volume, etc. Hold for release instructions (including departure delay information) are used to inform a pilot or a controller (either directly or through an authorized relay) that an IFR departure clearance is not valid until a release time or additional instructions have been received.

(See ICAO term HOLDING POINT.)

HOLD-IN-LIEU OF PROCEDURE TURN– A hold-in-lieu of procedure turn must be established over a final or intermediate fix when an approach can be made from a properly aligned holding pattern. The hold-in-lieu of procedure turn permits the pilot to align with the final or intermediate segment of the approach and/or descend in the holding pattern to an altitude that will permit a normal descent to the final approach fix altitude. The hold-in-lieu of procedure turn is a required maneuver (the same as a procedure turn) unless the aircraft is being radar vectored to the final approach course, when “NoPT” is shown on the approach chart, or when the pilot requests or the controller advises the pilot to make a “straight-in” approach.

HOLD PROCEDURE– A predetermined maneuver which keeps aircraft within a specified airspace while awaiting further clearance from air traffic control. Also used during ground operations to keep aircraft within a specified area or at a specified point while awaiting further clearance from air traffic control.

(See HOLDING FIX.)

(Refer to AIM.)

HOLDING FIX– A specified fix identifiable to a pilot by NAVAIDs or visual reference to the ground used as a reference point in establishing and maintaining the position of an aircraft while holding.

(See FIX.)

(See VISUAL HOLDING.)

(Refer to AIM.)

L

LAA–

(See LOCAL AIRPORT ADVISORY.)

LAANC–

(See LOW ALTITUDE AUTHORIZATION AND NOTIFICATION CAPABILITY.)

LAHSO–

(See LAND AND HOLD SHORT OPERATIONS.)

LAND AND HOLD SHORT OPERATIONS– Operations that include simultaneous takeoffs and landings and/or simultaneous landings when a landing aircraft is able and is instructed by the controller to hold short of an intersecting runway or taxiway, a predetermined point, or an approach/departure flightpath. Pilots are expected to promptly inform the controller if the hold short clearance cannot be accepted.

(Refer to AIM.)

LAND-BASED AIR DEFENSE IDENTIFICATION ZONE (ADIZ)– An ADIZ over U.S. metropolitan areas, which is activated and deactivated as needed, with dimensions, activation dates, and other relevant information disseminated via NOTAM.

(See AIR DEFENSE IDENTIFICATION ZONE.)

LANDING AREA– Any locality either on land, water, or structures, including airports/heliports and intermediate landing fields, which is used, or intended to be used, for the landing and takeoff of aircraft whether or not facilities are provided for the shelter, servicing, or for receiving or discharging passengers or cargo.

(See ICAO term LANDING AREA.)

LANDING AREA [ICAO]– That part of a movement area intended for the landing or take-off of aircraft.

LANDING DIRECTION INDICATOR– A device which visually indicates the direction in which landings and takeoffs should be made.

(See TETRAHEDRON.)

(Refer to AIM.)

LANDING DISTANCE AVAILABLE (LDA)– The runway length declared available and suitable for a landing airplane.

(See ICAO term LANDING DISTANCE AVAILABLE.)

LANDING DISTANCE AVAILABLE [ICAO]– The length of runway which is declared available and suitable for the ground run of an aeroplane landing.

LANDING MINIMUMS– The minimum visibility prescribed for landing a civil aircraft while using an instrument approach procedure. The minimum applies with other limitations set forth in 14 CFR part 91 with respect to the Minimum Descent Altitude (MDA) or Decision Height (DH) prescribed in the instrument approach procedures as follows:

a. Straight-in landing minimums. A statement of MDA and visibility, or DH and visibility, required for a straight-in landing on a specified runway, or

b. Circling minimums. A statement of MDA and visibility required for the circle-to-land maneuver.

Note: Descent below the MDA or DH must meet the conditions stated in 14 CFR section 91.175.

(See CIRCLE-TO-LAND MANEUVER.)

(See DECISION HEIGHT.)

(See INSTRUMENT APPROACH PROCEDURE.)

(See MINIMUM DESCENT ALTITUDE.)

(See STRAIGHT-IN LANDING.)

(See VISIBILITY.)

(Refer to 14 CFR part 91.)

LANDING ROLL– The distance from the point of touchdown to the point where the aircraft can be brought to a stop or exit the runway.

LANDING SEQUENCE– The order in which aircraft are positioned for landing.

(See **APPROACH SEQUENCE**.)

LAST ASSIGNED ALTITUDE– The last altitude/flight level assigned by ATC and acknowledged by the pilot.

(See **MAINTAIN**.)

(Refer to 14 CFR part 91.)

LATERAL NAVIGATION (LNAV)– A function of area navigation (RNAV) equipment which calculates, displays, and provides lateral guidance to a profile or path.

LATERAL SEPARATION– The lateral spacing of aircraft at the same altitude by requiring operation on different routes or in different geographical locations.

(See **SEPARATION**.)

LDA–

(See **LOCALIZER TYPE DIRECTIONAL AID**.)

(See **LANDING DISTANCE AVAILABLE**.)

(See ICAO Term **LANDING DISTANCE AVAILABLE**.)

LF–

(See **LOW FREQUENCY**.)

LIGHTED AIRPORT– An airport where runway and obstruction lighting is available.

(See **AIRPORT LIGHTING**.)

(Refer to **AIM**.)

LIGHT GUN– A handheld directional light signaling device which emits a brilliant narrow beam of white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used to approve or disapprove anticipated pilot actions where radio communication is not available. The light gun is used for controlling traffic operating in the vicinity of the airport and on the airport movement area.

(Refer to **AIM**.)

LIGHT-SPORT AIRCRAFT (LSA)– An FAA-registered aircraft, other than a helicopter or powered-lift, that meets certain weight and performance. Principally it is a single-engine aircraft with a maximum of two seats and weighing no more than 1,430 pounds if intended for operation on water, or 1,320 pounds if not. It must be of simple design (fixed landing gear (except if intended for operations on water or a glider), piston powered, nonpressurized, with a fixed or ground adjustable propeller). Performance is also limited to a maximum airspeed in level flight of not more than 120 knots calibrated airspeed (CAS), have a maximum never-exceed speed of not more than 120 knots CAS for a glider, and have a maximum stalling speed, without the use of lift-enhancing devices of not more than 45 knots CAS. It may be certificated as either Experimental LSA or as a Special LSA aircraft. A minimum of a sport pilot certificate is required to operate light-sport aircraft.

(Refer to 14 CFR part 1, §1.1.)

LINE UP AND WAIT (LUAW)– Used by ATC to inform a pilot to taxi onto the departure runway to line up and wait. It is not authorization for takeoff. It is used when takeoff clearance cannot immediately be issued because of traffic or other reasons.

(See **CLEARED FOR TAKEOFF**.)

LOCAL AIRPORT ADVISORY (LAA)– A service available only in Alaska and provided by facilities that are located on the landing airport, have a discrete ground-to-air communication frequency or the tower frequency when the tower is closed, automated weather reporting with voice broadcasting, and a continuous ASOS/AWOS data display, other continuous direct reading instruments, or manual observations available to the specialist.

(See **AIRPORT ADVISORY AREA**.)

LOCAL TRAFFIC– Aircraft operating in the traffic pattern or within sight of the tower, or aircraft known to be departing or arriving from flight in local practice areas, or aircraft executing practice instrument approaches at the airport.

(See **TRAFFIC PATTERN**.)

LOCALIZER– The component of an ILS which provides course guidance to the runway.

(See **INSTRUMENT LANDING SYSTEM**.)

(See ICAO term **LOCALIZER COURSE**.)

(Refer to **AIM**.)

LOCALIZER COURSE [ICAO]– The locus of points, in any given horizontal plane, at which the DDM (difference in depth of modulation) is zero.

LOCALIZER OFFSET– An angular offset of the localizer aligned within 3° of the runway alignment.

LOCALIZER TYPE DIRECTIONAL AID (LDA)– A localizer with an angular offset that exceeds 3° of the runway alignment, used for nonprecision instrument approaches with utility and accuracy comparable to a localizer, but which are not part of a complete ILS.

(Refer to **AIM**.)

LOCALIZER TYPE DIRECTIONAL AID (LDA) PRECISION RUNWAY MONITOR (PRM) APPROACH– An approach, which includes a glideslope, used in conjunction with an ILS PRM, RNAV PRM or GLS PRM approach to an adjacent runway to conduct Simultaneous Offset Instrument Approaches (SOIA) to parallel runways whose centerlines are separated by less than 3,000 feet and 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 (LL)– 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 ALTITUDE AUTHORIZATION AND NOTIFICATION CAPABILITY (LAANC)– FAA and industry collaboration which automates the process of obtaining a required authorization for operations in controlled airspace.

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 (LF)– The frequency band between 30 and 300 kHz.

(Refer to AIM.)

LOCALIZER PERFORMANCE WITH VERTICAL GUIDANCE (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.)

N

NAS–

(See NATIONAL AIRSPACE SYSTEM.)

NAT HLA–

(See NORTH ATLANTIC HIGH LEVEL AIRSPACE.)

NATIONAL AIRSPACE SYSTEM– The common network of U.S. airspace; air navigation facilities, equipment and services, airports or landing areas; aeronautical charts, information and services; rules, regulations and procedures, technical information, and manpower and material. Included are system components shared jointly with the military.

NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE (NBCAP)– Airspace over United States territory located within the North American continent between Canada and Mexico, including adjacent territorial waters outward to about boundaries of oceanic control areas (CTA)/Flight Information Regions (FIR).

(See FLIGHT INFORMATION REGION.)

NATIONAL FLIGHT DATA DIGEST (NFDD)– A daily (except weekends and Federal holidays) publication of flight information appropriate to aeronautical charts, aeronautical publications, Notices to Airmen, or other media serving the purpose of providing operational flight data essential to safe and efficient aircraft operations.

NATIONAL SEARCH AND RESCUE PLAN– An interagency agreement which provides for the effective utilization of all available facilities in all types of search and rescue missions.

NATIONAL SECURITY AREA (NSA)–

(See SPECIAL USE AIRSPACE.)

NAVAID–

(See NAVIGATIONAL AID.)

NAVAID CLASSES– VOR, VORTAC, and TACAN aids are classed according to their operational use. The three classes of NAVAIDs are:

- a. T– Terminal.
- b. L– Low altitude.
- c. H– High altitude.

Note: The normal service range for T, L, and H class aids is found in the AIM. Certain operational requirements make it necessary to use some of these aids at greater service ranges than specified. Extended range is made possible through flight inspection determinations. Some aids also have lesser service range due to location, terrain, frequency protection, etc. Restrictions to service range are listed in the Chart Supplement.

NAVIGABLE AIRSPACE– Airspace at and above the minimum flight altitudes prescribed in the CFRs including airspace needed for safe takeoff and landing.

(Refer to 14 CFR part 91.)

NAVIGATION REFERENCE SYSTEM (NRS)– The NRS is a system of waypoints developed for use within the United States for flight planning and navigation without reference to ground based navigational aids. The NRS waypoints are located in a grid pattern along defined latitude and longitude lines. The initial use of the NRS will be in the high altitude environment. The NRS waypoints are intended for use by aircraft capable of point-to-point navigation.

NAVIGATION SPECIFICATION [ICAO]– A set of aircraft and flight crew requirements needed to support performance-based navigation operations within a defined airspace. There are two kinds of navigation specifications:

a. RNP specification. A navigation specification based on area navigation that includes the requirement for performance monitoring and alerting, designated by the prefix RNP; e.g., RNP 4, RNP APCH.

b. RNAV specification. A navigation specification based on area navigation that does not include the requirement for performance monitoring and alerting, designated by the prefix RNAV; e.g., RNAV 5, RNAV 1.

Note: The Performance-based Navigation Manual (Doc 9613), Volume II contains detailed guidance on navigation specifications.

NAVIGATIONAL AID– Any visual or electronic device airborne or on the surface which provides point-to-point guidance information or position data to aircraft in flight.

(See AIR NAVIGATION FACILITY.)

NAVSPEC–

(See NAVIGATION SPECIFICATION [ICAO].)

NBCAP AIRSPACE–

(See NATIONAL BEACON CODE ALLOCATION PLAN AIRSPACE.)

NDB–

(See NONDIRECTIONAL BEACON.)

NEGATIVE– “No,” or “permission not granted,” or “that is not correct.”

NEGATIVE CONTACT– Used by pilots to inform ATC that:

a. Previously issued traffic is not in sight. It may be followed by the pilot’s request for the controller to provide assistance in avoiding the traffic.

b. They were unable to contact ATC on a particular frequency.

NFDD–

(See NATIONAL FLIGHT DATA DIGEST.)

NIGHT– The time between the end of evening civil twilight and the beginning of morning civil twilight, as published in the Air Almanac, converted to local time.

(See ICAO term NIGHT.)

NIGHT [ICAO]– The hours between the end of evening civil twilight and the beginning of morning civil twilight or such other period between sunset and sunrise as may be specified by the appropriate authority.

Note: Civil twilight ends in the evening when the center of the sun’s disk is 6 degrees below the horizon and begins in the morning when the center of the sun’s disk is 6 degrees below the horizon.

NO GYRO APPROACH– A radar approach/vector provided in case of a malfunctioning gyro-compass or directional gyro. Instead of providing the pilot with headings to be flown, the controller observes the radar track and issues control instructions “turn right/left” or “stop turn” as appropriate.

(Refer to AIM.)

NO GYRO VECTOR–

(See NO GYRO APPROACH.)

NO TRANSGRESSION ZONE (NTZ)– The NTZ is a 2,000 foot wide zone, located equidistant between parallel runway or SOIA final approach courses, in which flight is normally not allowed.

NONAPPROACH CONTROL TOWER– Author-izes aircraft to land or takeoff at the airport controlled by the tower or to transit the Class D airspace. The primary function of a nonapproach control tower is the sequencing of aircraft in the traffic pattern and on the landing area. Nonapproach control towers also separate aircraft operating under instrument flight rules clearances from approach controls and centers. They provide ground control services to aircraft, vehicles, personnel, and equipment on the airport movement area.

NONCOMMON ROUTE/PORTION– That segment of a North American Route between the inland navigation facility and a designated North American terminal.

NON-COOPERATIVE SURVEILLANCE– Any surveillance system, such as primary radar, that is not dependent upon the presence of any equipment on the aircraft or vehicle to be tracked.

(See COOPERATIVE SURVEILLANCE.)

(See RADAR.)

NONDIRECTIONAL BEACON– An L/MF or UHF radio beacon transmitting nondirectional signals whereby the pilot of an aircraft equipped with direction finding equipment can determine his/her bearing to or from the radio beacon and “home” on or track to or from the station. When the radio beacon is installed in conjunction with the Instrument Landing System marker, it is normally called a Compass Locator.

(See AUTOMATIC DIRECTION FINDER.)

(See COMPASS LOCATOR.)

NONMOVEMENT AREAS– Taxiways and apron (ramp) areas not under the control of air traffic.

NONPRECISION APPROACH–

(See NONPRECISION APPROACH PROCEDURE.)

NONPRECISION APPROACH PROCEDURE– A standard instrument approach procedure in which no electronic glideslope is provided; e.g., VOR, TACAN, NDB, LOC, ASR, LDA, or SDF approaches.

NONRADAR– Precedes other terms and generally means without the use of radar, such as:

a. Nonradar Approach. Used to describe instrument approaches for which course guidance on final approach is not provided by ground-based precision or surveillance radar. Radar vectors to the final approach course may or may not be provided by ATC. Examples of nonradar approaches are VOR, NDB, TACAN, ILS, RNAV, and GLS approaches.

(See FINAL APPROACH COURSE.)

(See FINAL APPROACH-IFR.)

(See INSTRUMENT APPROACH PROCEDURE.)

(See RADAR APPROACH.)

b. Nonradar Approach Control. An ATC facility providing approach control service without the use of radar.

(See APPROACH CONTROL FACILITY.)

(See APPROACH CONTROL SERVICE.)

c. Nonradar Arrival. An aircraft arriving at an airport without radar service or at an airport served by a radar facility and radar contact has not been established or has been terminated due to a lack of radar service to the airport.

(See RADAR ARRIVAL.)

(See RADAR SERVICE.)

d. Nonradar Route. A flight path or route over which the pilot is performing his/her own navigation. The pilot may be receiving radar separation, radar monitoring, or other ATC services while on a nonradar route.

(See RADAR ROUTE.)

e. Nonradar Separation. The spacing of aircraft in accordance with established minima without the use of radar; e.g., vertical, lateral, or longitudinal separation.

(See RADAR SEPARATION.)

NON-RESTRICTIVE ROUTING (NRR)– Portions of a proposed route of flight where a user can flight plan the most advantageous flight path with no requirement to make reference to ground-based NAVAIDs.

NOPAC–

(See NORTH PACIFIC.)

NORDO (No Radio)– Aircraft that cannot or do not communicate by radio when radio communication is required are referred to as “NORDO.”

(See LOST COMMUNICATIONS.)

NORMAL OPERATING ZONE (NOZ)– The NOZ is the operating zone within which aircraft flight remains during normal independent simultaneous parallel ILS approaches.

NORTH AMERICAN ROUTE– A numerically coded route preplanned over existing airway and route systems to and from specific coastal fixes serving the North Atlantic. North American Routes consist of the following:

a. Common Route/Portion. That segment of a North American Route between the inland navigation facility and the coastal fix.

b. Noncommon Route/Portion. That segment of a North American Route between the inland navigation facility and a designated North American terminal.

c. Inland Navigation Facility. A navigation aid on a North American Route at which the common route and/or the noncommon route begins or ends.

d. Coastal Fix. A navigation aid or intersection where an aircraft transitions between the domestic route structure and the oceanic route structure.

NORTH AMERICAN ROUTE PROGRAM (NRP)– The NRP is a set of rules and procedures which are designed to increase the flexibility of user flight planning within published guidelines.

NORTH ATLANTIC HIGH LEVEL AIRSPACE (NAT HLA)– That volume of airspace (as defined in ICAO Document 7030) between FL 285 and FL 420 within the Oceanic Control Areas of Bodo Oceanic, Gander Oceanic, New York Oceanic East, Reykjavik, Santa Maria, and Shanwick, excluding the Shannon and Brest Ocean Transition Areas. ICAO Doc 007 *North Atlantic Operations and Airspace Manual* provides detailed information on related aircraft and operational requirements.

NORTH PACIFIC– An organized route system between the Alaskan west coast and Japan.

NOT STANDARD– Varying from what is expected or published. For use in NOTAMs only.

NOT STD-

(See NOT STANDARD.)

NOTAM–

(See NOTICE TO AIRMEN.)

NOTAM [ICAO]– A notice containing information concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to personnel concerned with flight operations.

a. I Distribution– Distribution by means of telecommunication.

b. II Distribution– Distribution by means other than telecommunications.

NOTICE TO AIRMEN (NOTAM)– A notice containing information (not known sufficiently in advance to publicize by other means) concerning the establishment, condition, or change in any component (facility, service, or procedure of, or hazard in the National Airspace System) the timely knowledge of which is essential to personnel concerned with flight operations.

a. NOTAM (D)– A NOTAM given (in addition to local dissemination) distant dissemination beyond the area of responsibility of the Flight Service Station. These NOTAMs will be stored and available until canceled.

b. FDC NOTAM– A NOTAM regulatory in nature, transmitted by USNOF and given system wide dissemination.

(See ICAO term NOTAM.)

NRR–

(See NON-RESTRICTIVE ROUTING.)

NRS–

(See NAVIGATION REFERENCE SYSTEM.)

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.)

POINT-TO-POINT (PTP)– A level of NRR service for aircraft that is based on traditional waypoints in their FMSs or RNAV equipage.

POLAR TRACK STRUCTURE– A system of organized routes between Iceland and Alaska which overlie Canadian MNPS Airspace.

POSITION REPORT– A report over a known location as transmitted by an aircraft to ATC.

(Refer to AIM.)

POSITION SYMBOL– A computer-generated indication shown on a radar display to indicate the mode of tracking.

POSITIVE CONTROL– The separation of all air traffic within designated airspace by air traffic control.

POWERED-LIFT– A heavier-than-air aircraft capable of vertical takeoff, vertical landing, and low-speed flight that depends principally on engine-driven lift devices during these flight regimes and on nonrotating airfoil(s) for lift during horizontal flight. Powered-lift aircraft can operate on routes or altitudes specifically prescribed for powered-lift by the FAA.

PRACTICE INSTRUMENT APPROACH– An instrument approach procedure conducted by a VFR or an IFR aircraft for the purpose of pilot training or proficiency demonstrations.

PRE-DEPARTURE CLEARANCE– An application with the Terminal Data Link System (TDLS) that provides clearance information to subscribers, through a service provider, in text to the cockpit or gate printer.

PRE-DEPARTURE REROUTE (PDRR)– A capability within the Traffic Flow Management System that enables ATC to quickly amend and execute revised departure clearances that mitigate en route constraints or balance en route traffic flows.

PREARRANGED COORDINATION– A standardized procedure which permits an air traffic controller to enter the airspace assigned to another air traffic controller without verbal coordination. The procedures are defined in a facility directive which ensures approved separation between aircraft.

PREARRANGED COORDINATION PROCEDURES– A facility's standardized procedure that describes the process by which one controller must allow an aircraft to penetrate or transit another controller's airspace in a manner that assures approved separation without individual coordination for each aircraft.

PRECIPITATION– Any or all forms of water particles (rain, sleet, hail, or snow) that fall from the atmosphere and reach the surface.

PRECISION APPROACH–

(See PRECISION APPROACH PROCEDURE.)

PRECISION APPROACH PROCEDURE– A standard instrument approach procedure in which an electronic glideslope or other type of glidepath is provided; e.g., ILS, PAR, and GLS.

(See INSTRUMENT LANDING SYSTEM.)

(See PRECISION APPROACH RADAR.)

PRECISION APPROACH RADAR– Radar equipment in some ATC facilities operated by the FAA and/or the military services at joint-use civil/military locations and separate military installations to detect and display azimuth, elevation, and range of aircraft on the final approach course to a runway. This equipment may be used to monitor certain nonradar approaches, but is primarily used to conduct a precision instrument approach (PAR) wherein the controller issues guidance instructions to the pilot based on the aircraft's position in relation to the final approach course (azimuth), the glidepath (elevation), and the distance (range) from the touchdown point on the runway as displayed on the radar scope.

(See GLIDEPATH.)

(See PAR.)

(See ICAO term PRECISION APPROACH RADAR.)

(Refer to AIM.)

PRECISION APPROACH RADAR [ICAO]– Primary radar equipment used to determine the position of an aircraft during final approach, in terms of lateral and vertical deviations relative to a nominal approach path, and in range relative to touchdown.

PRECISION OBSTACLE FREE ZONE (POFZ)– An 800 foot wide by 200 foot long area centered on the runway centerline adjacent to the threshold designed to protect aircraft flying precision approaches from ground vehicles and other aircraft when ceiling is less than 250 feet or visibility is less than 3/4 statute mile (or runway visual range below 4,000 feet.)

PRECISION RUNWAY MONITOR (PRM) SYSTEM– Provides air traffic controllers monitoring the NTZ during simultaneous close parallel PRM approaches with precision, high update rate secondary surveillance data. The high update rate surveillance sensor component of the PRM system is only required for specific runway or approach course separation. The high resolution color monitoring display, Final Monitor Aid (FMA) of the PRM system, or other FMA with the same capability, presents NTZ surveillance track data to controllers along with detailed maps depicting approaches and no transgression zone and is required for all simultaneous close parallel PRM NTZ monitoring operations.

(Refer to AIM.)

PREDICTIVE WIND SHEAR ALERT SYSTEM (PWS)– A self-contained system used on board some aircraft to alert the flight crew to the presence of a potential wind shear. PWS systems typically monitor 3 miles ahead and 25 degrees left and right of the aircraft's heading at or below 1200' AGL. Departing flights may receive a wind shear alert after they start the takeoff roll and may elect to abort the takeoff. Aircraft on approach receiving an alert may elect to go around or perform a wind shear escape maneuver.

PREFERRED IFR ROUTES– Routes established between busier airports to increase system efficiency and capacity. They normally extend through one or more ARTCC areas and are designed to achieve balanced traffic flows among high density terminals. IFR clearances are issued on the basis of these routes except when severe weather avoidance procedures or other factors dictate otherwise. Preferred IFR Routes are listed in the Chart Supplement U.S., and are also available at https://www.fly.faa.gov/rmt/nfdc_preferred_routes_database.jsp. If a flight is planned to or from an area having such routes but the departure or arrival point is not listed in the Chart Supplement U.S., pilots may use that part of a Preferred IFR Route which is appropriate for the departure or arrival point that is listed. Preferred IFR Routes may be defined by DPs, SIDs, or STARs; NAVAIDs, Waypoints, etc.; high or low altitude airways; or any combinations thereof. Because they often share elements with adapted routes, pilots' use of preferred IFR routes can minimize flight plan route amendments.

(See ADAPTED ROUTES.)

(See CENTER'S AREA.)

(See INSTRUMENT APPROACH PROCEDURE.)

(See INSTRUMENT DEPARTURE PROCEDURE.)

(See STANDARD TERMINAL ARRIVAL.)

(Refer to CHART SUPPLEMENT U.S.)

PRE-FLIGHT PILOT BRIEFING–

(See PILOT BRIEFING.)

PREVAILING VISIBILITY–

(See VISIBILITY.)

PRIMARY RADAR TARGET– An analog or digital target, exclusive of a secondary radar target, presented on a radar display.

PRM–

(See AREA NAVIGATION (RNAV) GLOBAL POSITIONING SYSTEM (GPS) PRECISION RUNWAY MONITORING (PRM) APPROACH.)

(See PRM APPROACH.)

(See PRECISION RUNWAY MONITOR SYSTEM.)

PRM APPROACH– An instrument approach procedure titled ILS PRM, RNAV PRM, LDA PRM, or GLS PRM conducted to parallel runways separated by less than 4,300 feet and at least 3,000 feet where independent closely

spaced approaches are permitted. Use of an enhanced display with alerting, a No Transgression Zone (NTZ), secondary monitor frequency, pilot PRM training, and publication of an Attention All Users Page are required for all PRM approaches. Depending on the runway spacing, the approach courses may be parallel or one approach course must be offset. PRM procedures are also used to conduct Simultaneous Offset Instrument Approach (SOIA) operations. In SOIA, one straight-in ILS PRM, RNAV PRM, GLS PRM, and one offset LDA PRM, RNAV PRM or GLS PRM approach are utilized. PRM procedures are terminated and a visual segment begins at the offset approach missed approach point where the minimum distance between the approach courses is 3000 feet. Runway spacing can be as close as 750 feet.

(Refer to AIM.)

PROCEDURAL CONTROL [ICAO]– Term used to indicate that information derived from an ATS surveillance system is not required for the provision of air traffic control service.

PROCEDURAL SEPARATION [ICAO]– The separation used when providing procedural control.

PROCEDURE TURN– The maneuver prescribed when it is necessary to reverse direction to establish an aircraft on the intermediate approach segment or final approach course. The outbound course, direction of turn, distance within which the turn must be completed, and minimum altitude are specified in the procedure. However, unless otherwise restricted, the point at which the turn may be commenced and the type and rate of turn are left to the discretion of the pilot.

(See ICAO term PROCEDURE TURN.)

PROCEDURE TURN [ICAO]– A maneuver in which a turn is made away from a designated track followed by a turn in the opposite direction to permit the aircraft to intercept and proceed along the reciprocal of the designated track.

Note 1: Procedure turns are designated “left” or “right” according to the direction of the initial turn.

Note 2: Procedure turns may be designated as being made either in level flight or while descending, according to the circumstances of each individual approach procedure.

PROCEDURE TURN INBOUND– That point of a procedure turn maneuver where course reversal has been completed and an aircraft is established inbound on the intermediate approach segment or final approach course. A report of “procedure turn inbound” is normally used by ATC as a position report for separation purposes.

(See FINAL APPROACH COURSE.)

(See PROCEDURE TURN.)

(See SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE.)

PROFILE DESCENT– An uninterrupted descent (except where level flight is required for speed adjustment; e.g., 250 knots at 10,000 feet MSL) from cruising altitude/level to interception of a glideslope or to a minimum altitude specified for the initial or intermediate approach segment of a nonprecision instrument approach. The profile descent normally terminates at the approach gate or where the glideslope or other appropriate minimum altitude is intercepted.

PROGRESS REPORT–

(See POSITION REPORT.)

PROGRESSIVE TAXI– Precise taxi instructions given to a pilot unfamiliar with the airport or issued in stages as the aircraft proceeds along the taxi route.

PROHIBITED AREA–

(See SPECIAL USE AIRSPACE.)

(See ICAO term PROHIBITED AREA.)

PROHIBITED AREA [ICAO]– An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is prohibited.

PROMINENT OBSTACLE– An obstacle that meets one or more of the following conditions:

a. An obstacle which stands out beyond the adjacent surface of surrounding terrain and immediately projects a noticeable hazard to aircraft in flight.

b. An obstacle, not characterized as low and close in, whose height is no less than 300 feet above the departure end of takeoff runway (DER) elevation, is within 10 NM from the DER, and that penetrates that airport/heliport's diverse departure obstacle clearance surface (OCS).

c. An obstacle beyond 10 NM from an airport/heliport that requires an obstacle departure procedure (ODP) to ensure obstacle avoidance.

(See OBSTACLE.)

(See OBSTRUCTION.)

PROPELLER (PROP) WASH (PROP BLAST)– The disturbed mass of air generated by the motion of a propeller.

PROPOSED BOUNDARY CROSSING TIME– Each center has a PBCT parameter for each internal airport. Proposed internal flight plans are transmitted to the adjacent center if the flight time along the proposed route from the departure airport to the center boundary is less than or equal to the value of PBCT or if airport adaptation specifies transmission regardless of PBCT.

PROPOSED DEPARTURE TIME– The time that the aircraft expects to become airborne.

PROTECTED AIRSPACE– The airspace on either side of an oceanic route/track that is equal to one-half the lateral separation minimum except where reduction of protected airspace has been authorized.

PROTECTED SEGMENT– The protected segment is a segment on the amended TFM route that is to be inhibited from automatic adapted route alteration by ERAM.

PT–

(See PROCEDURE TURN.)

PTP–

(See POINT-TO-POINT.)

PTS–

(See POLAR TRACK STRUCTURE.)

PUBLIC AIRCRAFT OPERATION (PAO)– A UAS operation meeting the qualifications and conditions required for the operation of a public aircraft.

(See AC-1.1)

(See AIM)

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 with flight instrumentation (when advisory lateral and vertical guidance is provided) and/or pilotage or dead reckoning navigation techniques 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.)

b. Advanced – Required Navigation Performance (A–RNP). A navigation specification based on RNP that requires advanced functions such as scalable RNP, radius–to–fix (RF) legs, and tactical parallel offsets. This sophisticated Navigation Specification (NavSpec) is designated by the abbreviation “A–RNP”.

c. Required Navigation Performance (RNP) Airspace. A generic term designating airspace, route(s), leg(s), operation(s), or procedure(s) where minimum required navigational performance (RNP) have been established.

d. Actual Navigation Performance (ANP). A measure of the current estimated navigational performance. Also referred to as Estimated Position Error (EPE).

e. Estimated Position Error (EPE). A measure of the current estimated navigational performance. Also referred to as Actual Navigation Performance (ANP).

f. Lateral Navigation (LNAV). A function of area navigation (RNAV) equipment which calculates, displays, and provides lateral guidance to a profile or path.

g. Vertical Navigation (VNAV). A function of area navigation (RNAV) equipment which calculates, displays, and provides vertical guidance to a profile or path.

REROUTE IMPACT ASSESSMENT (RRIA)– A capability within the Traffic Flow Management System that is used to define and evaluate a potential reroute prior to implementation, with or without miles–in–trail (MIT) restrictions. RRIA functions estimate the impact on demand (e.g., sector loads) and performance (e.g., flight delay). Using RRIA, traffic management personnel can determine whether the reroute will sufficiently reduce demand in the Flow Constraint Area and not create excessive “spill over” demand in the adjacent airspace on a specific route segment or point of interest (POI).

RESCUE COORDINATION CENTER (RCC)– A search and rescue (SAR) facility equipped and manned to coordinate and control SAR operations in an area designated by the SAR plan. The U.S. Coast Guard and the U.S. Air Force have responsibility for the operation of RCCs.

(See ICAO term RESCUE CO-ORDINATION CENTRE.)

RESCUE CO-ORDINATION CENTRE [ICAO]– A unit responsible for promoting efficient organization of search and rescue service and for coordinating the conduct of search and rescue operations within a search and rescue region.

RESOLUTION ADVISORY– A display indication given to the pilot by the Traffic alert and Collision Avoidance System (TCAS II) recommending a maneuver to increase vertical separation relative to an intruding aircraft. Positive, negative, and vertical speed limit (VSL) advisories constitute the resolution advisories. A resolution advisory is also classified as corrective or preventive.

RESTRICTED AREA–

(See SPECIAL USE AIRSPACE.)

(See ICAO term RESTRICTED AREA.)

RESTRICTED AREA [ICAO]– An airspace of defined dimensions, above the land areas or territorial waters of a State, within which the flight of aircraft is restricted in accordance with certain specified conditions.

RESUME NORMAL SPEED– Used by ATC to advise a pilot to resume an aircraft’s normal operating speed. It is issued to terminate a speed adjustment where no published speed restrictions apply. It does not delete speed restrictions in published procedures of upcoming segments of flight. This does not relieve the pilot of those speed restrictions that are applicable to 14 CFR section 91.117.

RESUME OWN NAVIGATION– Used by ATC to advise a pilot to resume his/her own navigational responsibility. It is issued after completion of a radar vector or when radar contact is lost while the aircraft is being radar vectored.

(See RADAR CONTACT LOST.)

(See RADAR SERVICE TERMINATED.)

RESUME PUBLISHED SPEED– Used by ATC to advise a pilot to resume published speed restrictions that are applicable to a SID, STAR, or other instrument procedure. It is issued to terminate a speed adjustment where speed restrictions are published on a charted procedure.

RHA–

(See REFINED HAZARD AREA.)

RID–

(See REMOTE IDENTIFICATION.)

RMI–

(See RADIO MAGNETIC INDICATOR.)

RNAV–

(See AREA NAVIGATION (RNAV).)

RNAV APPROACH– An instrument approach procedure which relies on aircraft area navigation equipment for navigational guidance.

(See AREA NAVIGATION (RNAV).)

(See INSTRUMENT APPROACH PROCEDURE.)

RNAV VISUAL FLIGHT PROCEDURE (RVFP)– An RVFP is a special visual flight procedure flown on an IFR flight plan. It is flown in visual conditions and clear of clouds must be maintained. An RVFP is flown using an approved RNAV system to maintain published lateral and vertical paths to runways without an instrument approach procedure. It requires an ATC clearance and may begin at other points along the path of the charted procedure when approved by ATC. An RVFP is not published in the Federal Register for public use and the operator is required to have a specific Operations Specification approval. Required ceiling and visibility minima are published on the procedure chart. An RVFP does not have a missed approach procedure and is not evaluated for obstacle protection.

ROAD RECONNAISSANCE (RC)– Military activity requiring navigation along roads, railroads, and rivers. Reconnaissance route/route segments are seldom along a straight line and normally require a lateral route width of 10 NM to 30 NM and an altitude range of 500 feet to 10,000 feet AGL.

ROGER– I have received all of your last transmission. It should not be used to answer a question requiring a yes or a no answer.

(See AFFIRMATIVE.)

(See NEGATIVE.)

ROLLOUT RVR–

(See VISIBILITY.)

ROTOR WASH– A phenomenon resulting from the vertical down wash of air generated by the main rotor(s) of a helicopter.

ROTORCRAFT– A heavier-than-air aircraft that depends principally for its support in flight on the lift generated by one or more rotors.

ROUND-ROBIN FLIGHT PLAN– A single flight plan filed from the departure airport to an intermediary destination(s) and then returning to the original departure airport.

ROUTE– A defined path, consisting of one or more courses in a horizontal plane, which aircraft traverse over the surface of the earth.

(See AIRWAY.)

(See JET ROUTE.)

(See PUBLISHED ROUTE.)

(See UNPUBLISHED ROUTE.)

ROUTE ACTION NOTIFICATION– EDST notification that an ADR/ADAR/AAR has been applied to the flight plan.

(See ATC PREFERRED ROUTE NOTIFICATION.)

(See EN ROUTE DECISION SUPPORT TOOL.)

S

SAA–

(See SENSE AND AVOID.)

(See SPECIAL ACTIVITY AIRSPACE.)

SAFETY ALERT– A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller’s judgment, places the aircraft in unsafe proximity to terrain, obstructions, or other aircraft. The controller may discontinue the issuance of further alerts if the pilot advises he/she is taking action to correct the situation or has the other aircraft in sight.

a. Terrain/Obstruction Alert– A safety alert issued by ATC to aircraft under their control if ATC is aware the aircraft is at an altitude which, in the controller’s judgment, places the aircraft in unsafe proximity to terrain/obstructions; e.g., “Low Altitude Alert, check your altitude immediately.”

b. Aircraft Conflict Alert– A safety alert issued by ATC to aircraft under their control if ATC is aware of an aircraft that is not under their control at an altitude which, in the controller’s judgment, places both aircraft in unsafe proximity to each other. With the alert, ATC will offer the pilot an alternate course of action when feasible; e.g., “Traffic Alert, advise you turn right heading zero nine zero or climb to eight thousand immediately.”

Note: The issuance of a safety alert is contingent upon the capability of the controller to have an awareness of an unsafe condition. The course of action provided will be predicated on other traffic under ATC control. Once the alert is issued, it is solely the pilot’s prerogative to determine what course of action, if any, he/she will take.

SAFETY LOGIC SYSTEM– A software enhancement to ASDE–3, ASDE–X, and ASSC, that predicts the path of aircraft landing and/or departing, and/or vehicular movements on runways. Visual and aural alarms are activated when the safety logic projects a potential collision. The Airport Movement Area Safety System (AMASS) is a safety logic system enhancement to the ASDE–3. The Safety Logic System for ASDE–X and ASSC is an integral part of the software program.

SAFETY LOGIC SYSTEM ALERTS–

a. ALERT–

1. An actual situation involving two real Safety Logic tracks (aircraft/aircraft, aircraft/vehicle, or aircraft/other tangible object) that the Safety Logic System has predicted will result in an imminent collision, based upon the Safety Logic parameters.

2. An actual situation involving a single Safety Logic track arriving to, or departing from, a closed runway.

3. An actual situation involving a single Safety Logic track arriving to a taxiway.

b. FALSE ALERT–

1. Alerts generated by one or more false surface radar or cooperative surveillance targets, that the ASDE system has interpreted as real tracks and placed into Safety Logic.

2. Alerts in which the Safety Logic System did not perform correctly, based upon the design specifications and Safety Logic parameters.

3. Alerts generated by surface radar targets caused by moderate or greater precipitation.

c. NUISANCE ALERT–

An alert in which one or more of the following is true:

1. The alert is generated by a known situation that is not considered an unsafe operation, such as LAHSO or other approved operations.

2. The alert is generated by inaccurate cooperative surveillance data received by the Safety Logic System.

3. One or more of the aircraft involved in the alert is not intending to use a runway/taxiway (helicopter, pipeline patrol, non–Mode C overflight, etc.).

d. VALID NON–ALERT– A situation in which the Safety Logic System correctly determines that an alert is not required, based upon the design specifications and Safety Logic parameters.

e. INVALID NON-ALERT– A situation in which the Safety Logic System did not issue an alert when an alert was required, based upon the design specifications and Safety Logic parameters.

SAIL BACK– A maneuver during high wind conditions (usually with power off) where float plane movement is controlled by water rudders/opening and closing cabin doors.

SAME DIRECTION AIRCRAFT– Aircraft are operating in the same direction when:

- a.** They are following the same track in the same direction; or
- b.** Their tracks are parallel and the aircraft are flying in the same direction; or
- c.** Their tracks intersect at an angle of less than 45 degrees.

SAR–

(See **SEARCH AND RESCUE**.)

SATELLITE-BASED AUGMENTATION SYSTEM (SBAS) – A wide coverage augmentation system in which the user receives augmentation information from a satellite-based transmitter.

(See **WIDE-AREA AUGMENTATION SYSTEM (WAAS)**.)

SAW–

(See **AVIATION WATCH NOTIFICATION MESSAGE**.)

SAY AGAIN– Used to request a repeat of the last transmission. Usually specifies transmission or portion thereof not understood or received; e.g., “Say again all after **ABRAM VOR**.”

SAY ALTITUDE– Used by ATC to ascertain an aircraft’s specific altitude/flight level. When the aircraft is climbing or descending, the pilot should state the indicated altitude rounded to the nearest 100 feet.

SAY HEADING– Used by ATC to request an aircraft heading. The pilot should state the actual heading of the aircraft.

SCHEDULED TIME OF ARRIVAL (STA)– A STA is the desired time that an aircraft should cross a certain point (landing or metering fix). It takes other traffic and airspace configuration into account. A STA time shows the results of the TBFM scheduler that has calculated an arrival time according to parameters such as optimized spacing, aircraft performance, and weather.

SE SAR–

(See **SURVEILLANCE ENHANCED SEARCH AND RESCUE**.)

SEA LANE– A designated portion of water outlined by visual surface markers for and intended to be used by aircraft designed to operate on water.

SEARCH AND RESCUE– A service which seeks missing aircraft and assists those found to be in need of assistance. It is a cooperative effort using the facilities and services of available Federal, state and local agencies. The U.S. Coast Guard is responsible for coordination of search and rescue for the Maritime Region, and the U.S. Air Force is responsible for search and rescue for the Inland Region. Information pertinent to search and rescue should be passed through any air traffic facility or be transmitted directly to the Rescue Coordination Center by telephone.

(See **FLIGHT SERVICE STATION**.)

(See **RESCUE COORDINATION CENTER**.)

(Refer to **AIM**.)

SEARCH AND RESCUE FACILITY– A facility responsible for maintaining and operating a search and rescue (SAR) service to render aid to persons and property in distress. It is any SAR unit, station, NET, or other operational activity which can be usefully employed during an SAR Mission; e.g., a Civil Air Patrol Wing, or a Coast Guard Station.

(See **SEARCH AND RESCUE**.)

SECNOT–

(See **SECURITY NOTICE**.)

SECONDARY RADAR TARGET– A target derived from a transponder return presented on a radar display.

SECTIONAL AERONAUTICAL CHARTS–

(See AERONAUTICAL CHART.)

SECTOR LIST DROP INTERVAL– A parameter number of minutes after the meter fix time when arrival aircraft will be deleted from the arrival sector list.

SECURITY NOTICE (SECNOT) – A SECNOT is a request originated by the Air Traffic Security Coordinator (ATSC) for an extensive communications search for aircraft involved, or suspected of being involved, in a security violation, or are considered a security risk. A SECNOT will include the aircraft identification, search area, and expiration time. The search area, as defined by the ATSC, could be a single airport, multiple airports, a radius of an airport or fix, or a route of flight. Once the expiration time has been reached, the SECNOT is considered to be canceled.

SECURITY SERVICES AIRSPACE – Areas established through the regulatory process or by NOTAM, issued by the Administrator under title 14, CFR, sections 99.7, 91.141, and 91.139, which specify that ATC security services are required; i.e., ADIZ or temporary flight rules areas.

SEE AND AVOID– When weather conditions permit, pilots operating IFR or VFR are required to observe and maneuver to avoid other aircraft. Right-of-way rules are contained in 14 CFR part 91.

SEGMENTED CIRCLE– A system of visual indicators designed to provide traffic pattern information at airports without operating control towers.

(Refer to AIM.)

SEGMENTS OF A SID/STAR–

a. En Route Transition– The segment(s) of a SID/STAR that connect to/from en route flight. Not all SIDs/STARs will contain an en route transition.

b. En Route Transition Waypoint– The NAVAID/fix/waypoint that defines the beginning of the SID/STAR en route transition.

c. Common Route– The segment(s) of a SID/STAR procedure that provides a single route serving an airport/runway or multiple airports/runways. The common route may consist of a single point. Not all conventional SIDs will contain a common route.

d. Runway Transition– The segment(s) of a SID/STAR between the common route/point and the runway(s). Not all SIDs/STARs will contain a runway transition.

e. Runway Transition Waypoint (RTW)– On a STAR, the NAVAID/fix/waypoint that defines the end of the common route or en route transition and the beginning of a runway transition (In the arrival route description found on the STAR chart, the last fix of the common route and the first fix of the runway transition(s)).

SEGMENTS OF AN INSTRUMENT APPROACH PROCEDURE– An instrument approach procedure may have as many as four separate segments depending on how the approach procedure is structured.

a. Initial Approach– The segment between the initial approach fix and the intermediate fix or the point where the aircraft is established on the intermediate course or final approach course.

(See ICAO term INITIAL APPROACH SEGMENT.)

b. Intermediate Approach– The segment between the intermediate fix or point and the final approach fix.

(See ICAO term INTERMEDIATE APPROACH SEGMENT.)

c. Final Approach– The segment between the final approach fix or point and the runway, airport, or missed approach point.

(See ICAO term FINAL APPROACH SEGMENT.)

d. Missed Approach– The segment between the missed approach point or the point of arrival at decision height and the missed approach fix at the prescribed altitude.

(Refer to 14 CFR part 97.)

(See ICAO term MISSED APPROACH PROCEDURE.)

SELF-BRIEFING– A self-briefing is a review, using automated tools, of all meteorological and aeronautical information that may influence the pilot in planning, altering, or canceling a proposed route of flight.

SENSE AND AVOID (SAA)– The capability of an unmanned aircraft to detect (sense) and avoid collisions with other aircraft and all obstacles, whether airborne or on the ground while operating in the NAS.

SEPARATION– In air traffic control, the spacing of aircraft to achieve their safe and orderly movement in flight and while landing and taking off.

(See SEPARATION MINIMA.)

(See ICAO term SEPARATION.)

SEPARATION [ICAO]– Spacing between aircraft, levels or tracks.

SEPARATION MINIMA– The minimum longitudinal, lateral, or vertical distances by which aircraft are spaced through the application of air traffic control procedures.

(See SEPARATION.)

SERVICE– A generic term that designates functions or assistance available from or rendered by air traffic control. For example, Class C service would denote the ATC services provided within a Class C airspace area.

SEVERE WEATHER AVOIDANCE PLAN (SWAP)– An approved plan to minimize the affect of severe weather on traffic flows in impacted terminal and/or ARTCC areas. A SWAP is normally implemented to provide the least disruption to the ATC system when flight through portions of airspace is difficult or impossible due to severe weather.

SEVERE WEATHER FORECAST ALERTS– Preliminary messages issued in order to alert users that a Severe Weather Watch Bulletin (WW) is being issued. These messages define areas of possible severe thunderstorms or tornado activity. The messages are unscheduled and issued as required by the Storm Prediction Center (SPC) at Norman, Oklahoma.

(See AIRMET.)

(See CONVECTIVE SIGMET.)

(See CWA.)

(See GRAPHICAL AIRMEN'S METEOROLOGICAL INFORMATION.)

(See SIGMET.)

SFA–

(See SINGLE FREQUENCY APPROACH.)

SFO–

(See SIMULATED FLAMEOUT.)

SFI

(See SPECIAL GOVERNMENT INTEREST.)

SHF–

(See SUPER HIGH FREQUENCY.)

SHORT RANGE CLEARANCE– A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while air traffic control facilities are coordinating and obtaining the complete clearance.

SHORT TAKEOFF AND LANDING AIRCRAFT (STOL)– An aircraft which, at some weight within its approved operating weight, is capable of operating from a runway in compliance with the applicable STOL characteristics, airworthiness, operations, noise, and pollution standards.

(See VERTICAL TAKEOFF AND LANDING AIRCRAFT.)

SIAP–

(See STANDARD INSTRUMENT APPROACH PROCEDURE.)

SID–

(See STANDARD INSTRUMENT DEPARTURE.)

SIDESTEP MANEUVER– A visual maneuver accomplished by a pilot at the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1,200 feet to either side of the runway to which the instrument approach was conducted.

(Refer to AIM.)

SIGMET– A weather advisory issued concerning weather significant to the safety of all aircraft. SIGMET advisories cover severe and extreme turbulence, severe icing, and widespread dust or sandstorms that reduce visibility to less than 3 miles.

(See AIRMET.)

(See CONVECTIVE SIGMET.)

(See CWA.)

(See GRAPHICAL ARMEN'S METEOROLOGICAL INFORMATION.)

(See ICAO term SIGMET INFORMATION.)

(See SAW.)

(Refer to AIM.)

SIGMET INFORMATION [ICAO]– Information issued by a meteorological watch office concerning the occurrence or expected occurrence of specified en-route weather phenomena which may affect the safety of aircraft operations.

SIGNIFICANT METEOROLOGICAL INFORMATION–

(See SIGMET.)

SIGNIFICANT POINT– A point, whether a named intersection, a NAVAID, a fix derived from a NAVAID(s), or geographical coordinate expressed in degrees of latitude and longitude, which is established for the purpose of providing separation, as a reporting point, or to delineate a route of flight.

SIMULATED FLAMEOUT– A practice approach by a jet aircraft (normally military) at idle thrust to a runway. The approach may start at a runway (high key) and may continue on a relatively high and wide downwind leg with a continuous turn to final. It terminates in landing or low approach. The purpose of this approach is to simulate a flameout.

(See FLAMEOUT.)

SIMULTANEOUS CLOSE PARALLEL APPROACHES– A simultaneous, independent approach operation permitting ILS/RNAV/GLS approaches to airports having parallel runways separated by at least 3,000 feet and less than 4,300–feet between centerlines. Aircraft are permitted to pass each other during these simultaneous operations. Integral parts of a total system are radar, NTZ monitoring with enhanced FMA color displays that include aural and visual alerts and predictive aircraft position software, communications override, ATC procedures, an Attention All Users Page (AAUP), PRM in the approach name, and appropriate ground based and airborne equipment. High update rate surveillance sensor required for certain runway or approach course separations.

SIMULTANEOUS (CONVERGING) DEPENDENT APPROACHES– An approach operation permitting ILS/RNAV/GLS approaches to runways or missed approach courses that intersect where required minimum spacing between the aircraft on each final approach course is required.

SIMULTANEOUS (CONVERGING) INDEPENDENT APPROACHES– An approach operation permitting ILS/RNAV/GLS approaches to non-parallel runways where approach procedure design maintains the required aircraft spacing throughout the approach and missed approach and hence the operations may be conducted independently.

SIMULTANEOUS ILS APPROACHES– An approach system permitting simultaneous ILS approaches to airports having parallel runways separated by at least 4,300 feet between centerlines. Integral parts of a total system are ILS, radar, communications, ATC procedures, and appropriate airborne equipment.

(See PARALLEL RUNWAYS.)

(Refer to AIM.)

SIMULTANEOUS OFFSET INSTRUMENT APPROACH (SOIA)– An instrument landing system comprised of an ILS PRM, RNAV PRM or GLS PRM approach to one runway and an offset LDA PRM with glideslope or an RNAV PRM or GLS PRM approach utilizing vertical guidance to another where parallel runway spaced less than 3,000 feet and at least 750 feet apart. The approach courses converge by 2.5 to 3 degrees. Simultaneous close parallel PRM approach procedures apply up to the point where the approach course separation becomes 3,000 feet, at the offset MAP. From the offset MAP to the runway threshold, visual separation by the aircraft conducting the offset approach is utilized.

(Refer to AIM)

SIMULTANEOUS (PARALLEL) DEPENDENT APPROACHES– An approach operation permitting ILS/RNAV/GLS approaches to adjacent parallel runways where prescribed diagonal spacing must be maintained. Aircraft are not permitted to pass each other during simultaneous dependent operations. Integral parts of a total system ATC procedures, and appropriate airborne and ground based equipment.

SINGLE DIRECTION ROUTES– Preferred IFR Routes which are sometimes depicted on high altitude en route charts and which are normally flown in one direction only.

(See PREFERRED IFR ROUTES.)

(Refer to CHART SUPPLEMENT U.S.)

SINGLE FREQUENCY APPROACH– A service provided under a letter of agreement to military single-piloted turbojet aircraft which permits use of a single UHF frequency during approach for landing. Pilots will not normally be required to change frequency from the beginning of the approach to touchdown except that pilots conducting an en route descent are required to change frequency when control is transferred from the air route traffic control center to the terminal facility. The abbreviation “SFA” in the DoD FLIP IFR Supplement under “Communications” indicates this service is available at an aerodrome.

SINGLE-PILOTED AIRCRAFT– A military turbojet aircraft possessing one set of flight controls, tandem cockpits, or two sets of flight controls but operated by one pilot is considered single-piloted by ATC when determining the appropriate air traffic service to be applied.

(See SINGLE FREQUENCY APPROACH.)

SKYSPOTTER– A pilot who has received specialized training in observing and reporting inflight weather phenomena.

SLASH– A radar beacon reply displayed as an elongated target.

SLDI–

(See SECTOR LIST DROP INTERVAL.)

SLOW TAXI– To taxi a float plane at low power or low RPM.

SMALL UNMANNED AIRCRAFT SYSTEM (sUAS)– An unmanned aircraft weighing less than 55 pounds on takeoff, including everything that is on board or otherwise attached to the aircraft.

SMAR–

(See SPECIAL MILITARY ACTIVITY ROUTE.)

SN–

(See SYSTEM STRATEGIC NAVIGATION.)

SPACE-BASED ADS-B (SBA)– A constellation of satellites that receives ADS-B Out broadcasts and relays that information to the appropriate surveillance facility. The currently deployed SBA system is only capable of receiving broadcasts from 1090ES-equipped aircraft, and not from those equipped with only a universal access transceiver (UAT). Also, aircraft with a top-of-fuselage-mounted transponder antenna (required for TCAS II installations) will be better received by SBA, especially at latitudes below 45 degrees.

(See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST.)

(See AUTOMATIC DEPENDENT SURVEILLANCE-BROADCAST OUT.)

SPACE LAUNCH AND REENTRY AREA– Locations where commercial space launch and/or reentry operations occur. For pilot awareness, a rocket-shaped symbol is used to depict space launch and reentry areas on sectional aeronautical charts.

SPEAK SLOWER– Used in verbal communications as a request to reduce speech rate.

SPECIAL ACTIVITY AIRSPACE (SAA)– Airspace with defined dimensions within the National Airspace System wherein limitations may be imposed upon operations for national defense, homeland security, public interest, or public safety. Special activity airspace includes but is not limited to the following: Air Traffic Control Assigned Airspace (ATCAA), Altitude Reservations (ALTRV), Military Training Routes (MTR), Air Refueling Tracks and Anchors, Temporary Flight Restrictions (TFR), Special Security Instructions (SSI), etc. Special Use Airspace (SUA) is a subset of Special Activity Airspace.

(See SPECIAL USE AIRSPACE.)

SPECIAL AIR TRAFFIC RULES (SATR)– Rules that govern procedures for conducting flights in certain areas listed in 14 CFR part 93. The term “SATR” is used in the United States to describe the rules for operations in specific areas designated in the Code of Federal Regulations.

(Refer to 14 CFR part 93.)

SPECIAL EMERGENCY– A condition of air piracy or other hostile act by a person(s) aboard an aircraft which threatens the safety of the aircraft or its passengers.

SPECIAL FLIGHT RULES AREA (SFRA)– An area in the NAS, described in 14 CFR part 93, wherein the flight of aircraft is subject to special traffic rules, unless otherwise authorized by air traffic control. Not all areas listed in 14 CFR part 93 are designated SFRA, but special air traffic rules apply to all areas described in 14 CFR part 93.

SPECIAL GOVERNMENT INTEREST (SGI)– A near real-time airspace authorization for part 91 or part 107 UAS, which supports activities that answer significant and urgent governmental interests. These include: national defense, homeland security, law enforcement, and emergency operations objectives.

SPECIAL INSTRUMENT APPROACH PROCEDURE–

(See INSTRUMENT APPROACH PROCEDURE.)

SPECIAL MILITARY ACTIVITY ROUTE (SMAR)– A route, which may also be charted on the VFR Sectional Chart, that shows the extent of the airspace allocated to an associated IFR Military Training Route within which the Department of Defense conducts periodic operations involving Unmanned Aircraft Systems (UAS).

SPECIAL USE AIRSPACE– Airspace of defined dimensions identified by an area on the surface of the earth wherein activities must be confined because of their nature and/or wherein limitations may be imposed upon aircraft operations that are not a part of those activities. Types of special use airspace are:

a. Alert Area– Airspace which may contain a high volume of pilot training activities or an unusual type of aerial activity, neither of which is hazardous to aircraft. Alert Areas are depicted on aeronautical charts for the information of nonparticipating pilots. All activities within an Alert Area are conducted in accordance with Federal Aviation Regulations, and pilots of participating aircraft as well as pilots transiting the area are equally responsible for collision avoidance.

b. Controlled Firing Area– Airspace wherein activities are conducted under conditions so controlled as to eliminate hazards to nonparticipating aircraft and to ensure the safety of persons and property on the ground.

c. Military Operations Area (MOA)– Permanent and temporary MOAs are airspace established outside of Class A airspace area to separate or segregate certain nonhazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted. Permanent MOAs are depicted on Sectional Aeronautical, VFR Terminal Area, and applicable En Route Low Altitude Charts.

Note: Temporary MOAs are not charted.

(Refer to AIM.)

d. National Security Area (NSA)– Airspace of defined vertical and lateral dimensions established at locations where there is a requirement for increased security of ground facilities. Pilots are requested to voluntarily avoid flying through the depicted NSA. When a greater level of security is required, flight through an NSA may be temporarily prohibited by establishing a TFR under the provisions of 14 CFR section 99.7. Such prohibitions will be issued by FAA Headquarters and disseminated via the U.S. NOTAM System.

(Refer to AIM)

e. Prohibited Area– Airspace designated under 14 CFR part 73 within which no person may operate an aircraft without the permission of the using agency.

(Refer to AIM.)

(Refer to En Route Charts.)

f. Restricted Area– Permanent and temporary restricted areas are airspace designated under 14 CFR part 73, within which the flight of aircraft, while not wholly prohibited, is subject to restriction. Most restricted areas are designated joint use and IFR/VFR operations in the area may be authorized by the controlling ATC facility when it is not being utilized by the using agency. Permanent restricted areas are depicted on Sectional Aeronautical, VFR Terminal Area, and applicable En Route charts. Where joint use is authorized, the name of the ATC controlling facility is also shown.

Note: Temporary restricted areas are not charted.

(Refer to 14 CFR part 73.)

(Refer to AIM.)

g. Warning Area– A warning area is airspace of defined dimensions extending from 3 nautical miles outward from the coast of the United States, that contains activity that may be hazardous to nonparticipating aircraft. The purpose of such warning area is to warn nonparticipating pilots of the potential danger. A warning area may be located over domestic or international waters or both.

SPECIAL VFR CONDITIONS– Meteorological conditions that are less than those required for basic VFR flight in Class B, C, D, or E surface areas and in which some aircraft are permitted flight under visual flight rules.

(See SPECIAL VFR OPERATIONS.)

(Refer to 14 CFR part 91.)

SPECIAL VFR FLIGHT [ICAO]– A VFR flight cleared by air traffic control to operate within Class B, C, D, and E surface areas in meteorological conditions below VMC.

SPECIAL VFR OPERATIONS– Aircraft operating in accordance with clearances within Class B, C, D, and E surface areas in weather conditions less than the basic VFR weather minima. Such operations must be requested by the pilot and approved by ATC.

(See SPECIAL VFR CONDITIONS.)

(See ICAO term SPECIAL VFR FLIGHT.)

SPECIALIST–PROVIDED SERVICES–

Services delivered directly by a flight service specialist via ground/ground communication, air/ground communication, in-person, or technology (for example, speech-to-text, email, or short message service).

SPEED–

(See AIRSPEED.)

(See GROUND SPEED.)

SPEED ADJUSTMENT– An ATC procedure used to request pilots to adjust aircraft speed to a specific value for the purpose of providing desired spacing. Pilots are expected to maintain a speed of plus or minus 10 knots or 0.02 Mach number of the specified speed. Examples of speed adjustments are:

a. “Increase/reduce speed to Mach point (number).”

b. “Increase/reduce speed to (speed in knots)” or “Increase/reduce speed (number of knots) knots.”

SPEED ADVISORY– Speed advisories that are generated within Time-Based Flow Management to assist controllers to meet the Scheduled Time of Arrival (STA) at the meter fix/meter arc. See also Ground-Based Interval Management–Spacing (GIM–S) Speed Advisory.

SPEED BRAKES– Moveable aerodynamic devices on aircraft that reduce airspeed during descent and landing.

SPEED SEGMENTS– Portions of the arrival route between the transition point and the vertex along the optimum flight path for which speeds and altitudes are specified. There is one set of arrival speed segments adapted from each transition point to each vertex. Each set may contain up to six segments.

SPOOFING– Denotes emissions of GNSS–like signals that may be acquired and tracked in combination with or instead of the intended signals by civil receivers. The onset of spoofing effects can be instantaneous or delayed, and effects can persist after the spoofing has ended. Spoofing can result in false and potentially confusing, or hazardingly misleading, position, navigation, and/or date/time information in addition to loss of GNSS use.

SQUAWK (Mode, Code, Function)– Used by ATC to instruct a pilot to activate the aircraft transponder and ADS–B Out with altitude reporting enabled, or (military) to activate only specific modes, codes, or functions. Examples: “Squawk five seven zero seven;” “Squawk three/alpha, two one zero five.”

(See TRANSPONDER.)

STA–

(See SCHEDULED TIME OF ARRIVAL.)

STAGING/QUEUING– The placement, integration, and segregation of departure aircraft in designated movement areas of an airport by departure fix, EDCT, and/or restriction.

STAND BY– Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait as in “stand by for clearance.” The caller should reestablish contact if a delay is lengthy. “Stand by” is not an approval or denial.

STANDARD INSTRUMENT APPROACH PROCEDURE (SIAP)–

(See INSTRUMENT APPROACH PROCEDURE.)

STANDARD INSTRUMENT DEPARTURE (SID)– A preplanned instrument flight rule (IFR) air traffic control (ATC) departure procedure printed for pilot/controller use in graphic form to provide obstacle clearance and a transition from the terminal area to the appropriate en route structure. SIDs are primarily designed for system enhancement to expedite traffic flow and to reduce pilot/controller workload. ATC clearance must always be received prior to flying a SID.

(See IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES.)

(See OBSTACLE DEPARTURE PROCEDURE.)

(Refer to AIM.)

STANDARD RATE TURN– A turn of three degrees per second.

STANDARD TERMINAL ARRIVAL (STAR)– A preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STARs provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

STANDARD TERMINAL ARRIVAL CHARTS–

(See AERONAUTICAL CHART.)

STANDARD TERMINAL AUTOMATION REPLACEMENT SYSTEM (STARS)–

(See DTAS.)

STAR–

(See STANDARD TERMINAL ARRIVAL.)

STATE AIRCRAFT– Aircraft used in military, customs and police service, in the exclusive service of any government or of any political subdivision thereof, including the government of any state, territory, or possession of the United States or the District of Columbia, but not including any government-owned aircraft engaged in carrying persons or property for commercial purposes.

STATIC RESTRICTIONS– Those restrictions that are usually not subject to change, fixed, in place, and/or published.

STATIONARY AIRSPACE RESERVATION– The term used in oceanic ATC for airspace that encompasses activities in a fixed volume of airspace to be occupied for a specified time period. Stationary Airspace Reservations may include activities such as special tests of weapons systems or equipment; certain U.S. Navy carrier, fleet, and anti–submarine operations; rocket, missile, and drone operations; and certain aerial refueling or similar operations.

(See STATIONARY ALTITUDE RESERVATION.)

STATIONARY ALTITUDE RESERVATION (STATIONARY ALTRV)– An altitude reservation which encompasses activities in a fixed volume of airspace to be occupied for a specified time period. Stationary ALTRVs may include activities such as special tests of weapons systems or equipment; certain U.S. Navy carrier, fleet, and anti–submarine operations; rocket, missile, and drone operations; and certain aerial refueling or similar operations.

STEP TAXI– To taxi a float plane at full power or high RPM.

STEP TURN– A maneuver used to put a float plane in a planing configuration prior to entering an active sea lane for takeoff. The STEP TURN maneuver should only be used upon pilot request.

STEPDOWN FIX– A fix permitting additional descent within a segment of an instrument approach procedure by identifying a point at which a controlling obstacle has been safely overflown.

STEREO ROUTE– A routinely used route of flight established by users and ARTCCs identified by a coded name; e.g., ALPHA 2. These routes minimize flight plan handling and communications.

STNR ALT RESERVATION– An abbreviation for Stationary Altitude Reservation commonly used in NOTAMs.

(See STATIONARY ALTITUDE RESERVATION.)

STOL AIRCRAFT–

(See SHORT TAKEOFF AND LANDING AIRCRAFT.)

STOP ALTITUDE SQUAWK– Used by ATC to instruct a pilot to turn off the automatic altitude reporting feature of the aircraft transponder and ADS–B Out. It is issued when a verbally reported altitude varies by 300 feet or more from the automatic altitude report.

(See ALTITUDE READOUT.)

(See TRANSPONDER.)

STOP AND GO– A procedure wherein an aircraft will land, make a complete stop on the runway, and then commence a takeoff from that point.

(See LOW APPROACH.)

(See OPTION APPROACH.)

STOP BURST–

(See STOP STREAM.)

STOP BUZZER–

(See STOP STREAM.)

STOP SQUAWK (Mode or Code)– Used by ATC to instruct a pilot to stop transponder and ADS–B transmissions, or to turn off only specified functions of the aircraft transponder (military).

(See STOP ALTITUDE SQUAWK.)

(See TRANSPONDER.)

STOP STREAM– Used by ATC to request a pilot to suspend electronic attack activity.

(See JAMMING.)

STOPOVER FLIGHT PLAN– A flight plan format which permits in a single submission the filing of a sequence of flight plans through interim full-stop destinations to a final destination.

STOPWAY– An area beyond the takeoff runway no less wide than the runway and centered upon the extended centerline of the runway, able to support the airplane during an aborted takeoff, without causing structural damage to the airplane, and designated by the airport authorities for use in decelerating the airplane during an aborted takeoff.

STRAIGHT-IN APPROACH IFR– An instrument approach wherein final approach is begun without first having executed a procedure turn, not necessarily completed with a straight-in landing or made to straight-in landing minimums.

(See LANDING MINIMUMS.)

(See STRAIGHT-IN APPROACH VFR.)

(See STRAIGHT-IN LANDING.)

STRAIGHT-IN APPROACH VFR– Entry into the traffic pattern by interception of the extended runway centerline (final approach course) without executing any other portion of the traffic pattern.

(See TRAFFIC PATTERN.)

STRAIGHT-IN LANDING– A landing made on a runway aligned within 30° of the final approach course following completion of an instrument approach.

(See STRAIGHT-IN APPROACH IFR.)

STRAIGHT-IN LANDING MINIMUMS–

(See LANDING MINIMUMS.)

STRAIGHT-IN MINIMUMS–

(See STRAIGHT-IN LANDING MINIMUMS.)

STRATEGIC PLANNING– Planning whereby solutions are sought to resolve potential conflicts.

sUAS–

(See SMALL UNMANNED AIRCRAFT SYSTEM.)

SUBSTITUTE ROUTE– A route assigned to pilots when any part of an airway or route is unusable because of NAVAID status. These routes consist of:

- a. Substitute routes which are shown on U.S. Government charts.
- b. Routes defined by ATC as specific NAVAID radials or courses.
- c. Routes defined by ATC as direct to or between NAVAIDs.

SUNSET AND SUNRISE– The mean solar times of sunset and sunrise as published in the Nautical Almanac, converted to local standard time for the locality concerned. Within Alaska, the end of evening civil twilight and the beginning of morning civil twilight, as defined for each locality.

SUPPLEMENTAL WEATHER SERVICE LOCATION– Airport facilities staffed with contract personnel who take weather observations and provide current local weather to pilots via telephone or radio. (All other services are provided by the parent FSS.)

SUPPS– Refers to ICAO Document 7030 Regional Supplementary Procedures. SUPPS contain procedures for each ICAO Region which are unique to that Region and are not covered in the worldwide provisions identified in the ICAO Air Navigation Plan. Procedures contained in Chapter 8 are based in part on those published in SUPPS.

SURFACE AREA– The airspace contained by the lateral boundary of the Class B, C, D, or E airspace designated for an airport that begins at the surface and extends upward.

SURFACE METERING PROGRAM– A capability within Terminal Flight Data Manager that provides the user with the ability to tactically manage surface traffic flows through adjusting desired minimum and maximum departure queue lengths to balance surface demand with capacity. When a demand/capacity imbalance for a surface resource is predicted, a metering procedure is recommended.

SURFACE VIEWER– A capability within the Traffic Flow Management System that provides situational awareness for a user–selected airport. The Surface Viewer displays a top–down view of an airport depicting runways, taxiways, gate areas, ramps, and buildings. The display also includes icons representing aircraft and vehicles currently on the surface, with identifying information. In addition, the display includes current airport configuration information such as departure/arrival runways and airport departure/arrival rates.

SURPIC– A description of surface vessels in the area of a Search and Rescue incident including their predicted positions and their characteristics.

(Refer to FAA Order JO 7110.65, Para 10–6–4, INFLIGHT CONTINGENCIES.)

SURVEILLANCE APPROACH– An instrument approach wherein the air traffic controller issues instructions, for pilot compliance, based on aircraft position in relation to the final approach course (azimuth), and the distance (range) from the end of the runway as displayed on the controller's radar scope. The controller will provide recommended altitudes on final approach if requested by the pilot.

(Refer to AIM.)

SURVEILLANCE ENHANCED SEARCH AND RESCUE (SE SAR)– An automated service used to enhance search and rescue operations that provides federal contract flight service specialists direct information from the aircraft's registered tracking device.

SUSPICIOUS UAS– Suspicious UAS operations may include operating without authorization, loitering in the vicinity of sensitive locations, (e.g., national security, law enforcement facilities, and critical infrastructure), or disrupting normal air traffic operations resulting in runway changes, ground stops, pilot evasive action, etc. The report of a UAS operation alone does not constitute suspicious activity. Development of a comprehensive list of suspicious activities is not possible due to the vast number of situations that could be considered suspicious. ATC must exercise sound judgment when identifying situations that could constitute or indicate a suspicious activity.

SWAP–

(See SEVERE WEATHER AVOIDANCE PLAN.)

SWSL–

(See SUPPLEMENTAL WEATHER SERVICE LOCATION.)

SYSTEM STRATEGIC NAVIGATION– Military activity accomplished by navigating along a preplanned route using internal aircraft systems to maintain a desired track. This activity normally requires a lateral route width of 10 NM and altitude range of 1,000 feet to 6,000 feet AGL with some route segments that permit terrain following.

ground-based air traffic surveillance sensors, typically from radar targets. TIS-B service will be available throughout the NAS where there are both adequate surveillance coverage (radar) and adequate broadcast coverage from ADS-B ground stations. Loss of TIS-B will occur when an aircraft enters an area not covered by the GBT network. If this occurs in an area with adequate surveillance coverage (radar), nearby aircraft that remain within the adequate broadcast coverage (ADS-B) area will view the first aircraft. TIS-B may continue when an aircraft enters an area with inadequate surveillance coverage (radar); nearby aircraft that remain within the adequate broadcast coverage (ADS-B) area will not view the first aircraft.

TRAFFIC IN SIGHT– Used by pilots to inform a controller that previously issued traffic is in sight.

(See NEGATIVE CONTACT.)

(See TRAFFIC ADVISORIES.)

TRAFFIC MANAGEMENT INITIATIVE (TMI)– Tools used to manage demand with capacity in the National Airspace System (NAS.) TMIs can be used to manage NAS resources (e.g., airports, sectors, airspace) or to increase the efficiency of the operation. TMIs can be either tactical (i.e., short term) or strategic (i.e., long term), depending on the type of TMI and the operational need.

TRAFFIC MANAGEMENT PROGRAM ALERT– A term used in a Notice to Airmen (NOTAM) issued in conjunction with a special traffic management program to alert pilots to the existence of the program and to refer them to a special traffic management program advisory message for program details. The contraction TMPA is used in NOTAM text.

TRAFFIC MANAGEMENT UNIT– The entity in ARTCCs and designated terminals directly involved in the active management of facility traffic. Usually under the direct supervision of an assistant manager for traffic management.

TRAFFIC NO FACTOR– Indicates that the traffic described in a previously issued traffic advisory is no factor.

TRAFFIC NO LONGER OBSERVED– Indicates that the traffic described in a previously issued traffic advisory is no longer depicted on radar, but may still be a factor.

TRAFFIC PATTERN– The traffic flow that is prescribed for aircraft landing at, taxiing on, or taking off from an airport. The components of a typical traffic pattern are departure, upwind leg, crosswind leg, downwind leg, base leg, and final approach.

a. Upwind Leg– A flight path that begins after departure and continues straight ahead along the extended runway centerline. Upwind leg is an extension of departure and is used when issuing control instructions for separation, spacing or sequencing.

b. Crosswind Leg– A flight path at right angles to the landing runway off its upwind end.

c. Downwind Leg– A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.

d. Base Leg– A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.

NOTE–

ATC may instruct a pilot to report a “2-mile left base” to Runway 22. This instruction means that the pilot is expected to maneuver their aircraft into a left base leg that will intercept a straight-in final 2 miles from the approach end of Runway 22 and advise ATC.

REFERENCE–

Pilot’s Handbook of Aeronautical Knowledge, FAA–H–8083–25, Chapter 14, Airport Operations, Traffic Patterns.

e. Final Approach– A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

NOTE–

ATC may instruct a pilot to report “5-mile final” to Runway 22. This instruction means that the pilot should maneuver their aircraft onto a straight-in final and advise ATC when they are five miles from the approach end of Runway 22.

f. Departure– The flight path that begins after takeoff and continues straight ahead along the extended runway centerline. The departure climb continues until reaching a point at least 1/2 mile beyond the departure end of the runway and within 300 feet of the traffic pattern altitude.

REFERENCE–

Pilot's Handbook of Aeronautical Knowledge, FAA-H-8083-25, Chapter 14, Airport Operations, Traffic Patterns.

(See STRAIGHT-IN APPROACH VFR.)

(See TAXI PATTERNS.)

(See ICAO term AERODROME TRAFFIC CIRCUIT.)

(Refer to 14 CFR part 91.)

(Refer to AIM.)

TRAFFIC SITUATION DISPLAY (TSD)– TSD is a computer system that receives radar track data from all 20 CONUS ARTCCs, organizes this data into a mosaic display, and presents it on a computer screen. The display allows the traffic management coordinator multiple methods of selection and highlighting of individual aircraft or groups of aircraft. The user has the option of superimposing these aircraft positions over any number of background displays. These background options include ARTCC boundaries, any stratum of en route sector boundaries, fixes, airways, military and other special use airspace, airports, and geopolitical boundaries. By using the TSD, a coordinator can monitor any number of traffic situations or the entire systemwide traffic flows.

TRAJECTORY– A EDST representation of the path an aircraft is predicted to fly based upon a Current Plan or Trial Plan.

(See EN ROUTE DECISION SUPPORT TOOL.)

TRAJECTORY-BASED OPERATIONS (TBO)– An Air Traffic Management method for strategically planning and managing flights throughout the operation by using Time-Based Management (TBM), information exchange between air and ground systems, and the aircraft's ability to fly trajectories in time and space. Aircraft trajectory is defined in four dimensions – latitude, longitude, altitude, and time.

TRAJECTORY MODELING– The automated process of calculating a trajectory.

TRAJECTORY OPTIONS SET (TOS)– A TOS is an electronic message, submitted by the operator, that is used by the Collaborative Trajectory Options Program (CTOP) to manage the airspace captured in the traffic management program. The TOS will allow the operator to express the route and delay trade-off options that they are willing to accept.

TRANSFER OF CONTROL– That action whereby the responsibility for the separation of an aircraft is transferred from one controller to another.

(See ICAO term TRANSFER OF CONTROL.)

TRANSFER OF CONTROL [ICAO]– Transfer of responsibility for providing air traffic control service.

TRANSFERRING CONTROLLER– A controller/facility transferring control of an aircraft to another controller/facility.

(See ICAO term TRANSFERRING UNIT/CONTROLLER.)

TRANSFERRING FACILITY–

(See TRANSFERRING CONTROLLER.)

TRANSFERRING UNIT/CONTROLLER [ICAO]– Air traffic control unit/air traffic controller in the process of transferring the responsibility for providing air traffic control service to an aircraft to the next air traffic control unit/air traffic controller along the route of flight.

Note: See definition of accepting unit/controller.

TRANSITION– The general term that describes the change from one phase of flight or flight condition to another; e.g., transition from en route flight to the approach or transition from instrument flight to visual flight.

TRANSITION POINT– A point at an adapted number of miles from the vertex at which an arrival aircraft would normally commence descent from its en route altitude. This is the first fix adapted on the arrival speed segments.

TRANSITIONAL AIRSPACE– That portion of controlled airspace wherein aircraft change from one phase of flight or flight condition to another.

TRANSITIONAL HAZARD AREA (THA)– Used by ATC. Airspace normally associated with an Aircraft Hazard Area within which the flight of aircraft is subject to restrictions.

(See AIRCRAFT HAZARD AREA.)

(See CONTINGENCY HAZARD AREA.)

(See REFINED HAZARD AREA.)

TRANSMISSOMETER– An apparatus used to determine visibility by measuring the transmission of light through the atmosphere. It is the measurement source for determining runway visual range (RVR).

(See VISIBILITY.)

TRANSMITTING IN THE BLIND– A transmission from one station to other stations in circumstances where two-way communication cannot be established, but where it is believed that the called stations may be able to receive the transmission.

TRANSPONDER– The airborne radar beacon receiver/transmitter portion of the Air Traffic Control Radar Beacon System (ATCRBS) which automatically receives radio signals from interrogators on the ground, and selectively replies with a specific reply pulse or pulse group only to those interrogations being received on the mode to which it is set to respond.

(See INTERROGATOR.)

(See ICAO term TRANSPONDER.)

(Refer to AIM.)

TRANSPONDER [ICAO]– A receiver/transmitter which will generate a reply signal upon proper interrogation; the interrogation and reply being on different frequencies.

TRANSPONDER CODES–

(See CODES.)

TRANSPONDER OBSERVED – Phraseology used to inform a VFR pilot the aircraft's assigned beacon code and position have been observed. Specifically, this term conveys to a VFR pilot the transponder reply has been observed and its position correlated for transit through the designated area.

TRIAL PLAN– A proposed amendment which utilizes automation to analyze and display potential conflicts along the predicted trajectory of the selected aircraft.

TRSA–

(See TERMINAL RADAR SERVICE AREA.)

TRUST–

(See THE RECREATIONAL UAS SAFETY TEST.)

TSAS–

(See TERMINAL SEQUENCING AND SPACING.)

TSD–

(See TRAFFIC SITUATION DISPLAY.)

TURBOJET AIRCRAFT– An aircraft having a jet engine in which the energy of the jet operates a turbine which in turn operates the air compressor.

TURBOPROP AIRCRAFT– An aircraft having a jet engine in which the energy of the jet operates a turbine which drives the propeller.

TURBULENCE– An atmospheric phenomenon that causes changes in aircraft altitude, attitude, and or airspeed with aircraft reaction depending on intensity. Pilots report turbulence intensity according to aircraft's reaction as follows:

- a. Light** – Causes slight, erratic changes in altitude and or attitude (pitch, roll, or yaw).
- b. Moderate**– Similar to Light but of greater intensity. Changes in altitude and or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed.
- c. Severe**– Causes large, abrupt changes in altitude and or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control.
- d. Extreme**– The aircraft is violently tossed about and is practically impossible to control. It may cause structural damage.
(See CHOP.)
(Refer to AIM.)

TURN ANTICIPATION– (maneuver anticipation).

TVOR–

(See TERMINAL-VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION.)

TWO-WAY RADIO COMMUNICATIONS FAILURE–

(See LOST COMMUNICATIONS.)

V

VASI–

(See VISUAL APPROACH SLOPE INDICATOR.)

VCOA–

(See VISUAL CLIMB OVER AIRPORT.)

VDP–

(See VISUAL DESCENT POINT.)

VECTOR– A heading issued to an aircraft to provide navigational guidance by radar.

(See ICAO term RADAR VECTORING.)

VERIFY– Request confirmation of information; e.g., “verify assigned altitude.”

VERIFY SPECIFIC DIRECTION OF TAKEOFF (OR TURNS AFTER TAKEOFF)– Used by ATC to ascertain an aircraft’s direction of takeoff and/or direction of turn after takeoff. It is normally used for IFR departures from an airport not having a control tower. When direct communication with the pilot is not possible, the request and information may be relayed through an FSS, dispatcher, or by other means.

(See IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES.)

VERTICAL NAVIGATION (VNAV)– A function of area navigation (RNAV) equipment which calculates, displays, and provides vertical guidance to a profile or path.

VERTICAL SEPARATION– Separation between aircraft expressed in units of vertical distance.

(See SEPARATION.)

VERTICAL TAKEOFF AND LANDING AIRCRAFT (VTOL)– Aircraft capable of vertical climbs and/or descents and of using very short runways or small areas for takeoff and landings. These aircraft include, but are not limited to, helicopters.

(See SHORT TAKEOFF AND LANDING AIRCRAFT.)

VERTIPAD– A small, designated area, usually with a prepared surface, on a vertiport, airport, landing/takeoff area, apron/ramp, or movement area used for takeoff, landing, or parking of powered-lift aircraft.

VERTIPORT– An area of land, water, or a structure used or intended to be used to support the landing, takeoff, taxiing, parking, and storage of powered-lift aircraft or other aircraft that vertiport design and performance standards can accommodate.

VERY HIGH FREQUENCY (VHF)– The frequency band between 30 and 300 MHz. Portions of this band, 108 to 118 MHz, are used for certain NAVAIDs; 118 to 136 MHz are used for civil air/ground voice communications. Other frequencies in this band are used for purposes not related to air traffic control.

VERY HIGH FREQUENCY OMNIDIRECTIONAL RANGE STATION–

(See VOR.)

VERY LOW FREQUENCY (VLF)– The frequency band between 3 and 30 kHz.

VFR–

(See VISUAL FLIGHT RULES.)

VFR AIRCRAFT– An aircraft conducting flight in accordance with visual flight rules.

(See VISUAL FLIGHT RULES.)

VFR CONDITIONS– Weather conditions equal to or better than the minimum for flight under visual flight rules. The term may be used as an ATC clearance/instruction only when:

- a. An IFR aircraft requests a climb/descent in VFR conditions.

b. The clearance will result in noise abatement benefits where part of the IFR departure route does not conform to an FAA approved noise abatement route or altitude.

c. A pilot has requested a practice instrument approach and is not on an IFR flight plan.

Note: All pilots receiving this authorization must comply with the VFR visibility and distance from cloud criteria in 14 CFR part 91. Use of the term does not relieve controllers of their responsibility to separate aircraft in Class B and Class C airspace or TRSAs as required by FAA Order JO 7110.65. When used as an ATC clearance/instruction, the term may be abbreviated "VFR;" e.g., "MAINTAIN VFR," "CLIMB/DESCEND VFR," etc.

VFR FLIGHT–

(See VFR AIRCRAFT.)

VFR MILITARY TRAINING ROUTES (VR)– Routes used by the Department of Defense and associated Reserve and Air Guard units for the purpose of conducting low-altitude navigation and tactical training under VFR below 10,000 feet MSL at airspeeds in excess of 250 knots IAS.

VFR NOT RECOMMENDED– An advisory provided by a flight service station to a pilot during a preflight or inflight weather briefing that flight under visual flight rules is not recommended. To be given when the current and/or forecast weather conditions are at or below VFR minimums. It does not abrogate the pilot's authority to make his/her own decision.

VFR-ON-TOP– ATC authorization for an IFR aircraft to operate in VFR conditions at any appropriate VFR altitude (as specified in 14 CFR and as restricted by ATC). A pilot receiving this authorization must comply with the VFR visibility, distance from cloud criteria, and the minimum IFR altitudes specified in 14 CFR part 91. The use of this term does not relieve controllers of their responsibility to separate aircraft in Class B and Class C airspace or TRSAs as required by FAA Order JO 7110.65.

VFR TERMINAL AREA CHARTS–

(See AERONAUTICAL CHART.)

VFR WAYPOINT–

(See WAYPOINT.)

VHF–

(See VERY HIGH FREQUENCY.)

VHF OMNIDIRECTIONAL RANGE/TACTICAL AIR NAVIGATION–

(See VORTAC.)

VIDEO MAP– An electronically displayed map on the radar display that may depict data such as airports, heliports, runway centerline extensions, hospital emergency landing areas, NAVAIDs and fixes, reporting points, airway/route centerlines, boundaries, handoff points, special use tracks, obstructions, prominent geographic features, map alignment indicators, range accuracy marks, and/or minimum vectoring altitudes.

VISIBILITY– The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night. Visibility is reported as statute miles, hundreds of feet or meters.

(Refer to 14 CFR part 91.)

(Refer to AIM.)

a. Flight Visibility– The average forward horizontal distance, from the cockpit of an aircraft in flight, at which prominent unlighted objects may be seen and identified by day and prominent lighted objects may be seen and identified by night.

b. Ground Visibility– Prevailing horizontal visibility near the earth's surface as reported by the United States National Weather Service or an accredited observer.

c. Prevailing Visibility– The greatest horizontal visibility equaled or exceeded throughout at least half the horizon circle which need not necessarily be continuous.

d. Runway Visual Range (RVR)– An instrumentally derived value, based on standard calibrations, that represents the horizontal distance a pilot will see down the runway from the approach end. It is based on the sighting of either high intensity runway lights or on the visual contrast of other targets whichever yields the greater visual range. RVR, in contrast to prevailing or runway visibility, is based on what a pilot in a moving aircraft should see looking down the runway. RVR is horizontal visual range, not slant visual range. It is based on the measurement of a transmissometer made near the touchdown point of the instrument runway and is reported in hundreds of feet. RVR, where available, is used in lieu of prevailing visibility in determining minimums for a particular runway.

1. Touchdown RVR– The RVR visibility readout values obtained from RVR equipment serving the runway touchdown zone.

2. Mid-RVR– The RVR readout values obtained from RVR equipment located midfield of the runway.

3. Rollout RVR– The RVR readout values obtained from RVR equipment located nearest the rollout end of the runway.

(See ICAO term FLIGHT VISIBILITY.)

(See ICAO term GROUND VISIBILITY.)

(See ICAO term RUNWAY VISUAL RANGE.)

(See ICAO term VISIBILITY.)

VISIBILITY [ICAO]– The ability, as determined by atmospheric conditions and expressed in units of distance, to see and identify prominent unlighted objects by day and prominent lighted objects by night.

a. Flight Visibility– The visibility forward from the cockpit of an aircraft in flight.

b. Ground Visibility– The visibility at an aerodrome as reported by an accredited observer.

c. Runway Visual Range [RVR]– The range over which the pilot of an aircraft on the centerline of a runway can see the runway surface markings or the lights delineating the runway or identifying its centerline.

VISUAL APPROACH– An approach conducted on an instrument flight rules (IFR) flight plan which authorizes the pilot to proceed visually and clear of clouds to the airport. The pilot must, at all times, have either the airport or the preceding aircraft in sight. This approach must be authorized and under the control of the appropriate air traffic control facility. Reported weather at the airport must be: ceiling at or above 1,000 feet, and visibility of 3 miles or greater.

(See ICAO term VISUAL APPROACH.)

VISUAL APPROACH [ICAO]– An approach by an IFR flight when either part or all of an instrument approach procedure is not completed and the approach is executed in visual reference to terrain.

VISUAL APPROACH SLOPE INDICATOR (VASI)–

(See AIRPORT LIGHTING.)

VISUAL CLIMB OVER AIRPORT (VCOA)– A departure option for an IFR aircraft, operating in visual meteorological conditions equal to or greater than the specified visibility and ceiling, to visually conduct climbing turns over the airport to the published “climb-to” altitude from which to proceed with the instrument portion of the departure. VCOA procedures are developed to avoid obstacles greater than 3 statute miles from the departure end of the runway as an alternative to complying with climb gradients greater than 200 feet per nautical mile. Pilots are responsible to advise ATC as early as possible of the intent to fly the VCOA option prior to departure. These textual procedures are published in the ‘Take-Off Minimums and (Obstacle) Departure Procedures’ section of the Terminal Procedures Publications and/or appear as an option on a Graphic ODP.

(See AIM.)

VISUAL DESCENT POINT– A defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided the approach threshold of that runway, or approach lights, or other markings identifiable with the approach end of that runway are clearly visible to the pilot.

VISUAL FLIGHT RULES– Rules that govern the procedures for conducting flight under visual conditions. The term “VFR” is also used in the United States to indicate weather conditions that are equal to or greater than minimum VFR requirements. In addition, it is used by pilots and controllers to indicate type of flight plan.

(See INSTRUMENT FLIGHT RULES.)

(See INSTRUMENT METEOROLOGICAL CONDITIONS.)

(See VISUAL METEOROLOGICAL CONDITIONS.)

(Refer to 14 CFR part 91.)

(Refer to AIM.)

VISUAL HOLDING– The holding of aircraft at selected, prominent geographical fixes which can be easily recognized from the air.

(See HOLDING FIX.)

VISUAL LINE OF SIGHT (VLOS)– Condition of operations wherein the operator maintains continuous, unaided visual contact with the unmanned aircraft.

VISUAL METEOROLOGICAL CONDITIONS– Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.

(See INSTRUMENT FLIGHT RULES.)

(See INSTRUMENT METEOROLOGICAL CONDITIONS.)

(See VISUAL FLIGHT RULES.)

VISUAL OBSERVER (VO)– A person who is designated by the remote pilot in command to assist the remote pilot in command and the person operating the flight controls of the small UAS (sUAS) to see and avoid other air traffic or objects aloft or on the ground.

VISUAL SEGMENT–

(See PUBLISHED INSTRUMENT APPROACH PROCEDURE VISUAL SEGMENT.)

VISUAL SEPARATION– A means employed by ATC to separate aircraft in terminal areas and en route airspace in the NAS. There are two ways to effect this separation:

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

b. A pilot sees the other aircraft involved and upon instructions from the controller provides his/her own separation by maneuvering his/her aircraft as necessary to avoid it. This may involve following another aircraft or keeping it in sight until it is no longer a factor.

(See SEE AND AVOID.)

(Refer to 14 CFR part 91.)

VLF–

(See VERY LOW FREQUENCY.)

VMC–

(See VISUAL METEOROLOGICAL CONDITIONS.)

VOICE SWITCHING AND CONTROL SYSTEM (VSCS)– A computer controlled switching system that provides air traffic controllers with all voice circuits (air to ground and ground to ground) necessary for air traffic control.

(Refer to AIM.)

VOR– A ground-based electronic navigation aid transmitting very high frequency navigation signals, 360 degrees in azimuth, oriented from magnetic north. Used as the basis for navigation in the National Airspace System. The VOR periodically identifies itself by Morse Code and may have an additional voice identification feature. Voice features may be used by ATC or FSS for transmitting instructions/information to pilots.

(See NAVIGATIONAL AID.)

(Refer to AIM.)

VOR TEST SIGNAL–

(See VOT.)

VORTAC– A navigation aid providing VOR azimuth, TACAN azimuth, and TACAN distance measuring equipment (DME) at one site.

(See DISTANCE MEASURING EQUIPMENT.)

(See NAVIGATIONAL AID.)

(See TACAN.)

(See VOR.)

(Refer to AIM.)

VORTICES– Circular patterns of air created by the movement of an airfoil through the air when generating lift. As an airfoil moves through the atmosphere in sustained flight, an area of low pressure is created above it. The air flowing from the high pressure area to the low pressure area around and about the tips of the airfoil tends to roll up into two rapidly rotating vortices, cylindrical in shape. These vortices are the most predominant parts of aircraft wake turbulence and their rotational force is dependent upon the wing loading, gross weight, and speed of the generating aircraft. The vortices from medium to super aircraft can be of extremely high velocity and hazardous to smaller aircraft.

(See AIRCRAFT CLASSES.)

(See WAKE TURBULENCE.)

(Refer to AIM.)

VOT– A ground facility which emits a test signal to check VOR receiver accuracy. Some VOTs are available to the user while airborne, and others are limited to ground use only.

(See CHART SUPPLEMENT.)

(Refer to 14 CFR part 91.)

(Refer to AIM.)

VR–

(See VFR MILITARY TRAINING ROUTES.)

VSCS–

(See VOICE SWITCHING AND CONTROL SYSTEM.)

VTOL AIRCRAFT–

(See VERTICAL TAKEOFF AND LANDING AIRCRAFT.)

W

WA–

(See AIRMET.)

(See WEATHER ADVISORY.)

WAAS–

(See WIDE-AREA AUGMENTATION SYSTEM.)

WAKE RE–CATEGORIZATION (RECAT)– A set of optimized wake separation standards, featuring an increased number of aircraft wake categories, in use at select airports, which allows reduced wake intervals.

(See WAKE TURBULENCE.)

WAKE TURBULENCE– A phenomenon that occurs when an aircraft develops lift and forms a pair of counter–rotating vortices.

(See AIRCRAFT CLASSES.)

(See VORTICES.)

(Refer to AIM.)

WARNING AREA–

(See SPECIAL USE AIRSPACE.)

WAYPOINT– A predetermined geographical position used for route/instrument approach definition, progress reports, published VFR routes, visual reporting points or points for transitioning and/or circumnavigating controlled and/or special use airspace, that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.

WEATHER ADVISORY– In aviation weather forecast practice, an expression of hazardous weather conditions not predicted in the Aviation Surface Forecast, Aviation Cloud Forecast, or area forecast, as they affect the operation of air traffic and as prepared by the NWS.

(See AIRMET.)

(See GRAPHICAL AIRMEN'S METEOROLOGICAL INFORMATION.)

(See SIGMET.)

WEATHER RADAR PRECIPITATION INTENSITY– Existing radar systems cannot detect turbulence, however, there is a direct correlation between turbulence intensity and precipitation intensity. Controllers must issue all precipitation displayed on their user display systems. When precipitation intensity is not available, controllers will report intensity as UNKNOWN. When precipitation intensity levels are available, they will be described as follows:

- a. LIGHT (< 26 dBZ)
- b. MODERATE (26 to 40 dBZ)
- c. HEAVY (> 40 to 50 dBZ)
- d. EXTREME (> 50 dBZ)

WEATHER RECONNAISSANCE AREA (WRA)– A WRA is airspace with defined dimensions and published by Notice to Airmen, which is established to support weather reconnaissance/research flights. Air traffic control services are not provided within WRAs. Only participating weather reconnaissance/research aircraft from the 53rd Weather Reconnaissance Squadron and National Oceanic and Atmospheric Administration Aircraft Operations Center are permitted to operate within a WRA. A WRA may only be established in airspace within U.S. Flight Information Regions outside of U.S. territorial airspace.

WHEN ABLE–

a. In conjunction with ATC instructions, gives the pilot the latitude to delay compliance until a condition or event has been reconciled. Unlike “pilot discretion,” when instructions are prefaced “when able,” the pilot is expected to seek the first opportunity to comply.

b. In conjunction with a weather deviation clearance, requires the pilot to determine when he/she is clear of weather, then execute ATC instructions.

c. Once a maneuver has been initiated, the pilot is expected to continue until the specifications of the instructions have been met. "When able," should not be used when expeditious compliance is required.

WIDE-AREA AUGMENTATION SYSTEM (WAAS)– The WAAS is a satellite navigation system consisting of the equipment and software which augments the GPS Standard Positioning Service (SPS). The WAAS provides enhanced integrity, accuracy, availability, and continuity over and above GPS SPS. The differential correction function provides improved accuracy required for precision approach.

WIDE AREA MULTILATERATION (WAM)– A distributed surveillance technology which may utilize any combination of signals from Air Traffic Control Radar Beacon System (ATCRBS) (Modes A and C) and Mode S transponders, and ADS-B transmissions. Multiple geographically dispersed ground sensors measure the time-of-arrival of the transponder messages. Aircraft position is determined by joint processing of the time-difference-of-arrival (TDOA) measurements computed between a reference and the ground stations' measured time-of-arrival.

WILCO– I have received your message, understand it, and will comply with it.

WIND GRID DISPLAY– A display that presents the latest forecasted wind data overlaid on a map of the ARTCC area. Wind data is automatically entered and updated periodically by transmissions from the National Weather Service. Winds at specific altitudes, along with temperatures and air pressure can be viewed.

WIND SHEAR– A change in wind speed and/or wind direction in a short distance resulting in a tearing or shearing effect. It can exist in a horizontal or vertical direction and occasionally in both.

WIND SHEAR ESCAPE– An unplanned abortive maneuver initiated by the pilot in command (PIC) as a result of onboard cockpit systems. Wind shear escapes are characterized by maximum thrust climbs in the low altitude terminal environment until wind shear conditions are no longer detected.

WING TIP VORTICES–

(See VORTICES.)

WORDS TWICE–

a. As a request: "Communication is difficult. Please say every phrase twice."

b. As information: "Since communications are difficult, every phrase in this message will be spoken twice."

WS–

(See SIGMET.)

(See WEATHER ADVISORY.)

WST–

(See CONVECTIVE SIGMET.)

(See WEATHER ADVISORY.)

INDEX

[References are to page numbers]

A

- Accident, Aircraft, Reporting, 7-7-1
- Accident Cause Factors, 7-6-1
- Adherence to Clearance, 4-4-6
- ADS-B. *See* Automatic Dependent Broadcast Services
- ADS-R. *See* Automatic Dependent Surveillance-Rebroadcast
- Advisories
 - Braking Action, 4-3-13
 - Inflight Aviation Weather, 7-1-11
 - Minimum Fuel, 5-5-9
 - Traffic, 5-5-6
- Aerobatic Flight, 8-1-8
- Aerodrome Forecast (TAF), 7-1-75, 7-1-77
- 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, 5-6-14
- Air Route Surveillance Radar, 4-5-4
- 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, 4-1-22
 - Approach Control Service, Arriving VFR Aircraft, 4-1-2
 - Automatic Terminal Information Service, 4-1-9
 - 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, 4-1-7
 - IFR Approaches, 4-1-7
 - Operation Rain Check, 4-1-2
 - Radar Assistance to VFR Aircraft, 4-1-14
 - Radar Traffic Information Service, 4-1-11
 - Recording and Monitoring, 4-1-1
 - Safety Alert, 4-1-13
 - Terminal Radar Services for VFR Aircraft, 4-1-15
 - Tower En Route Control, 4-1-17
 - Traffic Advisory Practices, Airports Without Operating Control Towers, 4-1-2
 - Transponder Operation, ADS-B Out Operation, 4-1-18
 - Unicom, Use for ATC Purposes, 4-1-9
 - Unicom/Multicom, 4-1-8
- Air Traffic Control Radar Beacon System, 4-1-18, 4-5-3
- Aircraft
 - Arresting Devices, 2-3-35
 - Call Signs, 4-2-3
 - Lights, Use in Airport Operations, 4-3-29
 - Unmanned, 7-6-4
 - VFR, Emergency Radar Service, 6-2-1
- Aircraft Conflict Alert, 4-1-14
- Airport
 - Aids, Marking, 2-3-1
 - Holding Position, 2-3-14
 - 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), 4-1-5
 - Operations, 4-3-1
 - Communications, 4-3-20
 - Exiting the Runway, After Landing, 4-3-26
 - Flight Check Aircraft, In Terminal Areas, 4-3-29
 - Flight Inspection, 4-3-29
 - Gate Holding, Departure Delays, 4-3-21
 - Intersection Takeoffs, 4-3-15
 - Low Approach, 4-3-19
 - Low Level Wind Shear/Microburst Detection Systems, 4-3-12
 - Option Approach, 4-3-28
 - Signals, Hand, 4-3-30
 - Taxi During Low Visibility, 4-3-25
 - Traffic Control Light Signals, 4-3-19
 - Traffic Patterns, 4-3-1, 4-3-3
 - Use of Aircraft Lights, 4-3-29

[References are to page numbers]

- Use of Runways, 4-3-8
- VFR Flights in Terminal Areas, 4-3-21
- VFR Helicopter at Controlled Airports, 4-3-21
 - With Operating Control Tower, 4-3-1
 - Without Operating Control Tower, 4-3-6
- Remote Airport Advisory (RAA), 3-5-1
- Remote Airport Information Service (RAIS), 3-5-1, 4-1-5
- Signs, 2-3-1, 2-3-24
 - Destination, 2-3-32
 - Direction, 2-3-30
 - Information, 2-3-34
 - Location, 2-3-28
 - Mandatory Instruction, 2-3-25
 - Runway Distance Remaining, 2-3-34
- Airport Reservations, 4-1-22
- Airport Surface Detection Equipment, 4-5-4
- Airport Surface Surveillance Capability, 4-5-4
- Airport Surveillance Radar, 4-5-4
- Airspace, 3-1-1
 - Basic VFR Weather Minimums, 3-1-2
 - Class D, 3-2-8
 - Class E, 3-2-10
 - 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, 3-2-5
 - IFR Requirements, 3-2-1
 - IFR Separation, 3-2-1
 - Parachute Jumps, 3-2-2
 - Ultralight Vehicles, 3-2-1
 - Unmanned Free Balloons, 3-2-1
 - VFR Requirements, 3-2-1
 - Flight Levels, 3-1-3
 - General Dimensions, Segments, 3-1-1
 - Special Use, 3-4-1
 - VFR Cruising Altitudes, 3-1-3
- Airspace
 - Military Training Routes, 3-5-1
 - Non-Charted Airspace Areas, 3-5-11
 - Other Areas, 3-5-1
 - Parachute Jumping, 3-5-5
 - Temporary Flight Restrictions, 3-5-3
 - Terminal Radar Service Areas, 3-5-9
 - VFR Routes, Published, 3-5-5
 - Class B Airspace, VFR Transition Routes, 3-5-7, 3-5-8
 - VFR Corridors, 3-5-7
 - VFR Flyways, 3-5-6
- Airway, 5-3-16
- Airways, Course Changes, 5-3-19
- Alcohol, 8-1-2
- Alert, Safety, 4-1-13, 5-5-4
- Alert Areas, 3-4-2
- Alignment of Elements Approach Slope Indicator, 2-1-5
- Alphabet, Phonetic, 4-2-6
- ALS. *See* Approach Light Systems
- Altimeter
 - Density Altitude, 7-6-6
 - Errors, 7-2-1
 - Setting, 7-2-1
- Altitude
 - Automatic Reporting, 4-1-19
 - Effects, 8-1-3
 - Hypoxia, 8-1-3
 - High Altitude Destinations, 5-1-16
 - Mandatory, 5-4-8
 - Maximum, 5-4-8
 - Minimum, 5-4-8
- Ambulance, Air, 4-2-4
- Amended Clearances, 4-4-3
- Approach
 - Advance Information, Instrument Approach, 5-4-5
 - Approach Control, 5-4-4
 - Clearance, 5-4-28
 - Contact, 5-4-66, 5-5-2
 - Instrument, 5-5-2
 - Instrument Approach Procedure, Charts, 5-4-5
 - Instrument Approach Procedures, 5-4-30
 - Low, 4-3-19
 - Minimums, 5-4-55
 - Missed, 5-4-59, 5-5-3
 - No-Gyro, 5-4-39
 - Option, 4-3-28
 - Overhead Approach Maneuver, 5-4-67
 - Precision, 5-4-38
 - Surveillance, 5-4-38
 - Visual, 5-4-65, 5-5-6
- Approach Control Service, VFR Arriving Aircraft, 4-1-2
- Approach Light Systems, 2-1-1

[References are to page numbers]**Approaches**

IFR, 4-1-7

Parallel Runways, ILS/RNAV/GLS, 5-4-40

Radar, 5-4-38

Timed, 5-4-36

Area Navigation (RNAV), 5-3-17, 5-5-9 *See also* Area Navigation

Area Navigation (RNAV) Routes, 5-3-17

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, 2-3-35

ARSR. *See* Air Route Surveillance RadarARTCC. *See* Air Route Traffic Control CentersASDE-X. *See* Airport Surface Detection Equipment-Model X

Ash, Volcanic, 7-6-9

ASOS. *See* Automated Surface Observing SystemASR. *See* Airport Surveillance Radar; Surveillance Approach

ASSC, 4-5-4

ATCRBS. *See* Air Traffic Control Radar Beacon SystemATCT. *See* Control TowersATIS. *See* Automatic Terminal Information Service

Attitude Heading Reference System (AHRS), 1-1-21

Authority, Statutory, 1-1-1

Automated Surface Observing System (ASOS), 4-3-37, 7-1-31

Automated Weather Observing System (AWOS), 4-3-37, 7-1-27, 7-1-31

Automatic Altitude Reporting, 4-1-19

Automatic Dependent Surveillance-Broadcast Services, 4-5-12

Automatic Dependent Surveillance-Rebroadcast, 4-5-21

Automatic Flight Information Service (AFIS) – Alaska FSSs Only, 4-1-10

Automatic Terminal Information Service, 4-1-9

AWOS. *See* Automated Weather Observing System; Automated Weather Observing System (AWOS)**B**Balloons, Unmanned, 7-6-4
Free, 3-2-1**Beacon**

Aeronautical Light, 2-2-1

Code, 2-2-1

Marker, 1-1-14

Nondirectional Radio, 1-1-1

Beacons, Airport/Heliport, 2-1-12

Bird

Bird Strike

Reduction, 7-5-1

Reporting, 7-5-1

Hazards, 7-5-1

Migratory, 7-5-1

Bird/Other Wildlife Strike Reporting, Form. *See* Appendix 1

Braking Action Advisories, 4-3-13

Braking Action Reports, 4-3-13

Briefing, Preflight, 7-1-8

C**Call Signs**

Aircraft, 4-2-3

Ground Station, 4-2-5

Carbon Monoxide Poisoning, 8-1-5

CAT. *See* Clear Air TurbulenceCDR. *See* Coded Departure Route

Changeover Points, 5-3-20

Charted Visual Flight Procedures, 5-4-66

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, 3-2-4

Definition, 3-2-2

Flight Procedures, 3-2-3

Mode C Veil, 3-2-3

Operating Rules, 3-2-2

Pilot/Equipment Requirements, 3-2-2

Proximity Operations, 3-2-4

Separation, 3-2-4

[References are to page numbers]

- VFR Transition Routes, 3-5-7, 3-5-8
- Class C Airspace, 3-2-5
 - Air Traffic Services, 3-2-6
 - Aircraft Separation, 3-2-6
 - Definition, 3-2-5
 - Operating Rules, 3-2-5
 - Outer Area, 3-2-5
 - Pilot/Equipment Requirements, 3-2-5
 - Secondary Airports, 3-2-6
- Class D Airspace, 3-2-8
 - Definition, 3-2-8
 - Operating Rules, 3-2-9
 - Pilot/Equipment Requirements, 3-2-9
 - Separation for VFR Aircraft, 3-2-10
- Class E Airspace, 3-2-10
 - Definition, 3-2-10
 - Operating Rules, 3-2-10
 - Pilot/Equipment Requirements, 3-2-10
 - Separation for VFR Aircraft, 3-2-11
 - Types, 3-2-10
 - Vertical Limits, 3-2-10
- Class G Airspace, 3-3-1
 - IFR Requirements, 3-3-1
 - VFR Requirements, 3-3-1
- Clear Air Turbulence, 7-1-50
- Clearance
 - Abbreviated IFR Departure, 5-2-4
 - Adherence, 4-4-6
 - Air Traffic, 5-5-1
 - Air Traffic Control, 4-4-1
 - Amended, 4-4-3
 - Approach, 5-4-28
 - IFR, VFR-on-Top, 4-4-5
 - IFR Flights, 4-4-6
 - 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, 4-4-2
 - Pre-Taxi, 5-2-1
 - Prefix, 4-4-1
 - Taxi, 5-2-2
 - VFR Flights, 4-4-6
 - Void Times, 5-2-5
- Clearances, Special VFR Clearances, 4-4-3
- Clearing Procedures, Visual, 4-4-12
- Coded Departure Route, 4-4-3
- Cold Temperature, Barometric Altimeter Errors, 7-3-1
- Cold Temperature Airports, 7-3-2
- Cold Temperature Airports (CTA), Cold Temperature, 7-3-1
- Cold Temperature Operations, 5-1-20
 - Pilot Responsibilities, 5-5-3
- Collision, Avoidance, Judgment, 8-1-9
- 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, 5-3-15
 - Position Reporting, 5-3-14
 - Distress, 6-3-1
 - Radio, 4-2-1
 - Phonetic Alphabet, 4-2-6
 - Release, 4-1-1
 - Urgency, 6-3-1
- Conflict Alert, Aircraft, 4-1-14
- Contact Approach, 5-4-66
- Contact Procedures, 4-2-2
 - Initial Contact, 4-2-2
- Control of Lighting Systems, 2-1-9
- Control Towers, 4-1-1
- Controlled Firing Areas, 3-4-2
- Controller, Responsibility, 5-3-20, 5-4-65, 5-5-1
- COP. *See* Changeover Points
- CORONA, 7-6-11
- Course Lights, 2-2-1
- CVFP. *See* Charted Visual Flight Procedures

D

- Decompression Sickness, 8-1-5
- Defense VFR, DVFR, 5-1-15
- Density Altitude, Effects, 7-6-6
- Departure, Restrictions, 5-2-5
- Departure Control, 5-2-6
- Departures, Instrument, 5-5-8
- Discrete Emergency Frequency, 6-5-1

[References are to page numbers]

Distance Measuring Equipment, 1-1-5, 1-1-14,
5-3-25

Distress, 6-3-1

Ditching Procedures, 6-3-3

DME. *See* Distance Measuring Equipment

Doppler Radar, 1-1-22

E

Ear Block, 8-1-4

Effects of Cold Temperature on Baro-vertical, Cold
Temperature, 7-3-1

EFVS. *See* Enhanced Flight Vision Systems

ELT. *See* Emergency Locator Transmitters

Emergency, 6-1-1

Air Piracy, 6-3-7

Airborne Aircraft Inspection, 7-6-10

Aircraft, Overdue, 6-2-6

Body Signals, 6-2-7

Ditching Procedures, 6-3-3

Explosives Detection, FAA K-9 Team Program,
6-2-4

Fuel Dumping, 6-3-8

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, 6-2-7

Transponder Operation, 6-2-1

VFR Search and Rescue Protection, 6-2-6

Emergency Autoland System, 6-1-1

Emergency Descent System, 6-1-1

Emergency Locator Transmitter, 6-2-2

Enhanced Flight Vision Systems, 5-4-61

Escort, 6-2-1

Explosives, FAA K-9 Detection Team Program, 6-2-4

F

FAA Form 7233-1, Appendix 5-1

FAA Form 7233-4, Appendix 4-1

Final Guard, 3-5-1

FIS-B. *See* Flight Information Service-Broadcast

Fitness, Flight

Alcohol, 8-1-2

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, 7-5-1

Over National Parks, 7-5-1

Over National Refuges, 7-5-1

Safety, Meteorology, 7-1-1

Vision, 8-1-7

Flight Check Aircraft, 4-3-29

Flight Information Service-Broadcast, 4-5-18

Flight Information Services, 7-1-23

Flight Inspections Aircraft, 4-3-29

Flight Management System, 1-2-5

Flight Plan, Appendix 5-1

Change, 5-1-18

Proposed Departure Time, 5-1-18

Closing

DVFR, 5-1-18

VFR, 5-1-18

Defense VFR (DVFR) Flights, 5-1-15

IFR, Canceling, 5-1-18

IFR Flights, 5-1-11

VFR Flights, 5-1-10

Flight Plans, Military/DOD Use Only, 5-1-15

Flight Restricted Zone (FRZ), 3-5-10

Flight Restrictions, Temporary, 3-5-3

Flight Service Stations, 4-1-1

Flights, Outside the United States, 5-1-17

Flying, Mountain, 7-6-5

FMS. *See* Flight Management System

Forms

Bird Strike Incident/Ingestion Report, Appendix 1-1

Volcanic Activity Reporting Form, Appendix 2-1

[References are to page numbers]

Frequency, Instrument Landing System, 1-1-15

FRZ. *See* Flight Restricted Zone (FRZ)

FSS. *See* Flight Service Stations

Fuel Dumping, 6-3-8

G

Gate Holding, 4-3-21

Glideslope, Visual Indicators, 2-1-1

Global Navigation Satellite System (GNSS), GNSS,
5-1-14

Global Positioning System, 1-1-22

GPS. *See* Global Positioning System

Graphical Forecasts for Aviation (GFA), 7-1-6

Ground Based Augmentation System (GBAS) Landing
System (GLS), 1-1-39

Ground Station, Call Signs, 4-2-5

Ground Vehicle Operations, 4-1-7

Gulf of America Grid System, 10-1-5

H

Half-Way Signs, 7-6-7

Hand Signals, 4-3-30

Hazard

Bird, 7-5-1

Flight

Obstructions to Flight, 7-6-2

Potential, 7-6-1

Reporting Radio/Radar Altimeter Anomalies,
7-6-1

VFR in Congested Areas, 7-6-2

Ground Icing Conditions, 7-6-15

Mountain Flying, 7-6-5

Thermal Plumes, 7-6-16

Unmanned Balloons, 7-6-4

Volcanic Ash, 7-6-9

HDTA. *See* High Density Traffic Airports

Helicopter

IFR Operations, 10-1-1

Landing Area Markings, 2-3-24

VFR Operations at Controlled Airports, 4-3-21

Special Operations, 10-2-1

Wake Turbulence, 7-4-6

Helicopter Operations, Departure Procedures, 10-1-7

High Density Traffic Airports, 4-1-22

Hold, For Release, 5-2-5

Holding, 5-3-20

Holding Position Markings, 2-3-1, 2-3-14
for Instrument Landing Systems, 2-3-14
for Intersecting Taxiways, 2-3-14

Holding Position Signs, Surface Painted, 2-3-15

Hypoxia, 8-1-3

I

Icing Terms, 7-1-47

IFR, 4-4-5

Operations, To High Altitude Destinations, 5-1-16
Procedures, Use When Operating VFR, 5-1-2

IFR

Approaches, 4-1-7

Military Training Routes, 3-5-2

Separation Standards, 4-4-8

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, 7-7-1

Inertial Navigation System, 1-1-21

Inertial Reference Unit (IRU), 1-1-21

Initial Contact, 4-2-2

INS. *See* Internal Navigation System

Instrument Departure Procedures (DP), 5-2-7

Instrument Landing System, 1-1-11

Category, 1-1-16

Compass Locator, 1-1-15

Course, Distortion, 1-1-17

Distance Measuring Equipment, 1-1-14

Frequency, 1-1-15

Glide Path, 1-1-13

Glide Slope, 1-1-13

Glideslope, Distortion, 1-1-17

Holding Position Markings, 2-3-14

Inoperative Components, 1-1-16

Localizer, 1-1-11

Marker Beacon, 1-1-14

Minimums, 1-1-16

Instrument Meteorological Conditions (IMC), 5-2-7

[References are to page numbers]

Instrument Procedures, RNP AR (Authorization Required) , 5-4-53
 Integrated Terminal Weather System, 4-3-12
 Intercept, 6-2-1
 Interception
 Procedures, 5-6-9
 Signals, 5-6-11
 Interchange Aircraft, 4-2-5
 International Flight Plan, Appendix 4-1
 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, 6-2-4

L

LAHSO. *See* Land and Hold Short Operations
 Land and Hold Short Lights, 2-1-6
 Land and Hold Short Operations (LAHSO), 4-3-16
 Landing
 Minimums, 5-4-55
 Priority, 5-4-67
 Laser Operations, 7-6-12
 LDA. *See* Localizer-Type Directional Aid
 Leased Aircraft, 4-2-5
 LED Lighting Systems, 2-2-2
 Light Signals, Traffic Control, 4-3-19
 Lighting
 Aeronautical Light Beacons, 2-2-1
 Aids
 Airport, 2-1-1
 Approach Light Systems, 2-1-1
 Control of Lighting Systems, 2-1-9
 In-Runway Lighting, 2-1-6
 Pilot Control of Airport Lighting, 2-1-9
 Runway End Identifier Lights, 2-1-6
 Taxiway Lights, 2-1-13
 Airport/Heliport Beacons, 2-1-12
 Code Beacon, 2-2-1

Course, 2-2-1
 LED Lighting Systems, 2-2-2
 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, 4-1-5
 Local Flow Traffic Management Program, 5-4-3
 Localizer-Type Directional Aid, 1-1-13
 Locator, Compass, 1-1-15
 Long Range Navigation, 1-1-21
 LORAN. *See* Long Range Navigation
 Low Approach, 4-3-19
 Low Level Wind Shear Alert System (LLWAS),
 4-3-12, 7-1-54
 Low Level Wind Shear/Microburst Detection Systems,
 4-3-12
 LUAW. *See* Line Up and Wait

M

MAYDAY, 6-3-1
 MEDEVAC, 4-2-4
 Medical
 Carbon Monoxide Poisoning, 8-1-5
 Decompression Sickness, 8-1-5
 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, 7-1-40
 Automated Surface Observing System, 7-1-31
 Categorical Outlooks, 7-1-22
 Clear Air Turbulence, 7-1-50
 Cloud Heights, Reporting, 7-1-43
 Drizzle, Intensity, 7-1-44
 FAA Weather Services, 7-1-2
 ICAO, Weather Formats, 7-1-67
 Icing, Airframe, 7-1-46
 Inflight Aviation Weather Advisories, 7-1-11
 Inflight Weather Broadcasts, 7-1-22
 Microbursts, 7-1-50
 National Weather Service, Aviation Weather Service,
 7-1-1

[References are to page numbers]

Pilot Weather Reports, 7-1-44
 Precipitation, Intensity, 7-1-44
 Preflight Briefing, 7-1-8
 Runway Visual Range, 7-1-42
 Thunderstorms, 7-1-62
 Flying, 7-1-62
 Turbulence, 7-1-48
 Visibility, Reporting, 7-1-44
 Weather, Radar Services, 7-1-36
 Weather Observing Programs, 7-1-27
 Wind Shear, 7-1-49
 Military NOTAMs, 5-1-5
 Military Operations Areas, 3-4-2
 Military Training Routes, 3-5-1
 IFR, 3-5-2
 VFR, 3-5-2
 Minimum, Fuel Advisory, 5-5-9
 Minimum Safe Altitudes, 5-4-9
 Minimum Turning Altitude (MTA), 5-3-20
 Minimum Vectoring Altitudes, 5-4-19
 Minimums
 Approach, 5-4-55
 Instrument Landing Systems, 1-1-16
 Landing, 5-4-55
 Missed Approach, 5-4-59
 MOA. *See* Military Operations Areas
 Mountain Flying, 7-6-5
 Mountain Wave, 7-6-6
 Mountainous Areas, 5-6-14
 MSA. *See* Minimum Safe Altitudes
 MTA. *See* Minimum Turning Altitude (MTA)
 Multicom, 4-1-8
 MVA. *See* Minimum Vectoring Altitudes

N

National Forests, 7-5-1
 National Geospatial-Intelligence Agency (NGA),
 5-4-8
 National Parks, 7-5-1
 National Refuges, 7-5-1
 National Security, 5-6-1

ADIZ, 5-6-1
 ADIZ Requirements, 5-6-2
 Civil Aircraft Operations, 5-6-4
 Defense Area, 5-6-1
 Requirements, 5-6-1
 Territorial Airspace, 5-6-1
 National Security Areas, 3-4-3
 NAVAID
 Identifier Removal During Maintenance, 1-1-20
 Maintenance, 1-1-20
 Service Volumes, 1-1-6
 User Report, 1-1-20
 with Voice, 1-1-20
 Navigation, Aids, 1-1-1
 Nondirectional Radio Beacon, 1-1-1
 Radio, VHF Omni-directional Range, 1-1-1
 Navigation Specifications (Nav Specs), 1-2-5
 Navigational
 Aids
 Radio
 Distance Measuring Equipment, 1-1-5
 Doppler Radar, 1-1-22
 Identifier Removal During Maintenance, 1-1-20
 Instrument Landing System, 1-1-11
 Localizer-Type Directional Aid, 1-1-13
 Long Range Navigation, 1-1-21
 Navaid Service Volumes, 1-1-6
 NAVAIDs with Voice, 1-1-20
 Simplified Directional Facility, 1-1-18
 Tactical Air Navigation, 1-1-4
 VHF Omni-directional Range/Tactical Air
 Navigation, 1-1-5
 User Report, 1-1-20
 Inertial Navigation System, 1-1-21
 NDB. *See* Nondirectional Radio Beacon
 Near Midair Collision, 7-7-3
 NGA. *See* National Geospatial-Intelligence Agency
 NMAC. *See* Near Midair Collision
 Non-Charted Airspace Areas, 3-5-11
 Nondirectional Radio Beacon, 1-1-1
 Nonmovement Area Boundary Markings, 2-3-22
 NOTAM. *See* Notice to Airmen (NOTAM)
 Notice to Airmen
 NOTAM Contractions, 5-1-7
 NOTAM D, 5-1-4
 Notice to Airmen (NOTAM), 5-1-3
 Notice to Airmen (NOTAM) System, 5-1-3

[References are to page numbers]**O**

Obstacle Departure Procedures, 5-2-7
 Obstruction Alert, 4-1-13
 Obstruction Light, 2-2-1
 Operation Take-off, 4-1-2
 Operational Information System (OIS), 5-1-9
 Option Approach, 4-3-28

P

P-static, 7-6-11
 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, 4-2-6
 Pilot
 Authority, 6-1-1
 Responsibility, 4-1-17, 4-4-1, 4-4-4, 5-4-65, 5-5-1, 6-1-1, 7-4-7
 Pilot Control of Airport Lighting, 2-1-9
 Pilot Visits to Air Traffic Facilities, 4-1-1
 Pilot Weather Reports, 7-1-44
 Piracy, Air, Emergency, 6-3-7
 PIREPs. *See* Pilot Weather Reports
 Planning for Cold Temperature, Cold Temperature, 7-3-1
 Position Reporting, 5-3-14
 Pre-Departure Clearance Procedures, 5-2-1
 Precipitation Static, 7-6-11
 Precision Approach, 5-4-38
 Precision Approach Path Indicator, 2-1-4
 Precision Approach Radar, 4-5-4
 Precision Approach Systems, 1-1-41
 Preflight, Preparation, 5-1-1
 Priority, Landing, 5-4-67
 Procedure Turn, 5-4-33

Limitations, 5-4-36

Procedures

Arrival, 5-4-1
 En Route, 5-3-1
 Instrument Approach, 5-4-30
 Interception, 5-6-9

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, 4-5-3
 Airport Route Surveillance Radar, 4-5-4
 Airport Surveillance Radar, 4-5-4
 Approach Control, 5-4-4
 Approaches, 5-4-38
 Capabilities, 4-5-1
 Doppler, 1-1-22
 Limitations, 4-5-1
 Monitoring of Instrument Approaches, 5-4-39
 Precision Approach, 4-5-4
 Precision Approach Radar, 4-5-4
 Surveillance, 4-5-4

Radar Assistance to VFR Aircraft, 4-1-14

Radar Beacon, Phraseology, 4-1-21

Radar Sequencing and Separation, VFR Aircraft, TRSA, 4-1-16

Radar Traffic Information Service, 4-1-11

Radio, Communications, 4-2-1

Altitudes, 4-2-7
 Contact Procedures, 4-2-2
 Directions, 4-2-7
 Inoperative Transmitter, 4-2-9
 Phonetic Alphabet, 4-2-6
 Receiver Inoperative, 4-2-9
 Speeds, 4-2-8
 Student Pilots, 4-2-5
 Technique, 4-2-1
 Time, 4-2-8
 Transmitter and Receiver Inoperative, 4-2-9
 VFR Flights, 4-2-9

RCLS. *See* Runway Centerline Lighting

Receiver, VOR, Check, 1-1-3

REIL. *See* Runway End Identifier Lights

REL. *See* Runway Entrance Lights

[References are to page numbers]

Release Time, 5-2-5

Remote Airport Advisory (RAA), 3-5-1

Remote Airport Information Service (RAIS), 3-5-1, 4-1-5

Reporting Radio/Radar Altimeter Anomalies, 7-6-1

Required Navigation Performance (RNP), 5-4-25

Required Navigation Performance (RNP) Operations, 5-1-19, 5-5-9

Rescue Coordination Center
 Air Force, 6-2-5
 Alaska, 6-2-5
 Coast Guard, 6-2-5
 Joint Rescue, Hawaii, 6-2-6

Reservations, Airport, 4-1-22

Responsibility
 Controller, 5-3-20, 5-4-65, 5-5-1
 Pilot, 4-1-17, 4-4-1, 4-4-4, 5-4-65, 5-5-1, 6-1-1, 7-4-7

Restricted Areas, 3-4-1

Restrictions
 Departure, 5-2-5
 Flight, Temporary, 3-5-3

RNAV, 5-1-14

RNP AR (Authorization Required) Instrument Procedures, 5-4-53

Route
 Coded Departure Route, 4-4-3
 Course Changes, 5-3-19

Route System, 5-3-16

Runway
 Aiming Point Markings, 2-3-2
 Centerline Markings, 2-3-2
 Closed
 Lighting, 2-3-23
 Marking, 2-3-23
 Condition Reports, 4-3-13
 Demarcation Bar, 2-3-4
 Designators, 2-3-2
 Holding Position Markings, 2-3-14
 Markings, 2-3-1
 Separation, 4-4-11
 Shoulder Markings, 2-3-3
 Side Stripe Markings, 2-3-3
 Signs, Distance Remaining, 2-3-34
 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

RWSL System, Runway Status Light (RWSL) System.
 See Runway Status Light (RWSL) System

Runway, Visual Range, 7-1-42

Runways, Use, 4-3-8

RVR. *See* Runway Visual Range

S

Safety
 Alert, 5-5-4
 Alerts, 3-2-1
 Aircraft Conflict, 3-2-1
 Mode C Intruder, 3-2-1
 Terrain/Obstruction, 3-2-1
 Aviation, Reporting, 7-7-1
 Seaplane, 7-6-8

Safety Alert, 4-1-13
 Aircraft Conflict Alert, 4-1-14
 Obstruction Alert, 4-1-13
 Terrain Alert, 4-1-13

SAR. *See* Search and Rescue

Scanning Techniques, Visual, 4-4-12

Scuba Diving, Decompression Sickness, 8-1-5

SDF. *See* Simplified Directional Facility

Seaplane, Safety, 7-6-8

Search and Rescue, 6-2-1, 6-2-4

Security Identification Display Area, 2-3-36

See and Avoid, 5-5-5

Separation
 IFR, Standards, 4-4-8
 Runway, 4-4-11
 Visual, 4-4-11, 5-5-7
 Wake Turbulence, 7-4-8

Sequenced flashing lights (SFL), 2-1-9

SFL. *See* Sequenced flashing lights

SIDA. *See* Security Identifications Display Area

Side-Step Maneuver, 5-4-55

Signs
 Airport, 2-3-1
 Half-Way, 7-6-7

[References are to page numbers]

Simplified Directional Facility, 1-1-18
 Single Flights Conducted With Both VFR and IFR
 Flight Plans, 5-1-16
 Sinus Block, 8-1-4
 Small Unmanned Aircraft System (sUAS), 11-2-1
 Space Launch and Reentry Area, 7-6-17
 Special Air Traffic Rules (SATR), 3-5-10
 Special Flight Rules Area (SFRA), 3-5-10
 Washington, DC, 3-5-10
 Special Instrument Approach Procedures, 1-1-41,
 5-4-32
 Special Traffic Management Programs, 4-1-22
 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, 3-4-2
 Special VFR Clearances, 4-4-3
 Speed, Adjustments, 4-4-8, 5-5-5
 Standard Instrument Departures, 5-2-7
 Standard Terminal Arrival, 5-4-1
 STAR. *See* Standard Terminal Arrival
 sUAS. *See* Small Unmanned Aircraft System (sUAS)
 Surface Painted Holding Position Signs, 2-3-15
 Surveillance Approach, 5-4-38
 Surveillance Radar, 4-5-4
 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, 4-3-25
 Taxiway

Centerline Markings, 2-3-7
 Closed
 Lighting, 2-3-23
 Marking, 2-3-23
 Edge Markings, 2-3-7
 Geographic Position Markings, 2-3-12
 Holding Position Markings, 2-3-14
 Markings, 2-3-1, 2-3-7
 Shoulder Markings, 2-3-8
 Surface Painted Direction Signs, 2-3-11
 Surface Painted Location Signs, 2-3-12
 Taxiway Centerline Lead-Off Lights, 2-1-6
 Taxiway Lights, 2-1-13
 Centerline, 2-1-13
 Clearance Bar, 2-1-13
 Edge, 2-1-13
 Runway Guard, 2-1-13
 Stop Bar, 2-1-13
 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
 Temporary Flight Restrictions, 3-5-3
 Terminal Arrival Area (TAA), 5-4-10
 Terminal Doppler Weather Radar (TDWR), 4-3-12,
 7-1-55
 Terminal Radar Service Areas, 3-5-9
 Terminal Radar Services for VFR Aircraft, 4-1-15
 Terminal Weather Information For Pilots System
 (TWIP), 7-1-59
 Terrain Alert, 4-1-13
 THL. *See* Takeoff Hold Lights
 Time
 Clearance Void, 5-2-5
 Release, 5-2-5
 TIS. *See* Traffic Information Service
 TIS-B. *See* Traffic Information Service-Broadcast
 Touchdown Zone Lights (TDZL), 2-1-6
 Tower En Route Control, 4-1-17
 Traffic
 Advisories, 5-5-6
 Local Flow Traffic Management Program, 5-4-3
 Traffic Advisory Practices, Airports Without Operating
 Control Towers, 4-1-2

[References are to page numbers]

Traffic Alert and Collision Avoidance System, 4-4-13
 Traffic Control Light Signals, 4-3-19
 Traffic Information Service, 4-5-5
 Traffic Information Service (TIS), 4-4-14
 Traffic Information Service–Broadcast , 4-5-17
 Traffic Patterns, 4-3-3
 Transponder Operation
 ADS-B Out Operation, 4-1-18
 Automatic Altitude Reporting, 4-1-19
 Code Changes, 4-1-20
 Emergency, 6-2-1
 Ident Feature, 4-1-20
 Tri-Color Visual Approach Slope Indicator, 2-1-4
 TRSA. *See* Terminal Radar Service Areas
 Turbulence, Wake, 7-4-1
 Air Traffic Separation, 7-4-8
 Development and New Capabilities, 7-4-9
 Helicopters, 7-4-6
 Pilot Responsibility, 7-4-7
 Vortex Behavior, 7-4-2
 Vortex Generation, 7-4-1
 Vortex Strength, 7-4-1
 TWIP. *See* Terminal Weather Information For Pilots System

U

UAS. *See* Unmanned Aircraft Systems (UAS)
 Ultralight Vehicles, 3-2-1
 Uncontrolled Airports, IFR Clearances, 5-2-2
 Unicom, 4-1-8
 Unidentified Flying Object (UFO) Reports, 7-7-3
 Unmanned Aircraft, 7-6-4
 Unmanned Aircraft Systems (UAS), 11-1-1
 Accidents and Incidents, 11-8-2
 Advanced Air Mobility, 11-6-1
 Air Traffic Control (ATC), 11-8-1
 Airspace Access, 11-4-1
 14 CFR Part 107, 11-4-1
 14 CFR Part 135, 11-4-4
 14 CFR Part 137, 11-4-4
 14 CFR Part 89, 11-4-3
 Airspace Restrictions To Flight, 11-4-6
 FAA–Recognized Identification Areas, 11-4-3

 FRIAs, 11-4-3
 PAO, 11-4-2
 Public Aircraft Operations, 11-4-2
 Recreational Flyers, 11-4-1
 Remote Identification, 11-4-3
 UAS Traffic Management (UTM), 11-4-8
 Waivers to 14 CFR Part 107, 11-4-1
 Best Practices, 11-8-1
 Environmental, 11-8-3
 Night Operations, 11-8-1
 Emergency UAS Authorizations, 11-8-3
 General, 11-1-1
 Access to the National Airspace System (NAS), 11-1-1
 Large UAS, 11-3-1
 Emerging Large UAS Civil Operations, 11-3-5
 Exemptions Under 49 USC 44807, 11-3-4
 Large Public UAS Operations, 11-3-1
 Operations on Airports, 11-7-1
 Pilot Testing, Certification and Responsibilities, 11-5-1
 14 CFR Part 135, 11-5-3
 14 CFR Part 137, 11-5-3
 Foreign Pilot Certification, 11-5-3
 Large Civil UAS, 11-5-3
 PAOs, 11-5-3
 Part 107 and Recreational Flyers, 11-5-1
 Public Aircraft Operations (PAOs), 11-5-3
 Precautions, 11-8-1
 Flight Near Manned Aircraft, 11-8-1
 Flight Over or Near People, 11-8-1
 Flight Over or Near Vehicles, 11-8-1
 Resources, 11-8-4
 Small Unmanned Aircraft System (sUAS), 11-2-1
 Part 107 sUAS, 11-2-1
 Recreational Flyers, 11-2-1
 Registration Requirements, 11-2-1
 Special Government Interest (SGI) Airspace Waivers, 11-8-3
 Urgency, 6-3-1

V

VASI. *See* Visual Approach Slope Indicator
 VDP. *See* Visual Descent Points
 Vectors, 5-5-4
 Vehicle Roadway Markings, 2-3-19
 VFR Corridors, 3-5-7
 VFR Flights in Terminal Areas, 4-3-21

[References are to page numbers]

VFR Flyways, 3–5–6
 VFR Military Training Routes, 3–5–2
 VFR Transition Routes, 3–5–7, 3–5–8
 VFR–on–Top, 5–5–8
 VHF Omni–directional Range, 1–1–1
 Minimum Operational Network (MON), 1–1–2
 VHF Omni–directional Range/Tactical Air Navigation,
 1–1–5
 Visual
 Approach, 5–4–65, 5–5–6
 Clearing Procedures, 4–4–12
 Glideslope Indicators, 2–1–1
 Scanning Techniques, 4–4–12
 Separation, 4–4–11, 5–5–7
 Visual Approach Slope Indicator, 2–1–1
 Visual Climb Over Airport, 5–2–11
 Visual Descent Point, 5–4–21
 Visual Meteorological Conditions (VMC), 5–2–7
 VOCA. *See* Visual Climb Over Airport
 Void Times, Clearance, 5–2–5
 Volcanic, Ash, 7–6–9
 Volcanic Activity Reporting, Forms. *See* Appendix 2
 VOR*See also* VHF Omni–directional Range
 Receiver Check, 1–1–3
 VOR Receiver Checkpoint Markings, 2–3–19
 VORTAC. *See* VHF Omni–directional Range/Tactical
 Air Navigation
 VR. *See* VFR Military Training Routes

W

Waivers, 4–1–22
 Wake, Turbulence, 7–4–1

Warning Areas, 3–4–2
 Weather, ICAO, Weather Formats, 7–1–67
 Weather Reconnaissance Area (WRA), 3–5–10
 Weather Systems Processor (WSP), 4–1–23, 4–3–12,
 7–1–56
 WSP. *See* Weather System Processor; Weather Systems
 Processor (WSP)
 VFR Flights in Terminal Areas, 4–3–21
 VFR Helicopter at Controlled Airports, 4–3–21
 With Operating Control Tower, 4–3–1
 Without Operating Control Tower, 4–3–6
 Remote Airport Advisory (RAA), 3–5–1
 Remote Airport Information Service (RAIS), 3–5–1,
 4–1–5
 Signs, 2–3–1, 2–3–24
 Destination, 2–3–33
 Direction, 2–3–30
 Information, 2–3–33
 Location, 2–3–28
 Mandatory Instruction, 2–3–25
 Runway Distance Remaining, 2–3–34
 Class E, 3–2–10
 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, 3–2–5
 IFR Requirements, 3–2–1
 IFR Separation, 3–2–1
 Parachute Jumps, 3–2–2
 Ultralight Vehicles, 3–2–1
 Unmanned Free Balloons, 3–2–1
 VFR Requirements, 3–2–1
 Flight Levels, 3–1–3
 General Dimensions, Segments, 3–1–1
 Special Use, 3–4–1
 VFR Cruising Altitudes, 3–1–3

