NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-426 (Rev. 03-21)**

INSTRUMENT NAVIGATION WORKBOOK

ADVANCED HELICOPTER TH-57C

2021

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
250 LEXINGTON BLVD SUITE 102
CORPUS CHRISTI TX 78419-5041

CNATRA P-426
N714
3 Mar 21

CNATRA P-426 (NEW. 03-21)

Subj: INSTRUMENT NAVIGATION WORKBOOK, ADVANCED HELICOPTER, TH-57C

1. CNATRA P-426 (NEW 03-21) PAT, "Instrument Navigation Workbook, Advanced Helicopter, TH-57C" is issued for information, standardization of instruction, and guidance to instructors and student military aviators within the Naval Air Training Command.

2. This publication is an explanatory aid to the Helicopter curriculum and shall be the authority for the execution of all flight procedures and maneuvers herein contained.

3. Recommendations for changes shall be submitted via the electronic Training Change Request (TCR) form located on the CNATRA Website.

D. F. WESTPHALL
By direction

Releasability and distribution:
This instruction is cleared for public release and is available electronically only via Chief of Naval Air Training Issuances Website, https://www.cnatra.navy.mil/pubs-pat-pubs.asp.

WORKBOOK

FOR

ADVANCED INSTRUMENT NAVIGATION

TH-57C

Q-2C-3156

LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original...0...3 Mar 21 (this will be the date issued)

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 268 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
COVER	0	7-1 – 7-9	0
LETTER	0	7-10 (blank)	0
iii - xiii	0	8-1 – 8-36	0
xiv (blank)	0	9-1 – 9-15	0
1-1 – 1-13	0	9-16 (blank)	0
1-14 (blank)	0	9-17 – 9-22	0
2-1 – 2-33	0	A-1	0
2-34 (blank)	0	A-2 (blank)	0
3-1 – 3-57	0	B-1	0
3-58 (blank)	0	B-2 (blank)	0
4-1 – 4-16	0		
5-1 – 5-28	0		
6-1 – 6-31	0		
6-32 (blank)	0		

INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE

The following interim Changes have been incorporated in this Change/Revision:

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

TABLE OF CONTENTS

TABLE OF FIGURES

WORKBOOK SCOPE

To demonstrate mastery of the subject material students should be able to answer a minimum of 80% of the review questions successfully

TERMINAL OBJECTIVES

1. Recall CNAF M-3710.7, FAA Flight Rules and Regulations, and FLIP procedures.

2. Recall approach procedures, approach clearances, ATIS, terminal radar control and other related information.

3 Recall elements of the airways route system and techniques for the proper utilization of navigational aids, specifically the VOR, TACAN, and VORTAC.

4. Interpret the functions of the TACAN and VOR navigation by solving given problems and answering related questions.

5. Interpret the functions of the instrument landing system (ILS) as it applies to the TH-57C.

6. State the use of non-directional radio beacons, ADF procedures, and the TH-57C helicopter direction finding equipment.

7. Recall elements of the Global Positioning System (GPS) and state techniques and procedures as they apply to the TH-57C.

8. Recall facts about the development, uses, and operation of the KT-79 Transponder.

9. Recall procedures and general information for executing Ground Controlled Approaches.

10. Recall IFR holding procedures.

11. Write voice reports in the correct format using the correct phraseology.

12 Resolve the correct procedure to follow in the event of two-way communication failure during IFR flight on the federal airways.

INTRODUCTION TO INSTRUMENT NAVIGATION ADVANCED HELICOPTER WORKBOOK

The purpose of this unit is to introduce, and review procedures and concepts related to instrument navigation. Special emphasis will be given to the advanced procedures needed by helicopter aviation students. Many of the specific details will pertain to a single-piloted TH-57C.

There is a multitude of publication instructions, regulations, and various other information sources that a pilot must be aware of before attempting a flight, especially in IFR conditions. This book will highlight some of the more important points and the ones that are most commonly misinterpreted or incorrectly applied. Source documents for this workbook are located on page C-1. All the information presented therein was current at the time of publication but is subject to change upon update and revision of the source documents. From time to time, various elements in these publications are either deleted, moved to another publication, or added. Thus, it is imperative the naval aviator stay abreast of all of the changes. ***The reason a thorough knowledge is important is that not only can ignorance of the proper procedures lead to a flight violation, but it may also lead to loss of an aircraft or even a life.***

Two of the most important publications involving naval aviators are the Federal Aviation Regulations (FAR) and the NATOPS General Flight and Operating Instructions (CNAF M-3710.7). The Federal Aviation Administration publishes the section which most concerns the military pilot; FAR Part 91. This section deals primarily with the rules of the road. The Chief of Naval Operations has set forth rules governing the operations of naval aircraft. These rules are found in the CNAF M-3710.7 (series) and incorporate many of the FAA requirements but the FAA has provisions for DoD exceptions.

HOW TO USE THIS WORKBOOK

Read and become familiar with these objectives. These objectives state the purpose of each chapter of instruction in terms of ***what you will be able to do*** after you complete the unit. Most importantly, your end-of-course examination is developed directly from these instructional objectives. Therefore, it is to your benefit to know all information the objectives are asking you to comprehend.

Read and comprehend the information in each chapter. Each chapter consists of a set of facts and explanations. After comprehending all facts and information indicated by the objectives, complete the post test and check your answers. If you answer the questions correctly, continue to the next chapter. If you incorrectly answer a question(s), review the objective and information covering that subject area.

Your exam will be based on the publications you have been issued for the class; ***however, it is imperative that when flight planning with current publications, you must review them for any changes that have been made since the date of the classroom publications.*** Course materials will only be updated if a substantial change has occurred, justifying the expense of ordering new materials.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER ONE
CNAF M-3710.7/FAR PART 91

100. INTRODUCTION

CNAF M-3710.7 paragraph - 1.3.3 states that "naval aircraft shall be operated in accordance with applicable provisions of FAR Part 91 except where this instruction prescribes more stringent requirements." However, there are a few areas in which FAA has permitted the Navy to deviate from FAR Part 91. In certain areas dealing with aircraft speed, alternate airport weather requirements, and special low-level missions, the Navy ***is less*** stringent than the corresponding regulation in the FAR Part 91.

101. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

The specific purpose of this chapter is to recall CNAF M-3710.7, FAA Flight Rules and Regulations, and FLIP procedures. Using the listed publications, the student should answer all questions on the criterion test.

Enabling Objectives

1. List the services of Flight Service Stations (FSS) and their standard operating frequencies.

2. State VFR/IFR semicircular cruising rules.

3. List FAR/CNAF cloud clearances and visibility requirements to operate in controlled airspace and uncontrolled airspace and special rules for helicopters (if any).

4. State the CNAF rules for operating helicopters in Class B, C, and D airspace and special rules for helicopters (if any).

5. List CNAF restrictions for operating aircraft near persons, vessels, vehicles, structures, disaster areas, resorts, cities, villages, and beaches.

6. State the responsibilities of an aircraft commander.

7. State the requirements for annual instrument evaluations.

8. List personnel authorized to start helicopter engines.

9. List personnel authorized to engage the rotors of helicopters.

10. State the CNAF requirements for the use of life rafts, life jackets, and parachutes, and special requirements for their use which apply to helicopters.

11. State the CNAF restrictions for the operation of aircraft near commercial and civil aircraft.

12. List CNAF standard instrument rating takeoff weather minimums.

13. State the CNAF definition of a multi-piloted aircraft.

14. State CNAF approach minimums for single-piloted and multi-piloted aircraft and special rules for helicopters (if any).

15. State CNAF requirements for selection of alternate airports on IFR flight plans.

16. Apply CNAF flight planning approach minimums at the destination airport for the approach being made.

17. Apply CNAF requirements for selection of an alternate airport.

18. Complete minimum fuel reserve as required by CNAF for turbine-powered helicopters.

102. SPECIFIC TOPIC AREAS

The following contains specific topic areas covered by either the FAR or CNAF M-3710.7 or both. It is imperative the naval aviator thoroughly understand each concept.

Emergencies

The FAA, realizing there are situations when a pilot may not be able to follow FAR, makes provisions for deviations from FAR. FAR Part 91.3 states, "In an emergency requiring immediate action, the pilot in command may deviate from any rule...to the extent required to meet that emergency."

Preflight Planning

FAR states a pilot in command shall, before beginning every flight, familiarize himself/herself with all available information concerning that flight. This information gathering is called "preflight planning" and should include (but is not limited to) information concerning weather, NOTAMs, fuel requirements, possible alternate or emergency airfields enroute, and anticipated delays.

Pilot in Command

FAR Part 91 states the "pilot in command" of an aircraft is the pilot responsible for the operation and safety of an aircraft. CNAF M-3710.7 paragraph 3.7.1 further defines the pilot in command as the pilot who is assigned the responsibility for the safe and orderly conduct of a flight and for the well-being of the crew. The authority and responsibility of the pilot in command shall not be transferred during flight.

CNAF M-3710.7 paragraph 3.7.1 additionally states the authority and responsibility of a pilot in command is independent of rank or seniority in relation to other participants in the flight ***except*** in the following situations:

1. OFFICER IN TACTICAL COMMAND EMBARKED. Wing, group, or squadron commanders, if embarked on a mission involving aircraft of their command retain full authority and responsibility regarding command, including the mission in which participating.

2. FLAG OR GENERAL OFFICER EMBARKED. A flag or general officer eligible for command at sea or in the field embarked aboard an aircraft as a passenger, may elect to exercise his authority to command the aircraft, thereby assuming full responsibility for the safe orderly conduct of the flight.

103. REQUIREMENTS FOR INSTRUMENT RATINGS AND QUALIFICATIONS

CNAF M-3710.7, Chapter 13 gives guidelines on the requirements for a standard or special instrument rating, as well as annual requirements for qualification. The instrument check ride you will fly at the end of the radio instrument syllabus constitutes your initial qualification, which expires one year after the last day of the month in which the evaluation was completed. Renewal of instrument ratings shall be accomplished annually.

Within the six months preceding the date of the instrument evaluation flight, each pilot must have completed a minimum of:

1. Six hours of instrument flight, either actual or simulated.

2. Twelve approaches (six precision and six non-precision), either actual or simulated.

Within 12 months, a minimum of:

1. Twelve hours of instrument flight, either actual or simulated.

2. Eighteen approaches (twelve precision and six non-precision), either actual or simulated.

Furthermore, a formal instrument ground syllabus with a written examination must be completed within 60 days prior to the evaluation flight. If such a syllabus is not available, the command to which the pilot is assigned shall ensure the completion of an examination.

Standard ratings are assigned with 50 hours of instrument flight and successful completion of an instrument flight evaluation. Special ratings require:

1. Five years of military and nonmilitary flying experience.

2. Two thousand hours flight time.

3. One hundred hours of military actual instrument time.

Instrument evaluation flights are conducted in accordance with the NATOPS Instrument Flight Manual (NIFM). The instrument flight evaluation consists of two parts; one part covers basic instrument flying and the other covers the planning and conduct of a flight under actual or simulated instrument conditions in control areas. Specific maneuvers to be evaluated and their grading criteria are listed in NIFM. An unsatisfactory grade in any area shall result in an unsatisfactory grade for the flight.

OPNAVINST 3710.7(Series)
NATOPS INSTRUMENT FLIGHT MANUAL

NATOPS INSTRUMENT RATING REQUEST

1. NAME *(Last, first, middle initial)*:	2. RANK:	3. EDIPI NUMBER:	4. DATE OF LAST EVALUATION
5. UNIT:	6. CREW POSITION & QUALIFICATIONS:	7. HOURS IN MODEL:	8. DATE OF CHECK FLIGHT:
9. AIRCRAFT MODEL:	10. AIRCRAFT BUNO	11. FLIGHT DURATION	12. EXPIRATION DATE:

13. MISCELLANEOUS SUMMARY		
ITEM	LAST 6 MO.	LAST 12 MO.
PRECISION APPROACHES		
NON-PRECISION APPROACHES		

18. INSTRUMENT PILOT TIME			
ITEM	LAST 12 MO.	LAST 6 MO.	TOTAL ALL YEARS
ACTUAL			
SIMULATED			
INSTRUMENT PILOT TIME TOTAL			0
TOTAL YEARS FLYING EXPERIENCE *(Military and Commercial)*			

14. TOTAL PILOT TIME

15. CURRENT RATING:

16. ISSUED RATING:

17. SIGNATURE OF APPLICANT:

WRITTEN EXAMINATION

19. THIS IS TO CERTIFY THAT THE APPLICANT HAS...

☐ SATISFACTORILY ☐ UNSATISFACTORILY

COMPLETED THE WRITTEN EXAMINATION FOR AN INSTRUMENT RATING AS REQUIRED BY THE NATOPS INSTRUMENT FLIGHT MANUAL.

20. 1ST EXAM*(Grade)*:	21. 2ND EXAM*(Grade)*:	22. 3RD EXAM*(Grade)*:
23. EXAMINING OFFICER		24. RANK:
25. UNIT:		26. DATE OF EXAM:

FLIGHT EVALUATION

27. PART ONE *(Basic Instruments)*	Q	U	28. PART TWO *(Instrument flight within control areas with emphasis on VOR/TACAN where feasible)*	Q	U
1 INSTRUMENT TAKEOFF *(Optional)*			1 FLIGHT PLANNING		
2 CLIMBING, DESCENDING, AND TIMED TURNS*			2 CLEARANCE COMPLIANCE		
3 STEEP TURNS*			3 INSTRUMENT APPROACHES		
4 RECOVERY FROM UNUSUAL ATTITUDES*			4 COMMUNICATIONS AND NAVIGATION EQUIPMENT		
5 VOR/TACAN POSITIONING			5 EMERGENCY PROCEDURES		
6 PARTIAL PANEL AIRWORK*			6 VOICE PROCEDURES		
7			7		

* Not required when evaluation is conducted under actual instrument conditions.

29. FLIGHT EXAMINER:	30. RANK:	31. DATE:	32. SIGNATURE:

33. REMARKS:

34. UNIT COMMANDER:	35. RANK:	36. DATE:	37. SIGNATURE:

OPNAV 3710/2 (REV 4/2016) FOR OFFICIAL USE ONLY - PRIVACY ACT SENSITIVE. Any misuse or unauthorized disclosure of this information may result in both criminal and civil penalties.

Figure 1-1 NATOPS Instrument Rating Request (CNAF 3710/2)

104. INSTRUMENT FLIGHT REQUIREMENTS

CNAF M-3710.7 prescribes general flight and operation instructions and procedures applicable to all naval aircraft. Therefore, all designated Naval Aviators should be familiar with its contents.

For the purposes of this course of instruction and the examination, Chapters 4, 5 (excluding ACM), 6 and 9 are testable along with the Glossary and Abbreviations appendices. Chapters 1, 3, 7, 8 and 13 have information you should be familiar with prior to your instrument check flight and receiving your wings

REVIEW QUESTIONS

The following publications may be used with this review.

- CNAF M-3710 series
- General Planning (GP)
- Area Planning (AP-1)
- IFR Supplement
- Low Altitude Approach Procedures, Volumes 14, 16, 17, 18, and 19, dated 21 Jul 2016
- Aeronautical Information Manual
- IFR Enroute Low Altitude Chart, dated 21 Jul 2016

1. Which sub-agency of the FAA is responsible for providing all aircraft with in-flight radio assistance such as weather broadcasts, VFR position reports and accepting amended flight plans?

a.	"Pensacola Metro"	b.	"Jacksonville Center"
c.	"Orlando Approach Control"	d.	"Dothan Radio"

2. In the absence of direct orders from higher authority, the responsibility for starting or continuing a mission with respect to weather or any other condition affecting safety of the aircraft rests with the pilot in command.

a.	True	b.	False

3. When the engine of a helicopter is started, the controls should be manned by a qualified ____________. Commanding Officers may authorize certain specifically qualified personnel, other than pilots, to ground test helicopters when a pilot is not available. Rotors shall not be engaged except by a qualified ____________.

a.	Pilot	Pilot	b.	Helicopter pilot	Helicopter pilot
c.	Pilot	Mechanic	d.	Mechanic	Pilot

4. Inflatable life preservers shall be worn during all flights originating from or terminating on ships or landing platforms and should be readily available when operating from aerodromes in the vicinity of coastal waters or when operating from inland aerodromes where takeoff, route of flight, or approach path is over water.

a.	True	b.	False

5. For the execution of a straight-in landing, the visibility required for helicopters may be reduced by one-half that of Category-A aircraft, but in no case may it be reduced to less than one-fourth mile or 1200 feet RVR for single-piloted aircraft.

a.	True (with some exceptions)	b.	False

6. In the case of major accidents, natural disasters, or events of high public interest, temporary flight restrictions may be placed in effect. Normally, the exact dimensions of this airspace will be included in the

a. VFR Supplement
b. IFR Supplement
c. NOTAMs
d. AP-1A/2A/3A.

7. According to CNAF M-3710.7, commercial and civil aircraft shall be avoided by at least ______ feet vertically or ______ mile(s) laterally.

a. 500 1
b. 500 2
c. 1000 1
d. 1000 2

8. Generally, Class "D" Airspace is composed of a ____________ and controls aircraft up to ___________ with horizontal limits as needed.

a. Control Tower 2500 AGL
b. Control Tower 2500 MSL
c. Control Tower 3000 AGL
d. Control Tower 3000 MSL

9. Helicopter flights within Class "D" airspace shall be in accordance with the local flight rules. Where no guidance is provided, pilots shall not exceed ______ AGL unless specifically cleared by the tower or other control agency.

a. 200
b. 500
c. 1000
d. 1200

10. No person may operate an aircraft within Class "B" Airspace unless that person has received ____________ from Air Traffic Control (ATC) prior to operation.

11. For a turbine-powered helicopter, CNAF M-3710.7 states that the planned reserve fuel after final landing at the destination or alternate, if required, shall not be less than that fuel required for 20 minutes of flight at a fuel consumption based on

a. Maximum endurance operation at normal cruise altitude.
b. Maximum endurance operation at 10,000 feet.
c. Operation at planned flight altitude.
d. Reserve fuel not required for a VFR flight.

12. For a standard card pilot departing North Myrtle Beach Rwy 23 and all equipment is up and operating, the absolute lowest takeoff weather minimums are

a. 200 ¼
b. 200 ½
c. 300 ¾
d. 300 1

13. According to CNAF M-3710.7, the TH-57C meets the requirements of a multi-piloted aircraft when being flown by two pilots, both meeting the requirements of the TH-57C NATOPS Manual.

a. True	b. False

14. With reported weather of 200 feet broken and 3 miles visibility, may a single-piloted helicopter depart NAS Meridian, Mississippi, on duty runway 19? If yes, could the departure be VFR?

a.	No	No	b.	Yes	Yes
c.	No	Yes	d.	Yes	No

15. What is the absolute lowest weather minimum for a single-piloted helicopter executing a precision (PAR, ILS) approach?

a. 200 ¼ or 1200 RVR

b. 200 ½ or 2400 RVR

c. Both a and b above, whichever is higher

d. 33 1

16. When selecting a suitable alternate, radar (PAR/ASR) approach minimums at the alternate may ***not*** be used by pilots flying

a. single-piloted aircraft.

b. multi-piloted aircraft.

c. aircraft with one operable UHF/VHF transceiver.

d. both a and c.

17. Alternate weather requirements are based on the pilot's best judgment as to the runway that will be in use upon arrival at the destination and alternate.

a. True	b. False

18. Assume that you are flying in a single-piloted TH-57C and your destination is Dobbins ARB, Georgia. The forecast winds at Dobbins at your planned ETA are 27015KT. What are your lowest approach minimums for the execution of an approach at Dobbins ARB?

a.	100	¾	b.	300	½
c.	200	½	d.	200	¼

19. In reference to question 18, Dobbins ARB forecast weather at your planned ETA (±1 hour) is KMGE BECMG 0350 14008KT 1600 +RA BKN004 OVC010 QNH 2992INS. To file an IFR flight plan to Dobbins, you must select a suitable alternate whose forecast is at least

a. 3000 3.
b. Non-precision approach published minimums plus 300 1.
c PAR approach published minimums plus 200 ½.
d. 1000 1.

20. You are planning an IFR flight to NAS Pensacola in a single-piloted helicopter. Pensacola's forecast weather at your planned ETA (±1 hour) is KNPA FM1200 20015KT 1600 FG BKN003 OVC010 QNH 2998INS. For flight planning purposes, what are your lowest approach minimums at NAS Pensacola?

a. 200 ¼ b. 200 ½
c. 400 ¼ d. 400 ½

21. In reference to question 20, and in accordance with CNAF M-3710.7, if NAS South Whiting is your planned alternate, what must NAS Whiting Field be forecasting before you can file an IFR flight to NAS Pensacola?

a. 300 ¼ b. 300 ½
c. 600 1 d. 400 1

22. Your destination is Tyndall AFB, Florida, and you are flying a single-piloted helicopter. The weather at Tyndall at your planned ETA (±1 hour) is KPAM TAF FM1400 03016KT 3200 RA BKN003 OVC010 QNH 3013INS. If Moody AFB, Georgia, is the only available alternate, what is the minimum weather Moody may be forecasting for you to file an IFR flight plan to Tyndall AFB?

a. 400 ½ b. 400 1
c. 700 1½ d. 3000 3

23. Assume you are planning a flight to NAS Whiting Field North in a TH-57 from NAS New Orleans with an ETE of 1+45 minutes and your TH-57 has 2+30 minutes of fuel on board. If Whiting is forecasting KNSE TAF BECMG 1819 12010KT 3200 RA BKN002 OVC010 QNH 2992INS at your planned ETA (±1 hour) and all the suitable alternates within 100 NM of Whiting are lower, can you file an IFR flight plan to Whiting Field?

a. Yes b. No

24. Assume you are flying a single-piloted TH-57C and your final destination is NAS North Whiting Field. Pensacola Approach Control has cleared you for North Whiting TACAN Rwy 14 approach and reports Whiting weather is KNSE FM1900 03006KT 4800 HZ BKN002 QNH 3016INS. May you accept the approach clearance and commence the approach?

a. Yes b. No

25. Outside of controlled airspace, a helicopter may be operated below 1200 feet AGL when the visibility is less than 1 statute mile.

a. True b. False

26. A helicopter is operating under special VFR clearance in Class "E" Airspace. Which of the following requirements does ***not*** apply?

a. Pilot and aircraft must be certified for instrument flight (except for CNATRA helicopter operations).
b. Remain 500 feet below clouds.
c. Authorization from ATC in Class "E" Airspace
d. Maintain 1-mile visibility unless waived for operational necessity.

27. VFR semicircular cruising rules begin at

a. 1000 feet MSL.
b. 2000 feet AGL.
c. 3000 feet MSL.
d. 3000 feet AGL.

28. What are FSS's two standard frequencies?

a. 255.4 272.2 b. 122.2 255.4
c. 243.0 255.2 d. 121.5 122.1

29. A TH-57C ***must*** have an operable clock with a sweep second hand for instrument flight.

a. True b. False

30. You are flying a TH-57C single-piloted, and your destination is forecasting at or above your lowest approach mins but below 3000 feet/3-mile visibility. With Keesler AFB as your alternate, what are the lowest acceptable weather mins for filing purposes?

a. 700 1¾ b. 800 2
c. 400 1 d. 300 ¾

31. Within 12 months of an instrument evaluation, a pilot is required to have a minimum of ______ hours of instrument flight and ______ approaches, (______ precision and ______ non-precision).

32. Helicopters may reduce Category A visibility on non-copter procedures to ______ of published minima, but no lower than ____________ when executing an approach. This is based on airspeeds not exceeding 90 knots on final approach.

SINGLE-PILOTED MINIMUMS

(___) = mins taken from approach plates
<___> = your mins derived using criteria in OPNAV 3710

I. FLIGHT PLANNING: Forecast weather for ETA + 1 hour.

Destination	Alternate
Destination: ________ name/ID	Alternate: ________ name/ID
CIG/VIS ______ WIND _____ /___	CIG/VIS ______ WIND _____ /___
3000/3	<Not Required>
(/) up to 3000/3	Non-Prec: (/) + 300/1 < > — Precision: (/) + 200/ 1/2 < >
Expected approaches TYPE RWY MINS ________(____) ________(____) ________(____)	
0/0 up to (____/____)	<3000/3>
Radar mins MAY be used for dest.	NO radar mins for alt.

II. TAKEOFF CRITERIA: Observed weather at actual time of takeoff.

Takeoff from: ____________ Wind _______ Rwy ____

Non-precision	Precision
(/)	(/)
or	or
300/1	200/1
< >	< >

III. ENROUTE: Observed and forecast weather for entire route.
Practice approaches at fields other than destination may be executed with no weather mins.

IV. APPROACH CRITERIA: Observed weather at the time of the approach.

	TYPE RWY	(PUB MINS)	<HELO MINS>
1.	________	(______)	<______>
2.	________	(______)	<______>
3.	________	(______)	<______>

Figure 1-2 Single-Piloted Minimums

REVIEW ANSWERS

1.	d.	GP	17.	a.	3710
2.	a.	3710	18.	d.	3710/APP VOLS
3.	b.	3710	19.	b.	3710
4.	a.	3710	20.	a.	3710
5.	a.	3710	21.	d.	APP VOLS
6.	c.	FAR 91	22.	b.	APP VOLS
7.	a.	3710	23.	b.	3710
8.	a.	(GP)	24.	b.	3710
9.	b.	3710	25.	a.	3710
10.	clearance	(AP-1)	26.	b.	3710/FAR
11.	c.	3710	27.	d.	FAR
12.	b.	3710	28.	b.	IFR Low Alt Chart
13.	a.	3710	29.	b.	3710
14.	d.	APP VOLS/3710	30.	c.	APP VOLS
15.	a.	3710	31.	12, 18, 12, 6	3710
16.	d.	3710	32.	½, ¼ mile or 1200 RVR	3710

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER TWO
DOD FLIGHT INFORMATION PUBLICATIONS

200. INTRODUCTION

This chapter reviews the DOD FLIP program and the following publications introduced to the students during primary flight training: IFR Supplement, Flight Information Handbook (FIH), IFR Enroute Low Altitude Charts, General Planning (GP), and Area Planning (AP) North and South America (AP/1).

In this chapter, a question-answer format is used throughout, instead of an end of chapter review. This is to provide reinforcement in learning to use a wide range of flight information publications

201. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

Demonstrate a working knowledge of information contained in the FLIP to include GP, AP, IFR Enroute Low Altitude Charts, IFR Enroute Supplement, and Flight Information Handbook (FIH).

Enabling Objectives

1. Be sufficiently familiar with the Table of Contents of the IFR Supplement in order to be able to locate information as needed.

2. Be sufficiently familiar with the IFR Supplement legend in order to be able to determine what each piece of information provided means as needed.

3. Using the IFR Supplement legend, understand what aeronautical information is listed for each airport and navigation facility.

4. For airports listed in section B (facilities directory) of the IFR Supplement, be able to locate and list specific airport information as needed, such as

    a. The airport classification.

    b. The airfield identifier.

    c. Field elevation.

    d. Runway lighting.

    e. Runway weight-bearing capacity.

    f. JASU available.

g. Fuel available.

h. Aircraft services available.

i. Airport operating procedures listed in airport remarks.

j. Communication frequencies for specific airport functions.

k. Airport Radio Aids to Navigation.

5. Be familiar with the various procedures located in Section C of the IFR Supplement to include:

a. ADIZ Procedures.

b. No-NOTAM Preventive Maintenance Schedules.

6. Be familiar with the information and procedures published in the Flight Information Handbook (FIH) including:

a. Table of Contents

b. Special Notices Section.

c. General Information Section

d. Emergency Procedures published in Section A, which apply to domestic flights.

e. National Flight Data and Procedures published in Section B, which apply to domestic flights.

f. Meteorological Information and Procedures published in Section C, which apply to domestic flights.

7. Be able to use the conversion tables listed in Section D.

8. Be able to locate and decipher abbreviations listed in Section F of the FIH.

9. Be able to locate and decipher NOTAM Codes listed in Section F of the FIH.

10. Understand the information provided on IFR Enroute Low Altitude Charts.

11. Be thoroughly familiar with the IFR Enroute Low Altitude Chart Legend and be able to locate and identify key information on the chart including:

a. Airport information

b. Radio Aids to Navigation

c. Flight Service Stations

d. Standard Flight Service Station Frequencies

e. Airspace information including:

i. Air Route Traffic Control Center (ARTCC) ("Center") boundaries

ii. ARTCC Remote Sites with Discrete Frequencies

iii. Controlled Area

iv. Class B, C, D, E AND G

v. Special Use Airspace

12. Be familiar with the information contained in the miscellaneous section of the legend.

13. Be familiar with the information and procedures published in the General Planning (GP) Publication.

14. Be able to use the Index for Aeronautical Information (GP Chapter 1) to locate information contained in the FLIP publications.

15. Be familiar with the structure and content of the Explanation of Terms (GP Chapter 2).

16. Be able to utilize GP Chapter 3 (FLIP Program) to gather information on the DoD FLIP program, individual FLIP products, and related publications.

17. Using GP Chapter 4 (Flight Plans) as a guide, correctly complete a DD Form 1801 International Flight Plan.

18. Given an aircraft service and type function of flight, be able to determine the correct written and verbal call signs using Chapter 5, Codes for Aircraft Identification.

19. Be familiar with the information and procedures contained in GP Chapter 6 (Pilot Procedures) to include but not limited to the sections outlined below.

a. National Procedures

b. Visual Flight Rules

c. Instrument Flight Rules

d. 6-6 RVSM Rules – Skip – only applies at flight level (FL) 290 and higher

e. Flight Planning

f. Enroute

g. Terminal

h. Additional Information

20. Be familiar with the information and procedures published in the Area Planning (GP) Publication (AP/1)

21. Review and be familiar with AP/1 Chapters One and Three (National Supplementary Procedures and North American Region – United States). Using the AP/1 as a reference, be able to answer questions on flight procedures, U.S. airspace and airports, to include but not limited to the areas outlined below:

– Flight Planning

i. Quota Flow Control – Air Route Traffic Control Centers (ARTCC)

ii. Airport Reservation Operations and Special Traffic Management Programs

iii. U.S. Controlled Airspace

iv. Supplementary Airport Information

v. Route and Area Restrictions

vi. DOE Nuclear Facilities

vii. Flight over charted U.S. Wildlife Refuges, Parks, and Forest Service Areas

viii. Washington D.C. National Capital Region

ix. Flight Hazards

x. Preferred IFR Routes

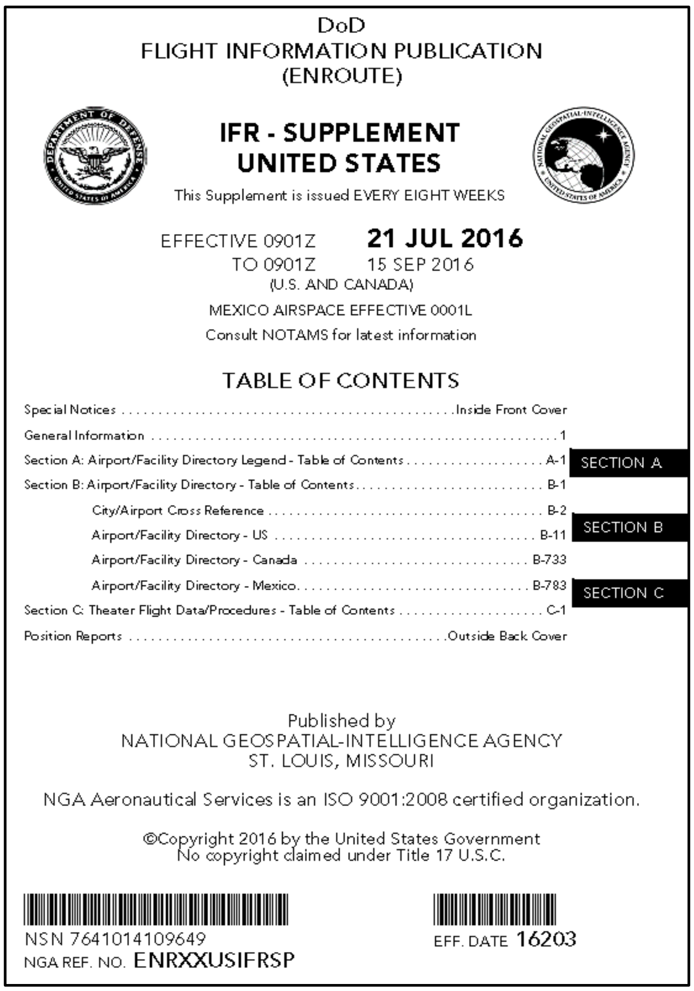
xi. Bird/Wildlife Hazard Data

xii. Terminal Noise Abatement Procedures

xiii. VOR Receiver Checkpoints

202. IFR SUPPLEMENT

The ***IFR Supplement*** is part of the enroute phase of the FLIP Program, and it is to be carried in the aircraft on all IFR flights. The ***IFR Supplement*** contains an alphabetical listing of all airports that have a published DOD instrument approach procedure and/or radar capability, integrated with an alphabetical listing of all NAVAIDs and ARTCC facilities. It also contains brief presentations on miscellaneous aeronautical information such as ADIZ procedures, No-NOTAM Preventive Maintenance Schedules, and Position Reports. The supplement is published every eight weeks and is printed in blue to distinguish it from the ***VFR Supplement***. It is the intent of this section to make you familiar with the general information and legend pages found in the supplement. These pages will assist you in becoming acquainted with the contents of the book. The IFR Supplement is broken down into sections as follows:



DoD
FLIGHT INFORMATION PUBLICATION
(ENROUTE)

IFR - SUPPLEMENT
UNITED STATES

This Supplement is issued EVERY EIGHT WEEKS

EFFECTIVE 0901Z **21 JUL 2016**
TO 0901Z 15 SEP 2016
(U.S. AND CANADA)
MEXICO AIRSPACE EFFECTIVE 0001L
Consult NOTAMS for latest information

TABLE OF CONTENTS

Published by
NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY
ST. LOUIS, MISSOURI

NGA Aeronautical Services is an ISO 9001:2008 certified organization.

NSN 7641014109649 EFF. DATE 16203
NGA REF. NO. ENRXXUSIFRSP

Figure 2-1 Front Cover of the IFR Supplement United States

The front cover Table of Contents is further sub-divided into a Table of Contents for each section: Section A covers the Airport/Facility Directory Legend. View page A-1 in the IFR Supplement. Section B is the Airport/Facility Directory. View pages B-1 through B-9. Section C consists of Theater Flight Data/Procedures. View page C-1.

203. IFR SUPPLEMENT QUESTIONS

Answer the following questions using the edition of the ***IFR Supplement*** provided. Answers are listed in the back of this text. Section A, Questions 1- 32 are taken from the Airport/Facility Directory Legend. They refer to the Lesperance INTL airport, page A-2, in the IFR Supplement.

1. Where can you find all US military NOTAMS and civil/international NOTAMs contained in the US NOTAM system? ______________________________________

2. Lesperance INTL airport is in what state? ______________________

3. The latitude and longitude of the airport are ____________________

4. Lesperance INTL's location identifier is _______________________.

NOTE

An airport identifier is shown by either a four-character ICAO code or a three- or four-character FAA code. When a four-letter identifier is shown, it is an ICAO (International Civil Aviation Organization) identifier in which the first letter is a prefix that identifies the country or a specific area of the world. Example**:** K for the U.S., M for Mexico, C for Canada, etc. The three characters following the prefix can be all letters or an alphanumeric combination. Example: Florala Muni, AL: 0J4 (no "K" since not ICAO)

5. If a pilot plans to take off from Lesperance INTL at 1500 local *standard* time, what time would he/she enter on the flight plan (Z-time)? ____________

6. The airport is geographically portrayed on the L-22 low altitude chart. (True/False)

7. What is the alternate name of Lesperance INTL? ________________

8. Lesperance INTL has a military tenant. (True/False)

9. Who is the military tenant at the field? ________________

10. What is the airport elevation? ________________

11. Lesperance INTL lighting (for RWY 9) consists of ___________.

    a. strip lights, and HIRL
    b. strip lights, approach lights, and HIRL
    c. PAPI, HIRL, REIL, and BP (NATO Standard)
    d. strip lights, HIRL, HIAL, sequenced flashing lights

12. The longest usable runway is 8904 feet long and is made of asphalt. (True/False)

13. If your aircraft requires an MA-1 power starting unit, will such power be available? _____

14. Can JP-4 aviation fuel be obtained at Lesperance INTL? ______

15. What is the NATO code for JP-4? ________________

16. What does the prefix NC signify when used in the fuel section of the airport directory? __________________

NOTE

The following is reproduced from CNAF M-3710.7:

9.3 AIRCRAFT FUEL PURCHASE

Because the cost of fuel from non-contract commercial sources is considerably higher than that from military or contract sources, unit commanders and pilots in command shall make every effort to purchase fuel from military or government contract sources. Navy and Marine Corps flight personnel are not authorized to purchase aircraft fuel/oil from other than military or government contract sources ***except*** when one of the following apply:

a. Mission requirements dictated stopping at a facility without military or contract fuel sources.

b. The flight terminated as the result of an emergency.

c. The flight terminated at an alternate airport in lieu of filed destination.

17. What type of aviation oil is available at the airport? ____________________

18. In order to use the Navy facilities at Lesperance INTL you must be on official business (True/False). What does "official business only" indicate? __________________

19. Are Customs available at Lesperance INTL? _________________________

20. What is the frequency for the pilot to dispatcher service? ________________

NOTE

Pilot to dispatcher (PTD) is a communication facility established to enable pilots to transmit NON-ATC information (i.e., servicing, maintenance, VIP information, etc.) to Base Operations. Radio call sign is "Operations."

21. What is the name of the Approach Control serving this airport? ________________Does it have radar capability? _________________

22. Prior to taking off on an IFR flight, a pilot would receive his clearance on 281.4 or 121.4 or (CLNC DEL). (True/False)

NOTE

All IFR flights must have clearance prior to takeoff. Normally this clearance is relayed from ATC to the pilot via the tower on a ground control frequency. At a busy airport, a special frequency is set aside for this task and is listed as a clearance delivery frequency. At airports with no clearance delivery frequency a telephone number to the FSS handling clearances may be listed in the communications section under that airport.

23. Pilot to Metro (PMSV) service is available on frequency 344.6. (True/False)

NOTE

Pilot to Metro (PMSV) services are available from all Naval Meteorology and Oceanography Command (NAVMETOCCOM) and USMC aviation weather activities. They are also available at select Air Force Bases and Army Airfields. (See the FIH for specific locations). PMSVs provide a means whereby the pilot can communicate directly with a weather forecaster. The radio call sign for this service is METRO, e.g., "Lesperance METRO." Maximum use of this service is encouraged when requesting or reporting enroute weather.

24. What is the significance of an X following a frequency? _________________

25. The Clermont VOR/DME has interference-free service of 40 NM below 14,500 feet MSL. (True/False)

26. The Clermont VOR/DME has a Radio Class Code of (HA). (True/False)
What is the meaning of (HA)? _________________

27. The MHW code for an NDB means it is a non-directional radio beacon (power less than 50 watts (25NM)/without voice. (True/False)

28. What is the channel number of the Clermont DME? _________________

29. What is the three-letter location identifier of the VOR? _______________

NOTE

Normally the three-letter location identifiers of the NAVAIDs are the same as the field they serve; however, there are exceptions to this rule.

30. What are the bearing and distance to the Clermont NDB from the field? _______________

In addition to airports, the airport/facility directory also contains Flight Service Stations, Air Route Traffic Control Centers, and enroute navigation facilities.

Questions 33-34 are taken from the front cover of the IFR Supplement.

31. The IFR Supplement is issued every eight weeks? _______________ (True/False)

32. Special notices of a permanent nature will be carried for two issues and then incorporated in the appropriate section of the applicable FLIP product. (True/False)

SECTION B

33. ACORE is __________

a. a Flight Service Station

b. an NDB

c. an Air Route Traffic Control Center

34. What is the FSS that serves the area surrounding the Oshkosh, WI VORTAC

NOTE

If there is no Flight Service Station named in parentheses, then the controlling service station's name is identical to the name of the NAVAID. If the word "radio" does not appear, then the enroute charts or the ***VFR Supplement*** must be consulted to determine the controlling Flight Service Station.

35. At Jacksonville INTL airport, transient aircraft can expect servicing at the Air National Guard (ANG) ramp. (True/False)

36. Transient aircraft require a PPR at Jacksonville NAS. (True/False)

37. During what hours will noise abatement be in effect at Jacksonville NAS? __________

38. JP-5 fuel is available at Jacksonville NAS. (True/False)

39. You could expect to contact Approach Control on 377.05 or 123.8 at Jacksonville NAS. (True/False)

40. At Jacksonville NAS, you could expect Cecil VOR to have voice capability. (True/False)

41. The course and distance from NAS Jacksonville to the Cecil VOR are ____________º and ________miles.

42. At Jacksonville INTL, the DINNS NDB is coded (H). What does this mean? __________.

SECTION C

43. Minimum weather conditions for No-NOTAM preventive maintenance for USN facilities with two instrument approach NAVAIDs are __________________________.

44. Where can No NOTAM preventive maintenance schedule for USAF facilities be found ________________________

45. The allowable position tolerance for penetration of an ADIZ over water are _____minutes and ________ nautical miles from centerline of intended track.

46. Flights that remain within 10 NM of the point of departure do not have to file IFR or DVFR if they intend to penetrate an ADIZ. (True/False)

47. When a flight intends to penetrate or operate within the ADIZ, a ___________ or __________ flight plan will be filed with an appropriate aeronautical facility prior to __________.

204. IFR SUPPLEMENT ANSWERS

1. Primary: https://www.notams .jcs.mil Alternate: https://www.notams.faa.gov

2. FL-Florida

3. N24 01.90 X W81 35.26

4. KLES

5. 1300. See UTC +2 on Legend

6. False (H-4H) (L-12F)

7. Tavish Field

8. True

9. Navy

10. 301 feet MSL

11. c.

12. False 8596

13. Yes

14. No

15. F-40

16. No contract fuel

17. - 128

18. True (See page A-25 IFR Supplement

19. Yes, with prior notice

20. 372.2 MHz

21. Lesperance Approach Control; Yes (indicated by the symbol R) (Definition of R located on page A-4

22. True

23. True

24. Available on request only. (See page A-3

25. True

26. True - Normal anticipated interference-free service below 14,500’ AGL – 40 NM.

27. True

28. Ch 122

29. CMF

30. 227° 9.5 NM

31. True (front cover)

32. False. Special notices of a permanent nature will be carried for three issues. (inside cover)

33. B. (See Section B)

34. Green Bay FSS

35. False

36. True

37. Mon – Sat btn 0300 – 1300Z++ and Sun 0300 – 1700++

38. True

39. True

40. False (See page A-27 Radio Class Code)

41. 267°/11.3 NM to VOR from field

42. Non-directional Radio Beacon power 50 watts to less than 2000 watts (50 NM). (See IFR Supp, Sec A)

43. Ceiling 3000 and visibility 5 SM

44. Published under applicable NAVAID, ILS/RADAR, or Terminal FLIP Radar

45. +/-5; 20

46. True

47. DVFR; IFR; takeoff

205. FLIGHT INFORMATION HANDBOOK (FIH) GENERAL INFORMATION

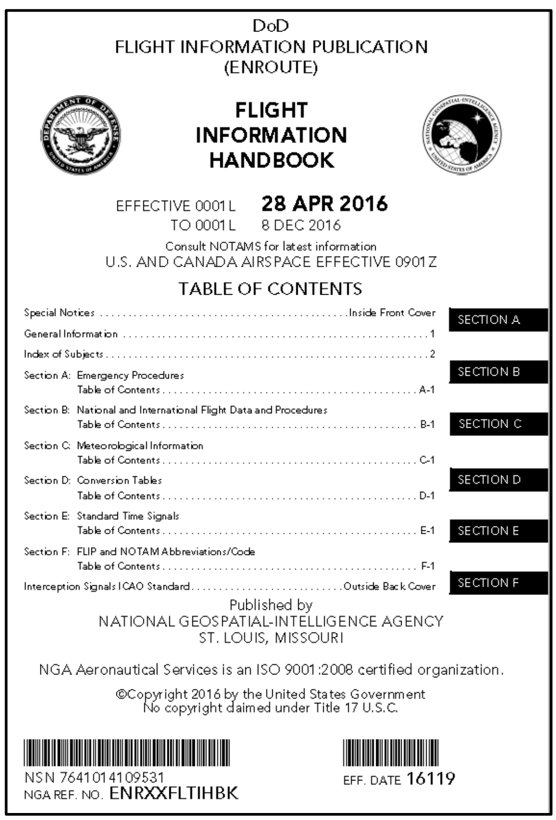
General

The Flight Information Handbook is a DOD FLIP issued every 32 weeks. It contains aeronautical information, which is required by DOD aircrews in flight, but which is not subject to frequent changes. Sections include Emergency Procedures, National and International Flight Data and Procedures, Meteorological Information, Conversion Tables, Standard Time Signals, and FLIP/NOTAM abbreviations/codes. This publication is intended for U.S. military use.

The information and procedures published are for National and International (ICAO) use. This course will focus primarily on the information and procedures for National use (domestic flights).

Page 2 is an index of subjects listed in alphabetical order (see page 2 of FIH).

Each section has a separate table of contents. See pages A-1, B-1, C-1, D-1, E-1 and F-1 in the FIH.


DoD
FLIGHT INFORMATION PUBLICATION
(ENROUTE)

FLIGHT
INFORMATION
HANDBOOK

EFFECTIVE 0001L 28 APR 2016
TO 0001L 8 DEC 2016
Consult NOTAMS for latest information
U.S. AND CANADA AIRSPACE EFFECTIVE 0901Z

TABLE OF CONTENTS

Published by
NATIONAL GEOSPATIAL-INTELLIGENCE AGENCY
ST. LOUIS, MISSOURI

NGA Aeronautical Services is an ISO 9001:2008 certified organization.

©Copyright 2016 by the United States Government
No copyright claimed under Title 17 U.S.C.

NSN 7641014109531
NGA REF. NO. ENRXXFLTIHBK
EFF. DATE 16119

Figure 2-2 Flight Information Handbook – Front Cover

206. FLIGHT INFORMATION HANDBOOK QUESTIONS

Using the Index of Subjects and Table of Contents for each section, answer the following questions:

1. NAS Pensacola has less than continuous Pilot to Metro (PMSV) service and weather radar. (True/False)

2. In the vicinity of Patrick AFB, FL, you may receive updated weather information on Patrick PMSV frequency ___________________.

3. Prior to taking off on any military flight, it is mandatory for the pilot to obtain weather and NOTAM information. If a pilot is departing a nonmilitary airfield in the vicinity of Andrews Air Force Base, how can weather and NOTAM information be obtained?

4. A PIREP (Pilot Weather Report) shall be made under which conditions?

   a. In flight when requested

   b. When unusual and unforecast weather is encountered

   c. When weather conditions on an IFR approach differ from the latest observation

   d. When a missed approach is executed due to weather

   e. When a wind shear is encountered on departure or arrival

   f. In all the above conditions

5. When not in radar environment, position reports are required over each designated compulsory reporting point along the route as indicated by the position reporting symbols shown on the FLIP Enroute charts and passing each direct route reporting point or fix used in the flight plan. (True/False)

6. Position reports on an IFR flight plan are never given in a radar environment. (True/False)

7. When in controlled airspace, pilots shall report immediately any loss of navigational or air/ground communications capability to ____________________.

8. What are CIRVIS reports? _______________________________

9. An aircraft equipped with a transponder on a VFR flight would normally use a transponder Mode 3/A Code of ______________________________________.

10. The abbreviation ATIS means ______________________________.

NOTE

ATIS information is prerecorded and is normally broadcast over the same frequency as the VOR serving the terminal area or UHF frequencies.

11. While listening to ATIS at Barksdale AFB, the Bird Watch Condition was stated as SEVERE. What does this indicate? ____.

12. To indicate two-way radio communication failure to ATC, the transponder should be adjusted to reply on Mode 3/A Code _________________.

13. When two-way communications are lost in VMC, if able to maintain flight in VMC, the pilot will land _______________________ and notify _______________________.

14. When lost communications occur in IMC and ATC has not issued an assigned route or a route to be expected in a further clearance, the pilot shall proceed:

15. An emergency wave-off signal from a wave-off lighting system at USN/USMC airfields may be signaled to aircraft on final approach by ___________________ lights flashing near the runway touchdown zone

16. List the meaning of the following abbreviations.

a. ADIZ_______________________ d. DVFR _____________________
b. ALSF-1_____________________ e. HIRL _______________________
c. CIRVIS_____________________ f. ICAO _______________________

17. The ICAO NOTAM code is published to enable the coding of information regarding the establishment, condition or change of ___________________, ___________________ , and ________________, ________________ to _________________ in flight, or ________________ and _________________ facilities. Encoding facilitates the dissemination of NOTAMs by __________________the transmission time over telecommunication channels.

18. All NOTAM code groups contain five letters. The first letter of the group is always ____________________

19. Decode the following:

a. QLBAK ________________
b. QFMAU SAR OPS UFN SR TIL SS ________________

20. How does a pilot know if he/she is in a radar environment?

21. Pilots will make position reports in radar environment when requested by ATC. (True/False)

The lighting A_4 symbol denotes what type of approach lighting?

207. FLIGHT INFORMATION HANDBOOK ANSWERS

1. False

2. 344.6

3. Via phone to the weather squadron at Andrews AFB (COMM 618-256-9755 or DSN 858-2840/5826) (Refer to Section C - Table of Contents: pages C2-C4)

4. f. (See Pilot Weather Reports (PIREPS) Format - C-65)

5. True (FAA ATC Procedures - Position Reports)

6. False, position will be given in radar environment if ATC requests.

7. ATC or FSS (Section B)

8. Security reports of information vital to the security of the U.S. and Canada (Section B)

9. 1200 (Section B)

10. **A**utomatic **T**erminal **I**nformation **S**ervice

11. SEVERE indicates a high potential for a bird strike (Section B)

12. 7600 (Section A)

13. As soon as practicable; ATC (Two-Way Radio Failure - Section A)

14. by the route filed in the flight plan

15. red, high intensity.

16. See Section F, List of Abbreviations

17. radio aids; aerodromes; lighting facilities; danger; aircraft; search; rescue; reducing.

18. Q

19. a. Aerodrome beacon resumed normal operation.
    b. Meteorological service not available due to search and rescue operation until further notice from sunrise to sunset.

20. ATC says you are in "RADAR CONTACT." (See page B-5; B-6)

21. True

22. MALS and MALSF or SSALS and SSALF (See Section B)

208. IFR ENROUTE LOW ALTITUDE CHARTS

These charts portray the airway system and related data required for IFR operations at altitudes below 18,000 feet MSL. Thirty-six variable scale charts are available covering the entire contiguous United States. A diagram showing the layout of all 36 charts is printed on the front cover of each chart for easy reference. Charts covering the entire area of intended flight must be carried in the aircraft for all IFR flights.

The effective date and the expiration date are shown on the cover of each chart. Publication cycle is every 8 weeks. Major changes to the airway structure and procedures are scheduled by the FAA to become effective coinciding with the publishing dates. Charts are revised accordingly and therefore, shall not be used prior to the effective date. Other information: e.g., frequencies, hours of operation, etc., are not necessarily scheduled to coincide with publish dates and changes occur daily. Action is taken to update this data during the revision cycle, but it has to be terminated fifteen days before the projected effective date of the issue under revision to permit printing and timely distribution to users. NOTAMs must be consulted for latest information on data changing after the cutoff date and during the life of the current charts.

209. AREA CHARTS

These charts portray the airway system and related data required for IFR operations in selected terminal areas at altitudes below 18,000 feet MSL. Publication cycle is every 8 weeks. Fourteen variable scale charts (depicting fourteen of the nation's busiest terminal areas) are printed on one sheet. A list of these 14 terminal areas can be found on each IFR enroute low altitude chart in the lower left corner of the map printed on the cover (see Figure 2-3). Note that each area that is on the area chart list is depicted on the map with a black dot and is printed in black.

Area charts will often include terminal NAVAID and airport information which may not be contained in the enroute charts. When conducting terminal flight operations in one of these areas, pilots should consult the area chart for preflight planning and in flight as necessary.

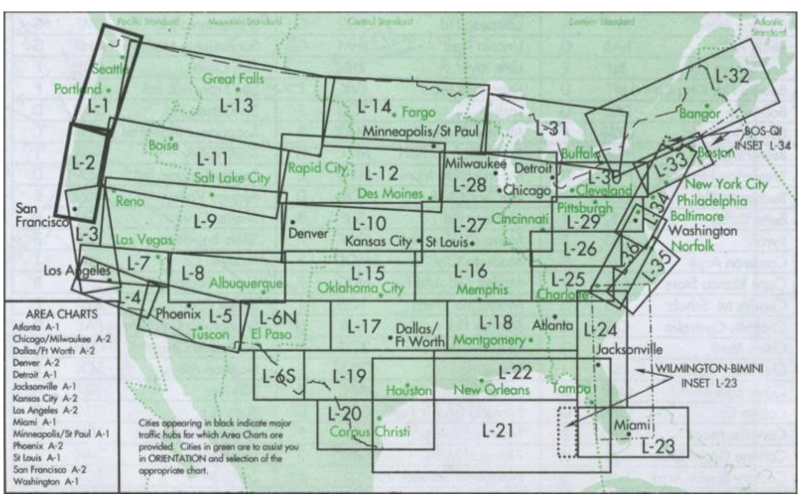


Figure 2-3 Chart Coverage for the IFR Enroute Low Altitude Charts

1. **MINIMUM ENROUTE ALTITUDES (MEAs):** The MEA between navigation aids along VOR airways is an altitude which will meet obstruction clearance requirements and also assure acceptable navigational signal reception.

2. **MINIMUM OBSTRUCTION CLEARANCE ALTITUDE (MOCA):** The specified altitude between radio fixes on VOR airways, which meets obstruction clearance requirements, and which assures acceptable navigational signal reception within 22 NM of a VOR.

3. **MINIMUM RECEPTION ALTITUDE (MRA):** The lowest altitude at which an intersection can be determined. This definition is outdated but is contained in the CFRs and slow to change. Definition does not take into account radial/DME or GPS capability. Ask an instructor to explain!

4. **MINIMUM CROSSING ALTITUDES (MCAs):** The lowest altitude at certain fixes at which an aircraft must cross when proceeding in the direction of a higher minimum enroute IFR altitude (MEA).

5. **OFF ROUTE OBSTRUCTION CLEARANCE ALTITUDES (OROCA):** An off-route altitude which provides obstruction clearance within each bounded latitude/longitude quadrant as shown on IFR charts. This altitude provides obstruction clearance of 1,000 feet in designated non-mountainous areas and a 2,000-foot vertical buffer in designated mountainous areas within the U.S.

NOTE

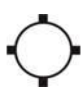
For further information on obstruction clearance requirements in the IFR environment see ***Minimum IFR Altitudes/MIA*** in GP Chapter 2.

STOP: ***Do not proceed further in this text until you have studied the chart legend in its entirety***.

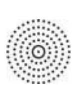
210. DIRECTION QUESTIONS

Answer the following questions in the spaces provided. Use the edition of the L-18 Low Altitude Chart provided in IFR ground school.

Explain the meaning of the following symbols:

1.  ______________________________

2.  ______________________________

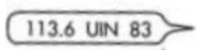
3.  ______________________________

4. 

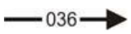
____

5. 

____

6. 

____

7. 

____

8. 

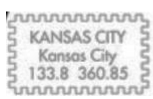
____

9. 

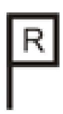
____

10.  ________________________________

11. ________________________________

12. 

____

13. 

____

14.  ________________________________

15. 

____

211. ENROUTE LOW ALTITUDE CHART QUESTIONS

1. The Low Altitude Charts are used for altitudes up to, but not including, _______ feet MSL.

2. IFR semicircular cruising rules apply to __________________airspace.

3. Fields printed in brown do not have _____________________.

4. Fields printed in blue have an approved instrument approach and/or RADAR minimum published in either the ________________________ or ____________.

5. List all the frequencies that are normally available at all Flight Service Stations. ______________________

6. Open area (white) indicates controlled airspace. (True/False)

7. All altitudes are MSL except as noted. (True/False)

8. All times are local time except as noted. (True/False)

9. All frequencies in blue are LF/MF type. (True/False)

The following questions are taken from the L-18, L-22, and L-24, Charts

10. What is the frequency of the Gulfport VOR? ________________

11. The Wisle LF/MF Non-directional Radio Beacon has voice capabilities. (True/False)

12. What is the lowest constant altitude you could maintain between Semmes and Monroeville along V-20 on an IFR flight? _________________

13. On a flight from Semmes VORTAC via V20 to Monroeville VORTAC, you would change VORs ______________ miles from Semmes at the ________________.

14. What are the course and distance from TENSA Intersection on V20 to the Monroeville VORTAC? ______________

15. From Cross City VORTAC southeast on V7, the first intersection is _________________ Intersection. In addition to using the GPS, this fix can be identified by the intersection of the ______ radial off of the ________ VORTAC and the _______ radial off of the ___________ VORTAC ***or*** the _______ radial and _______ DME off of ________ VORTAC.

16. Referring to the previous question, the symbol (flag) calls attention to the___________, which is _________ feet.

17. What FSS would you call in the vicinity of CRIMSON VOR (Chart L-18, panel H) for weather information? ______________

18. Approaching SIDON VORTAC (L-18, panel G) on V535 and departing south on V9, would SIDON be a compulsory reporting point (your aircraft is not in RADAR contact)? _____

19. What is the magnetic variation over the EUFAULA VORTAC? (L-18, panel I) ____________________

20. What is the distance from PECAN VORTAC (L-18, panel J) to GREENVILLE VORTAC (L-22, panel J) along V35? _________________

21. What is the distance from MARIANNA VORTAC (L-22, panel I) along V521 to CROSS CITY VORTAC (L-24, panel G)? ___________________________

22. Marianna is in the _____________ time zone.

23. What is the field elevation at Tyndall AFB? ____________

24. Tyndall's longest runway is _____________ feet long.

25. What is the radial and distance from HANDLE VORTAC to the WILME Intersection located east of Tyndall AFB? ____________________________

26. Over Seminole VORTAC, you would except to talk to ______________ Center on the following frequencies: __________________.

27. The dashed line around Tallahassee Regional marks off the boundaries of the _____________.

28. At what point would you switch from 116.5 to 110.2 on a flight from VIENNA VORTAC (NE of PECAN VORTAC) to WAYCROSS VORTAC along V243? ______________________

29. What is the name of the airport located within the ALMA VORTAC compass rose? Does it have a published instrument approach? _____. Can the approach be used by military aircraft? _______ (L-24, panel H)

30. Which Jacksonville Center remote transmitter site covers the ALMA VORTAC area? _______________ What frequency would you use? _________________

31. Which FSS serves the WAYCROSS VORTAC area? _________________

32. The lowest ***safe*** altitude that you could cross BAXLY Intersection (located NE of ALMA VORTAC) going south on V267 is ___________________.

33. What is the MOCA between ALMA VORTAC and LOTTS Intersection? _____________ (LOTTS Intersection is located on V157 NE of the ALMA VORTAC.)

34. Savannah/Hilton Head International airfield (L-24, panel H) is a ______________ airport.

   a. civil
   b. joint civil military
   c. military

35. What special use airspace is Wright AAF (SW of Savannah/Hilton Head) under? ______________________

36. What is the distance from SAVANNAH VORTAC south to CRAIG VORTAC via V37?

____

37. What does the blue dashed line circling Jacksonville International indicate?

____

38. What does the heavy green dashed box surrounding Jacksonville International indicate?

____

212. ENROUTE LOW ALTITUDE CHART ANSWERS

1. 18,000 feet

2. Uncontrolled (Pilots file in accordance with the appropriate cruising altitudes in order to facilitate a consistent standard; however, ATC will assign altitudes.)

3. Published Instrument Approach Procedure or Radar Minima

4. FAA Terminal Procedures Publications; DoD FLIPs.

5. 255.4/243.0 UHF -- 122.2/121.5 VHF

6. True (Class E unless otherwise indicated)

7. True

8. False

9. False

10. 109.0

11. False

12. 2000 feet MSL

13. 29 NM; AXEJA

14. 047º; 31 NM

15. ORATE; 152R; CROSS City (CTY); 241R; GATORS (GNV) VORTAC or 152R/018DME off CTY (Note arrows on chart. Refer to Figure 2-4 for a detailed view.)

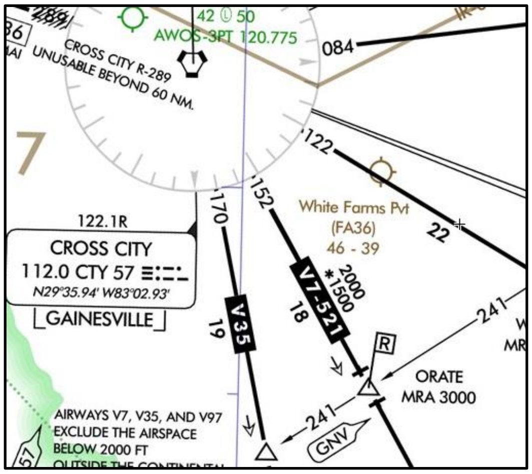


Figure 2-4 Example of Various Ways to Identify ORATE Intersection

16. MRA; 3000 (See Figure 2-4)
17. Anniston Radio
18. Yes
19. Approximately 4º West
20. 71 NM
21. 136 NM
22. Central Standard (-6 = UTC)
23. 17 ft. MSL
24. 10,008 feet
25. 099º 42 NM
26. Jacksonville; 128.625/343.8
27. Class C Airspace
28. 44 NM from VNA (30 NM from AYS)
29. Bacon Co.; Yes; Yes
30. ALMA; 127.575/269.025
31. MACON

32. 2300 feet (MOCA) 33. 1800

33. 1800

34. a.

35. Fort Stewart MOA "C2" and Coastal 7 MOA

36. 111

37. Class C airspace

38. Area Chart A-1 contains an enlarged area of the Jacksonville terminal area

213. GENERAL PLANNING QUESTIONS (GP)

The ability to quickly locate the correct publications, chapter, and section to answer aeronautical/IFR-related questions is the emphasis of this section. The body of information in the DOD FLIP Program is too large for memorization. The student aviator must be selective in studying, and familiar enough with all the publications to find answers to IFR questions.

This homework is designed to "walk you through" the GP and AP publications. The following questions are designed to familiarize you with the general format of the publications and to show you where information critical to IFR flight planning can be found. The questions are listed in the order of the information found in the publications.

1. Chapter One contains an index for ______________________.

Use the Index for Aeronautical Information for questions 2 and 3:

2. Information on IFR CLEARANCES can be found in ________________, Chapter ______.

3. Information regarding TWO-WAY RADIO FAILURE is located in the _______________.

4. Chapter Two provides an ________________________.

An understanding of the terminology used in instrument aviation is critical to learning the flight planning process. Although we are not requiring you to write out information about these terms, it is imperative that you take the time to read over the following terms. Your goal is not to memorize them; rather, it is to have a sound working knowledge of these terms and to know where to go to find out more. (Note: this list contains commonly used terms associated with instrument navigation training. It is not intended to represent an all-inclusive list of need-to-know items:

AIRCRAFT APPROACH CATEGORY

AIRCRAFT CLASSES

AIR DEFENSE IDENTIFICATION ZONE/ADIZ

AERONAUTICAL INFORMATION MANUAL/AIM

AIRMET/WA/AIRMAN'S METEOROLOGICAL INFORMATION

AIRPORT ADVISORY AREA

AIRPORT ADVISORY SERVICE/AAS

AIRPORT ELEVATION/FIELD ELEVATION

AIRPORT LIGHTING

AIRPORT SURVEILLANCE RADAR/ASR

AIRPORT TRAFFIC CONTROL SERVICE

AIR ROUTE TRAFFIC CONTROL CENTER/ARTCC

AIR TRAFFIC CLEARANCE/ATC CLEARANCE

AIRWAY/FEDERAL AIRWAY

ALTERNATE AIRPORT

APPROACH CLEARANCE

APPROACH CONTROL SERVICE

APPROACH SPEED

ARC

ATC CLEARS

AUTOMATIC DIRECTION FINDER/ADF

BEARING (P/CG—taken from the Pilot/Controller Glossary located in the FAA AIM)

BELOW MINIMUMS

CEILING (P/CG)

CHANGEOVER POINTS/COP

CIRCLE TO LAND MANEUVER/CIRCLING MANEUVER

CLEARANCE LIMIT (P/CG)

CLEARED AS FILED

CLEARED FOR (TYPE OF) APPROACH

CLEARED FOR APPROACH

CLEARED FOR THE OPTION

COMPULSORY REPORTING POINTS

CONTACT APPROACH CONTROLLED AIRSPACE (P/CG)

COURSE (P/CG)

DECISION HEIGHT/DH (P/CG)

DEPARTURE CONTROL

DEVIATION (P/CG)

DISCRETE CODE/DISCRETE BEACON CODE

DISCRETE FREQUENCY

DME FIX

ENROUTE DESCENT

EXECUTE MISSED APPROACH

FEEDER FIX

FEEDER ROUTE

FINAL

FINAL APPROACH COURSE

FINAL APPROACH FIX/FAF

FINAL APPROACH POINT/FAP

FINAL CONTROLLER

FLIGHT LEVEL (P/CG)

FLIGHT PLAN (P/CG)

FLIGHT SERVICE STATION/FSS

FLIGHT VISIBILITY

FUEL REMAINING

GLIDESLOPE/GLIDEPATH

GROUND CONTROLLED APPROACH/GCA(P/CG)

HANDOFF

HAZARDOUS INFLIGHT WEATHER ADVISORY/HIWAS

HEIGHT ABOVE AIRPORT/HAA

HEIGHT ABOVE LANDING/HAL

HEIGHT ABOVE TOUCHDOWN/HAT

HOLD/HOLDING PROCEDURE

HOLDING FIX

HOMING (P/CG)

IFR TAKEOFF MINIMUMS AND DEPARTURE PROCEDURES

INITIAL APPROACH FIX/IAF

INSTRUMENT APPROACH PROCEDURE/IAP/INSTRUMENT APPROACH (P/CG)

INSTRUMENT FLIGHT RULES/IFR (P/CG)

INSTRUMENT METEOROLOGICAL CONDITIONS – IMC

INTERSECTION

LANDING MINIMUMS/IFR LANDING MINIMUMS

LOCALIZER (P/CG)

LOST COMMUNICATIONS/TWO-WAY RADIO COMMUNICATIONS FAILURE

LOW ALTITUDE AIRWAY STRUCTURE/FEDERAL AIRWAYS

LOW APPROACH

MINIMUM CROSSING ALTITUDE/MCA

MINIMUM DESCENT ALTITUDE/MDA (P/CG)

MINIMUM ENROUTE IFR ALTITUDES/MEA

MINIMUM OBSTRUCTION CLEARANCE ALTITUDE/MOCA

MINIMUM RECEPTION ALTITUDE (P/CG)

MINIMUM SAFE ALTITUDE/MSA (P/CG)

MINIMUMS/MINIMA

MISSED APPROACH

MISSED APPROACH PROCEDURE (JCS/NATO; See GP, pg. 2-1for details on these sources)

NAVIGATIONAL AID CLASSES

NAVIGATIONAL AID/NAVAID

NO GYRO APPROACH/VECTOR

NONPRECISION APPROACH PROCEDURE/NONPRECISION APPROACH

NOTICE TO AIRMEN/NOTAM (P/CG)

OPTION APPROACH

PILOT IN COMMAND

PILOT'S DISCRETION

PILOT WEATHER REPORT/PIREP POSITION

REPORT/PROGRESS REPORT PRACTICE

INSTRUMENT APPROACH PRECISION

APPROACH RADAR/PAR (P/CG)

PREFERRED IFR ROUTES

PROCEDURE TURN/PT (JCS, NATO)

PROCEDURE TURN INBOUND

RADAR APPROACH (P/CG)

RADAR CONTACT (P/CG)

RADAR CONTACT LOST

RADAR SERVICE TERMINATED

RUNWAY VISUAL RANGE

SIGMET/WS SIGNIFICANT METEOROLOGICAL INFORMATION

SINGLE-PILOTED AIRCRAFT

SPECIAL USE AIRSPACE

STANDARD INSTRUMENT

DEPARTURE/SIDSTANDARD TERMINAL

ARRIVAL/STAR STRAIGHT-IN APPROACH

(IFR and VFR)

STRAIGHT-IN LANDING

SURVEILLANCE APPROACH (P/CG)

THRESHOLD CROSSING HEIGHT/TCH

TOUCHDOWN ZONE (P/CG)

TOUCHDOWN ZONE ELEVATION/TDZE

TRANSCRIBED WEATHER BROADCAST/TWEB

TRANSFER OF CONTROL (P/CG)

UNCONTROLLED AIRSPACE

VECTOR (P/CG, JCS)

VISIBILITY (P/CG)

VISUAL DESCENT POINT/VDP

VOT/VOR TEST SIGNAL

5. Chapter Three provides an overview of the entire _______________________ program.

6. The FLIP ________________ has been designed primarily for desk use and not for carrying in the aircraft

7. The publication cycle for the Flight Information Handbook is every ___________________.

8. __________ __________ __________is the official publication disseminating DOD worldwide foreign clearance requirements and information on personnel travel.

9. Chapter Four provides the necessary details for filling out a ________ ________.

10. Chapter Six outlines standard ____________________ while operating under both FAA and ICAO control.

11. Pilots should file IFR Flight Plans at least ________________ minutes prior to their estimated time of departure.

12. Initial clearances will include whenever practicable, the ___________________________ as the Clearance Limit.

13. There is no requirement for pilots to read back ATC clearances received while on the ground (Except runway assignment and hold short). (True/False)

14. The maximum airspeed for an aircraft at 5000 feet in the holding pattern is ___________

15. When using a VOR Receiver check point, IFR flight should not be attempted if the error exceeds +/- _____º in the air.

214. GENERAL PLANNING ANSWERS

1. Aeronautical Information
2. GP, 6
3. Flight Information Handbook
4. Explanation of Terms
5. DoD FLIP
6. Planning (documents and charts)
7. 32 weeks
8. Foreign Clearance Guide
9. Flight Plan
10. pilot procedures
11. 30
12. destination airport
13. True (except runway assignment and hold short or when requested by the controller)
14. 200 KIAS
15. 6º

215. AREA PLANNING (AP/1) QUESTIONS

Notice that the front cover states that this publication covers North and South America. Now turn to the Table of Contents and examine the contents of Chapter Three - National Supplementary Procedures. Note that the chapter is broken down by country, alphabetically. The following questions can be found in Chapter Three of AP/1, under the United States Section. (Disregard the first section regarding Reduced Vertical Separation Minimum).

Flight Planning

1. Quota Flow Control.

ARTCCs will hold __________________ number of aircraft that their primary and secondary holding fixes will safely accommodate without imposing undue limitations on control of other traffic operating within the ARTCC's airspace.

Class B Airspace.

2. Regardless of weather conditions, a(n)_____ ____________ is required for all aircraft to operate in Class B airspace.

3. Unless authorized by ATC, an operable transponder is required within ___ NM of the primary airport around which the Class B airspace is established.

Class C Airspace

4. The airspace area between the 5 NM and 10 NM rings begins at an altitude of ________ and extends to the same altitude as the inner circle.

Supplementary Airport Information

5. Should Hurlburt Field be used as an alternate by TW5 aircraft?

6. On the last leg of a cross country flight to Patrick AFB, FL, you arrive while operating IFR. After breaking out on the instrument approach, can you circle to land to Runway 11?

Route and Area Restrictions

7. Department of Energy (DOE) Nuclear facilities are considered National Security Areas and are specifically identified on VFR Sectionals. Under normal circumstances, these facilities must be contacted prior to overflying and their contact information is listed in this section. How many facilities are listed? _________

VOR Airborne Receiver Checkpoints.

8. The closest VOR Receiver Checkpoint from NAS Whiting Field is located at Crestview, FL. At 1200 feet over the rotating beacon, at Bob Sikes Airport, you will be on the ___ radial, distance ___ from the Crestview VOR.

216. AP/1 ANSWERS

1. the optimum

2. ATC clearance (Authorization)

3. 30

4. 1200 feet AGL

5. No

6. No, unless you cancel IFR.

7. 8

8. 106 +/- 6; 8.6 +/-.5 NM

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER THREE
IFR FLIGHTS

300. INTRODUCTION

This chapter is intended to review the important concepts of filing and flying an IFR flight plan. Additionally, it touches upon the organization of ATC and how it affects your flight.

301. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

Upon completion of this chapter, and in response to questions and examples given on the post test, the student will recall approach procedures, approach clearances, ATIS, terminal radar control and other related information with a minimum score of 80%.

Enabling Objectives

1. List the uses of each of the four FLIP publications.

2. List the information and services provided by ATIS.

3. State the two major responsibilities of Approach Control.

4. State the relationship between the ATRCC and Departure/Approach Controls.

5. State takeoff minimums for standard instrument-rated pilots and special instrument-rated pilots.

6. State the ceiling and visibility minimums for various approaches.

7. State specific ceiling and visibility minimums for the type of approach to be executed.

8. Label approach diagrams with correct approach procedures.

9. List the differences between a visual approach and a contact approach.

10. Define "Sidestep Maneuver."

11. State missed approach procedures.

12. Select the correct procedure by translating approach clearances issued by Approach Control.

13. Select the correct requested information provided by approach plates.

14. Determine when to use straight-in landing minimums or circling landing minimums.

15. Apply CNAF Instructions minimums for takeoff to various given situations.

16. Apply CNAF Instructions for approach minimums to various given situations.

17. Apply CNAF Instructions for selecting alternate airports in various given situations.

18. State which Navy/Marine flights require a flight plan.

19. List two acceptable types of flight plans as defined by CNAF M-3710.7.

20. State the type of flight plan used by the Training Command for syllabus flights within the local training area.

21. State what actions the pilot in command must take to close out the flight plan upon landing at a military or civilian airfield.

22. State what actions are required of the pilot in command to receive an IFR clearance from a military or civilian airfield, under the circumstances listed in this unit.

23. State which agency of the FAA handles flight following for the U.S. Navy.

24. State which personnel aboard the aircraft must be listed on the manifest.

25. State where the passenger manifest must be deposited before takeoff from a civilian airport.

26. State when a copy of the flight plan must be left with the passenger manifest.

27. State the reason for closing out a flight plan.

28. State the difference between closing out and canceling a flight plan.

29. State who is responsible for closing out a flight plan under all conditions.

30. State where a pilot can obtain a weather brief at a civilian airport.

31. State what is meant when a control tower says that a clearance is on request.

32. State what happens to a request for an ATC clearance from the time it is turned in to base operations at a military airfield until it is read to the pilot.

33. Define an ATC approved "visual approach."

34. Define an ATC approved "contact approach."

35. State the procedures for a charted visual approach.

302. FLIGHT PLANS

CNAF M-3710.7 (series) states:

A flight plan appropriate for the intended operation shall be submitted to the local air traffic control facility ***for all flights of naval aircraft*** except the following:

1. Flights of operational necessity.

2. Student training flights under the cognizance of the Naval Air Training Command conducted within authorized training areas. The Chief of Naval Air Training shall institute measures to provide adequate flight following service.

In other words, unless you are one of the exceptions listed, you ***will*** file a flight plan for ***all*** flights. Note, Training Command flights are exempted only when remaining within the local training area and are covered by the daily flight schedule.

CNAF M-3710.7 (series) also states the following:

1. Delivery of a properly prepared flight plan form to duty personnel at an established Base Operations Office at the point of departure assures that the appropriate ARTCC/FSS will be furnished with the essential elements of the flight plan and that a takeoff report will be made.

2. If no communications link exists between the point of departure and the ARTCC/FSS, the pilot may relay the flight plan to an appropriate FSS by commercial telephone. When unable to file in person or by telephone, the flight plan may be filed by radio as soon as possible after takeoff; however, flight in controlled airspace in IMC weather conditions without an ATC clearance is prohibited.

The requirement to file a flight plan can be satisfied in the following ways as defined by CNAF M-3710.7 and GP Chapter 4:

a. For flights originating from airfields at which a military operations department is located:

   – A DD Form 1801 International Flight Plan (Figure 3-1) shall be utilized for domestic and international VFR flights.

PRIORITY
<≡FF →
ADDRESSEE(S)

<≡

FILING TIME
ORIGINATOR

SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR

3. MESSAGE TYPE
<≡ (FPL
7. AIRCRAFT IDENTIFICATION
8. FLIGHT RULES
TYPE OF FLIGHT
<≡

9. NUMBER
TYPE OF AIRCRAFT
WAKE TURBULENCE CAT.
10. EQUIPMENT
<≡

13. DEPARTURE AERODROME
TIME
<≡

15. CRUISING SPEED
LEVEL
ROUTE

16. DESTINATION AERODROME
TOTAL EET HR/MIN
ALTN AERODROME
2ND ALTN AERODROME
<≡

18. OTHER INFORMATION

) <≡

NOT FOR TRANSMISSION

— FUEL/ → POB/ → RDO/ 121.5 → 243 → 500 → 8364 <≡

TYPE OF EQUIPMENT	LIFE JACKETS	RADIO FREQUENCY

POLAR → DESER → MARITIME → JUNGLE → GLOBAL → JACKETS → LIGHT → FLUORESCEI → <≡

DINGHIES → COVER → RMK/) <≡

REMARKS

AIRCRAFT SERIAL NUMBERS AND TYPE OF AIRCRAFT IN FLIGHT

CREW LIST ☐ ATTACHED ☐ LOCATED AT:

PASSENGER MANIFEST ☐ ATTACHED ☐ LOCATED AT:

NAME OF PILOT IN COMMAND
SIGNATURE OF APPROVING AUTHORITY
AIRCRAFT HOME STATION OR ORGANIZATION

DD Form 1801, MAY 87 (EG) *Previous edition is obsolete.* DOD INTERNATIONAL FLIGHT PLAN

Designed using Perform Pro, WHS/DIOR, Aug 94

Figure 3-1 (DD Form 1801)

b. For flights originating at airfields in the United States which do not have military installations:

i. For flights that will remain within the U.S. Domestic airspace, the FAA ICAO Flight Plan (FAA Form 7233-4, Figure 3-2) may be used or tell ATC you wish to file a "military flight plan."

NOTE

Effective 27 August 2019 the FAA discontinued the use of the Form 7233-1 Domestic Flight Plan.

ii. For flights that will be conducted in international airspace, the FAA ICAO Flight Plan shall be utilized.

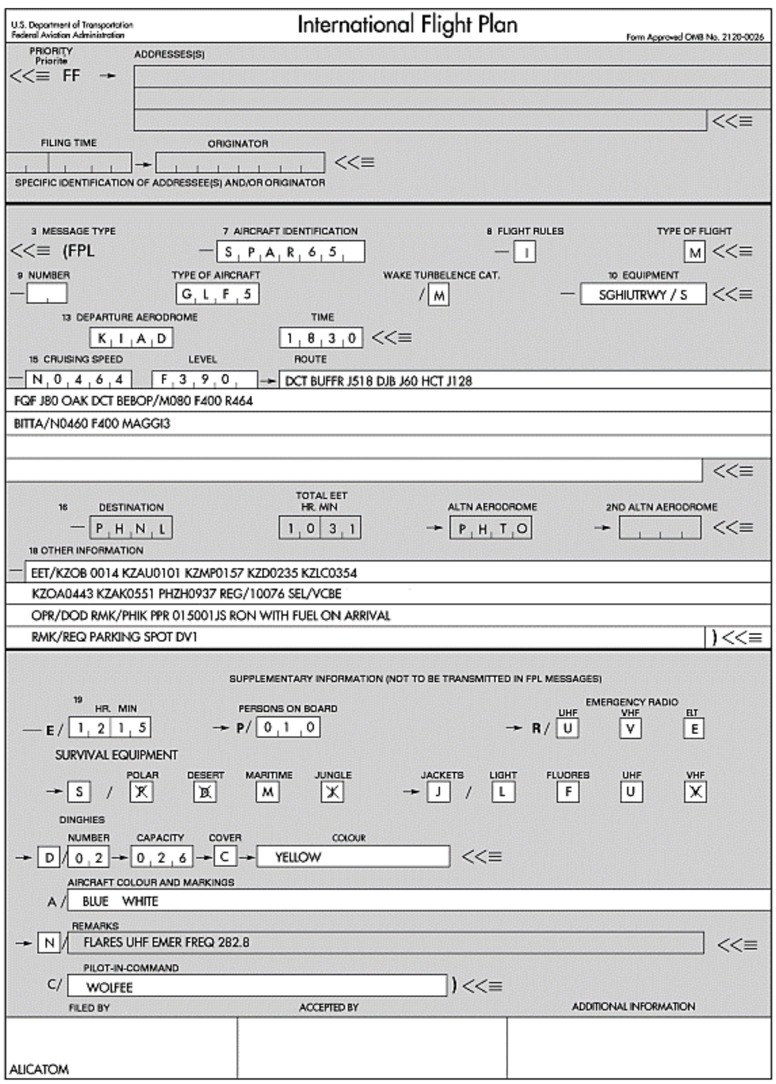

U.S. Department of Transportation
Federal Aviation Administration
International Flight Plan
Form Approved OMB No. 2120-0026
PRIORITY Priorite
<<≡ FF →
ADDRESSES(S)
<<≡
FILING TIME
ORIGINATOR
<<≡
SPECIFIC IDENTIFICATION OF ADDRESSEE(S) AND/OR ORIGINATOR
3 MESSAGE TYPE
<<≡ (FPL
7 AIRCRAFT IDENTIFICATION
— S P A R 6 5
8 FLIGHT RULES
— I
TYPE OF FLIGHT
M <<≡
9 NUMBER
TYPE OF AIRCRAFT
G L F 5
WAKE TURBELENCE CAT.
/ M
10 EQUIPMENT
— SGHIUTRWY / S <<≡
13 DEPARTURE AERODROME
K I A D
TIME
1 8 3 0 <<≡
15 CRUISING SPEED
— N 0 4 6 4
LEVEL
F 3 9 0
ROUTE
→ DCT BUFFR J518 DJB J60 HCT J128
FQF J80 OAK DCT BEBOP/M080 F400 R464
BITTA/N0460 F400 MAGGI3
<<≡
16 DESTINATION
— P H N L
TOTAL EET HR. MIN
1 0 3 1
ALTN AERODROME
→ P H T O
2ND ALTN AERODROME
→ <<≡
18 OTHER INFORMATION
— EET/KZOB 0014 KZAU0101 KZMP0157 KZD0235 KZLC0354
KZOA0443 KZAK0551 PHZH0937 REG/10076 SEL/VCBE
OPR/DOD RMK/PHIK PPR 015001JS RON WITH FUEL ON ARRIVAL
RMK/REQ PARKING SPOT DV1
) <<≡
SUPPLEMENTARY INFORMATION (NOT TO BE TRANSMITTED IN FPL MESSAGES)
19 HR. MIN
— E / 1 2 1 5
PERSONS ON BOARD
→ P/ 0 1 0
EMERGENCY RADIO UHF VHF ELT
→ R / U V E
SURVIVAL EQUIPMENT
POLAR DESERT MARITIME JUNGLE
→ S / P D M J
JACKETS LIGHT FLUORES UHF VHF
→ J / L F U V
DINGHIES
NUMBER CAPACITY COVER COLOUR
→ D / 0 2 → 0 2 6 → C → YELLOW <<≡
AIRCRAFT COLOUR AND MARKINGS
A / BLUE WHITE
REMARKS
→ N / FLARES UHF EMER FREQ 282.8 <<≡
PILOT-IN-COMMAND
C/ WOLFEE) <<≡
FILED BY
ACCEPTED BY
ADDITIONAL INFORMATION
ALICATOM
FAA FORM 7233-4 (7-93)

Figure 3-2 (FAA Form 7233-4)

c. For flights originating at points of departure outside the United States, a flight plan specified by the respective local authorities shall be used.

d. A daily flight schedule may be utilized provided:

i. The flight will be conducted and remain within the established local flying area.

ii. Sufficient information is provided to satisfy the needs of the local ATC facility.

iii. The cognizant facility operations department maintains responsibility for monitoring for overdue aircraft.

iv. The flight shall not be conducted in IMC except as agreed to by the local naval command and the responsible ATC agency.

303. OBTAINING A WEATHER BRIEF

Before filing a flight plan, a weather brief must be obtained. Whenever a DD 1801 flight plan is filed, naval aviators shall request a DD-175-1 flight route weather brief from a DOD qualified forecaster. The primary method for requesting and obtaining flight route weather briefings ashore is online through the web-enabled Flight Weather Briefer (FWB) system (https://fwb.metoc.navy.mil) operated by DOD-qualified meteorological forecasters at the Naval Aviation Forecast Center (NAFC), its satellite components, or within the Marine Corps Weather Services. Alternate methods of delivery are available upon request.

If operating from locations without access to FWB, Naval Aviators may obtain route weather forecast support from NAFC via 1-888-PILOTWX. Additionally, an approved flight route weather briefing may be obtained via a Flight Service Station (FSS) or through Air Force Weather and Marine Corps Services where available.

If the above listed services are not available, commercial weather forecasting services may be utilized.

NOTE

1. DD-175-1 flight route weather briefings will include a briefing (flimsy) number and brief void time. This flimsy number shall be listed in the appropriate location on the DD Form 1801. DD-175-1 briefs are only valid for 3.0 hours past briefing/FWB delivery time or ETD plus one-half hour. Briefings received more than 3.0 hours prior to takeoff will be void and require rebriefing prior to departure. Whenever possible, naval aviators should request a DD-175-1 flight route weather briefing at least 1 hour prior to proposed brief time to allow sufficient time for brief preparation.

2. Canned local area/route weather briefs (canned DD-175-1s) and associated canned local area/route brief numbers (CR) for flight plan filing will be available via FWB in accordance with local instruction for military airfields to streamline support for local flight operations using stereo routes, canned routes, local training routes, or MTRs. Any portions of the local area/route that are forecast for IMC will be clearly indicated on the canned local area/route weather brief, and it is incumbent on the pilot in command to remain cognizant of weather flight safety requirements. If significant portions of the local area are IMC or are covered by a WW, severe weather warning, or SIGMET, the local area/route weather brief and the associated CR may be suspended. Canned local area/route weather briefs will be updated in accordance with briefing void times above.

3. If required by local instruction to file a DD-1801 IFR flight plan for local air control only, the route of flight is intended for VMC within the field's defined local area, and the route is covered by a canned local area/route weather brief, the CR may be used for filing the flight plan.

4. For IMC flights within a field's defined local area covered by a canned local area/route weather brief, a CR may be used for filing a DD-1801 IFR flight plan as allowed by local instruction.

If departing from an airfield with a military operations facility, the aircrew shall submit a copy of the DD-175-1 and a completed DD-1801 to the operations department. The operations department passes your flight plan to FSS and inserts it into the ATC computer-based system.

Normally, you will file one of two types of flight plans—IFR or VFR. CNAF M-3710.7 provides clear guidance to aircrews when deciding which type to file:

"Regardless of weather, IFR flight plans shall be filed and flown whenever practicable as a means to reduce midair collision potential."

"To decrease the probability of midair collisions, all flights in naval aircraft shall be conducted in accordance with IFR to the maximum extent practicable. This shall include all point-to-point and "round robin" flights using Federal airways and other flights or portions thereof, such as flights to and from targets or operating areas accessible through IFR filing. All other flights shall be conducted under positive control to the maximum extent possible."

304. FLIGHT PLAN ACTIVATION AND FLIGHT FOLLOWING

In addition to the flight plan, the Navy has an agreement with the FAA to provide flight following. Flight following is designed to ensure search efforts are activated if an aircraft is overdue at its filed destination. The FSS in the local area is notified when you take off from a military airport by the tower. When departing a civilian airport, the tower will not notify FSS of your takeoff time (to activate the flight plan), so you must do this yourself once airborne. Using the ETE on the flight plan and the takeoff time, the receiving FSS will derive an ETA and pass it on to the FSS nearest your destination. When your flight plan is closed out (see CLOSING OF FLIGHT PLAN section below) the FSS at the destination is notified. If the destination FSS is not notified of your landing within 30 minutes of the ETA (15 minutes for jets), they begin a systematic search for your aircraft; therefore, it is critical that the pilot in command ensure that the flight plan is closed out. With local “Round Robin” flights, the local control tower will provide the flight following services.

NOTE

The mere presence of a control tower does not mean it will be operating when you takeoff or land.

305. CLOSING OF FLIGHT PLAN

Anytime your destination is a military airport, FSS notifies the destination of your impending arrival and ETA so your destination can prepare to receive you. When you arrive at your military airfield destination, tower personnel will close out your flight plan by notifying FSS of your arrival. In accordance with CNAF M-3710.7, the pilot ***shall*** either verbally confirm the closing of the flight plan with tower or Base Operations personnel or deliver a copy of the flight plan form to Base Operations.

When terminating your flight at a civilian airport, you must close out your flight plan with FSS by calling them on the radio as soon as you are on the ground, by stopping in at the FSS, or, most typically, by calling them on the phone. When appropriate communication links are known or suspected not to exist at the point of intended landing, a predicted landing time in lieu of the actual landing shall be reported to an appropriate aeronautical facility (e.g., FSS) while airborne. Regardless of the type of airport where you terminate your flight, it is the responsibility of the pilot in command/formation leader to ensure the proper agency is notified of flight termination.

The pilot in command may cancel an IFR flight plan at any time; however, ***cancellation of an instrument flight plan in no way meets the requirement for "closing out" the flight plan.*** Only when a landing report has been properly delivered to the nearest FSS can a flight plan be considered to be closed out.

You may have noticed considerable time was spent covering the closing out of your flight plan. To show you why it is so important, let us take a hypothetical case where you departed from a military base, enroute to another military base.

The tower notifies FSS of your departure, and FSS passes your ETA to your destination. About halfway to the destination, you encounter a severe cold front with extensive thunderstorm development and decide to cancel your IFR clearance and land at a nearby civilian field to wait out the storm. It is likely you would not tell ARTCC your intentions, but merely cancel your IFR clearance. Since you will be landing within a few minutes you decide not to file a new VFR flight plan while airborne. Upon landing at the civilian field, you forget to call FSS to close out your flight plan. Thirty minutes after your ETA, FSS calls the destination to see if you have arrived. Since you haven't, the next step is to contact Approach Control to see if you are under their control. They haven't heard from you, so ARTCC is contacted, and they say you canceled your IFR clearance but gave no further intentions. The local FSS has no record of a VFR flight plan, and you don't answer any radio calls. Since there is no record of your landing, there is a strong possibility you may have crashed, and a SAR effort is launched. With this scenario in mind, it is easy to understand why failing to close out your flight plan may result in a flight violation

306. MANIFEST REQUIREMENTS

It is the pilot-in-command's responsibility to ensure a complete manifest is left with a responsible person at the civilian airport (e.g., the airport manager or FSS). CNAF M-3710.7 states the following about manifests:

The pilot in command of a naval aircraft flight shall ensure a copy of the manifest is on file with a responsible agency at the point of departure before takeoff. The manifest shall include an accurate list of personnel aboard the aircraft, showing names, serial numbers, grade and service if military, duty station and status aboard the aircraft (passenger or crew). All persons aboard other than flight personnel are "passengers" and shall be manifested as such. When initial transmission of a flight plan by radio is permitted after takeoff in accordance with this instruction***, the depositing of such a personnel list continues to be a mandatory pre-takeoff requirement*** of the pilot in command of the flight. The pilot shall state the location of the required personnel list when filing by radio or telephone. Helicopter pilots engaged in search and rescue (SAR) missions, lifting reconnaissance parties, patrols, and outposts during field problems are released from manifest responsibilities when there is no proper agency available with whom a passenger manifest could be deposited.

307. RECEIVING AN IFR CLEARANCE AT AIRPORT WITHOUT AN OPERABLE TOWER

If departing IFR from an airfield without an operable tower, you can typically file a flight plan, obtain a weather brief, and deposit a manifest as necessary by phone or website, but there may be no way to activate your clearance before takeoff (e.g., there is no FSS frequency in range, the tower is closed, or there is no tower at the field). In these instances, it is possible to obtain a clearance while still on the ground from FSS or other appropriate source. This clearance will include a specific void time. You must enter the respective controlled airspace in which you are cleared by the given void time or the clearance is canceled. Takeoff into IMC is now authorized and a switch to departure control can be made when appropriate after takeoff. Additionally, a telephone number may be included in the communications section of the IFR supplement for airports without clearance delivery. This allows pilots to reach the appropriate FSS or ATC for that airport via phone and file a flight plan prior to take off.

308. AIR TRAFFIC CONTROL (ATC)

ATC issues all IFR flight plans and controls all air traffic in the United States with help from its subagencies:

Control Tower

The Control Tower is responsible for the safe, orderly, and expeditious movement of all known aircraft operating on and in the vicinity of an airport/airport traffic area (this includes permission to taxi, take off, and land). In addition, the tower will also provide for the safe separation of IFR aircraft in the terminal area. In certain metropolitan areas where a continuous terminal service between airports exists, tower will also provide Tower Enroute Control (TEC). It provides ATC services for primarily non-turbojet aircraft below 10,000 feet MSL between terminal areas.

TRACON (Terminal Radar Approach Control) is a terminal air traffic control facility providing approach and departure control services to all terminal and departing instrument air **traffic** ***as well as IFR aircraft transiting through their airspace. TRACONs will also provide radar flight following for VFR traffic on a workload permitting basis. TRACON is often referred to as Approach Control (APC) or Departure Control.***

Approach Control

The purpose of Approach Control is to control IFR flights which are arriving at (or departing from) airports which are located in controlled airspace during IFR conditions. Approach Control personnel are located in the tower (not necessarily in the tower of the departure/destination airport) or other ATC facilities in the vicinity of an airport.

Departure Control

Departure Control is an approach control function responsible for ensuring separation between departures.

Departure Control, utilizing radar, will normally clear aircraft out of the terminal area using standard instrument departures via radio navigation aids or via vectors. When a departure is to be vectored immediately following takeoff, the pilot will be advised before takeoff of the initial heading to be flown.

Air Route Traffic Control Center

ARTCC is responsible ***for all instrument enroute*** air traffic between terminal areas in controlled airspace and ***will also provide radar flight following for VFR traffic on a workload permitting basis.*** (Controlled airspace is discussed in the GP and AP/1)

ARTCCs (commonly referred to as “Center”) are capable of direct communications with IFR traffic on multiple frequencies. Maximum communication coverage is possible through the use of Remote Communications Air/Ground (RCAG) Facilities - unmanned VHF/UHF transmitter/receiver sites which are used to expand ARTCC air/ground communications coverage and to facilitate direct contact between pilots and controllers. Although some sites may be several hundred miles distance apart, they are remoted to their respective ARTCC by land lines or microwave links. Pilots should normally use these frequencies strictly for communications pertinent to the control of IFR aircraft. Flight plan filing, weather forecasts and similar data should normally be requested through FSS or appropriate military facilities capable of performing these services.

An ARTCC area 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 directed to change to the appropriate sector discrete frequency.

RCAG facilities usually are ***not*** equipped with emergency frequencies 121.5 and 243.0.

When directed to change frequencies, if communications cannot be established, the pilot should attempt to recontact the transferring controller for the assignment of an alternate frequency or other instructions.

There are 20 ARTCCs in the conterminous United States. Additional centers are located outside the conterminous U.S.; e.g., Honolulu, Anchorage, and San Juan. Names of the centers and frequencies are located in the IFR Supplement. The areas over which each center has jurisdiction are depicted on the Enroute Charts.

A listing of the ARTCCs in the conterminous United States is as follows:

1.	Albuquerque	8.	Houston	15.	Minneapolis
2.	Atlanta	9.	Indianapolis	16.	New York
3.	Boston	10.	Jacksonville	17.	Oakland
4.	Chicago	11.	Kansas City	18.	Salt Lake City
5.	Cleveland	12.	Los Angeles	19.	Seattle
6.	Denver	13.	Memphis	20.	Washington
7.	Ft. Worth	14.	Miami		

It is important to remember that VFR traffic, including aircraft operating between cloud layers or above an overcast layer, may be flying on or near airways without being in contact with ATC. Therefore, pilots should remain alert when flying IFR in VMC conditions, even when flying at an assigned "hard" altitude on an IFR flight plan. Remember, “See and Avoid” applies anytime you are in VMC conditions.

Flight Service Station (FSS)

FSS is responsible for providing aircraft with numerous services including in-flight radio assistance such as weather broadcasts, communication relay, and flight following services. Their standard operating frequencies include UHF 255.4 243.0 (emergency); VHF 122.2 121.5 (emergency); 123.6 (airport advisory) or as published in the Enroute Supplement or Low Altitude Charts.

Flight Service Stations are the air traffic service facilities within the National Airspace System that communicate directly with pilots to conduct preflight briefings, flight plan processing, inflight advisory services, search and rescue initiation, and assistance to aircraft in emergencies. FSSs will also relay ATC clearances, pass Notices to Airmen and provide updates on aviation meteorological information.

309. ATC CLEARANCES

The FAA defines an ATC clearance as an authorization by Air Traffic Control for an aircraft to proceed under specified traffic conditions within controlled airspace to prevent collision between known aircraft—should be noted that ATC clearances will only provide standard separation between IFR flights and those aircraft assigned "VFR Conditions on Top."

Clearance Delivery

At airports where a control tower is in operation, ATC clearances normally are relayed to pilots of departing aircraft by the tower "Ground Control" position. At many busy airports, a tower "Clearance Delivery" position has been established and a separate voice frequency has been designated for this purpose. No visual surveillance or control over the movement of traffic is exercised by the tower "Clearance Delivery" position. Clearances can also be received in flight from ATC when it is necessary to file a flight plan while airborne.

Readback of Clearance

Readback of a clearance is not required by FAA except that the pilot of an airborne aircraft shall read back those parts of ATC clearance containing altitudes and/or vectors; however, pilots shall read back clearances differing from the filed flight plan. Additionally, the pilot is expected to request clarification if any other part of a clearance is not fully understood; moreover, the pilot should read back any portion of the clearance as necessary for confirmation.

Clearance Compliance

A pilot is required to comply with all ATC clearances upon receipt; however, an ATC clearance does not constitute authority to violate any of the provisions of the FAR or CNAF Instructions. If ATC issues a clearance that would cause a pilot to violate a rule or regulation, or, if in the pilot's opinion, would place the aircraft in jeopardy, it is the pilot's responsibility to request an amended clearance. Additionally, the pilot is expected to notify ATC if equipment limitations forbids compliance with the clearance issued.

In certain situations, ATC will include the word "IMMEDIATELY" in an instruction only when expeditious compliance is required to avoid an imminent situation. If time permits, ATC will include the reason for this action.

In other situations, ATC will include the phrase "AT PILOT DISCRETION" to provide the pilot the flexibility to initiate the terms of the clearance when practical for the aircrew.

If an altitude change of an air traffic control clearance includes a provision to "CROSS (fix) AT/AT OR ABOVE/BELOW (altitude)," the manner (i.e., when to initiate, rate, etc.) in which the climb or descent is executed to comply with the crossing altitude is at the pilot's discretion. This authorization to descend at pilot's discretion is only applicable to that portion of the flight to which the crossing altitude restriction applies. [**AIM**, **Section. 4-4-10, para. a-e**]

Examples:

1. "NAVY ONE THREE ONE, DESCEND AND MAINTAIN SIX THOUSAND."

The pilot is expected to commence descent upon receipt of the clearance, and to descend until reaching the assigned altitude of 6000 feet.

2. "NAVY ONE THREE ONE, DESCEND AT PILOT'S DISCRETION, MAINTAIN THREE THOUSAND."

The pilot is authorized to conduct descent within the context of the term AT PILOT'S DISCRETION as described above.

3. "NAVY ONE THREE ONE, CROSS LAKEVIEW VOR AT OR ABOVE FIVE THOUSAND, DESCEND AND MAINTAIN THREE THOUSAND."

The pilot is authorized to conduct descent AT PILOT'S DISCRETION until reaching Lakeview VOR. He must comply with the clearance provision to cross the Lakeview VOR at or above 5,000 feet. After passing Lakeview VOR, he is expected to descend until reaching the assigned altitude of 3,000 feet.

4. "NAVY ONE THREE ONE, CROSS LAKEVIEW VOR AT THREE THOUSAND, MAINTAIN THREE THOUSAND."

The pilot is authorized to conduct descent AT PILOT'S DISCRETION; however, he must comply with the clearance provision to cross the Lakeview VOR at 3,000 feet.

5. "NAVY ONE THREE ONE, DESCEND NOW TO SEVEN THOUSAND, CROSS LAKEVIEW VOR AT OR BELOW FIVE THOUSAND, DESCEND AND MAINTAIN THREE THOUSAND."

The pilot should immediately begin a descent to 7,000 feet, then descend to 5,000 feet or below before crossing Lakeview VOR and finally continue down to 3,000 feet.

Adherence to Clearances

When an ATC clearance has been obtained, the pilot shall not deviate from the provisions thereof (except in an emergency) unless an amended clearance is obtained. The addition of a VFR or other restriction, (i.e., climb/descent at a particular point of time, crossing altitude, etc.), does not authorize a pilot to deviate from the route of flight or any other provision of the ATC clearance.

The most important and guiding principle to remember is that the last ATC clearance has precedence over related portions of the previous ATC clearance. When the route or altitude in a previously issued clearance is amended, the controller will restate applicable altitude restrictions. If altitude to maintain is changed or restated, whether before departure or while airborne, and previously issued altitude restrictions are omitted, those altitude restrictions are canceled, including departure procedure (DP) altitude restrictions. Pilots should always request route/altitude verification from ATC if any portion of a clearance is not understood. [**AIM**, **Section. 4-4-10, para. g**]

When an aircraft is vectored off a previously assigned route, the controller is required to tell the pilot the airway, route or point to which the aircraft is being vectored. [**GP; 6-10; para f**]

If a pilot, for any reason, is incapable of complying with any provision of an issued ATC clearance or restriction added thereto, he is expected to immediately advise ATC. A brief reason, such as, "UNABLE, ACCOUNT OF POWER CONSIDERATIONS," may be included if considered necessary. He may then expect an amended ATC clearance. [**GP; 6-10; para f**]

If thunderstorm conditions encountered are so severe that an immediate deviation from course and/or altitude is necessary and time will not permit approval by ATC, the pilot's emergency authority may be exercised. [**GP; 6-10; para g**]

The following information shall be furnished to ATC when requesting clearance to detour thunderstorm activity:

1. Proposed point at which detour will commence

2. Proposed route and extent of detour (direction and distance)

3. Altitude(s)

4. Point and estimated time where original route will be resumed

5. Flight conditions (IFR or VFR)

6. Any further deviation that may become necessary as the flight progresses

7. Advise if the aircraft is equipped with functioning airborne radar. [**GP**; 6-10; para C]

Clearance Limit [**GP**; 6-10; para c]

Initial clearances issued to departing aircraft will include, whenever practicable, the destination airport as the clearance limit. ATC may, however, use short-range clearance procedures instead of clearance to destination airport. When any part of the route beyond the short-range clearance limit differs from that specified in the original flight plan, clearance will include the proposed routing beyond said clearance limit.

When a flight has been cleared to a fix short of its destination airport, additional clearance to proceed beyond or instructions to hold at such fix, whichever is appropriate, will be issued at least five minutes before aircraft is estimated to reach the fix. If further clearance has not been received, hold in accordance with the charted holding pattern (FLIP Enroute Charts), or (if no pattern is charted at the clearance limit fix) hold in a standard pattern on the course on which the aircraft approached the fix.

Flights which are conducted in accordance with IFR for the initial part of the flight and VFR for subsequent portions will be cleared to the fix at which the IFR portion of the flight terminates.

Cruise Clearance

"CRUISE" is normally used only for relatively short flights in uncongested areas. The term "CRUISE" (instead of "MAINTAIN") is used in an ATC clearance to authorize a pilot to conduct flight at any altitude from the minimum IFR altitude up to and including the altitude specified in the clearance. The pilot may level off at any intermediary altitude within this block of airspace. Climb/descent within the block is to be made at the discretion of the pilot; however, once the pilot starts a descent and reports leaving an altitude in the block, he may not return to that altitude without additional ATC clearance. Further, it is approval for the pilot to proceed to and make an approach at the destination airport. [**AIM 4-4-3, para d**]

Maintain Clearance

The altitude instructions in an ATC clearance normally require that a pilot "MAINTAIN" the altitude at which the flight will operate when in controlled airspace. The pilot may not deviate from the assigned altitude until further instructed or, should the pilot desire a change while enroute, it will be requested at the time the change is desired. [**AIM 4-4-3, para d**]

IFR flights (below 18,000 ft MSL) are typically planned to fly altitudes in conformance with the following IFR cruising rules: odd thousands for eastbound flights and even thousands for westbound flights; therefore, pilots should initially request altitude assignments accordingly; however; ATC can deviate from this general concept as necessary in controlled airspace. [**AIM 3-3-3, para b**]

VFR On Top Clearance [AIM 5-5-13, para a and b]

This clearance must be requested by the pilot ***on an IFR flight plan***, and if approved, allows the pilot the choice (subject to any ATC restrictions) to select an altitude or flight level in lieu of an assigned altitude.

Clearances may be issued specifying that flights maintain "VFR CONDITIONS ON TOP" of a cloud, haze, smoke, or other meteorological formation provided:

1. The flight is conducted according to proper flight visibilities (3 miles if operating below 10,000 feet MSL and 5 miles if operating at or above 10,000 feet MSL).

2. The flight is conducted according to proper cloud clearances (at least 1000 feet vertically over clouds, etc.).

3. The pilot is advised of the reported height of the tops of the clouds/formation (or that no such reports have been received).

4. The flight is conducted according to the "see and avoid" principles applicable to VFR flights. In other words, although on an IFR flight plan, pilots will not be provided with an assigned altitude of "VFR CONDITIONS ON TOP." The responsibility for avoidance of collision rests with the pilot.

5. The flight is conducted at a VFR semicircular cruising altitude. (Over 3000 AGL; odd + 500 feet eastbound, even + 500 feet westbound.)

NOTE

> The same position reporting procedures apply whether a pilot is assigned "VFR CONDITIONS ON TOP" or a "hard" altitude.

Pilots must specifically request such clearances (on the ground or in the air). In other words, ATC will not ***initiate*** the issuance of "VFR CONDITIONS ON TOP" altitude assignments (or VFR climbs/descents, for that matter). The phrase by the pilot "WILL ACCEPT VFR CLIMB (VFR ON TOP, etc.,)" does not suffice for this purpose.

Combination Clearances (Composite IFR/VFR) (GP, CH 6, pg. 6-13**)**

Clearances issued when a flight plan indicates IFR for the first portion of flight and VFR for the latter portion will normally clear an aircraft to the point at which the change is proposed. Once the pilot has reported over the clearance limit and does not desire further IFR clearance, he shall advise ATC to cancel the IFR portion of his flight plan. Further clearance will not be necessary for VFR flight beyond that point. If the pilot desires to continue his IFR flight plan beyond the clearance limit, he shall contact ATC before reaching the clearance limit and request further IFR clearance. If the requested clearance is not received before reaching the clearance limit fix, the pilot will be expected to hold as explained previously.

Amended Clearances [AIM 4-4-4]

Amendments to the initial clearance will be issued at any time a controller deems such action necessary to avoid possible confliction between aircraft. Clearances will require that a flight "hold" or change altitude prior to reaching the point where standard separation from other IFR traffic would no longer exist. Some pilots have questioned this action and requested "traffic information" and were at a loss when the reply indicated "no traffic reported." In such cases, the controller has taken action to prevent a traffic confliction which would have occurred at a distant point.

A pilot may wish an explanation of the handling of his flight at the time of occurrence; however, controllers are not able to take time from their immediate control duties nor can they afford to overload the ATC communications channels to furnish explanations. Pilots may obtain an explanation by directing a letter or telephone call to the chief controller of the facility involved.

The pilot has the privilege of requesting a different clearance from that which has been issued by ATC if he feels that he has information which would make another course of action more practicable or if aircraft equipment limitations or military regulations forbid compliance with the clearance issued.

Pilots should pay particular attention to the clearance and not assume that the route and altitude are the same as requested in the flight plan. It is suggested that pilots make a written record of clearances at the time they are received and verify by repeating any portions that are complex or about which a doubt exists. It will be the responsibility of each pilot to accept or refuse the clearance issued.

Flight through Restricted Areas [AIM 3-4-3]

When an aircraft is operating on an IFR flight plan (including those cleared by ATC to maintain "VFR CONDITIONS ON TOP") ATC is responsible for obtaining clearance through the restricted area while it is "live" (active). If this is not possible, the flight will be routed to avoid the restricted area.

When an aircraft is operating on a VFR flight plan, the pilot is responsible for obtaining approval from the using or controlling agency before penetration and transit through the restricted area.

IFR Enroute Aircraft Separation [AIM 4-4-11]

Air traffic control effects separation of aircraft vertically by assigning different altitudes: longitudinally by providing an interval expressed in time or distance between aircraft on the same, converging, or crossing courses; and laterally by assigning different flight paths. When radar is employed in the separation of aircraft at the same altitude, a minimum of 3 miles separation is provided between aircraft operating within 40 miles of the radar antenna site, and 5 miles between aircraft operating beyond 40 miles from the antenna site. These minima may be increased or decreased in certain specific situations.

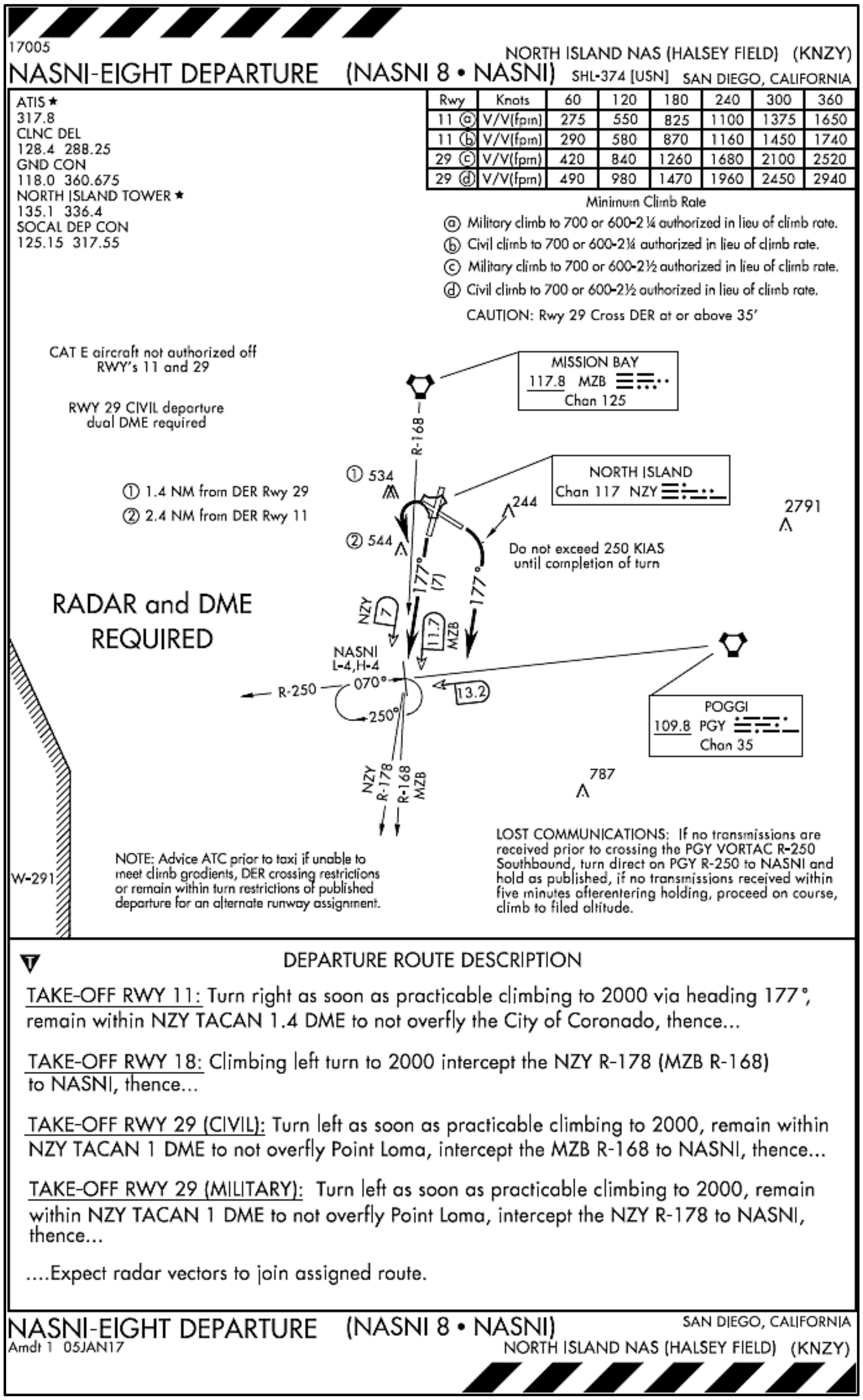


Figure 3-3 Departure Procedure (DP)

The ½ page hash marks in the top and bottom margins indicates that the chart is intended for High and Low altitude use. If the hash marks extended all the way across the top and bottom margins, this would indicate High use only.

310. INSTRUMENT DEPARTURES [AIM 5-2-8]

Instrument departure procedures (DPs) are preplanned instrument flight rule (IFR) procedures which provide obstruction clearance from the terminal area to the appropriate enroute structure. There are two types of DPs, Obstacle Departure Procedures (ODPs), printed either textually or graphically, and Standard Instrument Departures (SIDs), always printed graphically. All DPs, either textual or graphic may be designed using either conventional or RNAV criteria. RNAV procedures will have RNAV printed in the title, e.g., SHEAD TWO DEPARTURE (RNAV).

ODPs provide obstruction clearance via the least onerous route from the terminal area to the appropriate enroute structure. DPs are recommended for obstruction clearance and may be flown without ATC clearance unless an alternate departure procedure (SID or radar vector) has been specifically assigned by ATC. Graphic ODPs will have (OBSTACLE) printed in the procedure title, e.g., GEYSR THREE DEPARTURE (OBSTACLE), or CROWN ONE DEPARTURE (RNAV) (OBSTACLE).

SIDs are ATC procedures printed for pilot/controller use in graphic form to provide obstruction clearance and a transition from the terminal area to the appropriate e 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 enroute structure safely.

The controller will specify particular altitudes when they are not included in the published DP.

Example: "CLEARED STROUDSBURG ONE DEPARTURE, CROSS JERSEY INTERSECTION AT FOUR THOUSAND, CROSS ORANGE INTERSECTION AT SIX THOUSAND."

If it is necessary to assign a crossing altitude which differs from the DP altitude, the controller will repeat the changed altitude to the pilot for emphasis.

Example: "CLEARED STROUDSBURG ONE DEPARTURE, EXCEPT CROSS QUAKER AT FIVE THOUSAND. I SAY AGAIN, CROSS QUAKER AT FIVE THOUSAND."

When an instrument approach is initially developed for an airport, the procedure designer also does an assessment for departures. All departures are based on an aircraft taking off, crossing the end of the runway at 35 feet and then climbing up at 200 feet per nautical mile on runway heading up to 400 feet before being able to turn. If the aircraft can then turn in any direction without any obstructions, then that runway meets what is called ***diverse departure*** criteria. If any obstructions exist based on an obstacle clearance surface (OCS) gradient of 40:1 (40 feet of distance for every one foot of climb or 152-ft/NM) beginning at 35 feet over the end of the runway, then a specific obstacle DP is required for that airfield. This DP will require the pilot to adhere to an increase in climb gradient, increase standard takeoff minima to allow the pilot to visually clear the obstacle (see below), and/or assign a specific departure route. When an obstacle departure procedure is published for an aerodrome, it will be indicated on a given approach plate.

311. TAKEOFF/ALTERNATE MINIMUMS

FAR 91 prescribes takeoff rules and establishes standard takeoff minimums for civil operators. FAR 91 also establishes standard alternate minimums for those users. These will not be discussed in this unit since Navy pilots are specifically exempted from the takeoff/alternate minimums contained in FAR 91 as stated in the FLIP terminal low altitude approach plates. Instead, Navy and Marine Corps pilots will refer to CNAF Instruction 3710.7 for takeoff and alternate minimums.

CNAF Instruction 3710.7 takeoff minimums are as follows:

1. Special instrument rating - no takeoff ceiling or visibility minimums apply. Takeoff shall depend on the judgment of the pilot and urgency of flight.

2. Standard instrument rating - Published minimums for the available non-precision approach, but not less than 300-foot ceiling and 1 statute mile visibility. When a precision approach compatible with installed and operable aircraft equipment is available with published minimums less than 300/1, takeoff is authorized provided the weather is at least equal to the precision approach minimums for the landing runway in use, but never when the weather is less than 200 feet ceiling and one-half statute mile visibility/2400 feet RVR.

Certain aerodromes require nonstandard takeoff minimums to avoid obstacles during the initial climb out after takeoff. In such cases, the approach plate will depict a T symbol. This T symbol indicates at least one of the following conditions exist:

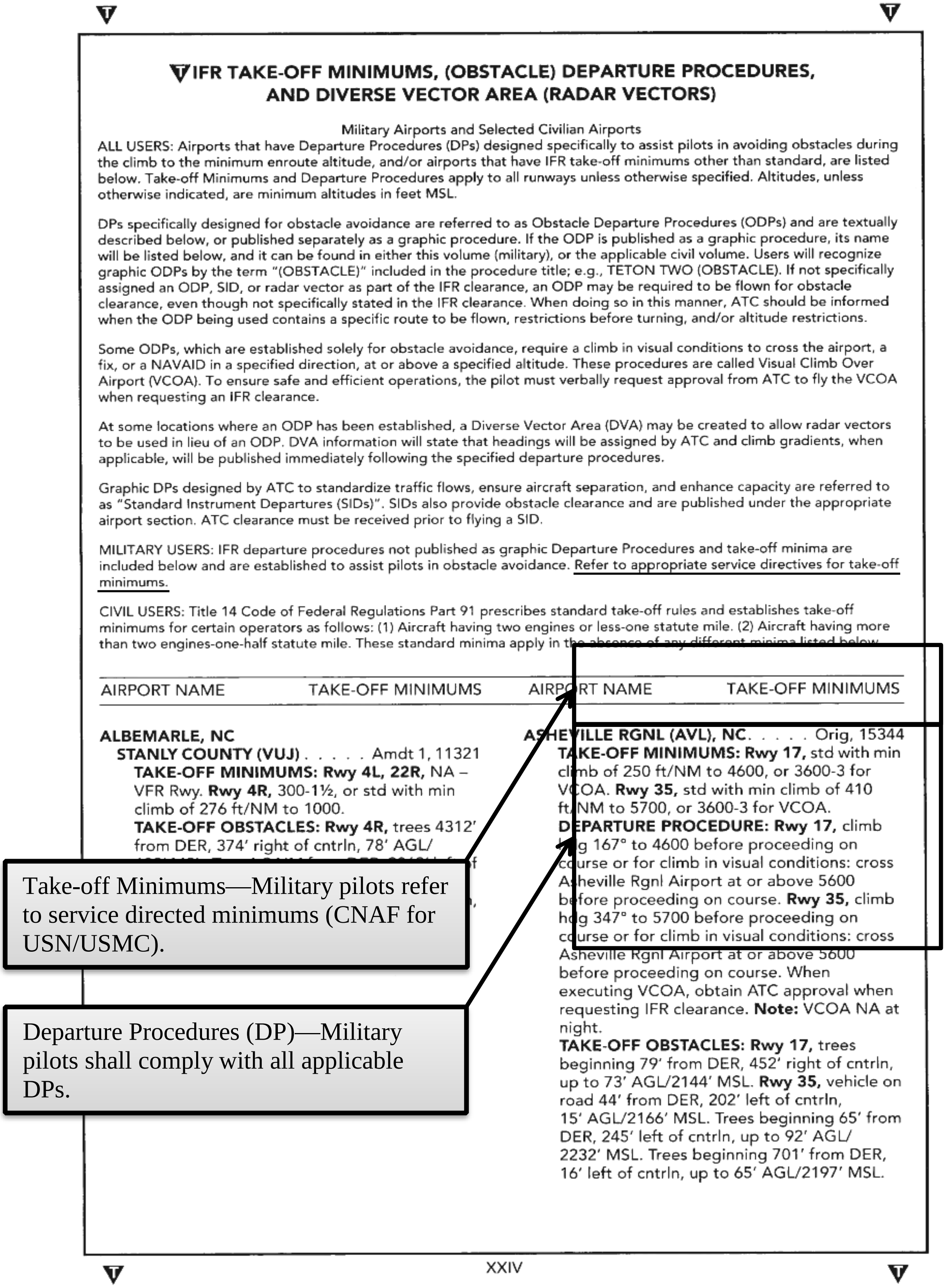
1. **IFR Take-Off Minimums**. In this case, takeoff weather minimums are not standard for civil pilots. USN/USMC pilots continue to apply CNAF takeoff minimums (explained in the previous paragraphs). These nonstandard minimums will be published in the front section of the FLIP Low Altitude IAPs (approach plates). See Figure 3-4.

2. **Obstacle Departure Procedures (ODP)**.

T Airports may also have an obstacle departure procedure published to assist pilots conducting IFR flight in avoiding obstructions during climb to the minimum enroute altitude. The published departure procedure applies to all pilots, including naval aviators and are contained in the front of the approach plates or can be published as a graphic procedure (in the approach plate section for the respective airport). Graphic ODPs can be recognized by the term "OBSTACLE" included in the procedure title (e.g., CATHEDRAL EIGHT DEPARTURE (OBSTACLE)).

3. **Diverse Vector Areas**

T Some airports may also have notes applicable to diverse vector areas to be used in conjunction with radar vectors on departure. In this case, radar vectors may be used in lieu of an ODP.



IFR TAKE-OFF MINIMUMS, (OBSTACLE) DEPARTURE PROCEDURES, AND DIVERSE VECTOR AREA (RADAR VECTORS)

Military Airports and Selected Civilian Airports

ALL USERS: Airports that have Departure Procedures (DPs) designed specifically to assist pilots in avoiding obstacles during the climb to the minimum enroute altitude, and/or airports that have IFR take-off minimums other than standard, are listed below. Take-off Minimums and Departure Procedures apply to all runways unless otherwise specified. Altitudes, unless otherwise indicated, are minimum altitudes in feet MSL.

DPs specifically designed for obstacle avoidance are referred to as Obstacle Departure Procedures (ODPs) and are textually described below, or published separately as a graphic procedure. If the ODP is published as a graphic procedure, its name will be listed below, and it can be found in either this volume (military), or the applicable civil volume. Users will recognize graphic ODPs by the term "(OBSTACLE)" included in the procedure title; e.g., TETON TWO (OBSTACLE). If not specifically assigned an ODP, SID, or radar vector as part of the IFR clearance, an ODP may be required to be flown for obstacle clearance, even though not specifically stated in the IFR clearance. When doing so in this manner, ATC should be informed when the ODP being used contains a specific route to be flown, restrictions before turning, and/or altitude restrictions.

Some ODPs, which are established solely for obstacle avoidance, require a climb in visual conditions to cross the airport, a fix, or a NAVAID in a specified direction, at or above a specified altitude. These procedures are called Visual Climb Over Airport (VCOA). To ensure safe and efficient operations, the pilot must verbally request approval from ATC to fly the VCOA when requesting an IFR clearance.

At some locations where an ODP has been established, a Diverse Vector Area (DVA) may be created to allow radar vectors to be used in lieu of an ODP. DVA information will state that headings will be assigned by ATC and climb gradients, when applicable, will be published immediately following the specified departure procedures.

Graphic DPs designed by ATC to standardize traffic flows, ensure aircraft separation, and enhance capacity are referred to as "Standard Instrument Departures (SIDs)". SIDs also provide obstacle clearance and are published under the appropriate airport section. ATC clearance must be received prior to flying a SID.

MILITARY USERS: IFR departure procedures not published as graphic Departure Procedures and take-off minima are included below and are established to assist pilots in obstacle avoidance. Refer to appropriate service directives for take-off minimums.

CIVIL USERS: Title 14 Code of Federal Regulations Part 91 prescribes standard take-off rules and establishes take-off minimums for certain operators as follows: (1) Aircraft having two engines or less-one statute mile. (2) Aircraft having more than two engines-one-half statute mile. These standard minima apply in the absence of any different minima listed below.

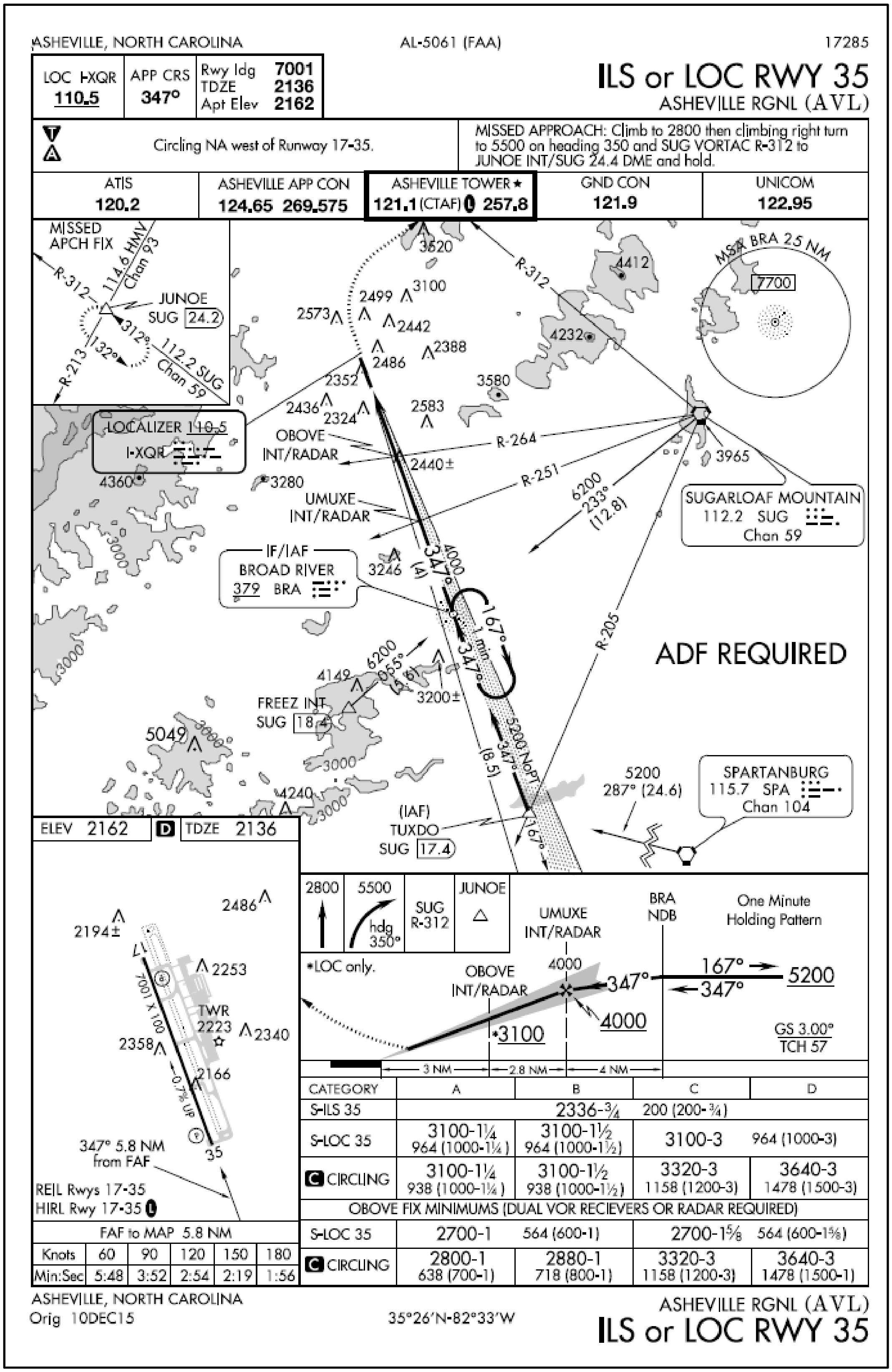
AIRPORT NAME TAKE-OFF MINIMUMS AIRPORT NAME TAKE-OFF MINIMUMS

ALBEMARLE, NC
STANLY COUNTY (VUJ) . . . . . Amdt 1, 11321
TAKE-OFF MINIMUMS: Rwy 4L, 22R, NA – VFR Rwy. **Rwy 4R,** 300-1½, or std with min climb of 276 ft/NM to 1000.
TAKE-OFF OBSTACLES: Rwy 4R, trees 4312' from DER, 374' right of cntrln, 78' AGL/

ASHEVILLE RGNL (AVL), NC. . . . . Orig, 15344
TAKE-OFF MINIMUMS: Rwy 17, std with min climb of 250 ft/NM to 4600, or 3600-3 for VCOA. **Rwy 35,** std with min climb of 410 ft/NM to 5700, or 3600-3 for VCOA.
DEPARTURE PROCEDURE: Rwy 17, climb hdg 167° to 4600 before proceeding on course or for climb in visual conditions: cross Asheville Rgnl Airport at or above 5600 before proceeding on course. **Rwy 35,** climb hdg 347° to 5700 before proceeding on course or for climb in visual conditions: cross Asheville Rgnl Airport at or above 5600 before proceeding on course. When executing VCOA, obtain ATC approval when requesting IFR clearance. **Note:** VCOA NA at night.
TAKE-OFF OBSTACLES: Rwy 17, trees beginning 79' from DER, 452' right of cntrln, up to 73' AGL/2144' MSL. **Rwy 35,** vehicle on road 44' from DER, 202' left of cntrln, 15' AGL/2166' MSL. Trees beginning 65' from DER, 245' left of cntrln, up to 92' AGL/2232' MSL. Trees beginning 701' from DER, 16' left of cntrln, up to 65' AGL/2197' MSL.

XXIV

Figure 3-4 Obstacle Departure Procedures



CATEGORY	A	B	C	D
S-ILS 35	2336-¾ 200 (200-¾)			
S-LOC 35	3100-1¼ 964 (1000-1¼)	3100-1½ 964 (1000-1½)	3100-3 964 (1000-3)	
CIRCLING	3100-1¼ 938 (1000-1¼)	3100-1½ 938 (1000-1½)	3320-3 1158 (1200-3)	3640-3 1478 (1500-3)
OBOVE FIX MINIMUMS (DUAL VOR RECIEVERS OR RADAR REQUIRED)				
S-LOC 35	2700-1 564 (600-1)		2700-1⅝ 564 (600-1⅝)	
CIRCLING	2800-1 638 (700-1)	2880-1 718 (800-1)	3320-3 1158 (1200-3)	3640-3 1478 (1500-1)

FAF to MAP 5.8 NM					
Knots	60	90	120	150	180
Min:Sec	5:48	3:52	2:54	2:19	1:56

ASHEVILLE, NORTH CAROLINA
Orig 10DEC15
35°26'N-82°33'W
ASHEVILLE RGNL (AVL)
ILS or LOC RWY 35

Figure 3-5 Takeoff Minimums (T) and Alternate Minimums (A) symbols

The symbol A on an approach plate directs pilots to the "IFR Alternate Minimums" section (Figure 3-6) in the front of each approach plate book and indicates that ***other than*** standard alternate minimums apply; however, these non-standard minimums apply to civil operators. Naval Aviators shall use CNAF M-3710.7 alternate minimums as usual. Also, in the IFR Alternate Minimums section, some airports will have ***NA*** listed underneath the listed approaches. The NA note will list when the restriction applies (e.g., When tower closed; When local weather not available; etc.). The restriction applies to all listed approaches unless annotated for specific approaches. All pilots, including military pilots, are subject to these restrictions.

A ALTERNATE MINS

INSTRUMENT APPROACH PROCEDURE CHARTS

A IFR ALTERNATE MINIMUMS

Standard alternate minimums for non-precision approaches and approaches with vertical guidance [NDB, VOR, LOC, TACAN, LDA, SDF, VOR/DME, ASR, RNAV (GPS) or RNAV (RNP)] are 800-2. Standard alternate minimums for precision approaches (ILS, PAR, or GLS) are 600-2. Airports within this geographical area that require alternate minimums other than standard or alternate minimums with restrictions are listed below. NA - means alternate minimums are not authorized due to unmonitored facility, absence of weather reporting service, or lack of adequate navigation coverage. Civil pilots see FAR 91. IFR Alternate Minimums: Ceiling and Visibility Minimums not applicable to USA/USN/USAF. Pilots must review the IFR Alternate Minimums Notes for alternate airfield suitability.

NAME ALTERNATE MINIMUMS

ALBEMARLE, NC
STANLY
COUNTY (VUJ) . . . . **NDB Rwy 22L①**
ILS or LOC Rwy 22L①②
RNAV (GPS) Rwy 4R
RNAV (GPS) Rwy 22L
NA when local weather not available.
①NA when control tower closed.
②Categories A,B,C,D, 700-2.

ASHEVILLE, NC
ASHEVILLE RGNL
(AVL) . . . . **ILS or LOC Rwy 35①③**
RNAV (GPS) Rwy 17②
RNAV (GPS) Rwy 35②
①ILS, LOC, Categories A,B, 1000-2; Category C, 1200-3; Category D, 1500-3.
②Category C, 1200-3; Category D, 1500-3.
③NA when control tower closed.

BEAUFORT, NC
MICHAEL J. SMITH
FIELD (MRH) . . . . **RNAV (GPS) Rwy 3**
RNAV (GPS) Rwy 8
RNAV (GPS) Rwy 14
RNAV (GPS) Rwy 21
RNAV (GPS) Rwy 26
RNAV (GPS) Rwy 32
NA when local weather not available.

BLACKSBURG, VA
VIRGINIA TECH/MONTGOMERY
EXECUTIVE (BCB) . . . . **RNAV (GPS) Rwy 12**
Category C, 900-2½.
NA when local weather not available.

NAME ALTERNATE MINIMUMS

BRISTOL-JOHNSON-KINGSPORT, TN
TRI-CITIES RGNL
TN/VA (TRI) . . . . **ILS or LOC Rwy 5①**
ILS or LOC Rwy 23②
NA when local weather not available.
NA when control tower closed.
①ILS, Categories A,B,C,D, 700-2. LOC, std.
②1000-3.

CHARLOTTE, NC
CHARLOTTE/DOUGLAS
INTL (CLT) . . . . **ILS or LOC Rwy 18L①**
ILS or LOC Rwy 18R①
ILS or LOC Rwy 23②
ILS or LOC Rwy 36L①
ILS or LOC Rwy 36R①
RNAV (GPS) Y Rwy 18L③
RNAV (GPS) Y Rwy 18R③
RNAV (GPS) Y Rwy 36L③
RNAV (GPS) Y Rwy 36R③
①ILS, LOC, Category C, 800-2¼; Category D, 800-2½.
②ILS, Categories A,B,C,D, 700-2. LOC, Standard.
③Category C, 800-2¼; Category D, 800-2½.

CHARLOTTESVILLE, VA
CHARLOTTESVILLE-
ALBEMARLE (CHO) . . . . **ILS or LOC Rwy 3①**
RNAV (GPS) Rwy 3③
RNAV (GPS) Y Rwy 21②
RNAV (GPS) Z Rwy 21④
NA when local weather not available.
①ILS, Categories A,B, 700-2; Category C, 900-2½; Category D, 900-2¾. LOC, Category C, 900-2½; Category D, 900-2¾.
②Category D, 900-2¾.
③Category C, 900-2½; Category D, 900-2¾.
④Categories A,B,C,D, 1000-4.

LVI

Figure 3-6 IFR Alternate Minimums

Some approach plates have the ▲ NA symbol annotated in the notes section of the top margin. This indicates that IFR minimums are not authorized for alternate use due to an unmonitored facility or the absence of weather reporting service.

Radar Traffic Information Service (Traffic Advisories)

This is a service provided by ATC on ***a workload permitting basis*** to advise pilots that there may be a potential traffic conflict with their aircraft either in its current position or on its intended route of flight. The issuance of traffic information by a controller is not mandatory. Many factors (such as limitations of the radar, volume of traffic, communications frequency congestion and workload) could prevent the controller from providing it. It must be understood by the pilot that this service is not intended to and in no way shall it relieve the pilot of the responsibility for continual vigilance to see and avoid other aircraft.

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. [**AIM 4-1-15**]

NOTE

> Radar ATC facilities normally display and monitor both primary and secondary radar when it is available, except that secondary radar 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 enroute areas where only secondary is available). Secondary radar 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 aircraft only." This means simply that only the aircraft which have transponders installed and in use will be depicted on ATC radar indicators when the primary radar is temporarily out of service.

Traffic Information/Flight Following (VFR)

VFR radar flight following or VFR radar advisory service (often referred to as "flight following") is essentially traffic advisories provided to VFR traffic upon request to ATC. This service does not include vectors away from conflicting traffic unless requested by the pilot. 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.

As Naval Aviators, we are required by CNAF to request radar advisories where available, provided no degradation of the assigned mission will result. Flight following is essential when flying VFR through high-density traffic areas. This serves as an additional precaution to the VFR see-and-avoid concept. ***Radar flight following with TRACON or ARTCC should not be confused with VFR flight following with FSS, which is tracking aircraft through pilot provided position reports.***

Traffic will be called out by ATC based on:

1. Radar identification using:

    a. clock position azimuth.

    b. distance (in nautical miles).

    c. direction target is proceeding; and

    d. type of aircraft and altitude if known.

2. Non-radar (aircraft giving position reports) identification using:

    a. distance and direction with respect to a fix.

    b. direction in which the target is proceeding; and

    c. type of aircraft and altitude if known.

Examples: "TRAFFIC TWELVE O'CLOCK, ONE ZERO MILES, SOUTHBOUND, DC-EIGHT, ONE ZERO THOUSAND."

"TRAFFIC TWELVE O'CLOCK, FIVE MILES WEST OF ALICE VOR, NORTHBOUND C-ONE THIRTY, FIVE THOUSAND."

"TRAFFIC, NUMEROUS TARGETS VICINITY OF RANDOLPH AIRPORT." ARRIVAL PROCEDURES

Induced Error

If your aircraft has a significant crab angle to maintain track, an adjustment will need to be made accordingly. As an example, in Figure 3-7, traffic information would be issued to the pilot of aircraft "C" as 2 o'clock. The actual position of the traffic as seen by the pilot of aircraft "C" would be 3 o'clock. Traffic information issued to aircraft "D" would be at an 11 o'clock position. Since it is not necessary for the pilot of aircraft "D" to apply wind correction (crab) to remain on track, the actual position of the traffic issued would be correct. Since the radar controller can only observe aircraft track (course) on the radar display, traffic advisories are issued accordingly, and pilots should give due consideration to this fact when looking for reported traffic.

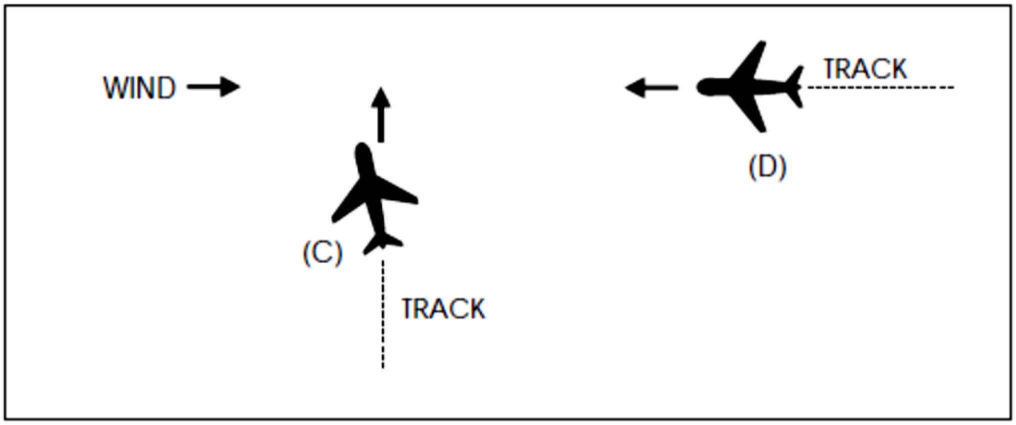


Figure 3-7 Example of Traffic Information

312. ARRIVAL PROCEDURES

Approach Clearance

Instrument approach procedures such as TACAN, VOR, GPS, ADF, ILS, and RNAV are depicted in the publication ***Low Altitude Instrument Approach Procedures***. Guidance on PAR and ASR approaches can also be found in these publications. On the initial voice contact with Approach Control, the pilot may indicate the ***type of instrument approach*** he desires to make. However, controllers will normally clear the pilot for the instrument approach procedure ***that will expedite traffic*** the most. This is usually accomplished by issuing a clearance for a specific approach procedure. If the pilot does not want such an approach, he may request a different type of approach, however, it may be necessary to withhold a clearance for the different approach until traffic conditions permit. Under such circumstances, the pilot may accept the suggested approach or wait for a different approach. If the pilot is involved in an emergency situation, he will be given priority over other air traffic and in the type of approach that may be necessary under the circumstances.

A clearance for a specific type of approach (VOR, ILS, etc.) to a pilot operating on an IFR flight plan does not mean that landing priority will be given over VFR traffic. Tower controllers handle all landing traffic, regardless of the type of flight plan, on a first-come-first-served basis. Because of local traffic or runway in use, it may be necessary for the controller, in the interest of safety, to provide a particular landing sequence. In any case, a landing sequence will be issued as soon as possible to enable the "IFR" pilot to adjust the flight path.

Anticipated Delay

1. If a delay is anticipated, center controllers will issue a holding clearance with an expected further clearance time at least five minutes before the aircraft is expected to reach the clearance limit.

2. If a delay is not anticipated, center controllers clear the pilot beyond the clearance limit before the aircraft reaches it by ***issuing an approach clearance or instructions to contact the terminal control facility*** (e.g., Approach Control).

The expected further clearance time is normally assigned by the ***center*** before the aircraft reaching the clearance limit and is later revised, if necessary, by Approach Control. (Close coordination is maintained between the center and Approach Control regarding expected further clearance times issued, highest holding altitude assigned, etc.)

Transfer of Control - (No Delay Anticipated)

1. If Approach Control services are ***not*** provided at the destination airport, the center controller will issue an approach clearance (with instructions to contact the Tower or Flight Service Station, usually upon commencing the approach).

2. If Approach Control services ***are*** provided at the destination airport, the center controller will issue a ***clearance to contact Approach Control*** at a specified ***time or place.***

Example: CONTACT (location name) - (terminal control function)
ON (frequency) or AT/WHEN (time, fix, or altitude)

Advance Approach Information [AIM 5-4-4]

When landing at airports with approach control services and where two or more IAPs are published, pilots will be provided in advance of their arrival with the type of approach to expect or that they may be vectored for a visual approach. This information will be broadcast either by a controller or on ATIS. It will not be furnished when the visibility is three miles or better and the ceiling is at or above the highest initial approach altitude established for any low altitude IAP for the airport.

Example: EXPECT (type) APPROACH
EXPECT VECTORS TO THE TRAFFIC PATTERN

The purpose of advance approach information is to aid the pilot in planning arrival actions; however, it is neither an ATC clearance nor a commitment and is subject to change. Pilots should bear in mind that fluctuating weather, shifting winds, blocked runways, etc., are conditions which may result in changes to approach information previously received.

Do not confuse Advance Approach Information with ATIS (Automatic Terminal Information Service). ATIS is the continuous broadcast of recorded noncontrolled information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. Advance Approach Information will not be furnished when ATIS is provided for the airport or when the visibility is three miles (or better) and the ceiling is at or above the highest initial approach altitude established for any approach procedures to the airport.

If the pilot relays correct ATIS code, controllers will not issue the following if current information on these items is contained in the ATIS broadcast. Ceiling and visibility may be omitted when the reported ceiling is at or above 5000 feet and the visibility is five miles in the ATIS broadcast.

TO ARRIVING IFR AIRCRAFT
1. Approach clearance or type of instrument approach to be expected
2. Runway (if different from that which the IPA is made)
3. Surface wind
4. Ceiling and visibility (If <1000 ft ceiling/highest circling minimum or < 3 miles visibility)
5. Altimeter setting

To reduce frequency congestion, pilots are expected to inform controllers of receipt of ATIS information when making initial contact with a controller on a newly assigned frequency.

ATIS broadcasts will be updated when there is a change in pertinent data in information contained therein. Each time an ATIS message is updated, the control facility will make a one-time announcement on appropriate control frequencies.

Example: "ATTENTION. NAVY WHITING AIRPORT INFORMATION HAS BEEN CHANGED TO INFORMATION ECHO."

The differences between ATIS information and Advance Approach Information should now be evident. You will recall that advance approach information will be provided to a pilot intending to land at an airport where Approach Control services are provided and where two or more instrument approach procedures are published. Remember, advance approach information will be in the form of the type of approach to expect or whether the aircraft will be vectored to the traffic pattern.

Commencing Approach – Reported Weather below Minimums. [FAA JO 4-7-8]

It should be noted that FAA controllers are not required to inform Navy pilots that the weather is below approach minimums. This determination is ultimately the pilot's responsibility. As a result, there may be instances when FAA controllers will clear military pilots for an approach with weather reported below minimums. For these situations CNAF M-3710.7 (Chapter 5) provides the following direction:

In a ***single-piloted*** aircraft:

An instrument approach shall not be commended if this reported weather is below published minima for the type of approach being conducted.

In a ***multi-piloted*** aircraft:

When reported weather is at or below published landing minima for the approach to be conducted, an approach shall not be commenced in multi-piloted aircraft unless the aircraft has the capability to proceed to a suitable alternate in the event of a missed approach.

These provisions are not intended to preclude single-piloted aircraft from executing practice approaches (when no landing is intended) at a facility where weather is reported below published minima when operating with an appropriate ATC clearance; however, the facility in question must **not** be the filed destination or alternate, and the weather at the filed destination must meet the filing criteria for an instrument clearance.

In summary, can a Navy ***multi-piloted*** aircraft request and receive an approach clearance from a controller when the reported weather is below approved published landing minimums? Yes.

313. INSTRUMENT APPROACH PROCEDURES [FAA JO 7110-ATC, 4-7-10, 4-8-1]

Controllers will issue one of two clearances to the pilot:

1. "Cleared for approach." ATC will use this clearance when only one approach is published for that airport or to authorize a pilot to execute his/her choice of instrument approach.

2. “Cleared for [name of specific approach].” ATC will issue this clearance when two or more approaches are published for that airport.

For a pilot to execute a particular instrument approach procedure, controllers will specify in the approach clearance ***the name of the approach as published on the approach plate.***

Example: "CLEARED FOR VOR B APPROACH."
"CLEARED FOR VOR RUNWAY THREE SIX APPROACH."

Normally, traffic conditions require controllers to issue a clearance specifying the ***type*** of approach. If the pilot is not familiar with the specified approach procedure, the ***controller should be advised,*** and the clearance will include detailed information on the execution of the specified approach.

The omission of a specific type of approach (e.g., TACAN, VOR, ADF, etc.) in the clearance, "CLEARED FOR APPROACH," indicates to the pilot that any published type of approach may be used at his/her discretion.

When an approach involves a procedure turn, the turn will be executed within the specified distance from the fix - normally ten miles; however, to provide adequate separation from departing traffic, controllers may specify the point at which the turn shall be executed (expressed in minutes or miles outbound from the fix) which will be consistent with the limitations of the approach procedure plate.

Upon reaching the initial approach fix, the pilot should always turn in the shortest direction to intercept the approach course. Holding entry procedures concerning the initial entry turn are not necessarily applicable to the situation of commencing an approach.

An aircraft which has been cleared to a holding fix and subsequently receives clearance for an 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) from the enroute structure to the IAF are part of the approach clearance.

Descent From Altitude – For Aircraft Operating On A Published Route [AIM 5-4-6]

Before arriving at the initial approach fix, if an approach clearance is received which ***contains no altitude restrictions*** (e.g., "CLEARED FOR VOR RUNWAY THREE ONE APPROACH"), the pilot has the option of maintaining his last assigned altitude or he may descend to:

1. The published minimum enroute altitude (MEA) or the published minimum obstruction clearance altitude (MOCA) within 22 NM of the NAVAID depicted on the FLIP ***Enroute*** Chart if the flight is being conducted along an airway, or

2. The published initial approach altitude (i.e., the published minimum altitude for a feeder route) depicted on the FLIP Terminal chart, in the case when the flight is transitioning from an outer (feeder) fix to the initial approach fix. Initial approach information is portrayed in the plan view of instrument approach charts by course lines, with an arrow indicating the direction. Minimum altitude and distance between fixes is also shown with the magnetic course.

Descent from Altitude -- For Aircraft on Unpublished Routes [AIM 5-4-6]

When operating on an unpublished route or while being radar vectored, the pilot, when an approach clearance is received, must 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.

Example (Figure 3-8):

Aircraft 1: The aircraft is established on a segment of a published route at 6000 feet.

"CLEARED FOR VOR RUNWAY THREE FOUR APPROACH." Aircraft may descend to 4000 feet.

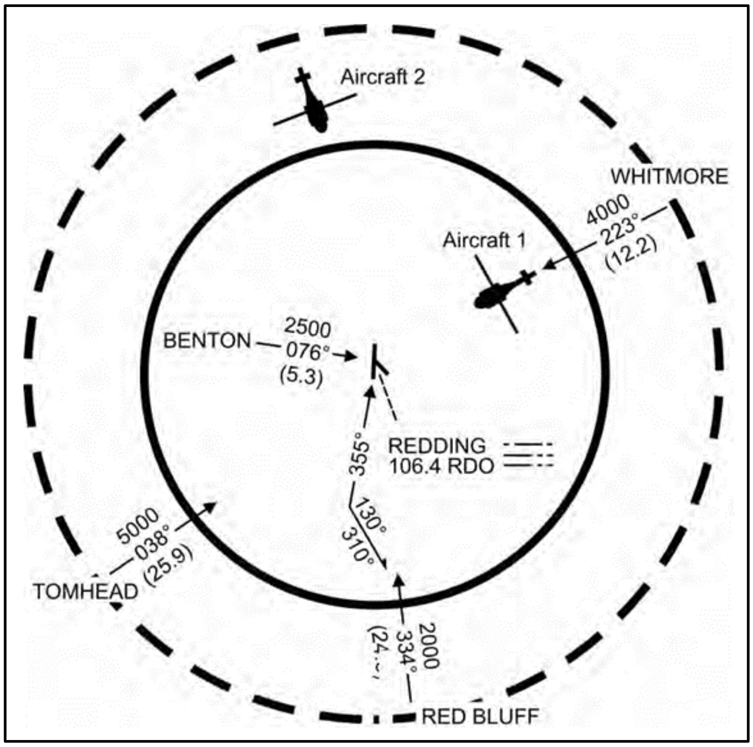


Figure 3-8 Instrument Approach Procedure

Example:

Aircraft 2: The aircraft is inbound to the VOR on an unpublished direct route at 7000 feet. ATC assigns the aircraft 5000 ft.

"CROSS THE REDDING VOR AT OR ABOVE FIVE THOUSAND, CLEARED FOR VOR RUNWAY THREE FOUR APPROACH."

Aircraft 2 may, at pilot's discretion, descend to 5000 ft immediately after receiving the clearance. Once established on an approach segment after arriving at the IAF, the aircraft may descend (as applicable) to the designated altitude published for that segment.

NOTE

The altitude assigned by ATC must assure IFR obstruction clearance from the point at which the approach clearance is issued until established on a segment of a published route or instrument approach procedure.

If an aircraft arrives at the initial approach fix with excessive initial approach altitude, an accepted technique for dissipating excessive altitude is to descend after arriving at the approach fix in a holding pattern established as depicted on the approach plate or if no pattern is depicted, in a holding pattern on the approach course (inbound to the fix), making turns on the procedure turn side of the approach course. Altitude loss, in this maneuver, may be continued to as low as the procedure turn altitude depicted on the chart, if necessary.

If pilots elect to make additional circuits to lose excessive altitude or to become better established on course, it is their responsibility to so advise ATC upon receipt of their approach clearance.

If the approach procedures depicted on the chart looked like this --

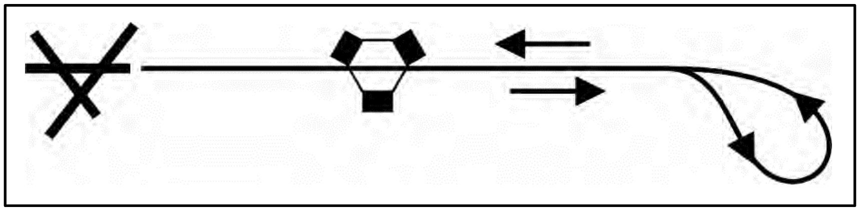


Figure 3-9 Approach Procedure

What would the holding pattern look like (to lose excessive initial approach altitude)?

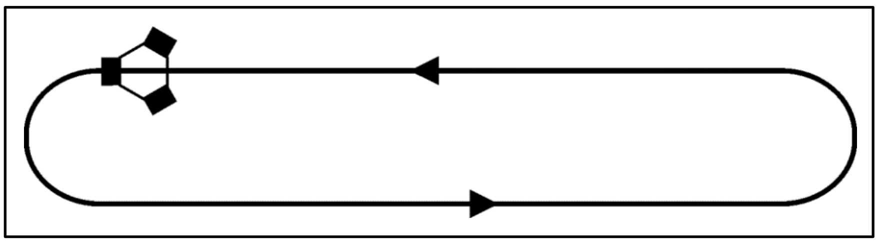


Figure 3-10 Holding Pattern

(Remember, be inbound to the fix and make turns on the procedure turn side of the approach course.)

Instrument Approach from Holding Pattern

When holding at a fix, usually an intersection, from which straight-in approaches are being conducted, clearances may specify the ***time of departure*** from the fix. Example: "DEPART XRAY INBOUND AT TWO SIX." This clearance does ***not*** constitute authority to commence an approach. It simply authorizes the pilot to depart the fix inbound toward the final approach fix. The pilot should adjust the flight path to leave the fix as closely as possible to the designated time. He must report leaving the fix, if in nonradar environment.

Descent, under the above circumstances, may be commenced when leaving the fix only if the pilot ***received clearance for a straight-in approach and when established on the inbound course.*** Otherwise, the pilot should hold the last assigned altitude, while inbound until he receives clearance for the straight-in approach. If clearance for a straight-in approach is not received, the pilot will be expected to execute the entire approach as published.

When holding at a fix (usually a NAVAID such as a VOR or Radio Beacon) from which procedure turn type approaches are being conducted, clearances will ***not*** normally specify the time to depart the fix. True, the holding clearance will have included a time at which the pilot can expect an approach clearance (expected further clearance time), but the pilot is not authorized to commence an approach at this "time" except under two-way radio failure.

Normally, an approach clearance will be issued at or before the expected further clearance time.

Descent from the last assigned altitude to the procedure turn minimum may be commenced upon receipt of the approach clearance. The pilot must report leaving the last assigned altitude.

Upon receipt of the approach clearance, the pilot may leave the holding pattern to intercept the final approach course inbound. In other words, ***a procedure turn is not required when an approach can be made from a properly aligned holding pattern***. Therefore, under these circumstances, a report departing the VOR outbound is unnecessary; simply acknowledge the approach clearance and report leaving the altitude.

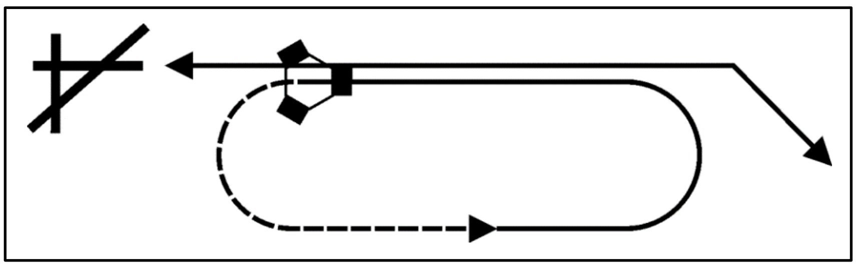


Figure 3-11 Leaving the Holding Pattern

Referring to Figure 3-11, assume approach clearance has been received on the outbound leg of the holding pattern. Additional circuits in the holding pattern are not required nor expected. Pilot should commence the approach with a turn toward the final approach course. If the pilots elect to make additional circuits to lose excessive altitude or to become better established on course, it is their responsibility to so advice ATC upon receipt of their approach clearance. Descent from published procedure turn altitude to final approach fix altitude will not commence until inbound on final approach course.

In this situation, the pilot should ensure such action will not allow the aircraft to exceed the maximum limiting distance for the execution of the procedure turn (usually ten miles).

Procedure Turns

"Procedure turn" means a maneuver prescribed when it is necessary to reverse direction to establish the aircraft on an intermediate 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 published procedure; however, for the “45-degree procedure turn,” the point at which the turn may be commenced and the type and rate of turn (BARB, TEARDROP, HOLDING-IN-LIEU-OF PROCEDURE TURN) are left to the discretion of the pilot. Maneuvering must be done on the barbed side of the course line.

A type of procedure turn which is occasionally used is the teardrop. The teardrop procedure turn consists of departure from an initial approach fix on an outbound course followed by a turn toward and intercepting the inbound course at or before the intermediate fix or point. When a teardrop type procedure turn is depicted and a course reversal is required, this type of turn must be executed.

The “holding-in-lieu of procedure turn” approach is also a procedure turn (despite the name) since it also provides for a course reversal to align the aircraft with the intermediate or final approach course. As with the teardrop approach, this approach must be executed as depicted.

A straight-in approach is an instrument approach procedure conducted by proceeding inbound to the final approach fix at the prescribed altitude and continuing inbound on the final approach course to the airport ***without making a procedure turn***. A straight-in approach is ***not necessarily completed with a straight-in landing*** or made to straight-in landing minimums.

A pilot shall not make a procedure turn (unless he so advises Approach Control and an appropriate clearance is received) when:

1. Issued a clearance for a straight-in approach (even though the published procedure depicts a procedure turn), or

2. The approach published on the FLIP Terminal Plate is designated "NoPT" (no procedure turn required), or

3. The aircraft is radar-vectored to a final approach position, or

4. The instrument approach procedure specifically prohibits use of a procedure turn.

Vectors to Final Approach Course

Where adequate radar coverage exists, radar facilities may vector aircraft to the final approach course for a straight-in approach.

Example: "DEPART (outer fix), HEADING (degrees), FOR VECTOR TO FINAL APPROACH COURSE FOR (approach name)."

Arriving aircraft are either cleared to an outer fix most appropriate to the route being flown (with holding instructions, if required), or, when radar hand-offs are effected between the Center and Approach Control, aircraft are cleared to a fix so located that the hand-off will be completed before the time the aircraft reaches the fix.

When radar hand-offs are used, after release to Approach Control, successive arriving flights are vectored to the appropriate final approach course (ILS, VOR, ADF, TACAN, etc.).

Radar vectors and altitudes will be issued as required for spacing and separating aircraft. Therefore, ***pilots must not deviate from the heading issued by Approach Control***. The radar vector issued for interception of the approach course will be such as to enable the pilot to establish his aircraft on the approach course before reaching the final approach fix. Aircraft will be cleared for a straight-in approach at the time the final heading for interception of the approach course is issued, or after the aircraft is established on the approach course before passing the final approach fix.

When established on the approach course, radar separation will be maintained and the pilot will be expected to complete the approach utilizing existing approach aids (ILS, VOR, ADF, etc.) as the primary means of navigation. After passing the final approach fix (outer marker, VOR, radio beacon, etc.), pilots are expected to proceed to the airport and complete the approach or effect the missed-approach procedure published for that airport.

314. EXPLANATION OF TERMS

Certain amendments to the FAR implemented new techniques and criteria associated with the manual titled U.S. Standard for Terminal Instrument Procedures (TERPS). This handbook contains criteria which are used to formulate, review, approve, and publish procedures for instrument approaches and departures of aircraft to and from civil and military airports. These procedures are promulgated in the Instrument Approach Procedures volume series. The minimums established for a particular airport shall be the lowest permitted by TERPS. Each procedure shall specify minimums for the various conditions stated in the procedure, e.g., straight-in, circling, alternate, and takeoff, as required.

Approach Categories - Six approach categories (A, B, C, D, E, and COPTER) control the landing minima for different types of aircraft. Landing minimums for a particular type aircraft depend upon the approach category in which it is placed.

It should be noted that approach speeds are based upon a value 1.3 times the stalling speed of the aircraft in the landing configuration at maximum certified gross landing weight. Thus, they are computed values, not the speed at which an aircraft flies an approach nor the NATOPS listed approach speed. An aircraft can fit into only one category, that being the highest category in which it meets the specification; however, this does not preclude the aircraft commander from using higher approach minimums if the speed at which the aircraft actually flies an approach is in a higher category.

Approach Category	Calculated Approach Speed
A	Speeds less than 91 knots
B	Speeds 91 – 120 knots
C	Speeds 121- 140 knots
D	Speeds 141 – 165 knots
E	Speeds over 165 knots

So, if approach category is based on stall speed where do helicopters fit in? Helicopters have procedures designed specifically for them called COPTER procedures. COPTER procedures are designed for helicopter use only and therefore are restricted to airspeeds of 90 knots or less. A COPTER procedure has a final approach direction instead of a runway designation and provides ***no circling minimums***. See section 213 for Copter approaches.

In the absence of COPTER MINIMA, helicopters may use the CAT A minimums of other procedures. Due to unique maneuverability and handling characteristics, helicopters may reduce the required visibility of non-copter procedures to one-half the published visibility minimum for CAT A aircraft, but in no case may it be reduced to less than one-fourth mile or 1200 feet RVR. If a helicopter pilot elects to fly the final segment of an approach a speed greater than 90 knots, then the minima for the respective category must be used and no visibility reduction is allowed. Additionally, some approach procedures specifically restrict visibility reduction by helicopters. Visibility may not be reduced below published for COPTER procedures since the helicopter's maneuverability has already been factored in.

Minimum Decent Altitude (MDA) - An altitude, specified in feet above MSL, below which descent will not be made until visual reference has been established with the runway environment and the aircraft is in a position to execute a safe landing. MDAs apply to non-precision straight-in and circling approaches. After passing the final approach fix inbound, such as during a VOR approach, the pilot can now descend to the MDA value on the altimeter.

Decision Height (DH)/Decision Altitude (DA) - An altitude, specified in feet above MSL, at which a missed approach shall be initiated when either visual reference has not been established with the runway environment or the aircraft is not in position to execute a safe landing. In U.S. airspace, DH and DA are used interchangeably and apply to precision approaches (e.g., ILS and PAR) while RNAV (GPS) approaches with vertical guidance (LPA and LNAV/VNAV) specifically identify the altitude as a DA; however, LPV DA and LNAV/VNAV DA approach minimums are not considered as "precision approaches" by the FAA/ICAO, despite the lower minimums (in some cases 200-1/2, as good as an ILS). They are classified as "approaches with vertical guidance" or APV.

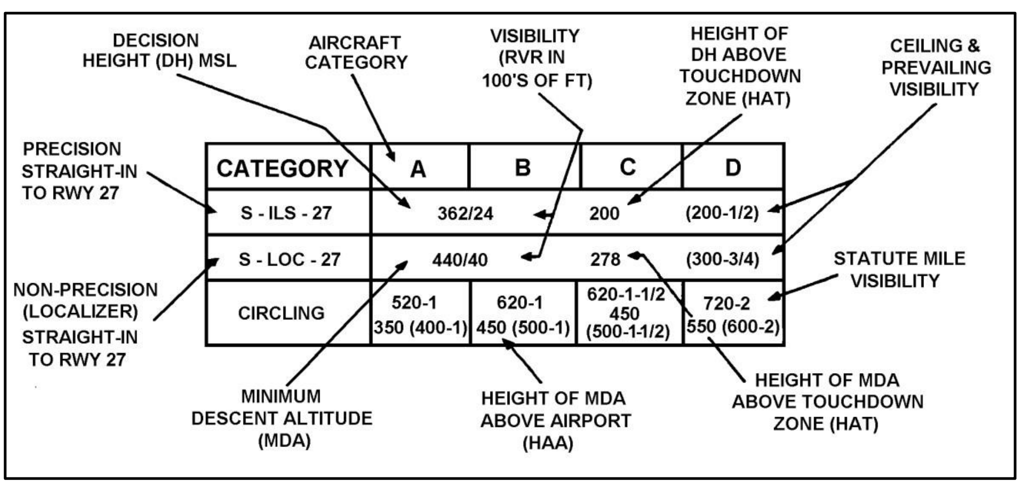


Figure 3-12 Sample Landing Minima Format

We have already defined MDA and DH in the preceding paragraphs. An explanation of the remaining terms used in the standard format above is as follows:

Height Above Airport - "Height Above Airport" (HAA) information indicates the height of the aircraft (when flying at the MDA) above the published airport elevation. The HAA will afford a minimum of 300 feet of obstruction clearance.

From the sample format on the previous page, it will be noted that when an aircraft of approach Category B is flying at the MDA of 620 feet MSL, it is actually 450 feet above the published elevation of the airport. Therefore, the published elevation of the airport must be 170 feet. The published airport elevation is a measurement of the highest point of all the usable runway surfaces.

Height Above Touchdown - "Height above touchdown" (HAT) information indicates the height of the aircraft (when at the DH or MDA) above the highest runway elevation in the touchdown zone (first 3000 feet of runway). This is published in conjunction with straight-in minimums. From the sample format on the previous page, it will be noted that when an aircraft executing a straight-in ILS Runway 27 approach (all approach categories of aircraft have the same minimums) reaches the DH of 362 feet MSL, it is actually 200 feet above the highest runway (specifically, Runway 27) elevation in the touchdown zone. Therefore, the highest point in the first 3000 feet of Runway 27 is 162 feet.

It will be noted that in our sample format the published elevation of the airport (170 feet) and the highest runway elevation of the touchdown zone of Runway 27 (162 feet) are ***not*** the same.

Ceiling - Ceiling values, shown in parenthesis, are for the military pilot's use in accordance with the directives of each service. Ceiling values are stated in round hundreds of feet (e.g., 100, 200, 300, etc.) and are equal to or greater than the height of the MDA or DH above field elevation.

Ceiling values should be checked by the Navy pilot in the preflight phase of flight to determine if the airport's forecast weather meets CNAF M-3710.7 requirements for filing purposes to a destination (or an alternate).

Ceiling minimums are not prescribed by the FAA in TERPS procedure as a landing minimum. Controllers will allow approaches down to the prescribed MDA or DH without regard to the reported ceiling. The published visibility will be the limiting condition for landing; however, it should be stressed that CNAF M-3710.7 series still requires that ***ceiling and visibility*** be considered to determine whether or not the airport is above minimums.

Runway Visual Range (RVR) - RVR is an instrumentally derived value based on standard calibrations that represent 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 greatest visual range. RVR, in contrast to prevailing visibility, is based on what a pilot in a moving aircraft should see looking down the runway. RVR is horizontal, and not slant visual range. It is based on the measurement of a transmissometer made near the touchdown point of the instrument runway and will be shown in ***hundreds of feet***. (Example: 24 equals 2400 feet.)

The RVR value depicted immediately following the lowest altitude (DH, MDA) is of value to be used for determining if the field is above minimums for the type of approach contemplated. The visibility value shown in parenthesis is for military pilots to use for the type of approach contemplated when visibility values that follow the MDA/DH are not available.

It should be noted that the RVR values may be authorized for both precision and non-precision approaches when straight-in landing minimums to a specific runway are depicted. In other words, RVR values will ***not*** be specified in conjunction with circling landing minimums.

Prevailing Visibility - Prevailing Visibility is the greatest horizontal distance at which targets of known distance are visible over at least half of the horizon. Prevailing visibilities are used in conjunction with circling approaches and when RVR is not available. It is normally determined by an observer on or close to the ground viewing buildings or other similar objects during the day and ordinary city lights at night. Under low visibility conditions, the observations are usually made at the control tower. Prevailing visibility minimums will be shown in statute miles and fractions thereof. (Example: 1½ equals one and one-half miles.)

315. LANDING MINS [FAA INSTRUMENT PROCEDURES HANDBOOK, CH 4]

Instrument Approach Chart Naming Conventions

The name of the instrument approach procedure is located in the upper and lower right-hand corner of the FLIP Instrument Approach Plates. One method used to name instrument approach procedures in the FLIP Approach Plates is to identify the type of facility which provides the final approach course guidance and the runway with which the facility is aligned (e.g., ILS Rwy 18, LOC (BC) Rwy 7, TACAN Rwy 36, LOC Rwy 4, GPS Rwy 32R, NDB (ADF) Rwy 21, VOR Rwy 15, VOR/DME Rwy 6, VORTAC Rwy 36, etc.). When operational requirements necessitate that more than one procedure be published to serve the same runway, using the same navigational aid, the procedures shall be numbered as follows: TACAN 2 Rwy 18, or lettered TACAN Y Rwy 18 and TACAN Z Rwy 18.

Straight-In Landing Minimums

The above types of approach procedures will specify ***straight-in*** landing minimums (and possibly, circling landing minimums as well) on the approach plate. In other words, when a ***runway reference*** is included in the name of the approach procedure, you can expect to find straight-in landing minimums on the approach plate. It is not unusual to find two approaches depicted on one approach plate.

Straight-in landing minimums are shown on an instrument approach procedure chart when ***the final approach course*** of the instrument approach procedure ***is within 30º of the runway (15º for GPS approaches) alignment and a normal descent can be made*** from minimum altitude at the final approach fix (or VDP is shown) to the runway surface. When either the normal rate of descent or the runway alignment factor is exceeded, a straight-in landing minimum is not published, and only circling minimums will be provided. The fact that a straight-in landing minimum is not published does ***not*** preclude the pilot from landing straight-in if he has the active runway in sight in sufficient time to make a normal approach for landing. Under such circumstances, and when cleared for landing on that runway, he is not expected to circle, although only circling minimums are published.

NOTE

Do not confuse the term "straight-in ***approach***" with "straight-in ***landing minimums***." It is ***not*** necessarily true that because the pilot is cleared for a straight-in approach, he can descend to the straight-in landing minimum -- sometimes he will have to use the "circling" landing minimum, dependent upon several factors. As an example, controllers will include in the approach clearance instructions to circle to the runway in use ***if landing will be made on a runway other than that aligned with the direction of the instrument approach.***

Example: "CLEARED FOR STRAIGHT-IN VOR RUNWAY TWO TWO APPROACH, CIRCLE TO RUNWAY FOUR."

Note carefully, in the foregoing example, that the pilot is cleared for a straight-in approach, but he must use circling minimums. Conversely, it is possible to be cleared for an out-and-in procedure turn type of approach and descend to the straight-in landing minimums after passing the final approach fix.

Circling Landing Minimums

Whenever the criteria used to establish straight-in landing minimums cannot be met, only circling landing minimums will be shown on the chart. (Of course, many approach procedures depict both straight-in landing minimums and circling landing minimums.) When only circling minimums are possible, the method used to name the procedure is to identify the type of facility which provides final approach course guidance (runway reference is omitted). For example, TAC-A, TAC-B, NDB (ADF)-A, NDB (ADF)-B, etc. The first procedure shall be given the letter A, although there may be no intention to formulate additional "circling" approach procedures.

The circling landing minimums published on the instrument approach procedure chart provide adequate obstruction clearance - a minimum of 300 feet in the circling approach area (FAA Order 8260.3 TERPS) - and the pilot should not descend below the published MDA until the aircraft is in a position to make a descent for a normal landing. The "circling approach area" mentioned previously expands as the approach categories of aircraft go "up" from the letters "A" to "E.” The larger the "circling approach area,” the more likely that it will encompass a higher obstruction which will require a corresponding increase in circling minimums.

Maneuvering at the Circling Minimums

Sound judgment and knowledge of his and the aircraft's capabilities are the criteria for a pilot to determine the exact maneuver in each instance, since airport design and the aircraft position, altitude, and airspeed must all be considered. The following basic rules apply:

1. Maneuver the shortest path to the base or downwind leg, as appropriate, under minimum weather conditions. There is no restriction to passing over the airport or other runways. Advising the controller of your intentions is recommended.

2. Study the airport diagram and turn away from obstruction and/or high terrain.

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

If visual reference is lost while maneuvering at the circling minimums, the ***missed approach specified for that particular procedure shall be executed***.

Descent Below MDA (or DH)

Visual Descent Points (VDPs) are being incorporated in nonprecision approach procedures. The VDP is a defined point on the final approach course of a nonprecision approach procedure (straight-in landing) from which normal descent from the MDA to the runway touchdown point may be commenced, provided visual reference required by 14 CFR Section 91.175(c)(3) is established (as outlined below). The VDP will normally be identified by DME on VOR and LOC procedures and by along-track distance to the next waypoint for RNAV procedures. The VDP is identified on the profile view of the approach chart by the symbol **V**.

1. VDPs are intended to provide additional guidance where they are implemented. No special technique is required to fly a procedure with a VDP. The pilot should not descend below the MDA prior to reaching the VDP and acquiring the necessary visual reference.

2. Pilots not equipped to receive the VDP should fly the approach procedure as though no VDP had been provided.

FAR 91 specifically states that no person may operate aircraft below the prescribed minimum descent altitude (or continue an approach below the decision height) unless -

1. The aircraft is in a position from which a normal approach to the runway of intended landing can be made; and

2. The runway environment is clearly visible to the pilot. ("Runway environment" is defined as the runway approach threshold, or approach lights or other markings identifiable with the approach end of that runway.)

NOTE

> DH indicates to the pilot the published descent profile is flown to the DH (MSL), where a missed approach will be initiated if visual references for landing are not established. Obstacle clearance is provided to allow a momentary descent below DH while transitioning from the final approach to the missed approach. (**AIM 5-4 – 5.J.4**)

A visual segment obstruction evaluation is accomplished during procedure design on all IAPs. Obstacles (both lighted and unlighted) are allowed to penetrate the visual segment obstacle identification surfaces. Identified obstacle penetrations may cause restrictions to instrument approach operations which may include an increased approach visibility requirement, not publishing a VDP, and/or prohibiting night instrument operations to the runway. There is no implicit obstacle protection from the MDA/DH to the touchdown point. Accordingly, it is the responsibility of the pilot to visually acquire and avoid obstacles below the MDA/DH during transition to landing.

1. Unlighted obstacle penetrations may result in prohibiting night instrument operations to the runway. A chart note will be published in the pilot briefing strip “Procedure NA at Night.”

2. Use of a VGSI may be approved in lieu of obstruction lighting to restore night instrument operations to the runway. A chart note will be published in the pilot briefing strip “Straight-in Rwy XX at Night, operational VGSI required, remain on or above VGSI glidepath until threshold.”

The highest obstacle (man-made, terrain, or vegetation) will be charted on the planview of an IAP. Other obstacles may be charted in either the planview or the airport sketch based on distance from the runway and available chart space. The elevation of the charted obstacle will be shown to the nearest foot above mean sea level. Obstacles without a verified accuracy are indicated by a ± symbol following the elevation value.

Sidestep Maneuver

A visual maneuver accomplished by a pilot in the completion of an instrument approach to permit a straight-in landing on a parallel runway not more than 1200 feet to either side of the runway to which the instrument approach was conducted. Aircraft will be cleared for a specified non-precision approach and landing on the adjacent parallel runway. The sidestep should be commenced as soon as possible after the runway or runway environment is in sight.

Example: "CLEARED TACAN 7 LEFT APPROACH, SIDESTEP 7 RIGHT APPROACH."

A clearance for a side-step maneuver to a parallel runway will only be granted when authorized by the instrument approach procedure. The side-step minimums for the approach will be published as a separate line of minima on the instrument approach chart. An example clearance will be: "Cleared ILS Runway 27R, side-step to Runway to 27L." Side-step minima are always flown to a Minimum Descent Altitude.

CATEGORY	A	B	C	D
S-ILS 27R	1185/40 200 (200-¾)			
S-LOC 27R	1420/40 435 (400-¾)		1420/55 435 (400-1¼)	
SIDESTEP 27L	1420/55 421 (400-1¼)		1420-1½ 421 (400-1½)	

Figure 3-13 Sidestep Landing Minima Format

If you are cleared to "side-step" to a parallel runway without published side-step minima, you should query the controller.

316. COPTER ONLY APPROACHES [AIM 10-1-2]

Pilots flying Copter Standard Instrument Approach Procedures (SIAPs) should utilize the published minima consistent with other instrument procedures, however reductions in visibility is not allowed (regardless if flying at a civil or military airfield). Additionally, the maximum airspeed is 90 KIAS on any segment of the approach or missed approach, with the exception of GPS Copter SIAPs (CNAF M-3710.7) (Figure 3-14). Pilots flying GPS Copter SIAPs approaches at civilian fields must limit the speed to 90 KIAS on the initial and intermediate segment of the approach, and to no more than 70 KIAS on the final and missed approach segments (Figure 3-14). This does not apply to Copter GPS SIAPs at military fields. These approaches at military fields are designed to be flown at 90 KIAS or less.

The missed approach segment TERPS clearance criteria for all Copter approaches take advantage of the helicopter's climb capabilities at slow airspeeds, resulting in high climb gradients. The obstacle clearance surface (OCS) used to evaluate the missed approach is a 20:1 inclined plane. This surface is twice as steep for the helicopter as the OCS used to evaluate a fixed-wing missed-approach segment. The helicopter climb gradient is therefore required to be double that of the airplane's required missed approach climb gradient. A minimum climb gradient of at least ***400 feet per NM*** is required unless a higher gradient is published on the approach chart, e.g., a helicopter with a ground speed of 70 knots is required to climb at a rate of 467 feet per minute (FPM). The advantage of using the 20:1 OCS for the helicopter missed approach segment instead of the 40:1 OCS used for the airplane is that obstacles that penetrate the 40:1 missed approach segment may not have to be considered. The result is the DA/MDA may be lower for helicopters than for other aircraft. The minimum required climb gradient of 400 feet per NM for the helicopter in a missed approach will provide 96 feet of required obstacle clearance (ROC) for each NM of flight path.

Published Visual Flight Path (**AIM 5-4-5**)

In isolated cases, an IAP may contain a published visual flight path. These procedures are annotated "Fly Visual to Airport" or "Fly Visual." A dashed arrow indicating the visual flight path will be included in the profile and plan views with an approximate heading and distance to the end of the runway. In isolated cases, an IAP may contain a published visual flight path. These procedures are annotated "Fly Visual to Airport" or "Fly Visual." A dashed arrow indicating the visual flight path will be included in the profile and plan views with an approximate heading and distance to the end of the runway (Figure 3-15). This is not to be confused with Charted Visual Flight Procedures (CVFP) discussed below.

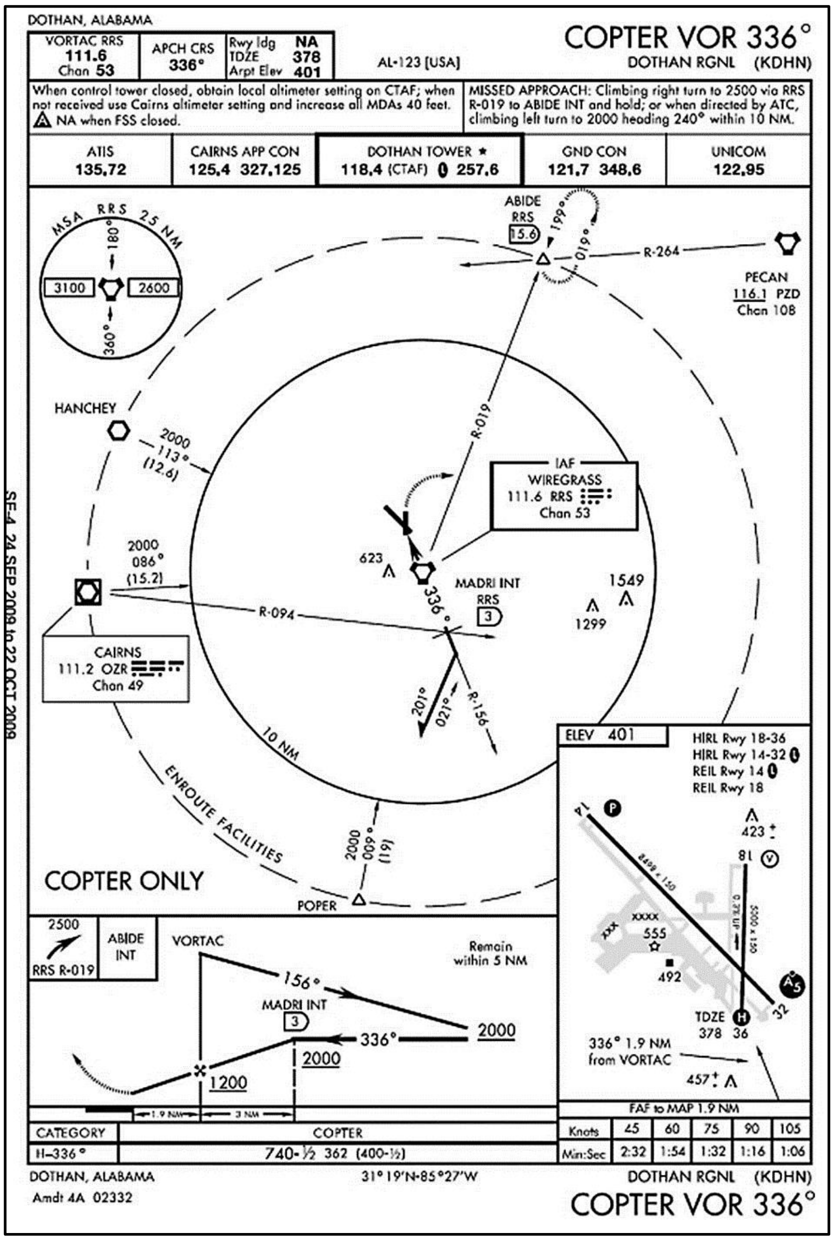


Figure 3-14 Copter Approach

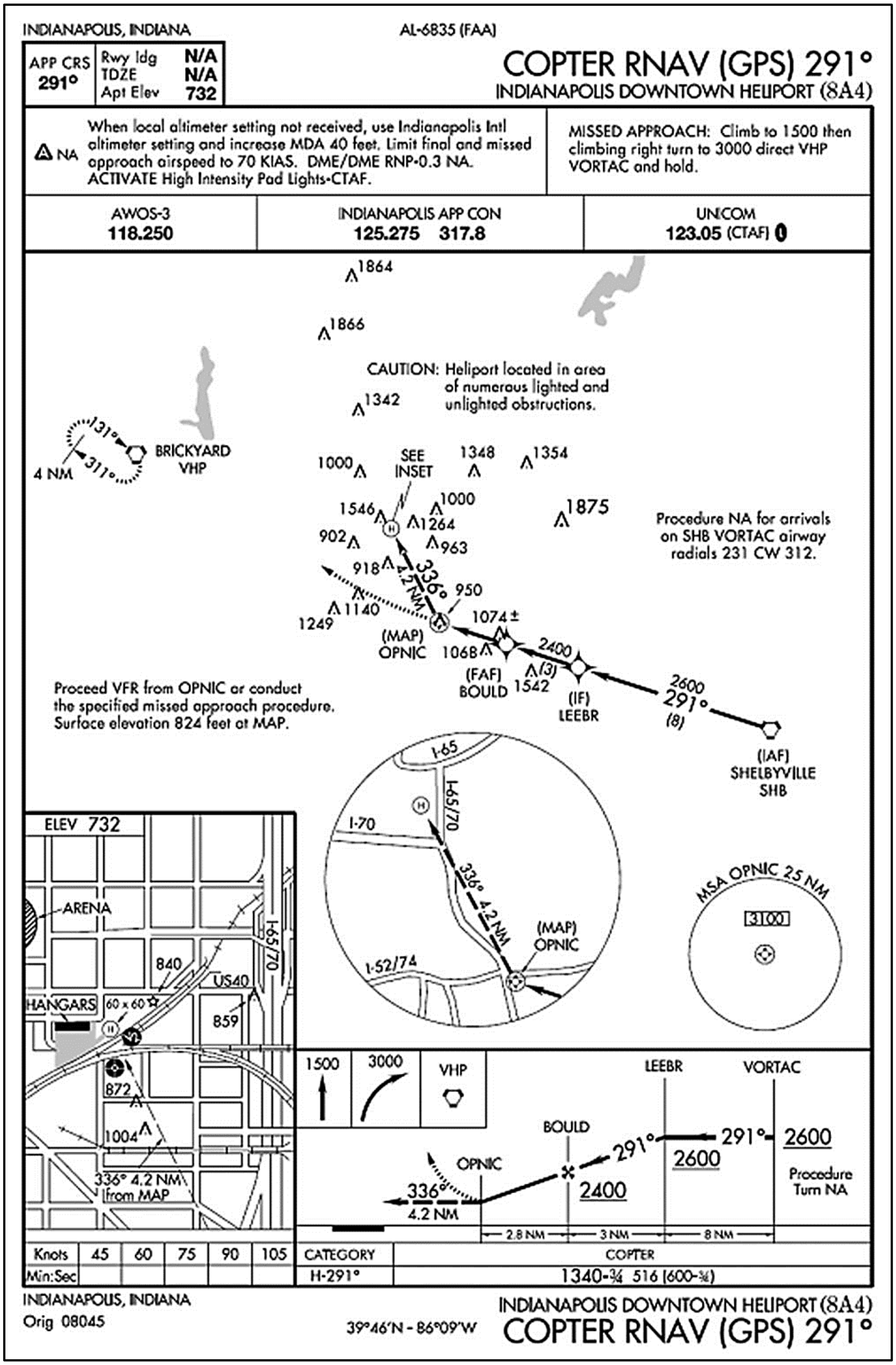


Figure 3-15 Copter RNAV Approach w/Visual Flight Path

317. VISUAL APPROACHES

Contact Approach [AIM 5-4-25]

A contact approach is defined as an approach wherein the pilot of an aircraft ***on an IFR flight plan***, having ATC authorization, operating clear of clouds with at least one mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, may deviate from the prescribed instrument approach procedure and proceed to the airport of destination by visual reference to the surface.

Example: "CLEARED FOR CONTACT APPROACH, MAINTAIN NOT ABOVE (altitude) (routing and/or reports as required), IF NOT POSSIBLE (alternate procedures) AND ADVISE."

In summary, controllers may authorize a contact approach to a pilot of an aircraft ***on an IFR flight plan*** provided:

1. The pilot so requests (ATC cannot initiate this approach).

2. The reported ground visibility at the destination airport is at least one statute mile for military aircraft.

3. The pilot can operate clear of clouds with at least one-mile flight visibility and a reasonable expectation of continuing to the destination airport in those conditions, and

4. Approved separation can be applied between aircraft so cleared and between those aircraft and other IFR/SVFR aircraft.

However, the pilot must realize that he assumes the responsibility for obstruction clearance by electing to abandon the safeguards which are guaranteed by compliance with a published instrument approach. This procedure is intended primarily as an alternative for a prescribed instrument approach procedure and pilots should use discretion in conducting a contact approach. It is ***not*** intended for:

1. use by a pilot on an IFR flight clearance to operate to an airport not having a published and functioning IAP.

2. an aircraft to conduct an instrument approach to on airport and then, when “in the clear,” discontinue that approach and proceed to another airport.

Visual Approach [AIM 5-4-24]

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

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.

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

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. Authorization to conduct a visual approach is an IFR authorization and does not alter IFR flight plan cancellation responsibility. Radar service is automatically terminated, without advising the pilot, when the aircraft is instructed to change to advisory frequency.

Charted Visual Flight Procedures [AIM 5-4-24]

Charted Visual Flight Procedures (CVFP) (Figure 3-16) 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. These procedures will be used only at airports with an operating control tower. Most approach charts will depict some NAVAID information which is for supplemental navigational guidance only. 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.

When landmarks used for navigation are not visible at night, the procedure will be annotated PROCEDURE NOT AUTHORIZED AT NIGHT. CVFPs usually begin within 20 flying miles from the airport. Published weather minimums for CVFPs are based on minimum vectoring altitudes rather than the recommended altitudes depicted on charts. CVFPs are not instrument approaches and do not have missed approach segments. ATC will not issue clearances for CVFPs when the weather is less than the published minimum. ATC will clear aircraft for a CVFP after the pilot reports siting 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. 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.

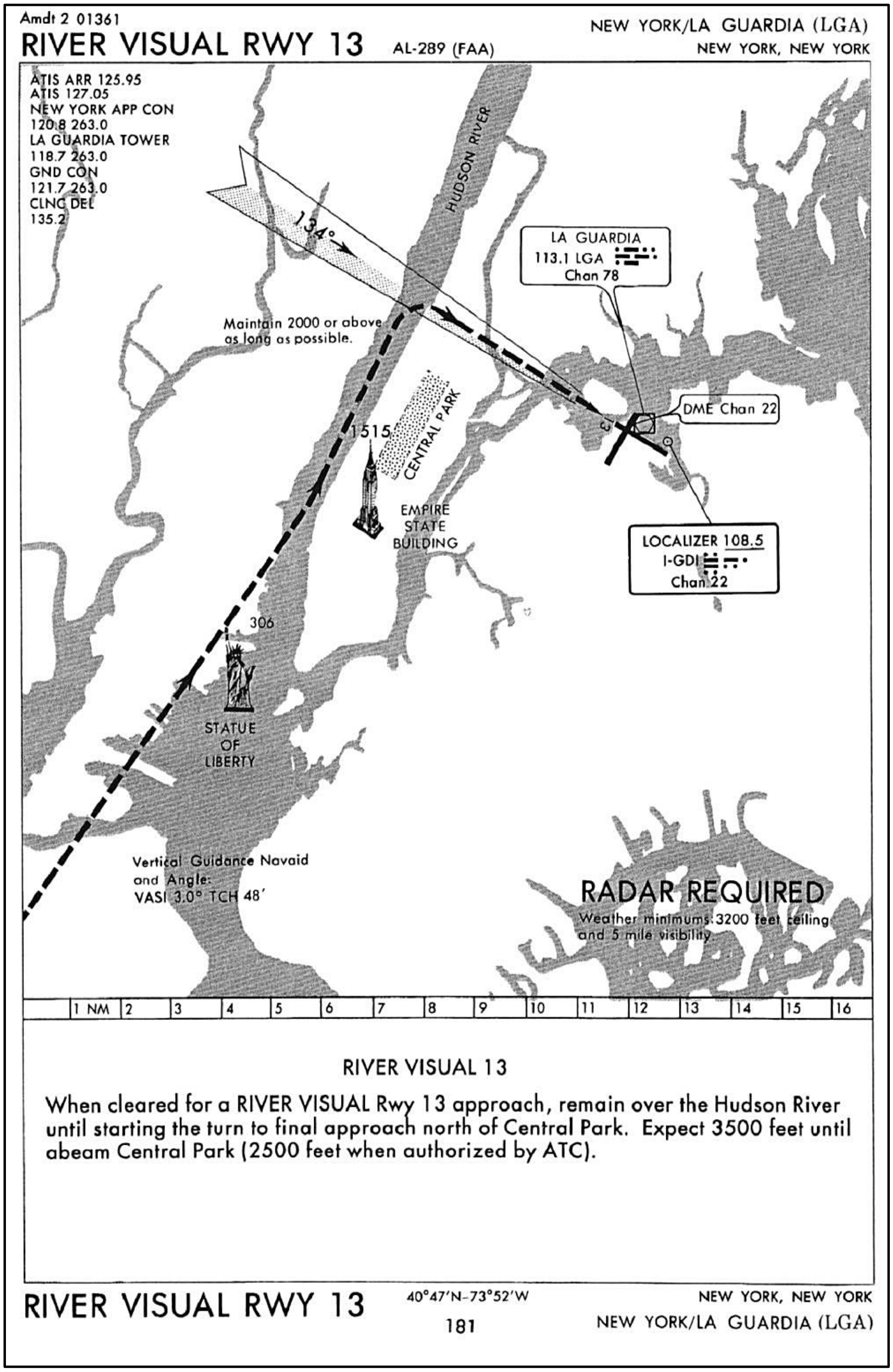


Figure 3-16 CVFP

318. MISSED APPROACH [AIM 5-4-21; 5-5-5]

When the required visual reference is not established upon reaching the missed-approach point, the pilot shall follow the prescribed missed-approach procedure (unless alternative missed-approach instructions have been issued) and obtain further clearance.

1. The pilot may request clearance for ***another approach***. Traffic permitting, an approach clearance may be issued immediately, or the flight may be required to hold until clearance for an approach can be issued.

2. The pilot may request a ***holding clearance*** to await improvement in the weather if the fuel remaining is sufficient and the weather trend indicates improvement.

3. The pilot may, at any time, request clearance to an ***alternate airport***.

Protected obstacle clearance areas for missed approach are predicated on the assumption that the missed approach is initiated at the decision altitude/height or at the missed approach point not lower than the MDA. Reasonable buffers are provided for normal maneuvers; however, no consideration is given to an abnormally early turn. Therefore, when an early missed approach is executed, pilots should, unless otherwise cleared, fly the lateral navigation path of the instrument approach procedure as specified on the approach plate to the missed approach point at or above the MDA ***before executing a turning maneuver***.

If visual reference is lost while circling to land from an instrument approach, the missed approach specified for that particular procedure must be followed (unless alternate missed approach instructions have been issued). To become established on the prescribed missed approach course, the pilot should make an initial climbing turn ***toward the landing runway*** and continue the turn until he is established on the missed approach course. Inasmuch as the circling maneuver may be accomplished in more than one direction, different patterns will be required to become established on the prescribed missed approach course, depending on the aircraft position at the time visual reference is lost. Adherence to the procedure will assure that an aircraft will remain within the circling and missed approach obstruction clearance areas.

319. TERMINATING INSTRUMENT FLIGHT

Many instrument flights terminate at airports where weather conditions are well above the instrument approach minimums. Consequently, it is often unnecessary, impractical, or even inadvisable to make a complete standard instrument approach; it is more likely, under these circumstances, that pilots will:

1. Cancel the IFR flight plan.

2. Request clearance for a CONTACT APPROACH.

3. Receive clearance for a VISUAL APPROACH.

After descending into VFR weather conditions, pilots often cancel their IFR flight plans because it may be beneficial to do so (especially at airports where no Approach Control is provided).

After canceling, the pilot is no longer required to complete the full standard instrument approach and may expedite landing by shortening the approach path. Also, canceling the IFR flight plan allows the pilot more freedom to maneuver his aircraft for sequencing with VFR traffic.

Retaining the IFR flight plan when operating in VFR weather conditions does ***not*** relieve the pilot of the responsibility of locating and avoiding other aircraft. Canceling an IFR flight plan is the pilot's prerogative. Controllers cannot disapprove such action. Recall that CNAF M-3710.7 requires all military flights use a flight plan.

This means you should file a VFR flight plan in the air, with the nearest flight service station, whenever you cancel your IFR clearance.

Canceling an IFR flight plan in the air ***does not*** relieve the pilot of the responsibility of ***closing out*** his flight plan after landing with the nearest FSS.

320. AIRPORT HOT SPOTS [FAA WEBSITE]

An airport "hot spot" is defined as "A location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary." Hot spots are designated on airfield diagrams as shown in Figure 3-17. Each DoD Terminal FLIP contains a list of designated hot spots as the last section of "Supplementary Enclosures" before the approach procedure charts begin. The FAA Airport Facility Directories contain a more descriptive listing of hot spot information and you can also find them online at or contact the airfield operations department or ground control for additional information. Failure to notice a hot spot could possibly result in an FAA pilot deviation report or worse!

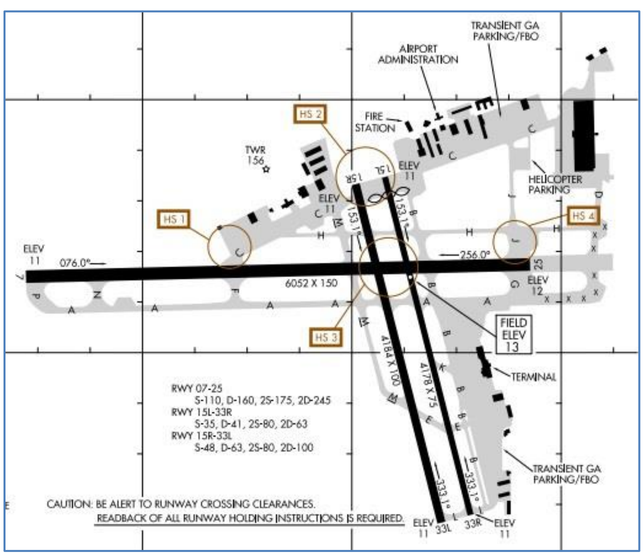


Figure 3-17 Airport Hot Spots

REVIEW QUESTIONS

1. The FLIP that depicts instrument approach procedures such as VOR or TACAN approaches is

   a. IFR Supplement.
   b. VFR Supplement.
   c. General Planning (GP).
   d. Instrument Approach Procedures.

2. Radar approach minima information is contained in

   a. IFR Supplement.
   b. VFR Supplement.
   c. General Planning (GP).
   d. Instrument Approach Procedures.

3. ILS approaches are depicted in

   a. Instrument Approach Procedures.
   b. IFR Supplement.
   c. VFR Supplement.
   d. Area Planning (AP).

4. An ATIS broadcast will include weather and visibility whenever the reported ceiling is below _______ feet and visibility is less than _______ miles

   a. 5000 5
   b. 4000 4
   c. 3000 3
   d. 1000 3

5. To relieve frequency congestion, pilots are expected to inform the controller of receipt of ATIS information.

   a. True b. False

6. An Approach Control can serve more than one airfield.

   a. True b. False

7. If Approach Control services are not provided at the destination airport, the controller will issue an approach clearance.

a. Tower
b. ARTCC
c. FSS
d. Ground Control

8. If Approach Control services are provided at the destination airport, the Center controller will issue a clearance to

a. Land.
b. Commence the approach and contact FSS.
c. Contact Approach Control.
d. Contact Tower.

9. Advance approach information will not be provided when ATIS is in operation.

a. True b. False

10. When the controller says, "CLEARED FOR APPROACH," the pilot may select any approach (VOR, GPS, TACAN, ILS, ADF) published for that location.

a. True b. False

11. Military pilots may ignore  on approach plates

a. True b. False

12. The pilot may leave a properly aligned holding pattern to intercept the final approach course, upon receipt of the approach clearance.

a. True b. False

13. When holding at an intersection fix from which straight-in approaches are being conducted, clearances will usually specify the time of departure from the fix (EFC).

a. True b. False

14. The holding pattern, to lose excessive initial approach course altitude, if none is depicted should be established on the approach course, making turns on the _____________ side of the approach course.

a. Holding Pattern
b. Procedure Turn
c. Final Approach Fix
d. Airfield

15. After radar vectors have established the aircraft inbound on the approach course, the pilot can expect a clearance for a straight-in approach.

a. True b. False

16. When the aircraft has been radar vectored to a final approach course, the pilot shall not execute a procedure turn.

a. True b. False

17. The term "Decision Height" applies only to precision approaches.

a. True b. False

18. In the minimum section of the approach plate, S-ILS-27 means

a. Precision approach to ILS, descend from 2700 feet.
b. Precision approach, straight-in landing to runway 27.
c. Non-precision straight-in to runway 27.
d. Precision straight-in to runway 9.

19. Visibility (RVR) minimums are always identical for precision and non-precision approaches.

a. True b. False

20. The published airport elevation is a measurement of

a. Tower height.
b. Lowest point of usable runway.
c. Highest point of usable runway.
d. Mean height of usable runway.

21. An RVR value of 40 depicted on a FLIP terminal plate represents

a. 400 feet.
b. 4000 feet.
c. 40 miles.
d. None of the above

22. When both an RVR value and a prevailing visibility value (in parenthesis) is shown, the one to be used for determining if the field is above the minimums for an approach to a straight-in landing is

a. RVR.
b. prevailing visibility.
c. either one.
d. Neither of these factors should be used.

23. Runway Visual Range is

a. Slant range.
b. Horizontal range.
c. Distance from threshold to point of intended touchdown.
d. Distance from which the runway is visible.

24. A Navy pilot of a multi-piloted aircraft may request and receive an approach clearance from a controller when the weather is below published minimums.

a. True b. False

25. FAA controllers are ***not*** required to inform Navy pilots that the weather is below approach minimums.

a. True b. False

26. After reported weather is below published landing minimums for the approach to be conducted, an approach shall not be commenced in multi-piloted aircraft unless

a. The FAA supervisor approves it.
b. The aircraft has the capability to proceed to alternate.
c. The Navy pilot specifically requests it.
d. There are no exceptions.

27. Whenever the criteria used to establish straight-in landing minimums cannot be met, only circling landing minimums will be shown on the chart.

a. True b. False

28. When only circling minimums are possible, the name of the approach procedures will not include a runway reference.

a. True b. False

29. When you are maneuvering at the circling minimums, you need ***not*** be in constant visual reference with the surface.

a. True b. False

30. When a runway reference is included in the name of an approach procedure, you can expect to find straight-in landing minimums on the approach plate.

a. True b. False

31. For straight-in landing minimums to be shown on the FLIP approach plate (for a non-GPS approach), the final approach course of the approach procedure must be within ___ degrees of the runway alignment

a. 15
b. 20
c. 25
d. 30

32. When cleared for a straight-in approach, you should always use straight-in landing minimums.

a. True b. False

33. When departing an airport with a  symbol, you as a military pilot are expected to comply with the takeoff weather minimums published in the IFR Takeoff Minimums Section of the Instrument Approach Procedures for the runway intended to be used.

a. True b. False

34. Circling landing minimums provide a minimum of ___ feet obstruction clearance in the "circling approach area."

a. 200
b. 300
c. 350
d. 400

35. Visual approaches are an IFR procedure conducted under IFR in visual meteorological conditions.

    a. True b. False

36. Controllers may clear an aircraft for a contact approach whether or not the pilot requests it.

    a. True b. False

37. In order to request a contact approach on an IFR flight plan, pilots must be clear of clouds and have _____________ flight visibility.

    a. 2000 feet
    b. 1 mile
    c. 1000 feet
    d. miles

38. A single-piloted aircraft may request a practice approach at his destination if the reported weather is above the approach minimums for the applicable approach(es) at that airport.

    a. True b. False

39. VFR Radar Traffic Advisory Services (radar flight following) is provided by who?

40. How long is your weather briefing good?

41. What flights require a weather briefing?

42. Who is responsible for closing your flight plan?

43. If you cancel your IFR flight plan in route, what must you do?

44. Who would you contact for a weather briefing if departing a civilian airfield where a military briefer is not locally available?

45. How could you file your flight plan at a civilian airport with no tower and the FSS not at the field?

46. With whom would you leave a copy of your clearance and manifest at a civilian airport?

47. If you don't close out your flight plan, what could happen?

48. What penalty could you receive if you don't close out your flight plan?

49. Which publication provides guidance for flight plan filing/submission?

50. According to CNAF M-3710.7 name one case in which you are not required to file a flight plan.

51. Name the five (5) items that constitute a flight plan as defined by CNAF M-3710.7.

52. Regardless of weather, VFR flight plans shall be filed and flown whenever practicable as a means to reduce midair collision potential?

a. True b. False

53. Charted Visual Flight Procedures (CVFPs) are charted ***visual*** approaches established for environmental/noise considerations, and/or when necessary for the safety and efficiency of air traffic operations.

a. True b. False

REVIEW ANSWERS

1.	d.	29.	b.
2.	d.	30.	a.
3.	a.	31.	d.
4.	a.	32.	b.
5.	a.	33.	b.
6.	a.	34.	b. U.S. Terminal Instrument Procedures (TERPS) criteria
7.	b.	35.	a.
8.	c.	36.	b.
9.	a.	37.	b.
10.	a.	38.	a.
11.	b.	39.	TRACON or ARTCC controllers (radar controllers) depending on whose airspace you are flying through.
12.	a.	40.	30 min after ETD or 3 hrs. after wx briefing time/FWB delivery time.
13.	a.	41.	All
14.	b.	42.	Pilot in command or formation leader
15.	a.	43.	file an IFR or VFR flight plan in the air to cover remainder of flight.
16.	a.	44.	FWB, 1-888-PILOTWX, FSS or USAF or USMC Weather Services
17.	a.	45.	Call FSS by phone or radio
18.	b.	46.	FSS (if located at airport)/airport manager (if unable to send by phone/website)
19.	b.	47.	ATC/FSS could launch SAR efforts
20.	c.	48.	Flight violation
21.	b.	49.	CNAF M-3710.7
22.	a.	50.	CNATRA Student training events; flights of operational necessity.
23.	b.	51.	DD-1801, Daily Flight Schedule, FAA Flight Plan, ICAO Flight Plan, flight plan specified by local authorities when departing from points outside CONUS
24.	a.	52.	b.
25.	a.	53.	a.
26.	b.		
27.	a.		
28.	a.		

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER FOUR
NAVIGATIONAL AIDS

400. INTRODUCTION

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

Practically all NAVAIDs transmit an identification signal, usually in Morse code; however, during periods of maintenance, the facility may radiate a T-E-S-T code (- ● ●●● -) or the code may be removed. Some VOR equipment decodes the identifier and displays it to the pilot for verification to charts. Certain NAVAIDs, namely, TACAN, ILS, localizers, and VORs.
The T-E-S-T code or the removal of the identifier to include the voice identifier, serves as a warning to pilots that the particular NAVAIDs have been officially taken over by "Maintenance" for tune up or repair and may be unreliable, even though on the air intermittently or constantly.

Except during shutdowns for maintenance purposes or unless otherwise noted in the FLIP-Enroute Supplement, all NAVAIDs operate continuously, e.g., 24 hours a day, 7 days a week, during VFR or IFR weather conditions.

A periodic check of the various NAVAIDs is conducted by FAA. If IFR conditions exist, a NOTAM may be issued advising that the NAVAID is shut down when undergoing maintenance. Therefore, pilots should check the NOTAMs before flight, regarding operation and use of the NAVAIDs.

The coded NOTAM messages can be decoded using the information found in Section F of the Flight Information Handbook.

Selected FSSs having voice capability on NAVAID frequencies, broadcast continuous automatic transcribed weather reports and other airway information such as current NOTAMs of NAVAIDs within 150 NM radius of the transmitting station. The "Radio Class Code" symbol AB denotes the transcribed weather broadcast and is found in the IFR Supplement. In each of the following examples of Radio Class Code symbols, transcribed weather broadcasts are transmitted on the NAVAID frequency: ABVOR, ABVORTAC, NDB (AB), etc.

Many NAVAIDs do not have voice capability. The Radio Class Code symbol **W** denotes unavailability of voice on the NAVAID frequency and is found in the FLIP Enroute Supplement. For example, MHW means that no voice is available on the low power NDB frequency. Certain NAVAIDs, such as TACANs and marker beacons, ***never*** have voice and although the Radio Class Code symbols do not include the letter W, it is understood that these NAVAIDs are always without voice. Voice capability indicates that the station is remotely linked to ATC for voice transmission. Not all TWEB/HIWAS capable stations have voice capability.

In the case of a VORTAC with transcribed weather broadcasts (ABVORTAC), the broadcast is transmitted on the VOR frequency only and ***not*** on the TACAN portion.

401. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

Upon completion of this chapter, the student will recall elements of the airways route system, GPS and techniques for the proper use of navigational aids, specifically the VOR, TACAN, VORTAC and GPS. To successfully complete the unit post test, the student should achieve a minimum score of 80%.

Enabling Objectives

In response to questions and examples given in the text, the student will do the following:

1. List the three fixed route systems established for air navigation purposes.

2. Define the Low Altitude Airways system and list its limitations.

3. List the limitations of NAVAIDs established by the "Radio Class Code."

4. List the navigational distance limitations in the low and high-altitude route structure.

5. State how VOR/TACAN NAVAID frequency interference has been eliminated.

6. State the means by which pilots are notified that NAVAIDs are out of service.

7. State the primary indication to a pilot when a NAVAID is unreliable for use.

8. List the two major components of the TACAN system.

9. List the advantages of the TACAN system.

10. List the limitations of the TACAN system.

11. State how the frequencies of a TACAN station are identified.

12. State the indications of the #2 needle (KLN-900 GPS equipped aircraft), or the #1 needle (GTN-650 equipped aircraft), when the RMI malfunctions.

13. State the components of a VORTAC station.

14. State the information received from a VORTAC.

15. State how a VORTAC station is identified.

16. State the difference between a VORTAC station and a VOR/DME station.

17. State the meaning of the acronym TACAN.

18. State the number of X-band and Y-band TACAN channels.

19. State the normal anticipated interference-free reception range of a TACAN.

20. Describe the TACAN cone of confusion.

21. State the methods and procedures for VOR and TACAN receiver checks.

402. AIRWAYS AND ROUTE SYSTEM

Three fixed route systems are established for air navigation purposes. They are:

1. ***The VOR and L/MF 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.

2. ***Jet Route System*** consists of jet routes established from Flight Level 180, to FL 450, inclusive. (Flight Levels are expressed in three-digit numbers representing hundreds of feet).

3. ***Area Navigation (RNAV) Routes.*** Published RNAV routes, including Q-Routes and T-Routes, can be flight planned for use by aircraft with RNAV capability. Q-Routes are available between 18,000 feet MSL and FL 450 inclusive. T-Routes are available between 1,200 feet above the surface up to but not including 18,000 feet MSL (some instances higher).

In the early stages of system development, all VORs were assigned different frequencies. As more VORs (and VORTACs) were added to the system an interference problem developed, as the same frequency had to be assigned to more than one NAVAID. For example, as many as 20 VORs use the same frequency. The interference problem was only partly solved by ensuring that those NAVAIDs assigned the same frequency were spaced far apart. The airway system is line- of-sight and aircraft at high altitudes could still experience frequency interference - the stronger of the two signals would take over and it could result in the pilot following the wrong signal. The interference problem was completely eliminated by establishing an operational limitation directive (a maximum distance up to the certain altitude) for navigational guidance on a NAVAID (Figure 4-1).

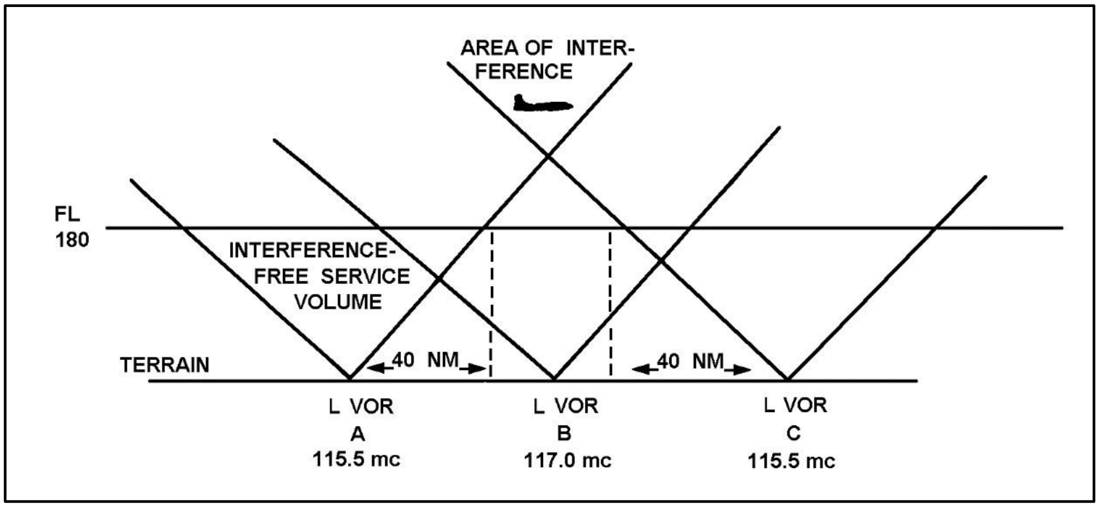


Figure 4-1 NAVAID

For the low-altitude structure, the operational limitations established are 40 nautical miles (NM) from the station up to FL 180, which provide interference-free service. These NAVAIDs are given a Radio Class designation L, which indicates the operational limitations free from another NAVAIDs interference. In Figure 4-1, although stations A and C are using the same frequency, aircraft flying in the low-altitude structure will not experience frequency interference.

Jet routes are supported by NAVAIDs classed as HA, which allow navigational guidance up to FL 450 to a distance of 130 NM from the NAVAID. Both classes of NAVAIDs, L and HA, have the same power and equipment and can be used at higher altitudes by aircraft closer to the NAVAID. Use of these facilities outside the service volume is not intended and may result in undependable or unreliable indications in the aircraft; however, all published routes and instrument approach procedures are frequency-protected, i.e., if pilots follow proper enroute procedures, they will not experience frequency interference.

Another class of NAVAIDs, (T), which are not used in the airway route system, are installed for departure and arrival procedures. (T) NAVAIDs are protected from interference for 25 NM up to 12,000 feet MSL.

When specifying a route other than an established airway, pilots should not plan to exceed the operational limitations imposed on the various NAVAIDs because of the interference problem which may be encountered.

From surface to 18,000’ MSL - FAR prescribe that altitude shall be in feet ***above*** sea level (QNH). Accordingly, the current reported altimeter setting of a station along the route and within 100 nautical miles of the aircraft shall be used. (GP 3-63) The pilot is not expected to compensate for temperature or pressure variances from the normal gradients.

When in the enroute phase of flight, pilots are not required to read back altimeter settings; however, pilots shall read back all altimeter settings received from approach control agencies when in the terminal phase of flight (during instrument approaches, arriving or departing holding fixes, etc.). (Exception: When under the control of the final controller on a GCA approach and the pilot has been released from further transmission requirements.)

Low-Altitude Airway System

The low-altitude airways extend from a "floor" of 1200 feet above the surface (except where designated at higher altitudes) up to, but not including, 18,000 feet MSL. The normal NAVAID spacing is 80 nautical miles (NM). The airspace area has a width of 8 NM, 4 NM each side of centerline, within 51 NM of the facility. Beyond 51 NM, the airways expand approximately 2 NM in total width every 13 NM. Additional airspace will be protected for aircraft executing turns at high airspeeds or when the airway course changes by 15° or more.

Aircraft will fly the centerline of the airway when operating IFR.

The low-altitude airways are predicated solely on VOR/VORTAC NAVAIDs and are depicted on aeronautical charts by a "V" (Victor) followed by the airway number, e.g., V20. These airways are numbered similarly to U.S. highways; airways which generally run east and west have even numbers. As in the highway numbering system, 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, a pilot in filing a flight plan needs to indicate only that airway number of the route which he plans to use.

Area Navigation (RNAV) Routes

Published RNAV routes, (T-routes (low altitude) and Q-routes (high altitude)), are depicted in blue and can be flight planned for use by aircraft with RNAV capability, subject to any limitations or requirements noted on enroute charts or by NOTAM.

403. VORS AND TACANS

The FAA operates VOR, VOR/DME, and VORTAC stations, plus DMEs collocated with NDBs. Federal agencies, states, local governments, and private entities own those not operated by the FAA. Additionally, the DOD operates its own VOR, VOR/DME, VORTAC stations, located predominately on military installations on the U.S. and overseas, which are available to all users. TACAN is a tactical air navigation system for the military services ashore, afloat, and airborne. It is the military counterpart of civil VOR/DME. TACAN provides bearing and distance information through collocated azimuth and DME antennas. TACAN is primarily collocated with the civil VOR stations (VORTAC facilities) to enable military aircraft to operate in the NAS and to provide DME information to civil users. The FAA and DOD currently operate a number of “stand-alone” TACAN stations in support of military flight operations within the NAS.

As flight procedures and route structure based on VORs are gradually being replaced with Performance-Based Navigation (PBN) procedures, the FAA is removing selected VORs from service. The reduction will transition from today’s VOR services to a Minimum Operational Network (MON). The VOR MON has been retained principally for IFR aircraft that are not equipped with DME/DME avionics; however, VFR aircraft may use the MON as desired. The

VOR MON will ensure that regardless of an aircraft's position in the contiguous United States (CONUS), a MON airport (equipped with legacy ILS or VOR approaches) will be within 100 nautical miles. These airports are referred to as "MON airports" and will have an ILS approach or a VOR approach if an ILS is not available. VORs to support these approaches will be retained in the VOR MON.

VHF Omnidirectional Range (VOR)

VOR was developed in the late 1940s to meet the demand for a reliable NAVAID in the growing world of civilian aviation. The transmission principle of the VOR is based upon the creation of a phase difference between two signals (Figure 4-2). One signal, the reference phase, is omnidirectional and radiates from the station in a circular pattern. The phase of this signal is constant throughout 360°. The other signal, the variable phase, rotating at 1800 rpm, causes its phase to vary at a constant rate. Magnetic north is used as the baseline for electronically measuring the phase relationships. At magnetic north, the signals are exactly in phase. A phase difference exists at any other point around the station. The aircraft receiver measures this difference and displays it on the RMI and CDI (or HSI). The VOR frequency range is 108.0 to 117.95 MHz. This range overlaps the VHF communications frequency band, therefore, the VOR receiver may be used as a secondary VHF communication receiver.

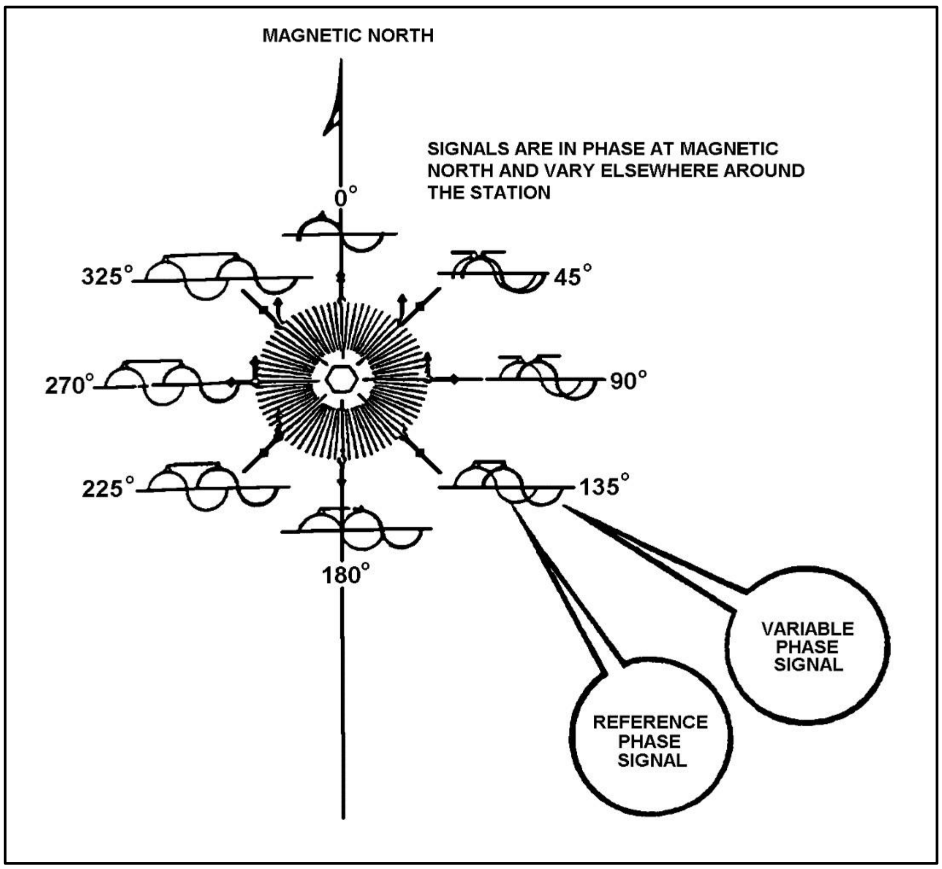


Figure 4-2 Phase Difference Between Two Signals

With the rapid increase in the late 1940s and early 1950s of civilian air traffic, a system was needed to help air traffic controllers maintain enroute air traffic separation. "Highways in the sky" or Victor Airways were created to ensure air traffic followed specific routes as opposed to haphazard, random routing. This system of Victor Airways was, and still is, predicated on VOR radials.

The TACAN channel at a VORTAC is paired to the VOR frequency; therefore, when a TH-57C pilot selects a VOR frequency at a VORTAC station using NAV-1, he will receive VOR radial information and distance, groundspeed, and time-to-station information if NAV-1 is selected on the KDI-572. Should the pilot change the NAV-1 mode from VOR to TAC, further "tuning" of the TACAN is not required. The frequency (FRQ) readout on the NAV-1 would show the paired TACAN channel. If a pilot is using a VOR/DME station to navigate, and switches to TAC mode on the NAV-1, there will be no radial information available and the FRQ display will be dashed. While in the VOR mode, the radial and distance displays on the NAV-1 will be blank. If the pilot depresses the CHK button on the NAV-1, radial and distance from the station will be displayed if using a VOR/DME or VORTAC station.

TACAN

TACAN was developed in the early 1950s to meet the military requirement for a portable aircraft navigation system for tactical use. It is considered superior to the VOR system in that it provides distance information in addition to bearing. The TACAN system enables the pilot to fix his position over the ground through the use of only one NAVAID. TACAN operates in the UHF range of 962-1213 MHz. All TACAN stations are assigned a channel that corresponds to a specific UHF frequency. There are 126 "X-band" channels currently in use in the TACAN system and 126 "Y-band" channels available for future use. To determine the TACAN channel of a NAVAID, consult appropriate FLIP publications.

The TACAN system provides the pilot with relative bearing and slant-range distance information with respect to selected TACAN or VORTAC ground station. The effective range of TACAN is limited to line of sight. Actual operating range depends on the altitude of the aircraft, weather, type of terrain, location and elevation of the ground transmitter and the transmitter power. The ground equipment provides radial information with two special rotating antennae, which rotate around a central, stationary antenna at 15 cps (revolutions or cycles per second). One main reference pulse and 8 auxiliary pulses occur on each cycle; therefore, a reference pulse occurs each 40° of rotation. The electronic equipment electronically measures the time lapse between the main reference pulse and the maximum signal strength of the rotating signal pattern. This determines the aircraft's bearing from the station within a 40-degree sector. Then, the time lapse between the auxiliary pulses and the maximum signal strength of the combined inner and outer antennae rotation of 135 cps is measured to determine the aircraft's position within the 40-degree sector.

Bearing information is accurate to plus or minus 1° of the designated radial and distance information is accurate to within one-half mile or 3% of the distance to the facility, whichever is greater. This means that at about 100 miles from the transmitter, you can be sure of your position within 2 miles either side of the indicated bearing and within 3 miles of the distance reading.

Distance is determined with TACAN equipment by measuring the elapsed time between transmission of interrogating pulses of the airborne set and reception of corresponding reply pulses of the ground station. The aircraft transmitter starts the process by sending out the interrogation pulses on an irregular, random basis. The ground station receiver then triggers its transmitter, which sends out the distance reply pulses in the same pattern in which they were received. This allows several aircraft to interrogate a station simultaneously. The aircraft equipment essentially divides the number of microseconds it took for an interrogation pulse to travel round trip by 12 to give distance from the station in nautical miles. Reliable signals may be received at distances up to 199 NM at line-of-sight altitude. When equipped, further processing of this information by the aircraft's equipment can produce groundspeed and time-to- station information for display to the pilot.

A "cone of confusion" up to 100° wide exists above the TACAN station, and in this cone no bearing information will be received. However, the identifier signal and distance information will continue to be received in the "cone." Although narrow at low altitudes, this "cone" expands to about 15 miles across at 40,000 feet and requires that holding patterns be located some distance from the station.

The station identifies itself about every 35 seconds with a three-letter identifier in Morse Code. It will be remembered that TACAN stations are without voice on the NAVAID frequency.

TACAN stations cannot provide scheduled weather broadcasts. TACAN installations are usually found only on military airports; however, many civilian fields have VORTAC stations.

When the compass card is known or suspected to be malfunctioning, the selected TACAN needle must be considered unreliable until verified by other means. In this situation, the TACAN needle will ***not*** point toward the TACAN facility (relative bearing) but ***may*** still indicate proper magnetic bearing information. The TACAN needle will provide bearing information in relation to the compass card, not the aircraft's heading. Additional information regarding the TACAN may be found in Appendix B.

VORTAC

The FAA has been in the process of integrating TACAN facilities with VOR facilities. These integrated facilities are called VORTACs. VORTAC, therefore, consists of two coaxially collocated components, VOR and TACAN, which provide three individual services: VOR azimuth on VHF (108.0 - 117.95 MHz), TACAN azimuth and TACAN distance (DME) on UHF TACAN channels. 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 NAVAID. Both components of a VORTAC can be envisioned as operating simultaneously and providing the three services at all times.

When tuned to a VORTAC, aircraft equipped with TACAN equipment only will receive TACAN bearing information, TACAN distance information, and the station identifier about every 35 seconds.

When tuned to a VORTAC, aircraft equipped with VOR equipment will only receive VOR bearing information and the station identifier signal, received simultaneously.

When tuned to a VORTAC, aircraft equipped with ***both*** VOR and TACAN equipment will receive both TACAN and VOR bearing information (readings should be about the same) as well as TACAN distance information and the station identifier signal (received continuously if monitoring the VOR receiver, etc.).

Some civil aircraft are equipped with a separate DME airborne unit as well as a VOR receiver. In this situation, when tuned to a VORTAC, the aircraft will receive VOR bearing information, TACAN distance information, and the station identifier signal (received continuously if monitoring the VOR receiver, etc.).

Concerning a VORTAC, the transmitted signals of VOR and TACAN are each identified by a 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 code for the VOR is transmitted continuously, except that about each half-minute, the VOR identification is omitted to allow an identification of the TACAN signal. A supplementary automatic voice identification has been added to the ***VOR*** portion of many VORTACs. An example of a combination code and voice identifier is as follows:

115.9 CEW = "— • — • • • — — CRESTVIEW VORTAC"

A limited number of VOR/DME facilities are included in the federal airway system. It should be recognized that a VOR/DME facility is ***not*** quite the same as a VORTAC facility. A VOR/DME facility is simply a VOR component collocated with a DME TRANSPONDER; however, the identifier signals are synchronized on timeshare basis as with VORTAC facilities.

When tuned to a VOR/DME, aircraft equipped with TACAN equipment will receive TACAN distance information and the station identifier (about every 35 seconds).

When tuned to a VOR/DME, aircraft equipped with only VOR equipment (no DME unit) will receive VOR bearing information and the station identifier.

Continuous automatic transcribed weather broadcasts and other information may be available on the VOR frequency of a VORTAC. Remember that voice is ***not*** available on TACAN frequency; therefore, after once identifying the TACAN signal of a VORTAC, pilots of aircraft using both VOR and TACAN should monitor the VOR frequency and not the TACAN frequency. When flying on an IFR flight plan, the pilot can make his job safer and much easier through the proper selection and setup of his navigation radios. He must ensure the NAVAIDs have been identified and are receiving accurate information. When flying on airways, the pilot should tune the next station on his VOR/TACAN receiver at the halfway point between the NAVAIDs that define the airway or at the designated changeover point as found on the low altitude charts. Otherwise, he may stray off the airway. The following chapters will deal with specific navigation systems.

404. NAVIGATION RECEIVER CHECKS

To meet requirements for VOR equipment accuracy checks before flight under IFR conditions and to ensure satisfactory operation of the airborne system, the FAA has provided pilots with the following means of checking VOR receiver accuracy:

1. VOR test facilities (VOTs).

2. Certified airborne checkpoints.

3. Certified checkpoints on the airport surface.

A safe practice is to make an operational accuracy check before each IFR flight. An operational check consists of:

1. An accuracy check of the CDI and HSI course deviation bar and RMI needles.

2. A check to ensure proper sensing of the TO/FROM indicator.

3. A check to ensure 10° CDI/HSI deviation needle swing from center to each side.

VOT

FAA VOR test facilities (VOTs) transmit test signals which provide users a convenient means to determine the operational status and accuracy of a VOR receiver on the ground where a VOT is located. VOT facilities are identified in the IFR Enroute Supplement Airport/Facility Directory in the NAVAIDs section.

To use the VOT, tune in the VOT frequency on your VOR receiver and identify it. VOT signals are identified by either a continuous series of dots or a continuous 1020 Hz tone. Rotate the HSI and CDI pointers to 0°. The HSI and CDI course deviation bars should center, and the TO/FROM indicator should show "FROM." The RMI needle for the selected NAV receiver will indicate 180° on any OBS setting. The maximum permissible bearing error is 4°.

Certified Airborne and Ground Checkpoints

Ground checkpoints are available in airport operations offices and are identified in the NOAA Airport/Facility Directory. Airborne checkpoints are published in the AP/1. They consist of certified radials received at specific points on the airport surface or over specific landmarks while airborne in the immediate vicinity of the airport.

Should an error in excess of ± 4° be indicated through use of a ground check, or ± 6° using the airborne check, IFR flight should not be attempted.

Dual System Checks

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

In-Flight Systems Check

If no check signal or point is available, VOR receivers may be checked using the following procedures:

1. Select a VOR radial that lies along the centerline of an established VOR airway.

2. Select a prominent ground point depicted along the selected radial, preferably more than 20 miles from the VOR ground facility and maneuver the aircraft directly over the point at a reasonably low altitude.

3. Note the VOR bearing indicated by the receiver when over the ground point.

The maximum permissible variation between the published radial and the indicated bearing is 6°.

For TACAN receivers, military bases normally designate a specific ground point for checking their accuracy. The tolerances are similar to the VOR: within ±4° of the designated radial and within one-half mile or 3 % of the distance to the facility, whichever is greater.

REVIEW QUESTIONS

1. When a pilot is unable to receive the identifier (either code or voice) from a NAVAID, he/she can assume:

   a. Normal VOR operations if his instruments are reacting normally to the signal.
   b. Normal VOR operations unless the alarm flag is showing on his deviation indicator.
   c. Abnormal VOR operation -- a warning that the signal may be unreliable.
   d. That the Flight Service Station is transmitting voice on UHF frequency.

2. A station classed as a BVORTAC means that scheduled weather broadcasts are made on both the VOR and TACAN portions of the VORTAC.

   a. True b. False

3. A station classed as VORTACW means that no voice is available on the VOR portion of the VORTAC.

   a. True b. False

4. NAVAIDs are normally operated only when weather conditions are less than VFR.

   a. True b. False

5. The "floor" of a low-altitude airway is usually 1200 feet above the surface.

   a. True b. False

6. Low-altitude airways extend up to, but do not include 18,000 feet MSL.

   a. True b. False

7. Jet airways extend from Flight Level 180 to Flight Level 450.

   a. True b. False

8. Jet airways are supported by NAVAIDs classed as L such as L VORTAC.

   a. True b. False

9. While in the enroute phase of flight, pilots are required to read back all altimeter settings.

   a. True b. False

10. While in the terminal phase of flight, pilots are ***not*** required to read altimeter settings received from Approach Control.

a. True b. False

11. Use of a NAVAID outside the intended service (volume) may result in unreliable indications in the aircraft.

a. True b. False

12. An NDB classed as MH has a greater power output than an NDB classed as H.

a. True b. False

13. The operational limitations established on an L VORTAC are 40 NM up to FL180.

a. True b. False

14. A pilot is proceeding on airways from "A" to "B." He should tune the next station, "B," on his VOR receiver

a. immediately after passing "A."
b. as soon as the alarm flag on his deviation indicator comes into view (receiver tuned to "A").
c. anywhere between "A" and "B."
d. at the VOR/VORTAC changeover symbol; if one is not indicated, at the halfway point between "A" and "B."

15. A radial is defined as a

a. true course from a TACAN/VOR.
b. true course to a TACAN/VOR.
c. magnetic bearing from a TACAN/VOR.
d. magnetic course to a TACAN/VOR.

16. TACAN stations transmit a three-letter identifier in Morse code approximately once every

a. two minutes.
b. 35 seconds.
c. 15 seconds.
d. few seconds (continuously).

17. Assuming that an aircraft has ample altitude and an unobstructed line-of-sight to a TACAN station, the maximum range for DME is how many miles?

a. 95
b. 155
c. 199
d. 295

18. When an aircraft is within the TACAN cone of confusion, which of the following is FALSE?

a. Bearing information will be received.
b. Distance information will be received.
c. The identifier signal will be received.
d. Both the identifier signal and distance information will be received.

19. TACAN installations are usually located on civil airports rather than military airports.

a. True b. False

20. When directly over a TACAN station at all altitudes, the DME should read "ZERO."

a. True b. False

21. To receive a DME reading, the airborne equipment must be transmitting.

a. True b. False

22. TACAN stations do NOT provide scheduled weather broadcasts.

a. True b. False

23. TACAN holding patterns are located some distance from the station because of the wide "cone of confusion."

a. True b. False

24. The scheduled weather broadcast, if available, is made on both the VOR and TACAN portions of a VORTAC.

a. True b. False

25. The identifier signal for the TACAN portion of a VORTAC is continuously transmitted.

a. True b. False

26. Which of the following may be received from a VORTAC station by an aircraft equipped with both VOR and TACAN equipment?

a. TACAN bearing, DME, VOR bearing
b. DME only
c. VOR bearing, DME only
d. DME, VOR bearing only

27. Which of the following services may be received from a VORTAC station by an aircraft equipped with TACAN equipment only?

a. TACAN bearing
b. HIWAS
c. Transcribed weather brief
d. VOR bearing

28. Which of the following services may be received from a VOR/DME installation by an aircraft equipped with TACAN equipment only?

a. TACAN bearing
b. DME
c. VOR bearing
d. VOR course

29. VOR stands for ____.

30. The frequency range of the VOR is ______to ________ MHz.

31. The low altitude airway system is based upon _________ radials.

32. Maximum error for a certified VOR ground check is plus or minus ________ degrees, and plus or minus ______ degrees for an airborne check.

REVIEW ANSWERS

1. c.
2. b.
3. a.
4. b.
5. a.
6. a.
7. a.
8. b.
9. b.
10. b. AP-1 pg. 3-63 8.d
11. a.
12. b.
13. a.
14. d.
15. c.
16. b.
17. c.
18. a.
19. b.
20. b.
21. a.
22. a.
23. a.
24. b.
25. b.
26. a.
27. a.
28. b.
29. VHF OMNI-DIRECTIONAL RANGE
30. 108.0 - 117.95
31. VOR
32. 4, 6

CHAPTER FIVE
TACAN AND VOR NAVIGATION

500. INTRODUCTION

Tactical Air Navigation (TACAN) is used for airways Flight and Instrument approaches and for tactical control of aircraft. TACAN is a navigational aid which provides azimuth and slant range distance (DME) information to the pilot, enabling precise fixing of geographical position at all times. TACAN stations operate in the UHF range (962 to 1213 MHz), are selected by dialing one of 126 "X" or "Y" channels and are identified by an aural Morse Code repeating every 35 seconds. As with VOR, reception range is limited by line of sight.

The VHF Omni-Directional Range (VOR) is a navigation system which operates in the VHF frequency range (108.00 to 117.95 MHz). VOR course information is not affected by lightning or other types of severe weather; however, reception is limited by line of sight. Normal reception range is 40–45 NM at 1000 feet AGL and increases with altitude. VOR provides azimuth information only, with accuracy being generally plus or minus 1º.

Most airways in the United States are defined by combination VOR and TACAN stations (VORTAC), which provide VOR and TACAN azimuth and TACAN distance (DME) at one site. The VOR portion of the facility is identified by a coded tone modulated at 1020 MHz or a combination of tone and voice. The TACAN is identified by a coded tone modulated at 1350 MHz, transmitted one time for each three or four times that the VOR is transmitted. DME furnishes reliable, line of sight, SLANT RANGE information at distances up to 199 NM with an accuracy of ½ mile or 3% of the distance, whichever is greater.

501. LESSON TOPIC LEARNING OBJECTIVES

Upon completion of this chapter, the student will interpret the functions of the TACAN and VOR Navigation by solving given problems and answering related questions on the post test with a minimum score of 80%.

Enabling Objectives

1. Identify the TACAN/VOR equipment installed in the TH-57C.

2. State the function of the KNI-582 as it applies to TACAN navigation.

3. Describe the Distance Measuring displays installed in the TH-57C.

4. List the steps to tune a TACAN/VOR channel on the NAV-1 navigation equipment.

5. Define the term "slant range."

6. State the TACAN arcing procedures.

7. Transcribe TACAN holding patterns from ATC holding instructions.

8. Solve holding entry procedures for TACAN holding.

9. Compute TACAN point-to-point direct courses using the KNI-582 RMI or CR-2 computer.

502. VOR - TACAN (KNS-81) PROCEDURES AND OPERATING INSTRUCTIONS

Navigation and NAVAIDS System in the TH-57C

The Navigation and NAVAIDS System consists of a NAV 1 and NAV 2 system, ADF system, Marker Beacon system, DME system, DME/TACAN system, GPS, and a Transponder and Altitude Encoder system. This system is coupled with the Compass/Heading system and Audio/ICS system.

The primary TH-57C navigation receivers are the KNS-81 and the GTN-650. Using the mode selector on the KNS-81, the pilot can select either VOR, VOR/RNV, VOR/RNV APR or TAC, TAC/RNV, TAC/RNV APR. In the VOR mode, the HSI displays conventional cross track deviation information of +10°. In the VOR/RNV mode the HSI/CDI displays constant course width information with a full-scale deflection of +5 NM. In this mode, a DME "unlock" will cause an HSI/CDI flag. The VOR mode must be used for an approach since the resolution of an off-course indication increase with decreasing distance to the station in standard VOR but remains a constant in VOR/RNV mode. The VOR/RNV mode would be used when flying waypoints to ensure the aircraft is kept within 5 NM of the simulated airway. The VOR/RNV APR mode would be used for an RNV approach using VOR waypoints. The sensitivity in this mode is +1.25 NM/needle (CDI/HSI) deflection.

It should be noted that, since the TH-57C is also equipped with an ADF and there are only two pointers on the RMIs, use of the ADF/VOR mode selector(s) on the RMI is required. For example, if the pilot selected an ADF station on the KR- 87 (ADF) and a VOR station on the KNS-81, he may want to select VOR on the double needle and ADF on the single needle, using the mode selector on the RMI to do so.

The NAV system is a VOR/LOC system, and a single TACAN system consisting of one KNS-81 receiver, a KDI-206 course deviation indicator (CDI), a KDI-525A horizontal situation indicator (HSI), and associated antennas. One KNS-81 receiver is installed in the radio console. (The KNS-81 consists of a VOR/Localizer receiver, an RNAV computer and a glideslope receiver, and control function for the KTU-709 TACAN is in a single unit. When combined with the CDI or HSI and DME Indicator the unit becomes a complete navigation system featuring three modes of VOR or TACAN OPERATION (VOR, VOR RNV, VOR RNV APR, TAC, TAC RNV, TAC RNV APR) and ILS. The unit also simultaneously displays waypoint parameters of frequency, radial and distance plus one of the ten waypoints. It can display TACAN or VOR radial and DME distance information when the CHK button is depressed. It also can display bearing from the VORTAC or waypoint in the DME indicators in place of groundspeed when the RAD button is depressed.

The TACAN equipment installed in the TH-57 consists of the remote-mounted KTU-709 transceiver and its associated antennae and the KDI-573 (Figure 5-1) Distance Measuring display located on the copilot's instrument panel which is slaved to the KDI-572 located on the pilot's instrument panel.

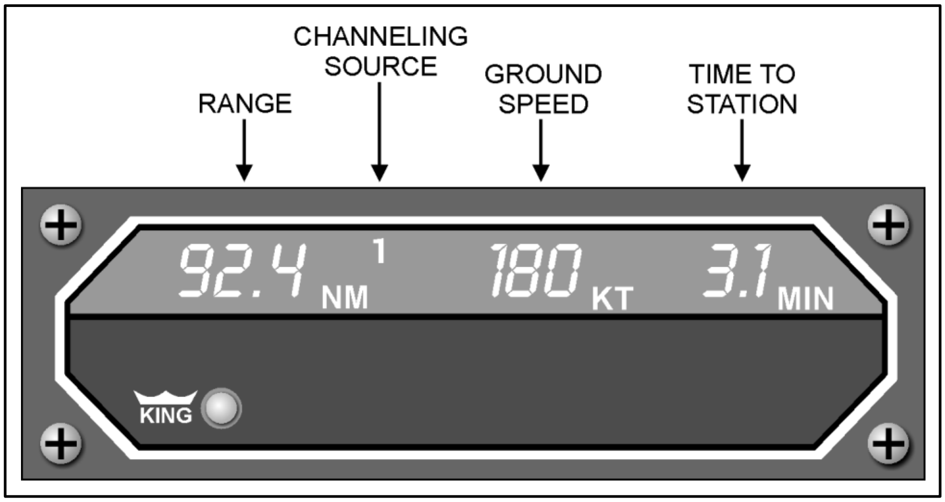


Figure 5-1 KDI-573

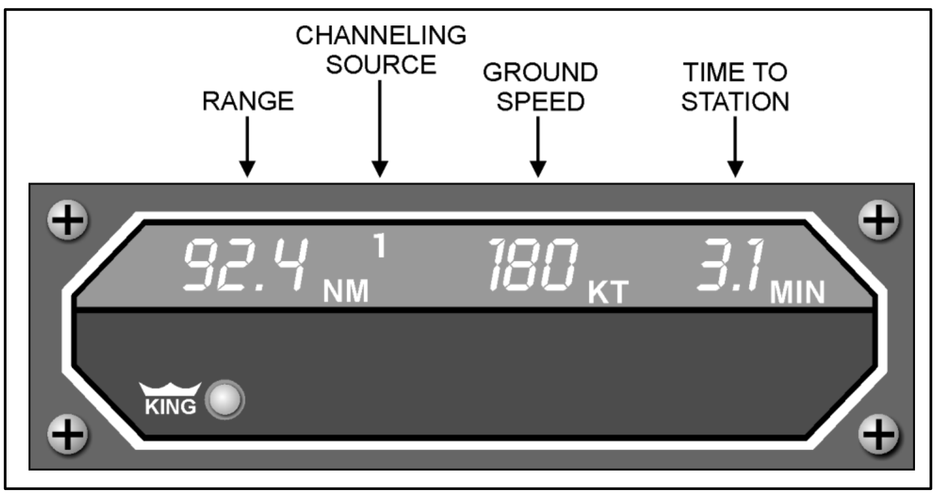


Figure 5-2 KDI-572

NOTE

In GTN 650 Equipped aircraft, the KDI-572 and KDI-573 will only display information from the KNS-81

By design, the integrated navigation system used in the TH-57C is capable of displaying only VOR radial or ILS course information. This problem is easily solved by a converter located within the KTU-709 which converts the TACAN signal input into a "synthesized" VOR radial output.

The system sends this synthesized radial information to the KNI-582 Radio Magnetic displays (RMI) located on the instrument panel. The pilot will also use the HSI to maintain the aircraft on the desired radial, while the copilot will use the conventional CDI for the same purpose.

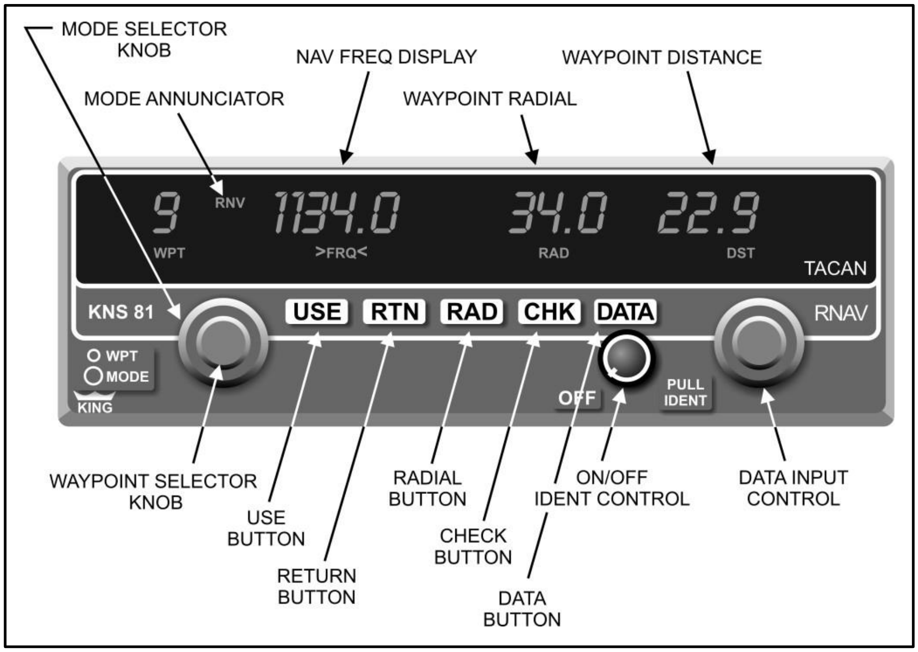


Figure 5-3 KNS-81 Control Functions

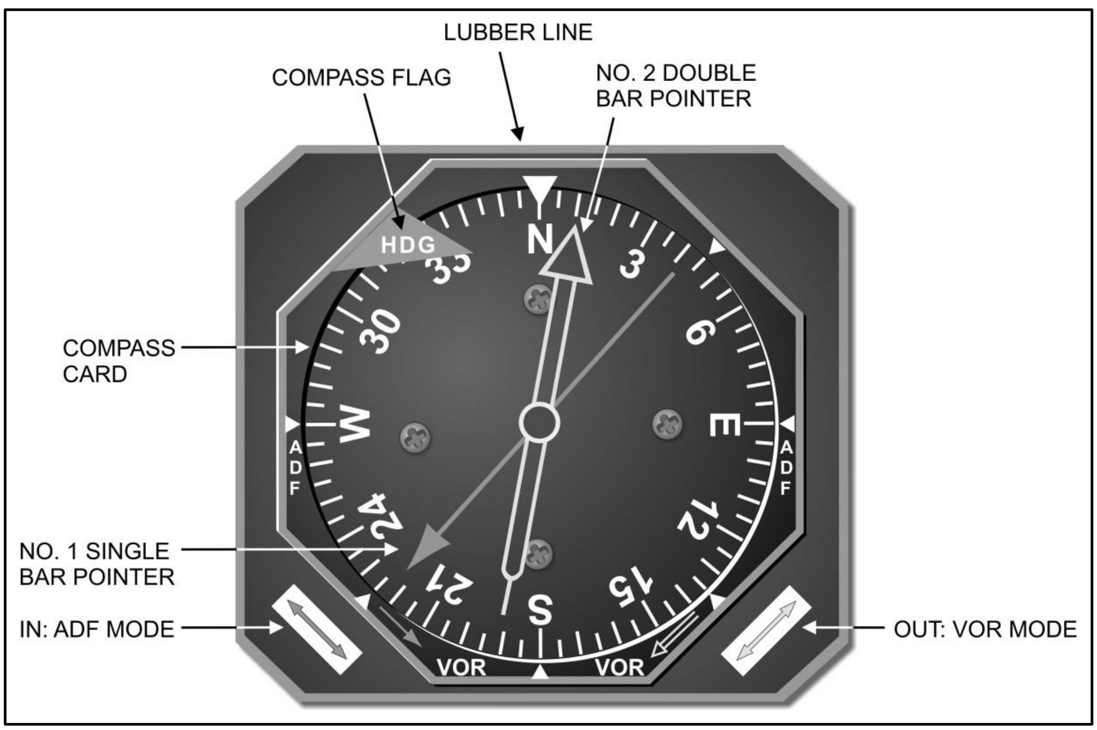


Figure 5-4 KNI-582 RMI

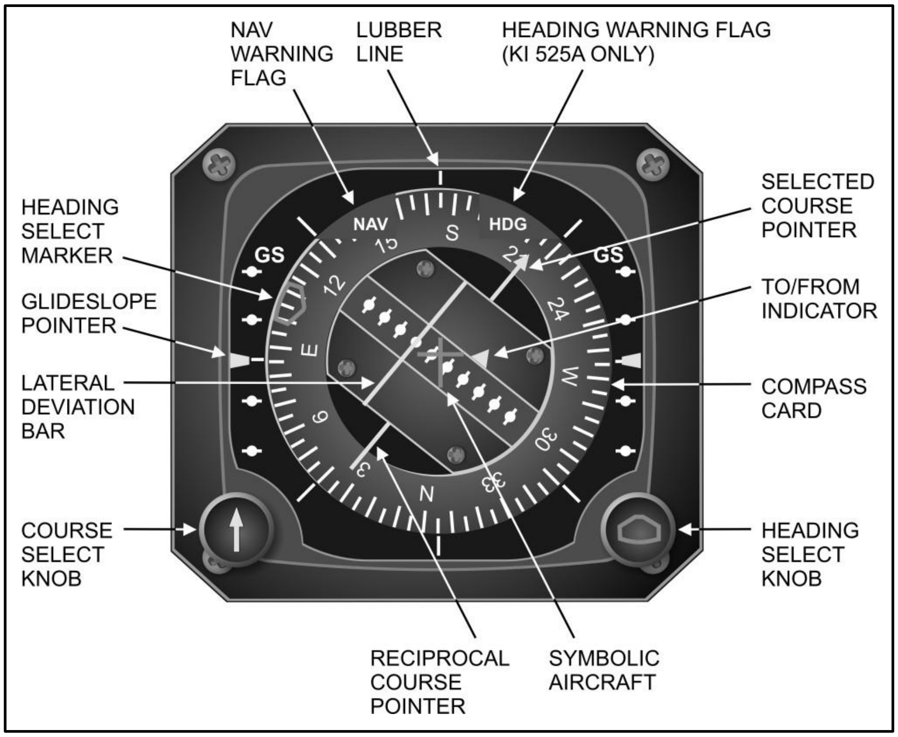


Figure 5-5 KDI-525A HSI

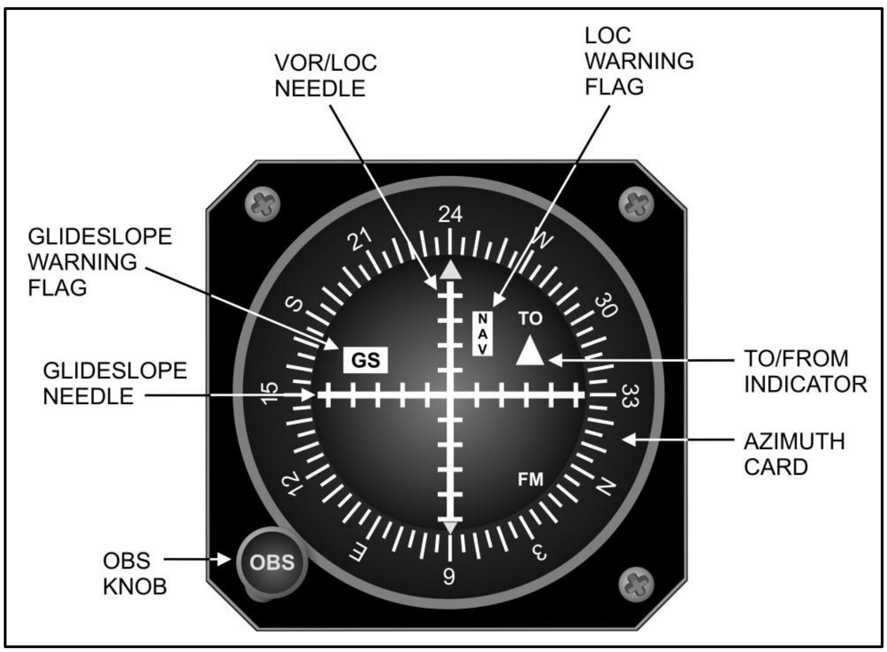


Figure 5-6 KDI-206 CDI

The pilot can select to navigate in the TACAN mode with the KNS-81. To tune the desired TACAN station on the KNS-81, follow these steps:

1. Turn power switch on and adjust volume as desired on the KNS-81.

2. Select TAC with mode select knob on the KNS-81. This mode gives the CDI and HSI ± 10-degree needle deflection.

3. Select desired TACAN channel with DATA input control knobs on the KNS-81. Momentarily press the USE button.

4. Push the DME button on the audio mixer panel in the ON/OFF switch on the KNS-81 to identify the station. (Ensure audio panel mixer switches are properly set.)

5. KDI-572/573 will indicate distance to the TACAN station, groundspeed and time to station.

6. The double needle on the RMIs will indicate radial information for the KNS-81 and the single needle on the RMIs will indicate GPS radial information.

NOTE

> Manual selection of single or double needles on the RMI may be necessary if the pilot has selected a station on the KR-87 (ADF).

Distance measuring equipment (DME) in the aircraft (VOR/DME or TACAN) provides distance to the station (slant-range), groundspeed and time-to-station as discussed previously in this text. Slant range is not equal to the aircraft's actual distance from the station over the ground. To understand why ***slant range*** is different from the actual distance you are from the station, you must remember that the aircraft is flying at some altitude above the ground. Thus, the slant range will be the hypotenuse of the triangle, while the actual distance to the station is equal to the adjacent side.

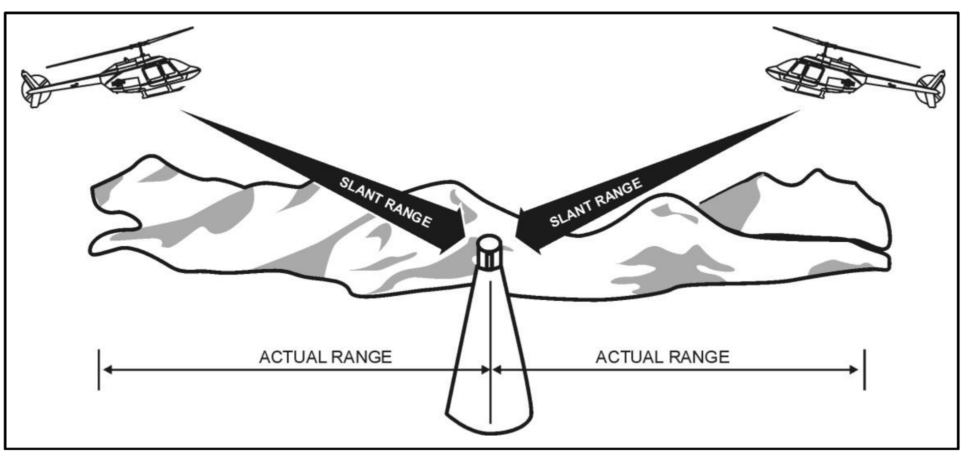


Figure 5-7 Slant Range

Since the hypotenuse is always the longest side of a right triangle, the slant range will always be greater than the distance along the ground.

Although the slant range must always be greater, the difference is usually small. For example, take an aircraft flying at an altitude of 6000 feet (1 NM) and indicating a slant range of 40 miles to the TACAN station. The pilot's actual distance to the station over the ground is 39.99 NM. There is only 1/100 of a mile difference between the slant range and the distance along the ground.

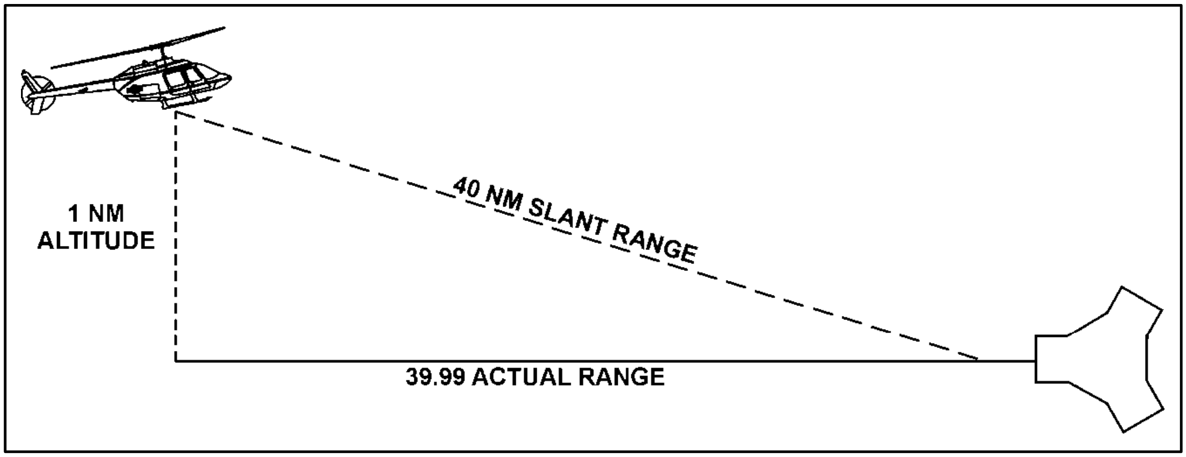


Figure 5-8 Slant Range vs. Actual Range

As you fly closer to the DME station, the difference between slant range and ground distance increases until you are directly over the station. At this point, the slant range equals the aircraft's altitude. Thus, if you were flying at an altitude of 6000 feet (1 NM), your slant range would decrease steadily until you were over the station.

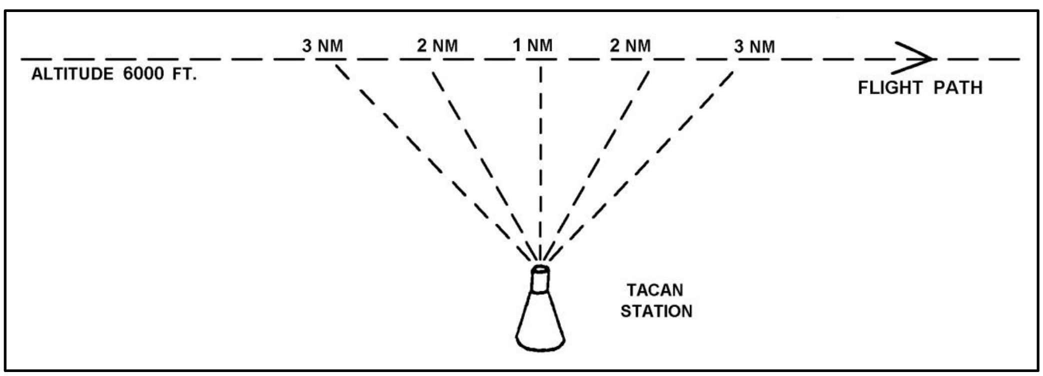


Figure 5-9 TACAN Station

As can be seen, the slant range is one mile when over the station, although the actual distance over the ground to the station is zero.

Another place where TACAN differs from VOR is in the cone of confusion. You may recall from previous texts and your flying experiences that VOR bearing information cannot be received when directly over the station. The VOR cone is 40-50 degrees wide and the area covered increases with altitude. TACAN stations also have a cone of confusion, but they are much larger. The TACAN cone is up to 100° wide. This works out to about 15 NM at 40,000

feet, and at an altitude of 5000 feet, it would be just under two miles wide or about one mile around the station.

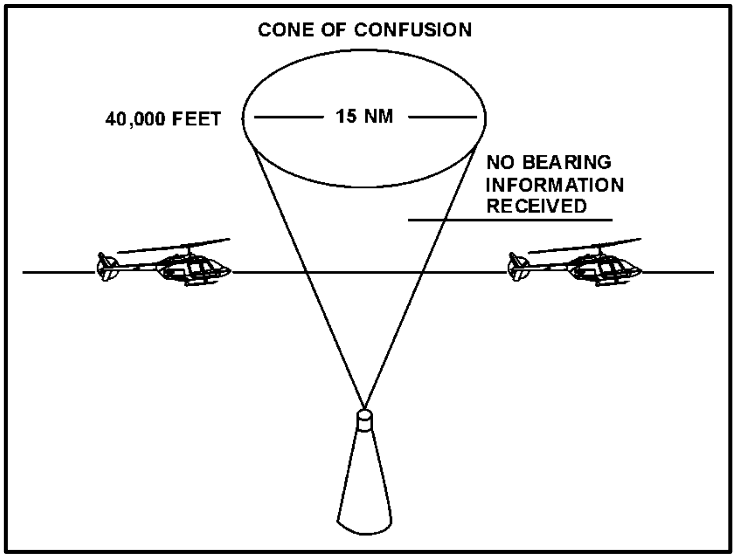


Figure 5-10 Cone of Confusion

Inside the TACAN cone, no bearing information can be received, but slant range information is still reliable. Because of the size of the TACAN cone, holding cannot be accomplished over a TACAN station. Instead, the holding pattern will be oriented at a holding fix at some specified range and bearing from the station. Station passage is also affected by the cone of confusion.

Since the slant range still functions, the minimum slant range or minimum DME will designate station passage. In other words, the range will decrease as you approach the station and will increase after you pass it. The point at which the slant range begins to increase again is station passage. Note that the range will probably not decrease to zero, unless you are flying extremely low.

503. HOLDING

In this section, procedures will be discussed for two eventualities that may occur while an aircraft is enroute to a destination. First, a holding clearance may be issued; secondly, you may lose radio communications. An aviator must be able to understand and respond correctly to either situation. Holding clearances may be issued by ATC to ensure IFR traffic separation criteria or sequence approaches due to a backup of arriving aircraft at a particular airport.

During this discussion, the student should use the plastic RMI device (no. 2B25) frequently to "visualize" the correct manner to comply with a holding clearance. Holding is the maneuvering of an aircraft within a specified airspace with respect to a particular fix. An aircraft will hold at a navigational fix. This fix can be a VOR, NDB, an intersection, or a TACAN radial/DME fix.

There are two instances when an aircraft must hold. The first is when instructed by the controller. The second is upon reaching a clearance limit. A clearance limit cannot be exceeded without further clearance; therefore, holding is mandatory until further clearance is obtained.

An example of the second situation might be: You are approaching your clearance limit with two-way communication. The controller is handling an emergency and is unable to give you further clearance before you arrive at the clearance limit.

A holding clearance will always contain an expected further clearance time (EFC). EFC times apply to aircraft regardless of the phase of flight. In the terminal environment, holding may also be utilized to descend an aircraft to an appropriate altitude from which an approach may be commenced. This is referred to as a shuttle descent.

The standard no-wind holding pattern is flown by following a specified holding course inbound to the holding fix, making a standard rate (3° per second) 180° turn to the right, flying a heading outbound to parallel the holding course, and making another 180° standard rate turn to the right to intercept and follow the holding course to the fix. The holding pattern is nonstandard when the turns are made to the left. Unless otherwise instructed by ATC, pilots are expected to hold in a standard pattern (Figure 5-11). You always hold inbound to the Fix identified in the holding clearance.

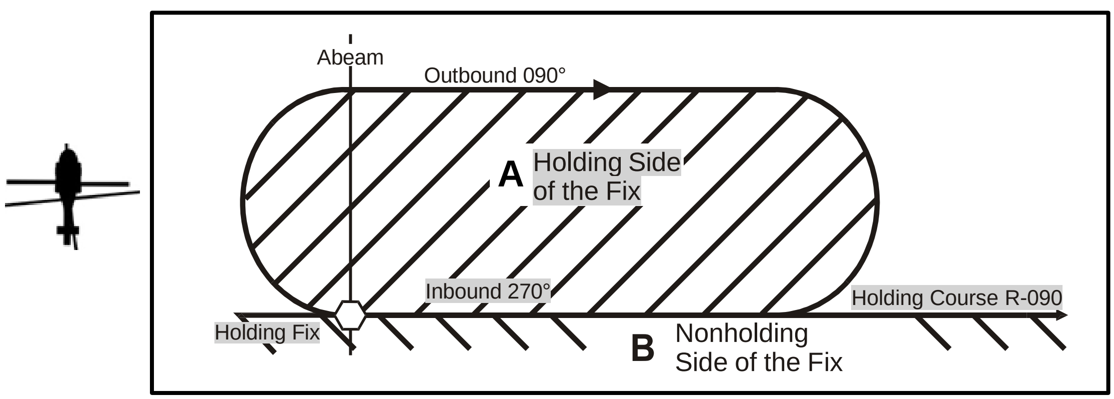


Figure 5-11 Holding Side of the Fix

NOTE

For more specific holding procedures, refer to Flight Training Instruction, Basic and Radio Instruments, Advanced Phase, TH-57 (CNATRA P-425).

The standard no-wind length of the legs of the holding pattern (except TACAN holding) is one minute at or below 14,000 feet and 1½ minutes above 14,000 feet. The length of the legs while using TACAN is specified in NM.

The inbound holding course is the course to the holding fix, while in the holding pattern. The outbound heading is the reciprocal of the inbound holding course. It should be noted that the holding side is the side of the holding pattern on which the turns are made.

ATC should issue holding instructions to you at least five minutes before you reach a clearance limit fix. If instructions are not received within three minutes of reaching the fix, reduce airspeed so as to cross the fix at or below the maximum holding airspeed. If holding instructions have not been received upon arrival at an enroute fix, hold in accordance with the depicted holding pattern. In the absence of a depicted pattern, hold in a standard pattern inbound to the fix on the course the aircraft approached the enroute fix.

In the terminal phase, if it is necessary to hold at the initial approach fix and no holding pattern is depicted on the appropriate approach plate, holding will be accomplished in a holding pattern on the final approach course inbound to the initial approach fix (IAF) making turns ***on the procedure turn side*** (Figures 5-12 and 5-13).

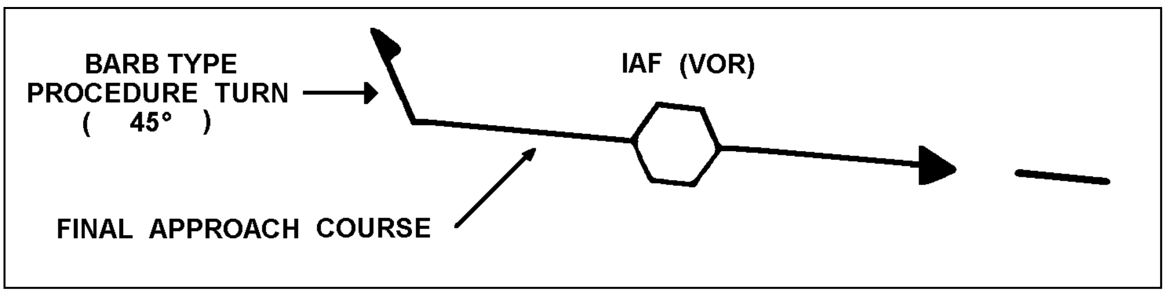


Figure 5-12 Making Turns on the Procedural Side #1

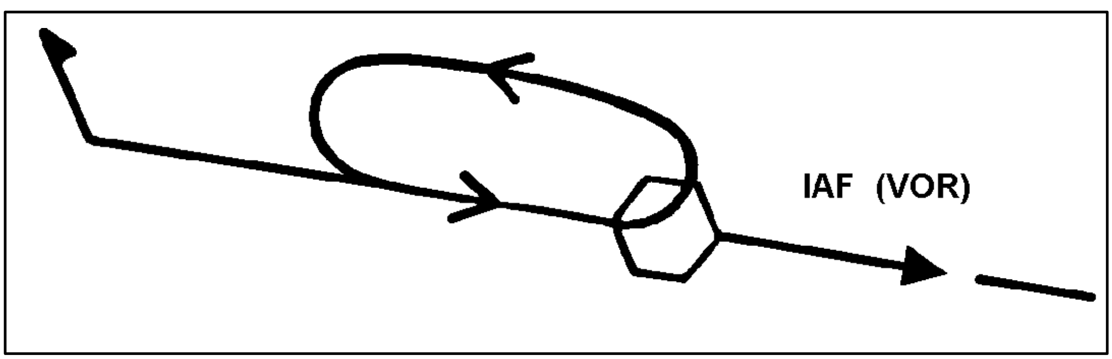


Figure 5-13 Making Turns on the Procedural Side #2

When you are given instructions for holding, the controller will designate:

1. The direction of holding from the fix
2. The holding fix
3. The radial, bearing, or airway on which the aircraft is to hold
4. Direction of turns (if nonstandard)
5. The assigned altitude (not required, if remaining the same)
6. The expected further clearance time.

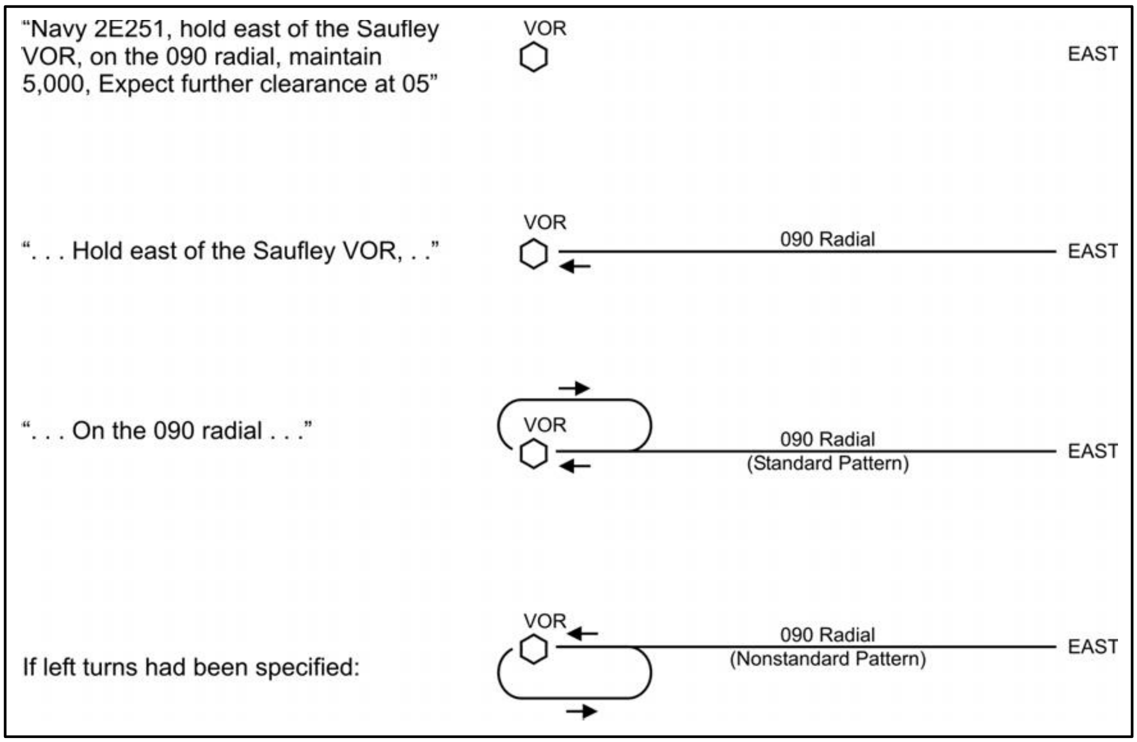


Figure 5-14 VOR - Holding

A TACAN holding fix is defined by a radial and distance. The holding pattern is not overhead of the NAVAID as with VOR holding patterns. Figure 5-15 illustrates a typical TACAN holding clearance.

"...hold west of the 20 DME fix on the 090 radial of the Jax VORTAC, 5-mile legs . . ."

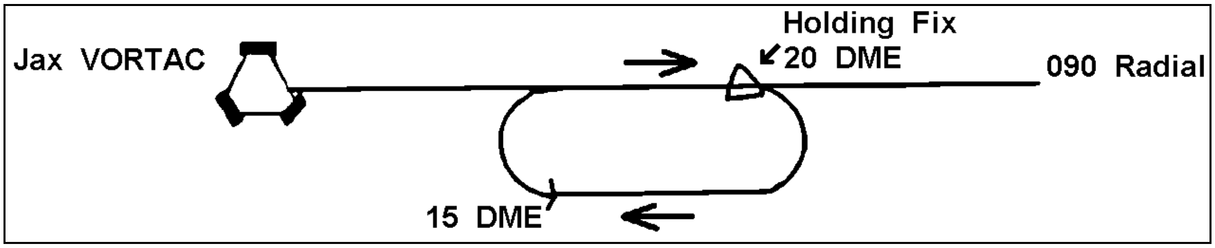


Figure 5-15 TACAN Holding

Pilots will not exceed the following maximum airspeeds while in the holding pattern unless depicted otherwise. If the situation requires airspeed greater than the maximum allowed for holding, notify ATC so that appropriate separation may be applied.

All aircraft

0 – 6000 feet MSL	200 KIAS
Above 6000 – 14,000 feet MSL	230 KIAS
Above 14,000 feet MSL	265 KIAS

Exceptions:

- Holding patterns at USAF airfields only – 310 KIAS maximum unless otherwise depicted.
- Holding patterns at Navy airfields only – 230 KIAS maximum all altitudes unless otherwise depicted.

HOLDING (FEDERAL AVIATION ADMINISTRATION)

- Whenever an aircraft is cleared to a fix other than the destination airport and delay is expected, it is the responsibility of the ATC controller to issue complete holding instruction (unless the pattern is charted), an Expect Further Clearance time and the best estimate of any additional enroute/terminal delay.
- If the holding pattern is charted and the controller does not issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. Holding instructions that contain ***only*** the holding direction (e.g., "Hold East") inform pilots that the pattern is charted

A voice report is mandatory upon arriving at and departing from a holding fix. Voice reports will be made to the appropriate controlling agency.

ARRIVAL EXAMPLE: *"Jacksonville Center, Navy 2E251, Saufley, 05, five thousand."*

DEPARTING EXAMPLE: *"Jacksonville Center, Navy 2E251, departing Saufley."*

As discussed previously, TACAN holding takes place at a specified fix outside the cone of confusion. The fix will be specified in the clearance as a radial and DME from the TACAN station. Example: "Hold west of the 10-mile DME on the 090 radial of the PODUNK TACAN, 2-mile legs, left turns . . ." This would be just like holding at an intersection except it would be easier to accomplish, since only one TACAN station is required to identify the fix as opposed to two VOR stations.

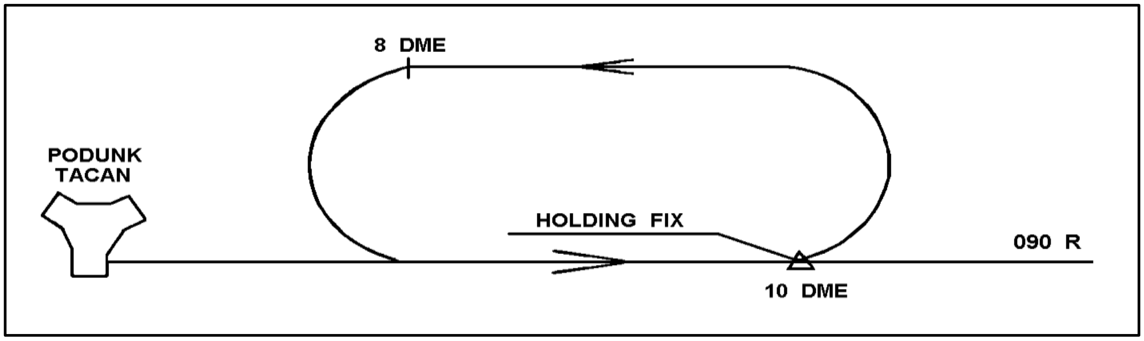


Figure 5-16 TACAN Holding

You will recall from VOR holding that the inbound leg had to be one minute. This sometimes required some quick computing to adjust the outbound leg to obtain one minute on the inbound leg. This is not necessary with TACAN holding, since you have slant range. In TACAN holding, the length of the legs is specified in the holding clearance, and turns are made after flying the specified distance. Thus, a clearance could read, "Hold east of the 5-mile DME on the 090 radial of the PODUNK TACAN, 2-mile legs . . ."

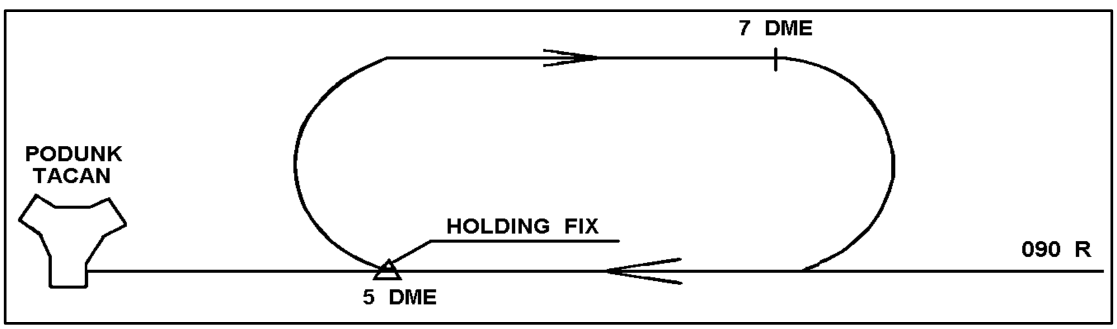


Figure 5-17 TACAN Holding

There are two standard and two nonstandard holding patterns that can be oriented about a TACAN radial/DME fix. A TACAN holding pattern can also be classified as either station-side or non-station-side.

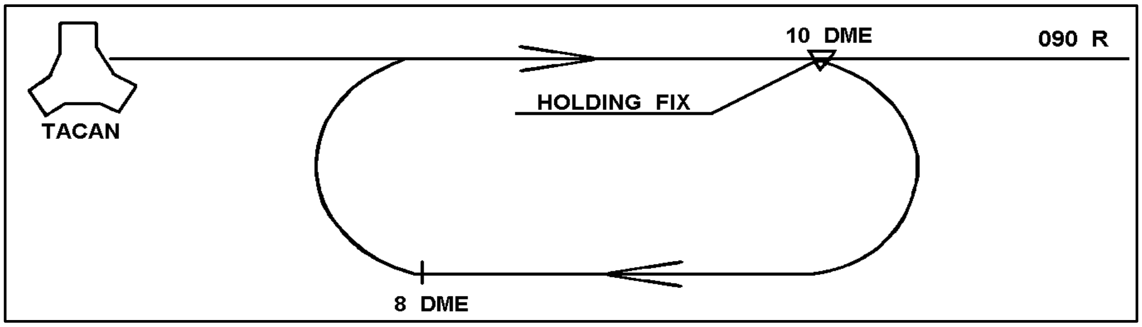


Figure 5-18 Station-side, Standard Holding Pattern

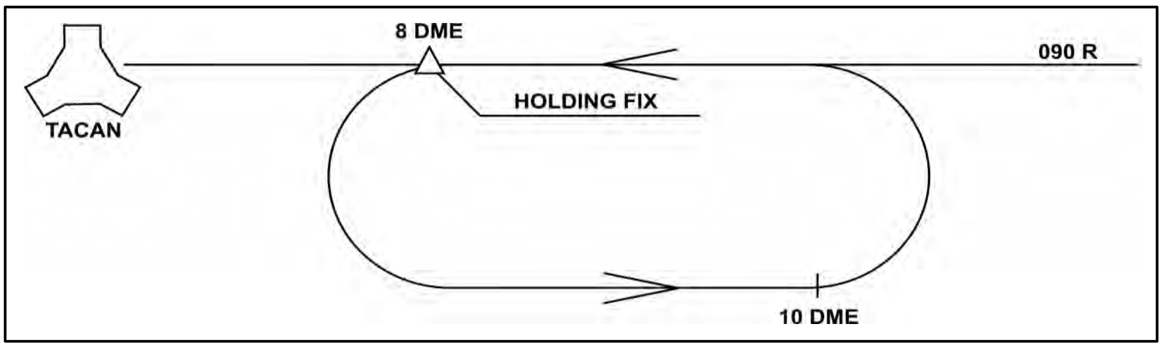


Figure 5-19 Nonstation-side, Nonstandard Holding Pattern

Figure 5-18 is an example of a station-side, standard holding pattern.

Figure 5-19 is an example of a nonstation-side, nonstandard holding pattern. Station-side holding occurs when the holding pattern is located between the holding fix and the station. An example would be as follows: "Hold west of the 7-mile DME on the 090 radial of the PODUNK TACAN, 2-mile legs . . ."

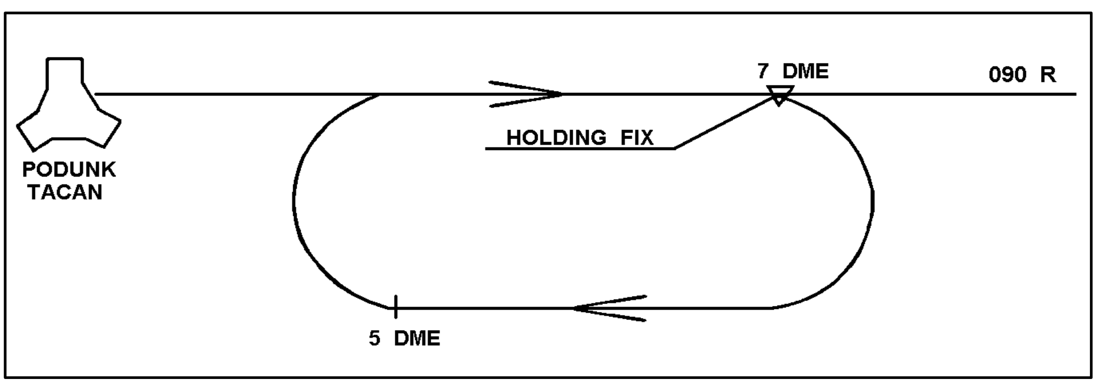


Figure 5-20 Station-Side Holding

Here, the inbound holding course takes you away from the TACAN station. For this and other types of holding, the inbound course ***to the holding fix*** is inserted into the CDI or HSI as appropriate. For station-side holding, the inbound leg is actually outbound from the station.

Note that in the holding instructions "Hold west . . .," the controller is telling the pilot the direction of the outbound holding course. Also, note that with station-side holding, the direction to hold "west" is 180° from the holding radial "090."

Holding entry procedures are the same for TACAN as they are for VOR; however, you must be careful to use the outbound holding course (as opposed to the holding radial) to determine the direction of turn. With VOR holding and TACAN nonstation-side holding, the outbound holding course and the holding radial are the same, but with TACAN station-side holding, the outbound holding course is the reciprocal of the holding radial. As long as you use the outbound holding course in all cases, you will have no difficulty in choosing the correct entry procedures. Remember, after initial holding fix passage, turn to the outbound holding course.

504. TACAN RANGE

The normal anticipated interference-free range of TACAN when below 18,000 feet MSL is 40 NM. This range increases with altitude up to a maximum of 130 NM in the jet airway structure; however, we will limit ourselves to discussing the low altitude airway structure. With a range limit of 40 NM, we could fly between any two TACAN stations within 80 NM of each other on an IFR flight plan. This would ensure that we could always receive one of the TACAN stations. A careful examination of a low altitude airways chart will show that some stations are considerably farther apart than 80 miles. For example, on V437, the distance from Ormond Beach VORTAC, FL to Savannah VORTAC, GA is 170 NM with an MEA of 8000. As long as you fly at or above the MEA on a designated airway, you can receive the appropriate NAVAIDs. To fly ***direct*** from one TACAN to another on an IFR flight plan, off airways, the maximum distance is 80 NM. To fly direct to or from a single TACAN station, the maximum distance is 40 NM.

It is possible a malfunction in either your TACAN set or the TACAN ground station will cause you to lose magnetic course information on your RMI. If this happens, you can still navigate to the station with the range indicator alone if it is operating properly.

To begin, you must turn the aircraft as necessary until the range stops decreasing. By definition, your course is now a tangent with respect to that particular range circle.

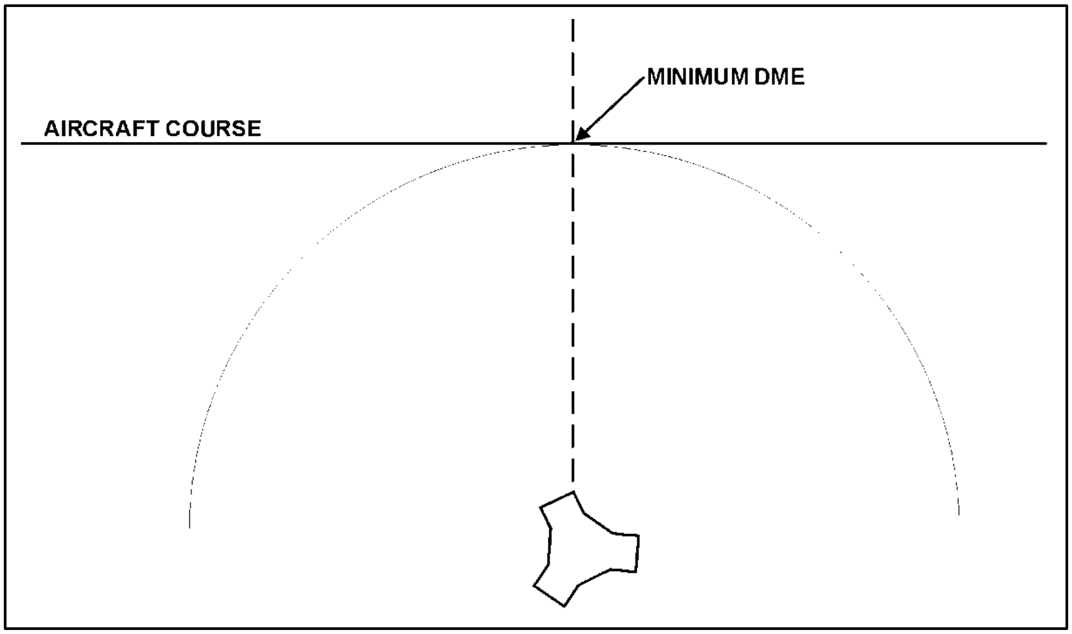


Figure 5-21 Course Tangent

Again, by definition, a line drawn through the tangent point and the center of the circle will be perpendicular to the course line. Therefore, turn 90º to the left or right and observe the range indicator. If it is decreasing, continue on that course to the station. If it is increasing, turn 180º and fly to the station. In a no-wind condition, this procedure will take you directly to the station. If a wind is encountered, you should still be able to fly to the station. If not, simply repeat the second half of the procedure when the range starts to increase again.

505. ARCING

Another procedure that is commonly used with TACAN or VOR/DME is ***arcing***. Arcing is a procedure most commonly used during a TACAN approach, but it can also be used in other portions of flight as well. In practice, the idea is to fly a portion of a circle (an arc) around a TACAN station, always remaining at a constant range. For example, you might have an initial approach fix at the point where 330 radial meets the 10 NM range circle and the final approach course is 090. To shoot the approach you must arc at 10 DME until you arrive at the 270 radial. At this point, you would turn to a course of 090º and fly inbound to the station, descending to the MDA (Figure 5-22).

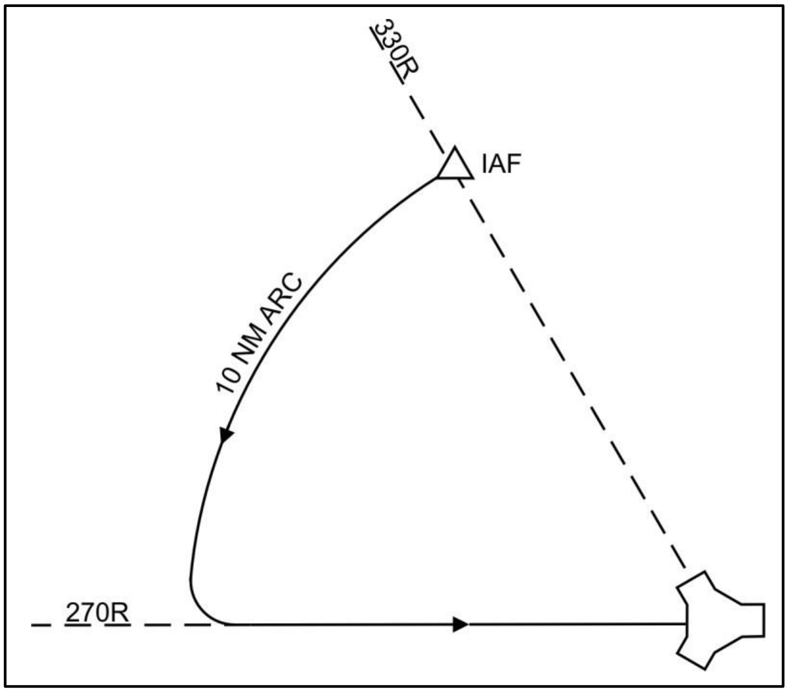


Figure 5-22 TACAN Approach

This is an example of a typical TACAN approach, so you can see the importance of being able to arc around the station.

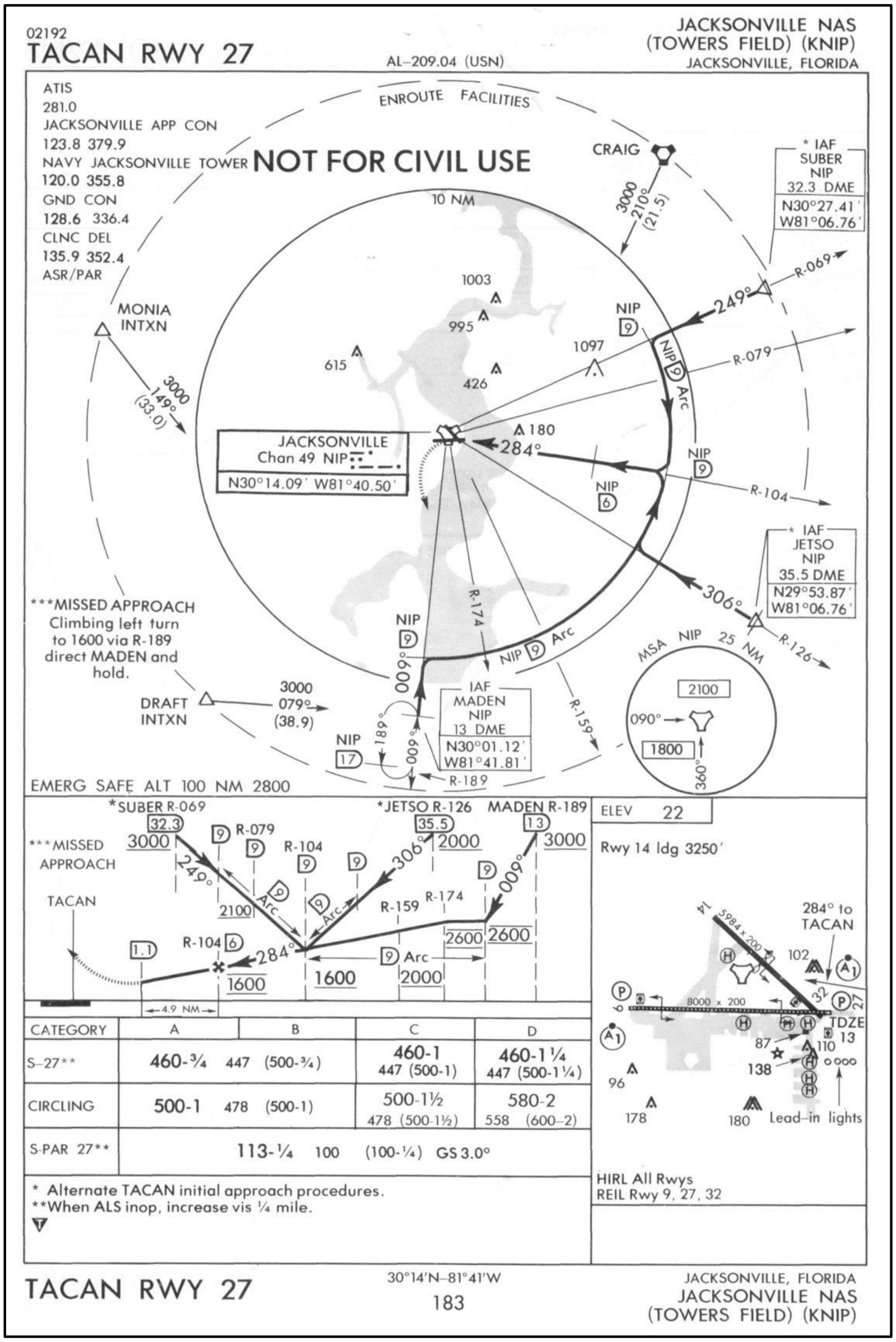


Figure 5-23 TACAN RWY 27

Consider the above approach (Figure 5-23). Assume the pilot has been instructed to hold at MADEN (189R/13DME) and then was cleared for the approach. The pilot, upon receiving approach clearance, would depart the holding pattern at any point and intercept the 189-radial inbound. The pilot would continue inbound on a course of 009º to the 9.5 DME and then turn right to intercept the 9 DME arc. To intercept an ***arc***, lead the arc by ***½ NM***.

Arcing itself is rather easy, and there are two methods of ***arcing***. The first method is to turn in the desired direction until the head of the appropriate RMI needle is exactly 90º from the aircraft's heading (at the 90º benchmark on the RMI). As long as you maintain the needle in this position, in a no-wind condition, you will fly a perfect ***arc*** around the station. The problem with this method is that you must be constantly changing your heading to keep the needle at the 90º position. This consumes much of your ***scan*** and attention that could be put to better use elsewhere in the cockpit.

A more simplified method of ***arcing*** is to break the ***arc*** up into a series of straight lines. To do this, turn the aircraft in the desired direction until the head of the RMI needle is 90º from the aircraft's heading, and then maintain that heading. Because you are flying a constant heading rather than an arc, the head of the RMI needle will fall. Allow the head to fall 5-10 degrees "below wingtip position," and then turn toward the station, raising the head of the RMI needle until it is in the 80-85 degree position. Maintain this heading until the head again drops to the 95-100 degree position. Then turn toward the station raising the head and continue to repeat this procedure until arriving at the desired radial. To simplify this procedure a little, think of the 90º position as your wingtip. To arc left, intercept the arc and hold your heading until the RMI needle drops 5-10 degrees below the wingtip. Then turn toward the station until the RMI needle is 5-10 degrees above the wingtip and hold that heading until it drops again.

Figure 5-24 RMI

To correct for any crosswinds, such as a wind blowing you closer to or farther away from the station merely turn the aircraft as necessary to maintain the range indicator on the specified range. To determine which way to turn, just remember that you must turn away from the station to increase the range, and toward the station to decrease the range. In other words, if you are arcing on the 10 DME arc and you are presently 11 NM from the station, then turn toward the station. As you turn toward the station, the head of the appropriate RMI needle will raise.

Continue the turn until the head is 10-20 degrees above the wingtip and then roll wings level. Fly the heading, noting the movement of the head of the RMI needle and the DME decreasing. If the DME does not decrease or is decreasing too slowly, turn toward the station and raise the head 5-10 degrees more.

When correcting for crosswinds, always remember that the DME should decrease when the head of the RMI needle is above the wingtip and increase when the head is below the wingtip. How many degrees should be above or below the wingtip depends on the crosswind and your distance from the arc. A good rule of thumb is, for every mile off the arc, fly an intercept of 10-20 degrees. For example, an aircraft arcing from the 240 radial to the 300 radial on the 10 DME arc is presently 12 NM from the station. To reintercept the arc, the pilot would turn right toward the station. As the pilot turned, the head of the RMI needle would raise above the wingtip. The pilot would continue the turn until the head was 20-40 degrees above the right wingtip. The wind is from the east and the pilot must correct for the wind.

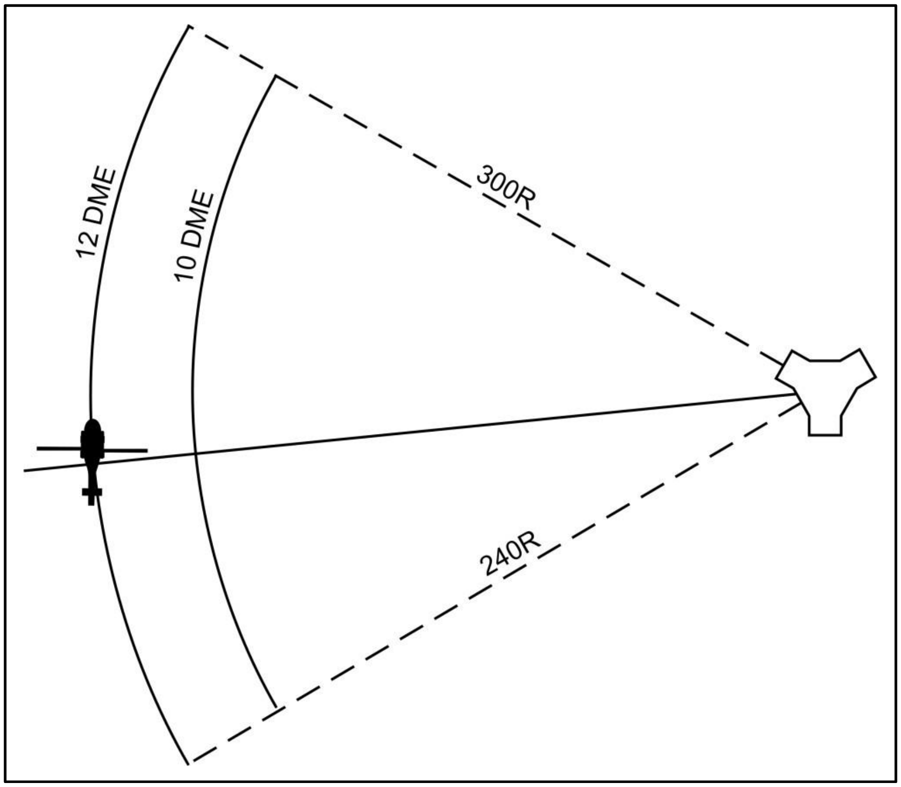


Figure 5-25 Correcting for Crosswinds

During flight planning, if you plan on shooting an arcing approach at your destination or alternate (if required), you will need to know the distance of an arc and your groundspeed to determine the total time and fuel required to fly the arc. To compute the distance of an arc, consider the following information: At a range of 60 NM from a TACAN station, one degree of arc constitutes one NM of distance of an arc. Thus, you can express the distance of an arc as a proportion of the 60 NM arc.

The formula for this is as follows:

$$\text{Distance of an arc} = \frac{\text{DME of an arc}}{60\ \text{NM}} \times \text{number of radials of arc}$$

Thus, an arc on the 16 NM range for 90º would look like this:

$$D = \frac{16}{60} \times 90 = 24$$

or

$$\text{CR-2 Computer Solution} = \frac{\text{DME}}{60} = \frac{\text{Distance of an arc}}{\text{number of radials of arc}}$$

Once you know the distance, it is time to compute groundspeed. This looks difficult at first glance (since your heading is always changing during the arc). To simplify matters, merely draw a straight line connecting the point where the arc begins, to the point where the arc ends. This line will constitute the "Average Course." You can now use this "Average Course," the forecast winds, and your true airspeed to compute a groundspeed. A technique for determining the average course using the CR-2 computer will be explained later in this workbook text under point-to-point navigation.

506. POINT TO POINT

Another very significant difference between navigating with a VOR and TACAN is that with TACAN a pilot can navigate himself ***directly*** from one TACAN radial/DME fix to another without first flying to the TACAN station. This is called ***point-to-point navigation*** and can be accomplished with the CR-2 computer or with the RMI.

The RMI is the primary tool for establishing a point-to-point direct course in flight. Think of the RMI as a map with the TACAN station in the center of the gauge. The aircraft is located on the tail of the RMI needle, and the radial of the destination can be easily identified on the RMI; however, we still need a range scale to accurately plot both positions; therefore, we take the greatest distance to be used in this computation and make the radius of the RMI equal to that range. Thus, if we are on the 135º/10 and want to go to the 045º/15, then 15 is the greatest range and the radius of the RMI equals 15 NM. Ten NM will now be 2/3 of the way from the center of the RMI, since 10 is 2/3 of 15. Using a pencil, we can imagine two dots on the clear face of the RMI. Then lay a pencil across the two dots to connect them. Knowing that you want to go from your present position to the desired location, place the pointed end of your pencil on top of the destination, and the blunt end over your present location. Now think of the pencil as an arrow, showing the heading to fly. Maintaining that heading, slide the arrow to the center of the gauge and you now have a makeshift RMI needle indicating the magnetic bearing to the destination.

This method should produce a course that is accurate within a 10º range, 5º either side.

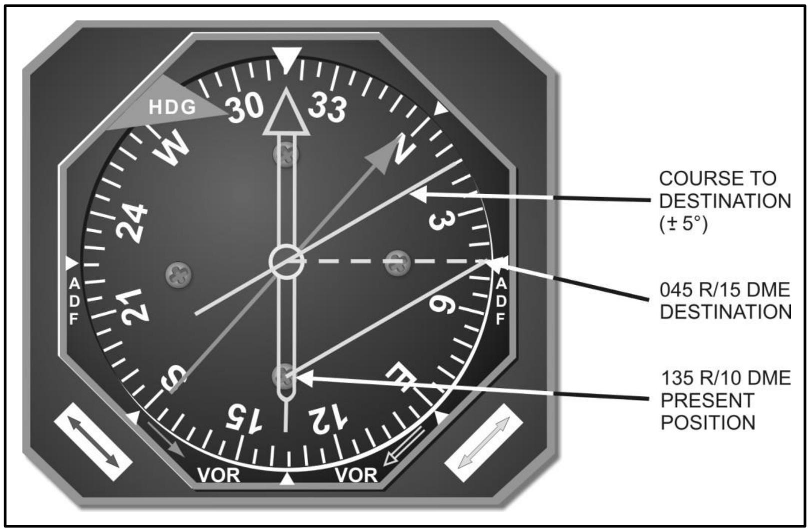


Figure 5-26 Point to Point Direct Course

When flying the intercept course during a point-to-point problem on the RMI, the destination point should be directly above your present position point. If it is not, turn the aircraft a few degrees as required so that a line connecting the two positions would be parallel to the aircraft's heading.

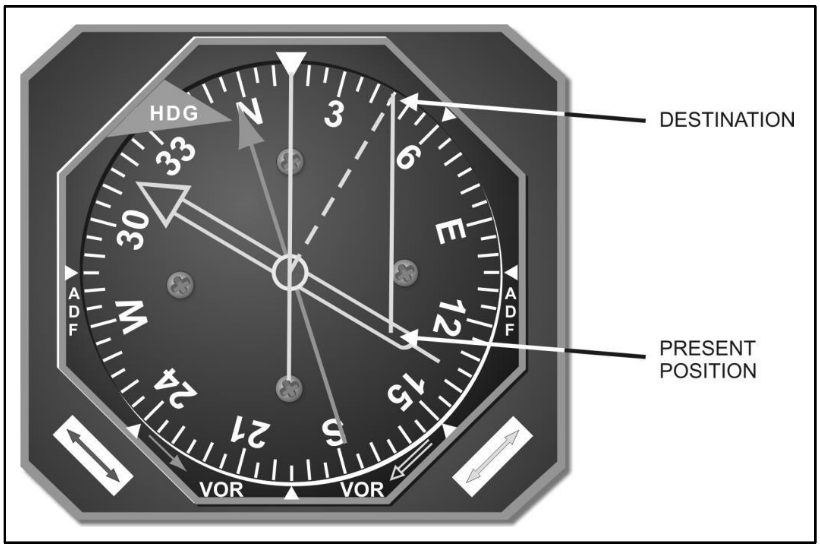


Figure 5-27 Intercept Point

To update your course using the RMI, you should completely recompute your course to your destination at several checkpoints. If there is a difference between the new course and the original one, you have a crosswind component affecting your track across the ground. To correct for this crosswind, turn to the new intercept heading and then turn even further to account for the crosswind. The extra amount will vary with the amount of crosswind, but 10° would be a reasonable starting point. This procedure is just like tracking on a radial, and as such, the amount of crab is variable.

NOTE

> Use of the HSI/CDI, while not required for point-to-point, will assist in the intercept of the new radial.

There are several ways to determine groundspeed with a TACAN set. If you are on an airway, or are tracking along a radial, then just note how far you travel in six minutes and multiply that mileage by 10 to get the groundspeed.

When you are not navigating along a radial, or airway, you cannot use the range indicator as your sole indication of distance covered. In this situation, you must use the CR-2 computer or its equivalent. As in point-to-point navigation, mark your present position on the computer. Fly for six minutes and mark this position on the computer. Now, connect these two points with a line. This line can be measured to give us the distance traveled in six minutes. When multiplied by 10, the product is the groundspeed. We are simply using a different means of determining how far we have traveled in six minutes.

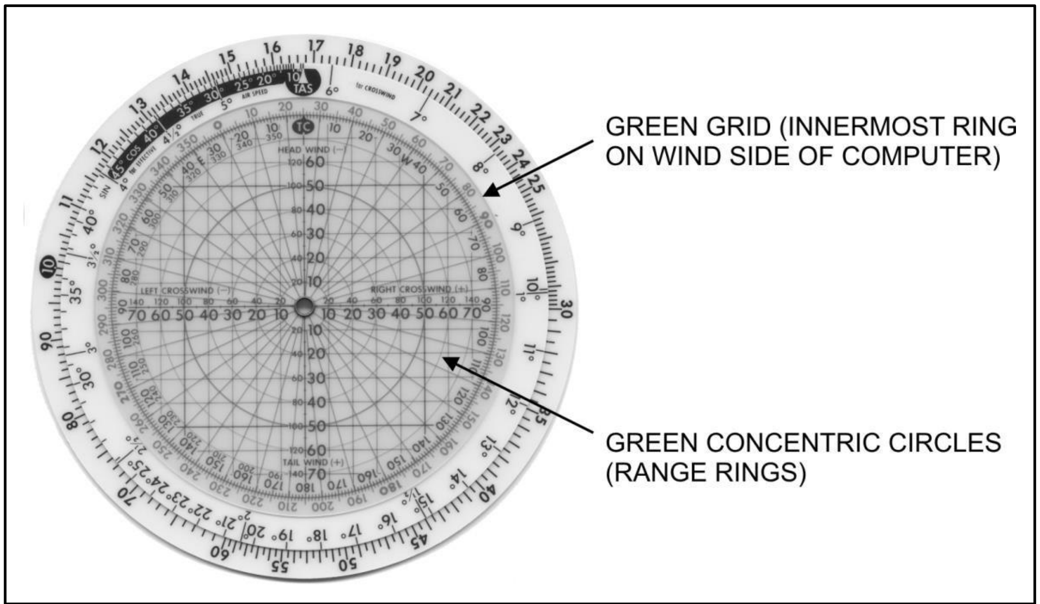


Figure 5-28 Range Indicator

Time permitting, you may use the CR-2 to compute a point-to-point. When using the CR-2 computer, you must visualize the computer as a map with the center of the circular (green) grid representing the TACAN station. Now, the green numbers around the edge of the circular grid represents radials of that TACAN station. Each of the (green) concentric circles around the station represent range rings. There is no particular value assigned to each ring. You must choose an appropriate value of range scale. The choice of range scale is based on the greatest range to be used in your computations. For example, you are on the 270 radial at 30 miles and want to go to the 180 radial at 25 miles; 30 NM is the greatest range, so you must adjust your range scale so that the 30 NM will fit on the grid. Since the grid has 8 concentric circles, each circle would represent 4 NM, giving a maximum usable radius of 32 NM.

NOTE

With a smaller scale, a more accurate course can be determined.

Once the range scale has been determined, merely place a dot at your present location (270 R/30 NM) and another dot at the destination (180 R/25 NM). These dots are drawn on the computer at the radial and range of each position. Now hold the computer so that the heavy black line with "TAS" at one end is at the top of the computer. Directly underneath the "TAS" you will now see a black circle with a "TC" inside it. The "TC" stands for "***TRUE COURSE***." This will now be referred to as the "top" of the computer.

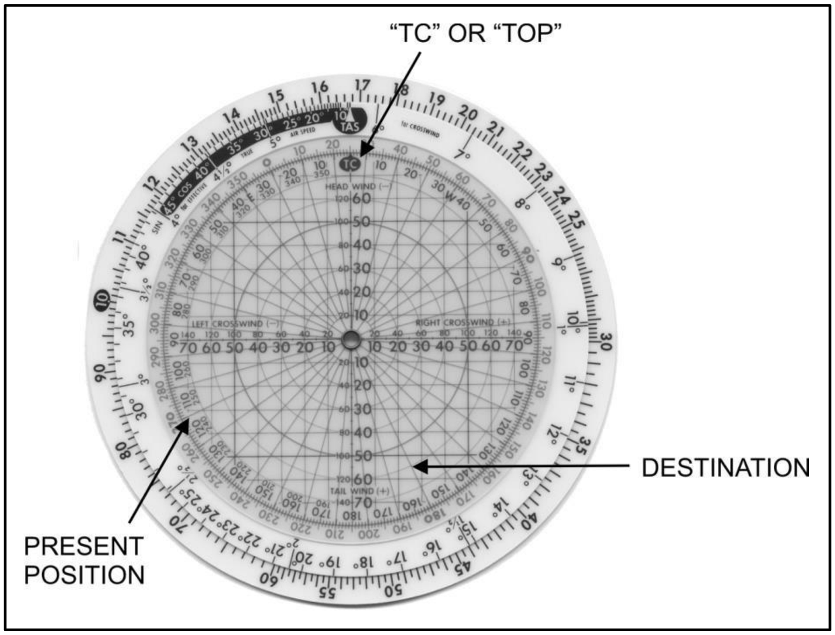


Figure 5-29 Range Scale

Now we have our two dots plotted, and the computer correctly oriented, we can compute the direct course between the two fixes. To do this, we must use the ***square*** (black) grid located behind the circular (green) grid. Turn the circular grid until a line connecting our two dots is exactly parallel to the vertical lines of the square (black) grid. Additionally, the dot representing our destination ***must*** be above the dot representing our present position. Your computer should now look like this:

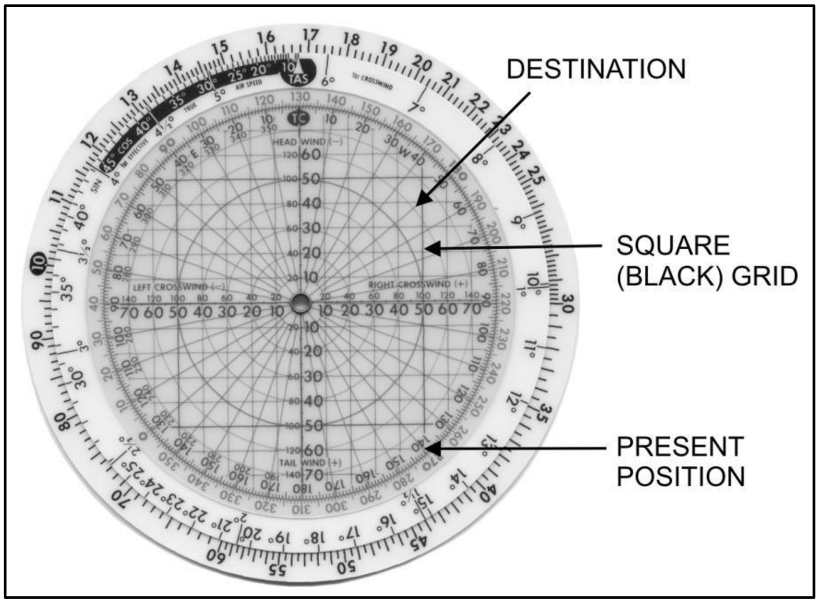


Figure 5-30 Square Grid

To find the direct course, read the number directly above the "TC" symbol at the top of the computer (130). This number (130) is the ***magnetic course*** to fly to the desired destination. The fact the "TC" stands for ***true course*** is not relevant in this particular operation.

In effect, what we have done is to draw a point on a chart (green circular grid) showing our present location, and another point showing the destination. Then we drew a line connecting these two points and used a nearby compass rose to determine the magnetic course of that line. Since the points are all drawn to scale, the distance between the dots is also to scale. To measure the distance, we merely assume the square (black) grid underneath the circular grid has the same range scale. In other words, we assume each square represents 4 NM, just like each circle was 4 NM. Now we count the number of squares between the 2 points, multiply by 4 (NM), and we have the distance between the two points. In this case, we get 39 NM. Thus, if we fly on a magnetic course of 130º for 39 NM (no wind), we will arrive at the desired destination.

Winds will affect this solution, so the point-to-point should be updated frequently using the RMI.

REVIEW QUESTIONS

1. What does the acronym TACAN stand for?

2. There are ______ X-band and ______ band TACAN channels for a total of ___________.

3. The KNI-582 (RMI) is used to display radial, course and heading information to the pilot. If a TACAN channel is tuned in the KNS-81, what needle on the RMI will indicate the TACAN radial?

4. The normal interference-free reception range of a TACAN ground station when below 18,000 feet MSL is ________ NM.

5. To tune a TACAN channel on the KNS-81, after turning the equipment on, select _______ using the mode select knob. After selecting the desired TACAN channel with the data input knob, identify the station by ________________. The distance measuring equipment displays will show ______________ ________________, ________________.

6. When flying in the cone of confusion, the only reliable information will be ____________.

7. "Slant range" is the aircraft's actual distance over the ground from the station. (True/False)

8. The most reliable means of determining TACAN station passage is __________________.

9. You have just received the following holding clearance: "Hold north on the Alexander VORTAC 160 radial/10 DME fix . . ." Is this a station-side or nonstation-side holding?
____

10. In reference to question 9, what is the outbound holding course? _____________.

11. Your holding clearance reads "Hold southeast on the Monroe VORTAC 330 radial/10 DME fix . . ." At initial holding fix passage, you are headed 050°. To enter holding, you would turn ______ (right/left) to _______ (heading),

12. Your holding instructions read "Hold west on the lake Charles VORTAC 260 radial/15 DME fix . . ." At initial holding fix passage, your heading is 195°. To enter holding you would turn ______ (right/left) to _______ (heading).

13. Your holding clearance reads "Hold west on the Hayes VORTAC 070 radial/20 DME fix, 2-mile legs . . ." On the outbound leg, the pilot would turn to intercept the inbound holding course at _______ DME.

14. You are presently 15 NM from the Fort Hayes VORTAC on the 060 radial and you have received clearance to fly to the 200 radial/21 fix. Using the CR-2 computer, determine the course and distance between the two fixes.

15. Your present position is on the 135 radial at 10 DME. What course and distance would you fly to the 020 radial/20 DME fix?

16. The first step in arcing is to turn the aircraft in the desired direction until the head of the RMI needle is exactly ____________ degrees from the aircraft's heading.

17. When flying an arc, it is important to remember that when the head of the RMI needle is above the wingtip, the DME to the station should __________ (decrease/increase)?

18. The initial approach fix for a TACAN arcing approach is on the 160 radial at 15 DME and the final approach radial is 080°. How many miles will you have to fly on the 15-mile arc?

19. In reference to question 18, what is the average course between the 160/15 DME fix and the 080/15 DME fix? __________.

20. The VOR navigation receiver used in the TH-57C is the ________________.

21. The HSI is used by the ________ (pilot/copilot) to maintain the aircraft on the desired radial in the TH-57C, while the ________ (pilot/copilot) uses the CDI for the same purpose.

22. To tune a VOR frequency, on the NAV-1, use the data select knob to select the desired frequency. For navigating the airways using the VOR, select _________ mode. Depressing the CHK on the NAV-1 will display __________ and __________ on the NAV-1 panel if the VOR frequency is paired to a TACAN channel.

REVIEW ANSWERS

1. Tactical Air Navigation
2. 126 . . . 126 . . . 252
3. Double (Yellow)
4. 40
5. TAC . . . pulling the ON/OFF switch and adjusting volume (ensuring the DME button on the audio panel is depressed) . . . slant range from the station, groundspeed, time-to-station
6. distance
7. False
8. minimum DME.
9. station-side
10 340
11. right . . . 150º
12. teardrop right . . . 230
13. 18 DME
14. 217 . . . 34
15. 359 . . . 25
16. 90
17. decrease
18. 20 NM
19. 030
20. KNS-81
21. pilot . . . copilot
22. VOR . . . radial . . . distance

CHAPTER SIX
INSTRUMENT LANDING SYSTEM

600. INTRODUCTION

The Instrument Landing System (ILS) is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway.

The ground equipment consists of two highly directional transmitting systems and three (or fewer) marker beacons. The directional transmitters are known as the localizer and glideslope transmitters.

The system may be divided into three parts:

1. Guidance information – localizer, glideslope

2. Range information – marker beacon, DME

3. Visual information – approach lights, touchdown and centerline lights, and runway lights

Compass locators located at the Outer Marker (OM) or Middle Marker (MM) may be substituted for marker beacons. DME, when specified in the procedure, may be substituted for the OM.

Some locations have a complete ILS installed on each end of a runway; on the approach end of Runway 4 and the approach end of Runway 22, for example. When such is the case, the ILS systems are not in service simultaneously.

601. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

Upon completion of this chapter, the student will interpret the functions of the instrument landing system as it applies to the TH-57C by answering related questions with a minimum score of 80%.

Enabling Objectives

1. Define the purpose of ILS.

2. List the two types of information received from the ILS.

3. Describe how the HSI is used by the pilot to maintain the helicopter on the ILS glideslope and course.

4. Describe how the CDI is used by the copilot to maintain the helicopter on the ILS glideslope and course.

5. Describe the function of the KR-21 marker beacon receiver.

6. Define the MAP (Missed Approach Point) on an ILS approach.

7. Interpret information from a published ILS approach procedure.

8. Select the correct minimums on a published ILS approach procedure.

9. Describe an ILS back course localizer approach.

10. Interpret information from a published back course localizer approach.

11. Interpret information from a published ILS/DME approach procedure.

602. ILS COMPONENTS

Localizer

The localizer transmitter, operating on one of the 40 ILS channels within the frequency range of 108.10 MHz to 111.95 MHz, emits signals which provide the pilot with course guidance to the runway centerline.

The approach course of the localizer, which is used with other functional parts, e.g., glideslope, marker beacons, etc., is called the front course. The localizer signal emitted from the transmitter at the far end of the runway is adjusted, if possible, so the distance between a full scale ***fly-left*** to a full scale ***fly-right*** indication equates to a linear width of approximately 700 feet at the runway threshold to provide a uniform sensitivity/response rate.

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 of the needle deflection on the airborne instrument 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*** has been published for the particular runway and is authorized by ATC.

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

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 1000 feet above the highest terrain along the course line and 4500 feet above the elevation of the antenna site. Proper off-course indications are provided throughout the following angular areas of the operational service volume:

1. To 10º either side of the course along a radius of 18 NM from the antenna, and

2. From 10 to 35 degrees either side of the course along a radius of 10 NM.

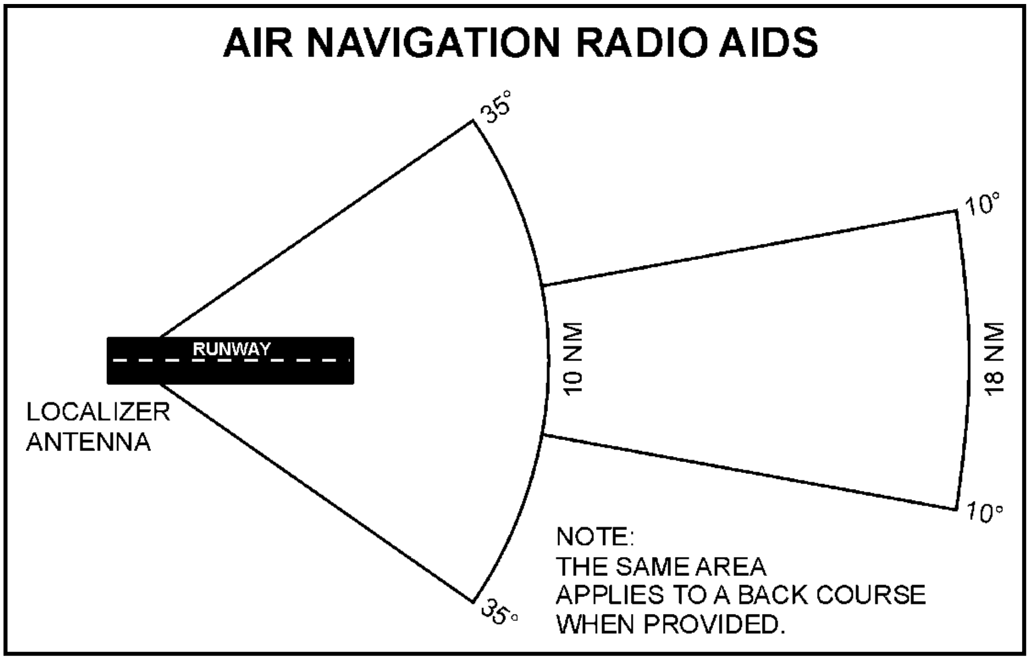


Figure 6-1 Normal Limits of Localizer Coverage

Proper off-course indications are generally not provided between 35-90 degrees either side of the localizer course; therefore, instrument indications of possible courses in the area from 35-90 degrees off-course should be disregarded.

Glideslope

The UHF glideslope transmitter, operating on one of the 40 ILS channels within the frequency range 329.15 MHz, to 335.00 MHz radiates its signals primarily in the direction of the localizer front course. Normally, a glideslope transmitter is not installed with the intent of radiating signals toward the localizer back course; however, there are a few runways at which an additional glideslope transmitter is installed to radiate signals primarily directed toward the localizer back course to provide vertical guidance. The two glideslope transmitters will operate on the same channel but are interlocked to avoid simultaneous radiation to support either the front course or the back course, but not both at the same time. Approach and landing charts for the runways which have glideslopes on the localizer back course will be depicted accordingly.

CAUTION

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

The glideslope transmitter is located between 750 and 1250 feet from the approach end of the runway (down the runway) and offset 250-650 feet from the runway centerline. It transmits a glidepath beam 1.4° wide.

NOTE

> The term "glidepath" means that portion of the glideslope that intersects the localizer.

The glidepath projection angle is normally adjusted to 3° above horizontal so that it intersects the MM at about 200 feet and the OM at about 1400 feet above the runway elevation. The glideslope is normally usable to the distance of 10 NM; *h*owever, at some locations, the glideslope has been certified for an extended service volume which exceeds 10 NM.

In addition to the desired glidepath, false course and reversal in sensing will occur at vertical angles considerably greater than the usable path. The proper use of the glideslope requires the pilot to maintain alertness as the glidepath interception is approached and interpret correctly the "fly-up" and "fly-down" instrument indications to avoid the possibility of attempting to follow one of the higher angle courses. If procedures are correctly followed and pilots are properly indoctrinated in glidepath instrumentation, these high angle courses should cause no difficulty in the glidepath navigation.

Every effort should be made to remain on the indicated glidepath. Exercise extreme caution to avoid deviations below the glidepath so that the predetermined obstacle/terrain clearance provided by an ILS IAP is maintained.

A glidepath facility provides a glidepath suitable for navigation down to the lowest authorized DH specified in the approved ILS approach procedure. The glidepath may not be suitable for navigation below the lowest authorized DH and any reference to glidepath indications below that height must be supplemented by visual reference to the runway environment. Glideslopes which support low visibility operations with no published DH are usable to runway threshold.

The published glideslope threshold crossing height (TCH) does not represent the height of the actual glideslope indication above the runway threshold. It is a theoretical height which represents a projection of the average or mean glidepath between four miles and the middle marker. For practical application, it is a reference used for planning purposes which represents the height above the runway threshold that an aircraft's glideslope antenna should be, if that aircraft remains on a trajectory formed by the four-mile-to-middle marker glidepath segment. Pilots must be aware of the vertical height between the aircraft's glideslope antenna and the main gear in the landing configuration and, at the DH, plan to adjust the descent angle accordingly if the published TCH indicates that the wheel crossing height over the runway threshold may not be satisfactory. Tests have indicated a comfortable wheel crossing height to be approximately 20 to 30 feet, depending on the type of aircraft.

Distance Measuring Equipment (DME)

When installed with an ILS and specified in the approach procedure, DME may be used in lieu of:

1. The OM.

2. A back course final approach fix (FAF).

3. For ARC initial approach courses.

In some cases, DME from a separate facility may be prescribed for use.

Marker Beacon

ILS marker beacons have a rated power output of 3 watts or less and an antenna array designed to produce an elliptical pattern with dimensions, at 1000 feet above the antenna, of approximately 2400 feet in width and 4200 feet in length. Airborne marker beacon receivers with a selective sensitivity feature should always be operated in the "low" sensitivity position for proper reception of ILS marker beacons.

Ordinarily, there are two marker beacons associated with an ILS, the outer marker (OM) and middle marker (MM); however, some locations may employ a third marker beacon to indicate the point at which the decision height should occur when used with a Category II ILS.

1. The OM normally indicates a position at which an aircraft at the appropriate altitude on the localizer course will intercept the ILS glidepath. The OM is modulated at 400 Hz and identified with continuous dashes at the rate of two dashes per second and a blue marker beacon light.

2. The MM normally indicates a position at which an aircraft is approximately 3500 feet from the landing threshold. This will also be the position at which an aircraft on the glidepath will be at an altitude of approximately 200 feet above the elevation of the touchdown zone (i.e., the point where the glide slope intercepts the decision height, at or near the missed approach point). The MM is modulated at 1300 Hz and identified with alternate dots and dashes keyed at the rate of 95 dot/dash combinations per minute and an amber marker beacon light.

3. The inner marker (IM), where installed, will indicate a point at which an aircraft is at a designated decision height (DH) on the glidepath between the MM and landing threshold for a Category II approach. The IM is modulated at 3000 Hz and identified with continuous dots keyed at the rate of six dots per second and a white marker beacon light.

A back course marker, where installed, normally indicates the ILS back course final approach fix where approach descent is commenced. The back course marker is modulated at 3000 Hz and identified with two dots at a rate of 72 to 95 two-dot combinations per minute and a white marker beacon light.

Compass Locator

Compass locator transmitters are often situated at the MM and OM sites. The transmitters have a power of less than 25 watts, a range of at least 15 miles and operate between 190 and 535 KHz.

NOTE

At some locations, higher powered radio beacons, up to 400 watts, are used as OM compass locators. These generally carry Transcribed Weather Broadcast (TWEB) information.

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

Inoperative Components

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

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

NOTE

Refer to the Inoperative Component Table in the U.S. Government low altitude approach Procedures, Supplementary Information Section, for adjustments to minimums due to inoperative airborne or ground system equipment.

603. ILS MINIMUMS

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

1. Category I - Decision Height (DH) 200 feet and Runway Visual Range (RVR) 2400 feet (with touchdown zone and center line lighting, RVR 1800) or (with Autopilot of FD or HUD, RVR 1,800 feet).

2. Category II - DH 100 feet and RVR 1200 feet.

3. Category IIIA - RVR 700 feet.

NOTE

Special authorization and equipment are required for Category II and IIIA.

604. ILS COURSE DISTORTION

All pilots should be aware that disturbance to ILS localizer and glideslope courses may occur when surface vehicles or aircraft are operated near the localizer and glideslope antennas. Most ILS installations are subject to signal interference by either surface vehicles, aircraft, or both. ILS CRITICAL AREAS are established near each localizer and glide slope antenna. Air Traffic Control (ATC) procedures exist to control the operation of vehicle or aircraft traffic on the portions of taxiways and runways that lie within the critical areas and to adjust the flow of arrival or departure traffic so that the proximity of one aircraft to an ILS antenna does not cause interference to the ILS course signals being used by another when the weather or visibility conditions are below specific values.

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

1. Weather Conditions - At or above ceiling 800 feet and/or visibility 2 miles

    a. No critical area protective action is provided under these conditions.

    b. If an aircraft advises the tower that an autoland or coupled approach will be conducted, an advisory will be promptly issued if a vehicle or aircraft will be in or over a critical area when the arriving aircraft is inside the ILS MM.

Example: GLIDESLOPE SIGNAL NOT PROTECTED

2. Weather Conditions - Less than ceiling 800 feet and/or visibility 2 miles.

    a. GLIDESLOPE CRITICAL AREA - Vehicles and aircraft are not authorized in the area when an arriving aircraft is between the ILS final approach fix and the airport unless the aircraft has reported the airport in sight and is circling or sidestepping to land on a runway other than the ILS runway.

    b. LOCALIZER CRITICAL AREA - Except for aircraft that land, exit a runway, depart, or execute a missed approach, vehicles and aircraft are not authorized in or over the critical area when an arriving aircraft is inside the outer marker (OM) or the fix used in lieu of the OM. Additionally, when the official weather observation is a ceiling of less than 200 feet or RVR less than 2000, vehicle and aircraft operations in or over the area are not authorized when an arriving aircraft is inside the ILS MM, or in the absence of a MM, ½ mile final.

3. While a critical area is not specifically established outward from the airport to the final approach fix, and aircraft holding below 5000 feet AGL inbound toward an airport between the ILS final approach fix and the airport can cause reception of unwanted localizer signal reflections by aircraft conducting an ILS approach. Accordingly, such holding is not authorized when weather or visibility conditions are less than ceiling 800 feet and/or visibility 2 miles.

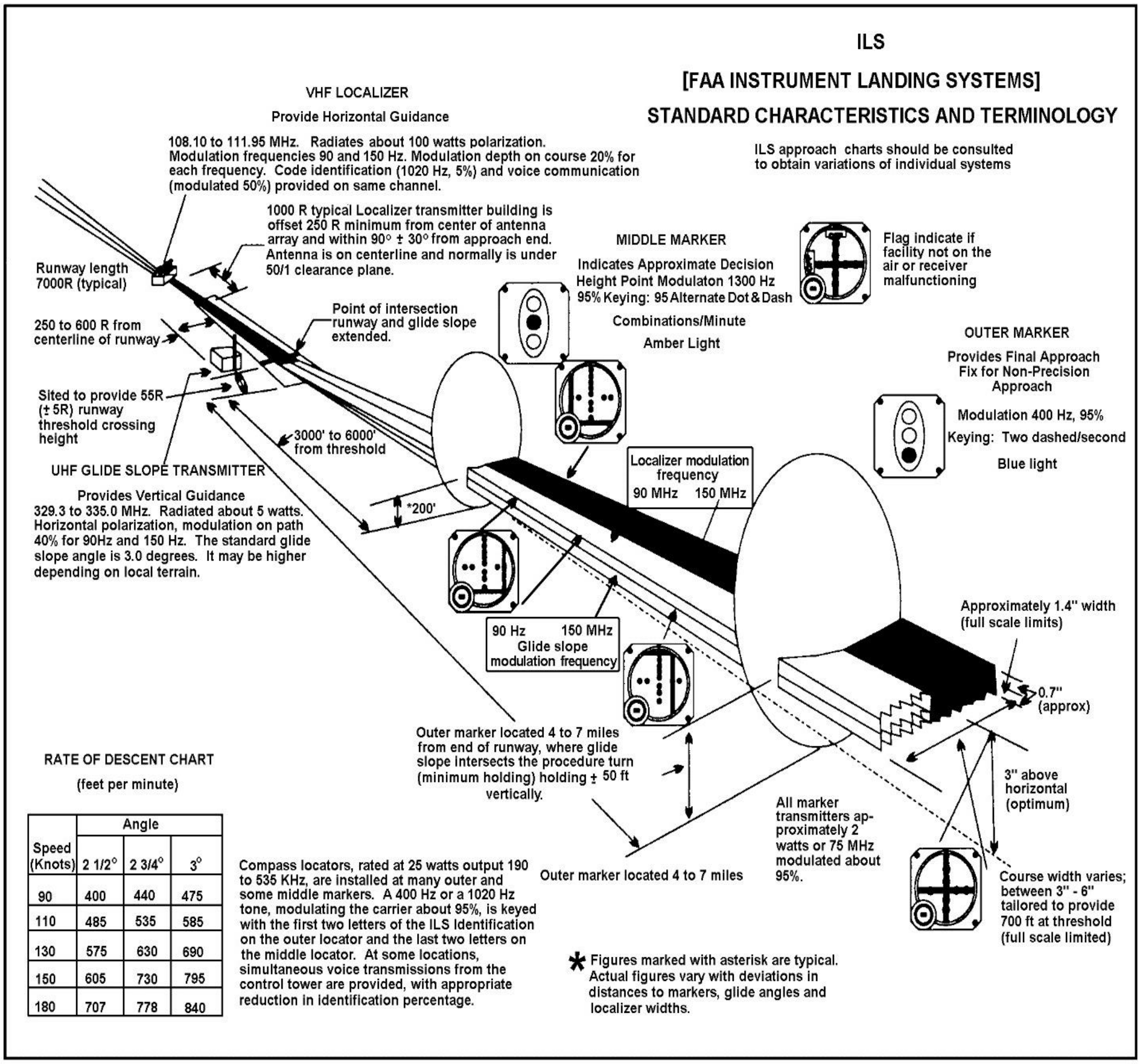


Figure 6-2 FAA Instrument Landing Systems

605. GUIDANCE INFORMATION

Localizer transmitters emit highly directional signals that provide very precise course guidance to the runway. These transmitters are located approximately 1000 feet beyond and to the side of the non-approach end of the ILS runway. The antenna is in line with the runway and radiates 90 and 150 Hz signal patterns on opposite sides of the extended runway centerline. The 150 Hz signal is on the right when looking at the runway from the approach end. (This is the shaded area of the localizer symbol on Enroute Charts and approach plates.) The 90 Hz signal is on the left. The course is formed along the runway centerline extended (toward the outer marker) where the signals overlap and are of equal strength. This course is called the FRONT COURSE (see the illustration below). The front course sector is approximately 5º wide extending 2½º either side of the course centerline. The course sector width may be tailored to provide an optimum width of 700 feet at the runway threshold. The localizer signal has a usable range of at least 18 miles within 10º of the course centerline.

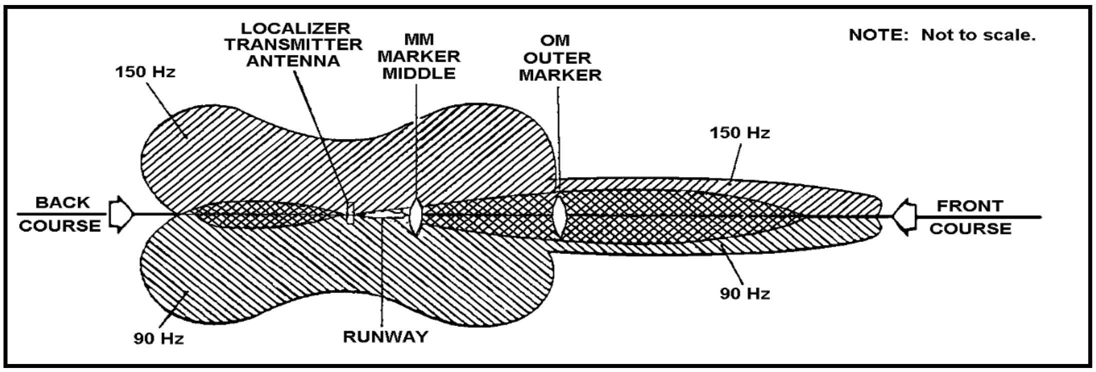


Figure 5-3 Localizer Transmitters

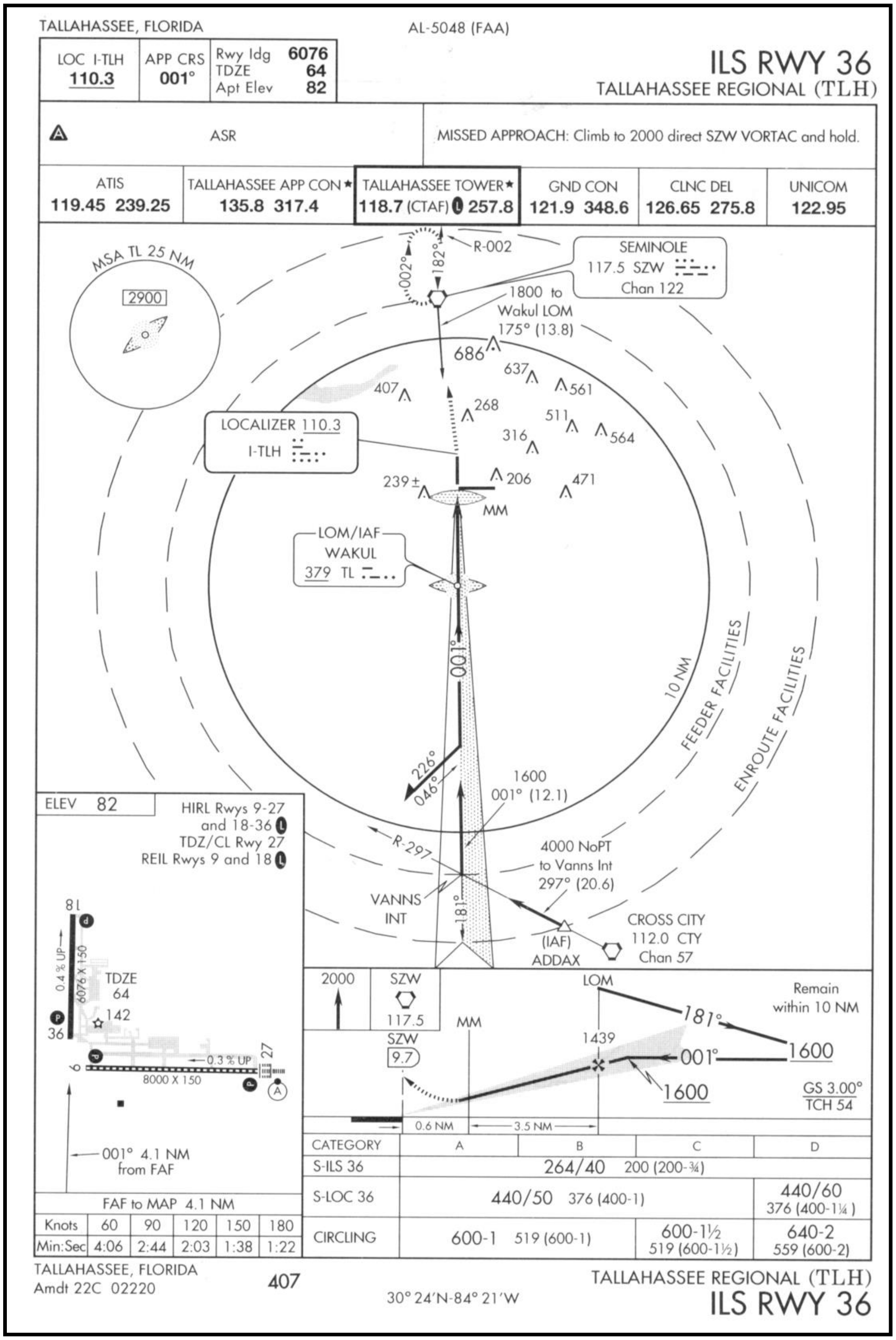
Most localizer transmitters also provide a signal pattern around the runway so that course signals also overlap in the opposite direction forming a BACK COURSE. Civilian operated localizer transmitters provide a usable back course signal, but military operated localizer transmitters do not. Localizer back course instrument approach procedures, as depicted on the approach plate are often published for civil airports. (Note that the shaded or 150 Hz portion of the localizer symbol is to the left when approaching the transmitter on the back course. The significance of this will be discussed in the flight procedures section of this workbook.) Normally, the glideslope information is not available during back course operations.

ILS localizer transmitters use the odd decimal VHF frequencies from 108.1 to 111.95 MHz (e.g., 110.3 MHz). The localizer transmitter emits continuous identification in the form of a coded three-letter station identifier preceded by the letter "I" (e.g., I-CRP). Some have voice capabilities.

The glideslope is normally intercepted from below but may be intercepted from above; however, if intercepting the ILS glideslope from above, pilots should be aware of the possibility of picking up a false glideslope indication. As the aircraft approaches the glideslope, a descent is initiated (or adjusted if intercepting from above) to establish the aircraft on glideslope. Power and nose attitude are then adjusted as necessary to maintain airspeed and glideslope until reaching DH

The importance of precise aircraft control cannot be overemphasized. The size of the localizer course and glideslope envelope decreases progressively throughout the approach. As the approach progresses, smaller pitch and bank corrections are required to maintain glidepath.

On an ILS approach the missed approach point is defined as that point along the localizer course and glideslope where the aircraft reaches its decision height (DH) expressed in feet above MSL. When glideslope information is not available, such as localizer-only approaches, timing or DME is used to define the missed approach point.



CATEGORY	A	B	C	D
S-ILS 36	264/40 200 (200-¾)			
S-LOC 36	440/50 376 (400-1)			440/60 376 (400-1¼)
CIRCLING	600-1 519 (600-1)		600-1½ 519 (600-1½)	640-2 559 (600-2)

FAF to MAP 4.1 NM

Knots	60	90	120	150	180
Min:Sec	4:06	2:44	2:03	1:38	1:22

TALLAHASSEE, FLORIDA
Amdt 22C 02220
407
30° 24'N-84° 21'W
TALLAHASSEE REGIONAL (TLH)
ILS RWY 36

Figure 6-4 ILS RWY 36

Visual Information

Special approach lighting systems are installed on main runways serviced by ILS approaches to aid the pilot in acquiring the runway environment under reduced ceiling and visibility conditions.

NOTE

When certain visual aids are inoperative or unusable, decision height and visibility minimums may have to be adjusted by the pilot. Refer to FAR Part 91 or the INOP Components table in the approach plates for specific information.

606. TH-57C ILS RECEIVERS AND DISPLAYS

The Instrument Landing System (ILS) is a precision approach system that provides azimuth and glideslope information to the pilot. It consists of a highly directional localizer (course) and glideslope transmitter with associated marker beacons, compass locators and, at some sites, distance measuring equipment.

The equipment installed in the TH-57C required to execute an ILS approach consists of the KNS-81, or GTN-650, the KR-21 marker beacon receiver and the KDI-525A (HSI) or the KI-206 (CDI). The KR-87 (ADF) would be used to receive the compass locator when appropriate. The number 1 and number 2 needles on the RMI are not used when executing an ILS unless the ILS has a compass locator or other NAVAID in the vicinity which has also been selected.

The GTN-650 equipment is designed to automatically function in the ILS mode whenever an ILS frequency is selected in VLOC mode with NAV-1 also selected. KNS-81 is in use if a localizer frequency is tuned, USE button is pressed, and NAV-2 is selected. In both cases, the signal is sent to the HSI and CDI when either NAV-1 or NAV-2 is selected, depending on desired NAV source.

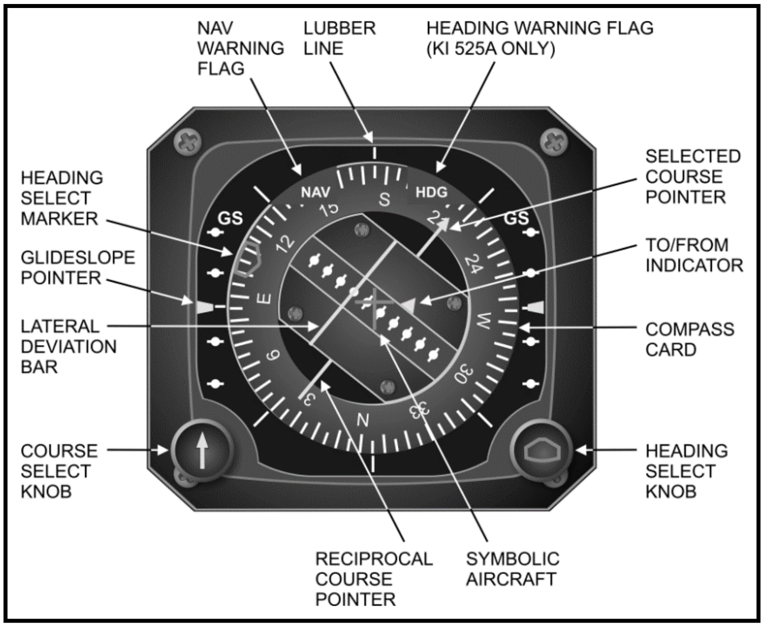


Figure 6-5 KDI-525A HSI

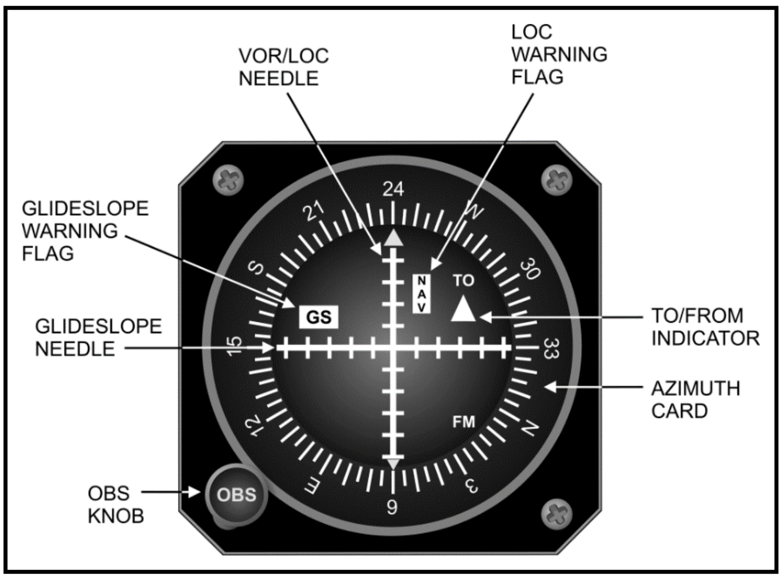


Figure 6-6 KDI-206 CDI

The HSI receives its input from the NAV-1 or NAV-2 depending on aircraft configuration, and NAV source selected. The HSI glideslope pointer has a full-scale sensitivity of 0.7°. It represents the actual aircraft deviation from the glideslope. When usable information is present, the glideslope pointer is out of view. When a valid signal is received, there is a 2–12 second delay before the pointers come into view. The lateral deviation bar on the HSI represents the localizer course deviation. When referenced to the symbolic aircraft, the position of the deviation bar is the same as the position of the chosen localizer course. The lateral deviation bar has a full-scale sensitivity of 3–6 degrees (depending upon ground facility).

The NAV flag will appear if the localizer signal is lost.

The CDI receives its input from the NAV-1 or NAV-2 depending on NAV source selected. In the TH-57C if the pilot and co-pilot have selected the same NAV source the CDI will repeat the HSI information, regardless of what is twisted into the CDI. The glideslope needle moves up or down, depending upon whether the aircraft is below or above glideslope. The glideslope warning flag appears if the signal is lost. The localizer needle indicates deviation from the localizer course. If the localizer signal is lost, the localizer warning signal appears. The sensitivity of both needles is similar to that of the HSI.

The CDI and HSI glideslope and course deviation indicators are extremely sensitive when used for an ILS approach. The pilot will make all corrections toward the needle/bar/pointer. When executing a back course localizer approach, reverse sensing occurs in the CDI; therefore, the pilot must make turns away from the course deviation or lateral deviation bar. The HSI will appear to show proper sensing if the front course is set in; therefore, the pilot will turn toward the course deviation or lateral deviation bar. The localizer is considered reliable within 18 NM of the transmitter and within 10° of the localizer course. The glideslope information is considered reliable within 10 NM of the transmitter, provided the aircraft is on the localizer course. Small, deliberate adjustments in rate of descent/climb and heading are necessary to keep the aircraft on glideslope and on course.

NOTE

If the front course is set in the HSI while outbound on a Front Course PT, it will appear to show proper sensing. The pilot will turn toward the deviation bar to correct, if off course.

The marker beacon receiver is energized regardless of whether an ILS frequency is selected or not. It provides audio signals to the KMA24H audio unit. If the MKR button is depressed on the pilot's audio panel, the pilot will hear the signals discussed previously when the aircraft passes over the marker beacons during the ILS or localizer approach. The blue light (labeled 0) on the KR-21 panel will flash on/off at a rate of two per second when the aircraft passes over the outer marker. The amber light (labeled M) will flash synchronously with the audio dots and dashes when the aircraft passes over the middle marker. The white light (labeled A) will be lighted while over the inner marker beacon. The inner marker is normally used to identify the decision height of a CAT II ILS, wherein the aircraft's altitude above the runway is normally 100 feet. The HI/LO switch on the KR-21 allows the pilot to vary the sensitivity of the KR-21 to the marker beacons 75 MHz signal. The effect of the "HI" position is to greatly enlarge the size of the cone-shaped "area of indication" above the station. An aircraft slightly off course would therefore be ensured of marker beacon signal reception. The high sensitivity position may be used to effectively give the pilot an advance indication that he is approaching the outer marker. The aural tone will begin about one mile from the outer marker at which time the pilot can slow to desired approach speed and perform final cockpit checks.

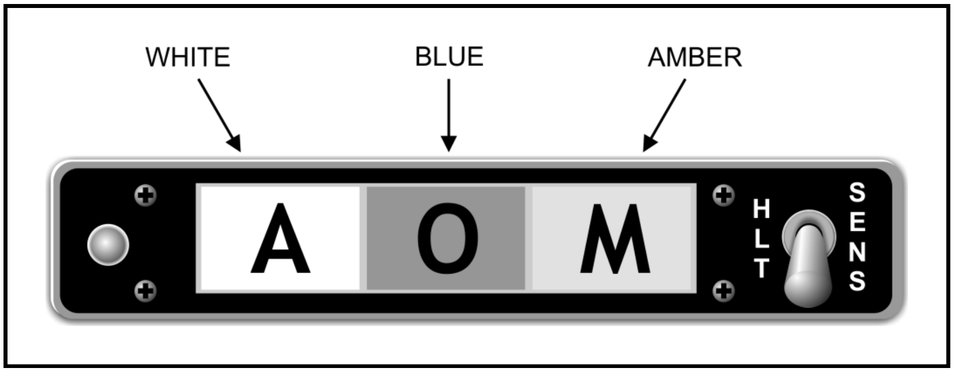


Figure 6-7 KR-21

Figure 6-8 shows ILS RWY 17 approach at Pensacola Regional Airport. There are two initial approach fixes listed: BRENT Intersection and PENSI Intersection. If a pilot files to BRENT, they should plan to execute the 45° procedure turn as shown. If a pilot has filed to PENSI, they would execute a straight-in ILS.

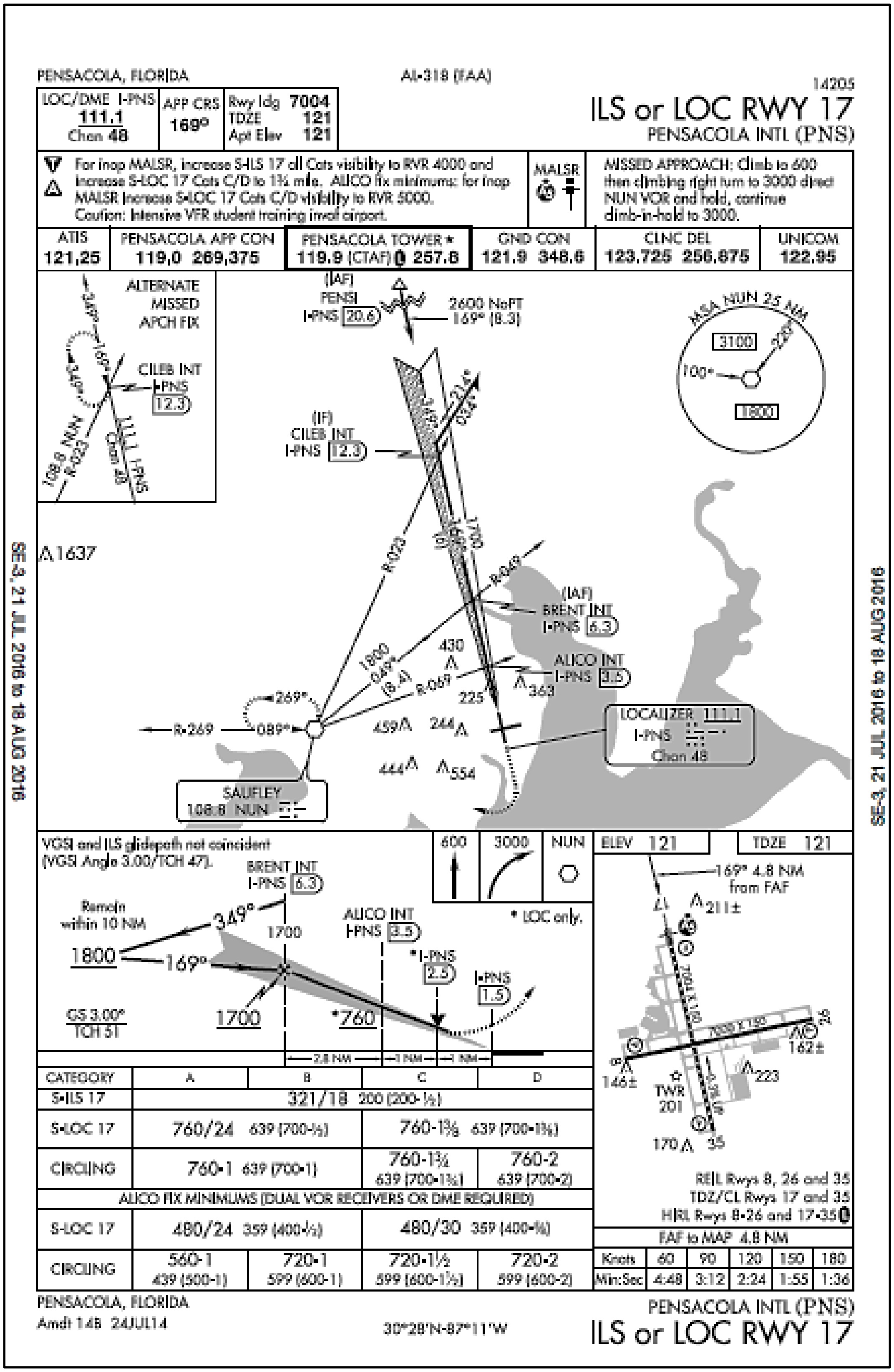


Figure 6-8 ILS RWY 17

On the profile section, the glideslope and threshold crossing heights of 3° and 51 feet respectively are listed. The glideslope can be used in the rate of descent table to determine an appropriate descent rate for the approach. If the duty runway is 17, the DH is 321 feet and the RVR requirement is 1800 feet. The DH designates the ILS MAP (Missed Approach Point). If maintained on the glideslope, the aircraft's altitude upon reaching the MAP should be 321 feet. Upon reaching the DH, if the visual reference with the runway environment (runway or runway/approach lights) is insufficient to complete the landing, the published missed approach procedures shall be executed.

Figure 6-9 shows the ILS Z RWY 19 at Eglin AFB. In this approach, aircraft Distance Measuring Equipment (DME), or suitable RNAV equipment for DME (GTN-650) is required only if flown as a localizer. After intercepting the ILS final approach course and glide slope, the pilot descends to the decision height of 265 feet (TH-57 helicopters are CAT A). On this approach, the MM serves as a back-up for the MAP (decision height) for the ILS approach.

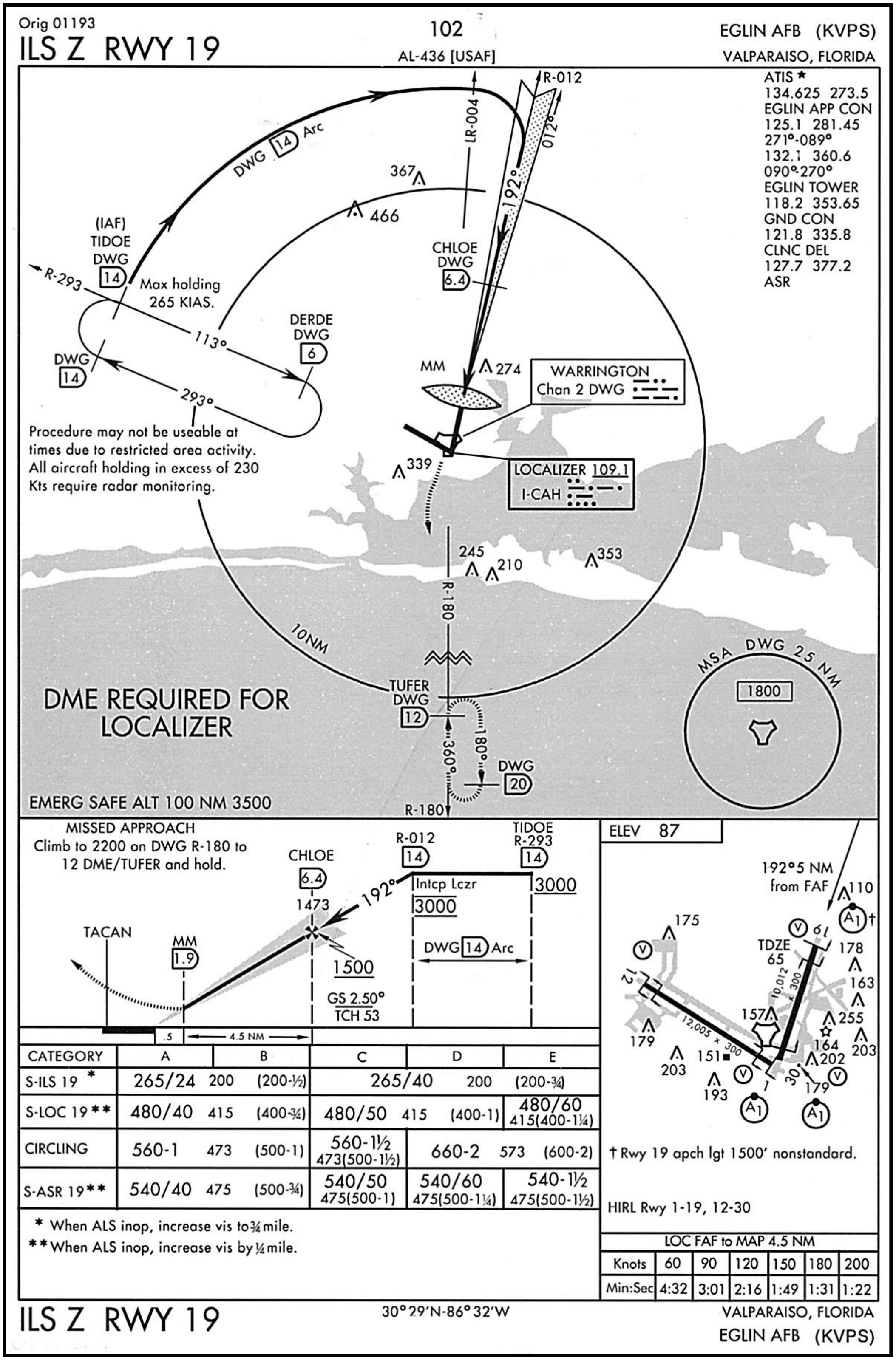
607. LOCALIZER APPROACHES PROCEDURES

The procedures used are very similar to those used on an ILS approach except the pilot must use timing from the FAF to identify the MAP. The localizer minimums for Figure 6-9 are listed as either S-LOC 19 or circling. For example, if the duty runway is 19, the pilot executing the localizer approach would descend (without the aid of a glideslope) to the MDA of 480 feet after crossing the FAF and time for 3:01 minutes from the FAF (at 90 knots groundspeed) to determine the MAP. If the runway in use is something other than 19, the circling MDA of 560 feet (CAT A) would be used.

A TH-57C pilot may execute a back course localizer approach to a straight-in or a circle to land. Figure 6-10 shows the LOC BC RWY 16R approach at Jackson International. The most significant difference between a front course localizer and a back course localizer is the reversal of the azimuth signal on the back course. The pilot would be required to make course corrections away from the lateral deviation bar or course deviation needle because of this "reverse sensing."

NOTE

> Only if using the CDI. With the front course set in the HSI, it will automatically compensate for "reverse sensing." A pilot using the HSI would make course corrections toward the lateral deviation bar.



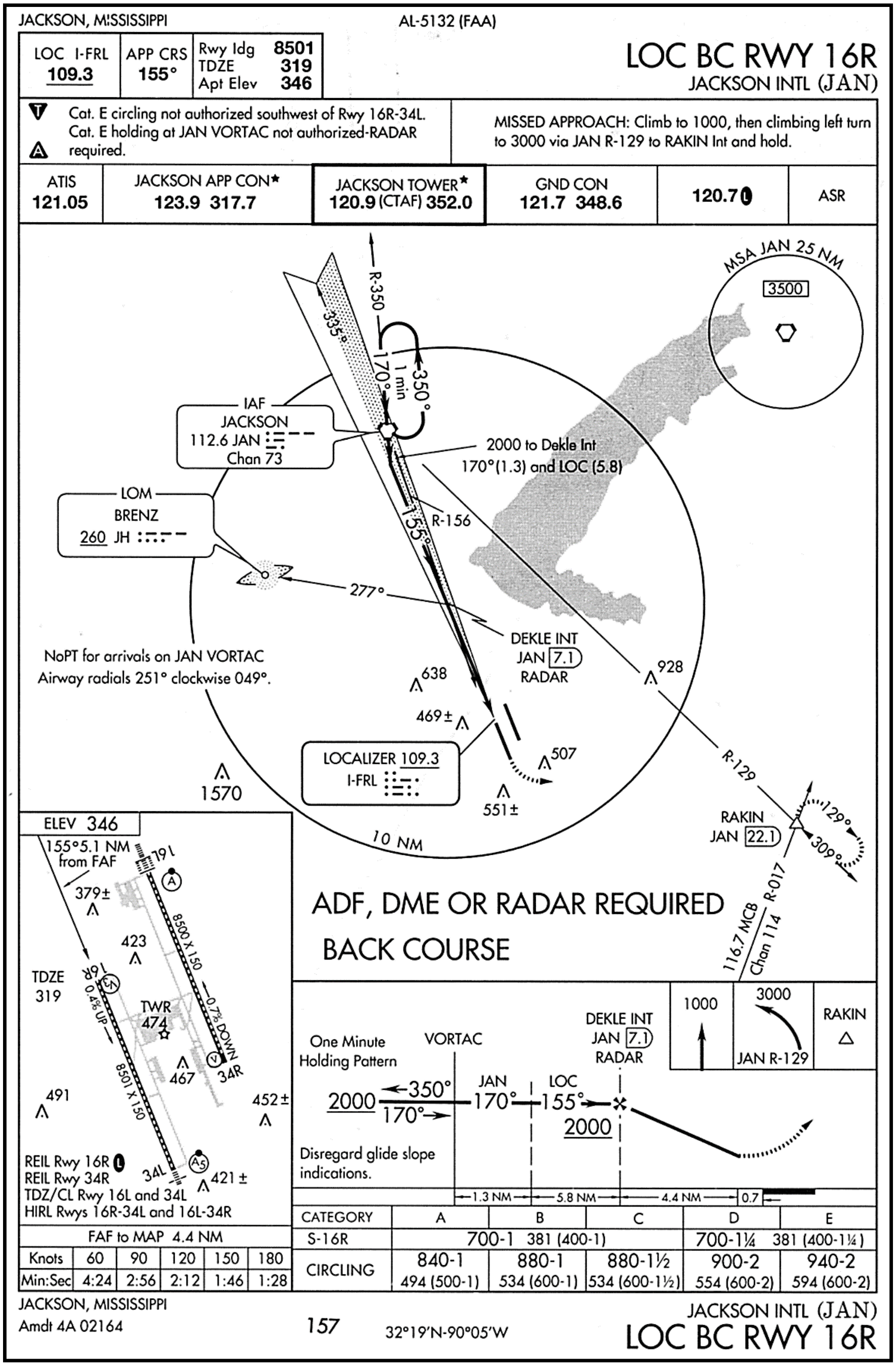
CATEGORY	A	B	C	D	E
S-ILS 19 *	265/24 200 (200-½)		265/40 200 (200-¾)		
S-LOC 19 **	480/40 415 (400-¾)		480/50 415 (400-1)		480/60 415(400-1¼)
CIRCLING	560-1 473 (500-1)		560-1½ 473(500-1½)	660-2 573 (600-2)	
S-ASR 19 **	540/40 475 (500-¾)		540/50 475(500-1)	540/60 475(500-1¼)	540-1½ 475(500-1½)

* When ALS inop, increase vis to ¾ mile.
** When ALS inop, increase vis by ¼ mile.

LOC FAF to MAP 4.5 NM

Knots	60	90	120	150	180	200
Min:Sec	4:32	3:01	2:16	1:49	1:31	1:22

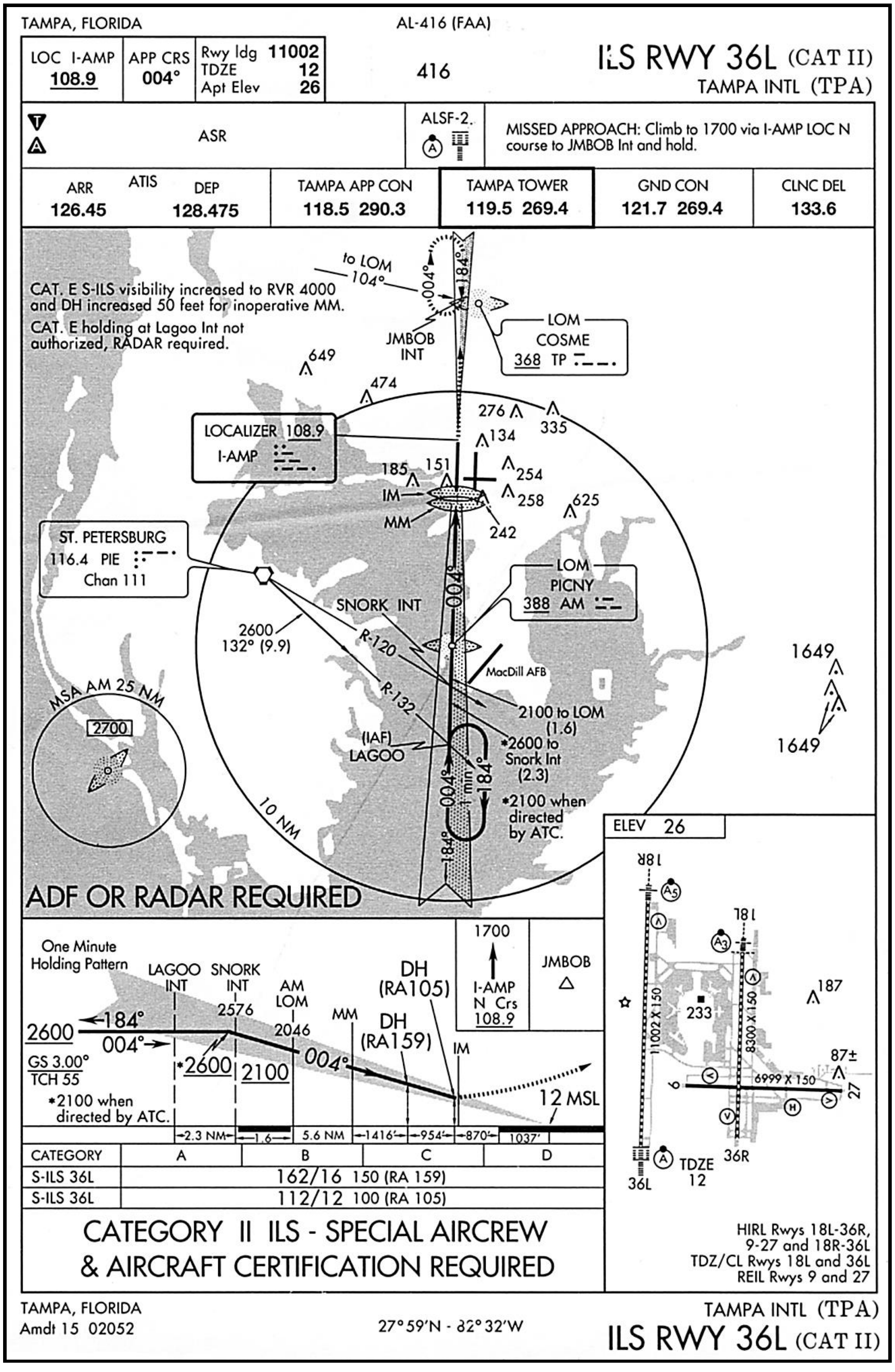
Figure 6-9 ILS Z RWY 19



FAF to MAP 4.4 NM					
Knots	60	90	120	150	180
Min:Sec	4:24	2:56	2:12	1:46	1:28

CATEGORY	A	B	C	D	E
S-16R	700-1 381 (400-1)			700-1¼ 381 (400-1¼)	
CIRCLING	840-1 494 (500-1)	880-1 534 (600-1)	880-1½ 534 (600-1½)	900-2 554 (600-2)	940-2 594 (600-2)

Figure 6-10 LOC BC RWY 16R



CATEGORY	A	B	C	D
S-ILS 36L	162/16 150 (RA 159)			
S-ILS 36L	112/12 100 (RA 105)			

Figure 6-11 ILS RWY 36L

Figure 6-11 shows the ILS RWY 36L at Tampa International. It is a Category II ILS approach, which means the HAT (Height Above Touchdown) is not less than 100 feet and the runway visual range is less than 1800 feet (but not less than 1200 feet). Radar altimeter equipment in the aircraft is required to identify the DH/MAP. The (RA 159, RA 105) in the minima section of the approach indicates a radar altimeter reading of 159 or 150 feet identifies the respective MAP.

Single-piloted aircraft in the Navy are limited to "200 feet ceiling/height above touchdown (HAT) and visibility 1/2 statute mile/2400 feet RVR or published minimums," whichever is higher (1/4 mile for copters). According to FAR Part 91, among the equipment required for CAT II ILS approaches down to a HAT of 150 feet is a marker beacon receiver with outer and middle marker aural and visual indicators and an automatic approach coupler or a flight director system. For CAT II approaches with a HAT of less than 150 feet, the aircraft must have an inner marker beacon capability or a radar altimeter in addition to the above-mentioned equipment. ***At this writing the TH-57C is not equipped with a flight control guidance system; therefore, the aircraft is not certified for CAT II ILS operations.***

608. ILS FLIGHT PROCEDURES

The procedures discussed in this text assume that the navigational facilities are properly tuned and identified, all aircraft equipment is operating correctly, and all switches are properly positioned. These procedures are generally accepted, but should not be construed as established, routine, or mandatory.

Course Orientation, Intercept and Tracking

When a compass locator is part of an ILS installation, orientation is simply a matter of ADF orientation as discussed in chapter seven. The value read under the head of the ADF needle is the course to the compass locator. Since the compass locator is collocated with either the outer marker or middle marker, the pilot merely tracks inbound toward the compass locator until he is within the reception range of the localizer.

As the aircraft approaches the localizer course, a smooth intercept is made using the same procedures as discussed in ADF procedures.

In the following illustration (Figure 6-12), the aircraft is located on the 300 course to the compass locator.

Figure 6-12 Compass Locator

As the aircraft moves within the reception range of the localizer, the HSI may be used as an aid in orientation. When the inbound front course localizer bearing is selected with the course selector, the aircraft's position relative to the localizer course will be the same as that presented in the VOR and TACAN units. If the inbound back course localizer bearing is selected with the course selector, the HSI will present "reverse sensing." When the aircraft is left of course, the lateral deviation bar is deflected to the left and when the aircraft is right of course, the lateral deviation bar is deflected to the right; therefore, the inbound front course localizer bearing should always be selected. Until the aircraft moves within the cone of the localizer, the lateral deviation bar will be deflected to one side. (Full scale deflection of the lateral deviation bar is 2½º either side of centerline.) As the aircraft moves within the cone of the localizer course, each dot on the lateral deviation scale represents ½º deviation from the localizer course. The following depictions, when applied to the accompanying approach plates, should help you visualize the aircraft's lateral position.

The ***outbound front course*** localizer bearing (126º) has been improperly selected; therefore, reverse sensing is displayed. The aircraft (in both depicted positions) is 1½º left (NE) of the localizer course (Figures 6-13/14).

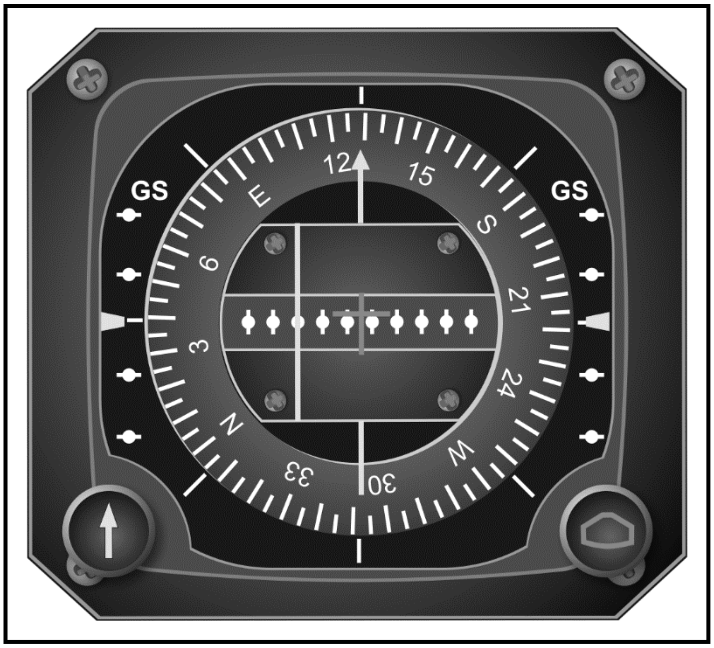


Figure 6-13 Outbound Front Course Localizer

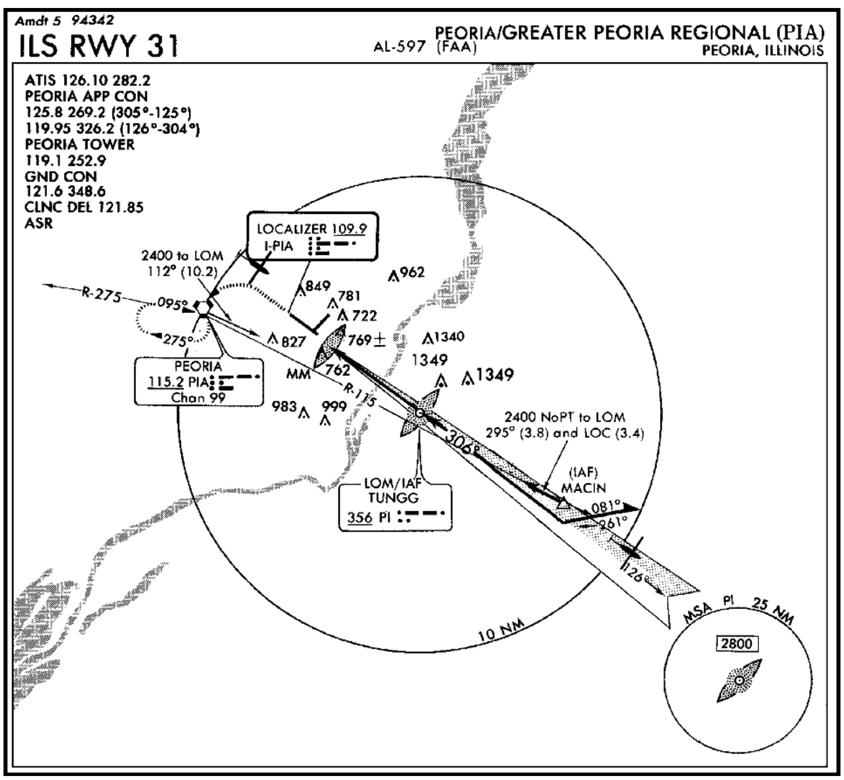


Figure 6-14 ILS RWY 31

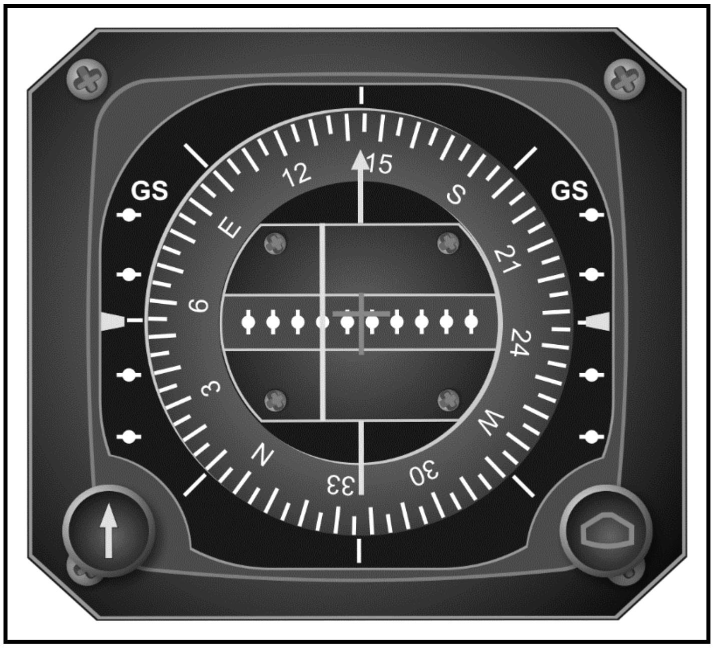


Figure 6-15 Southwest of Localizer Course

The aircraft (in the depicted position) is 1º right (Southwest) of the localizer course.

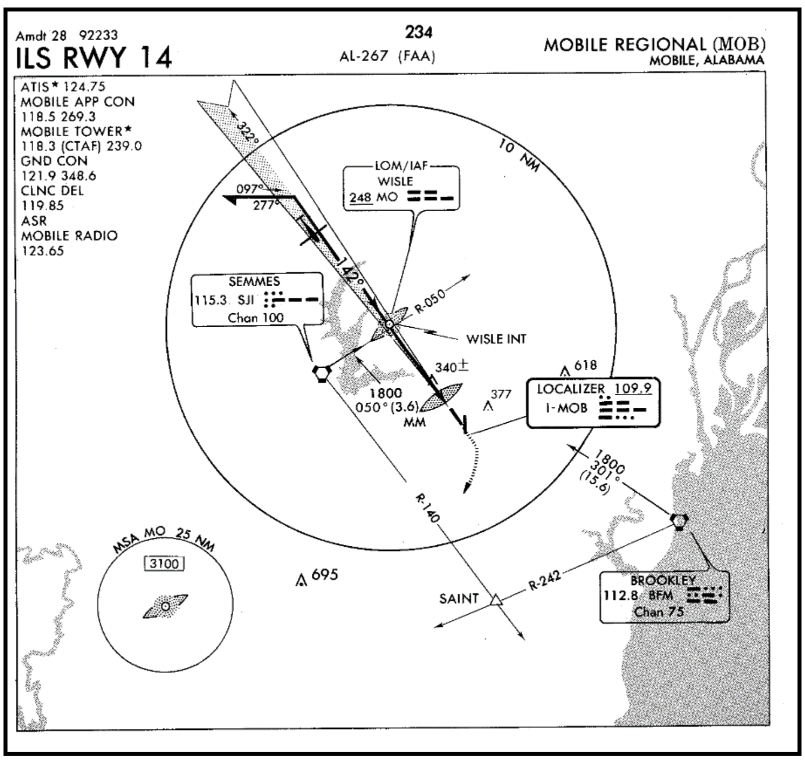


Figure 6-16 ILS RWY 14

Figure 6-17 West of the Localizer Course

The aircraft (in all depicted positions) is 2 ½º or more West (left) of the localizer course.

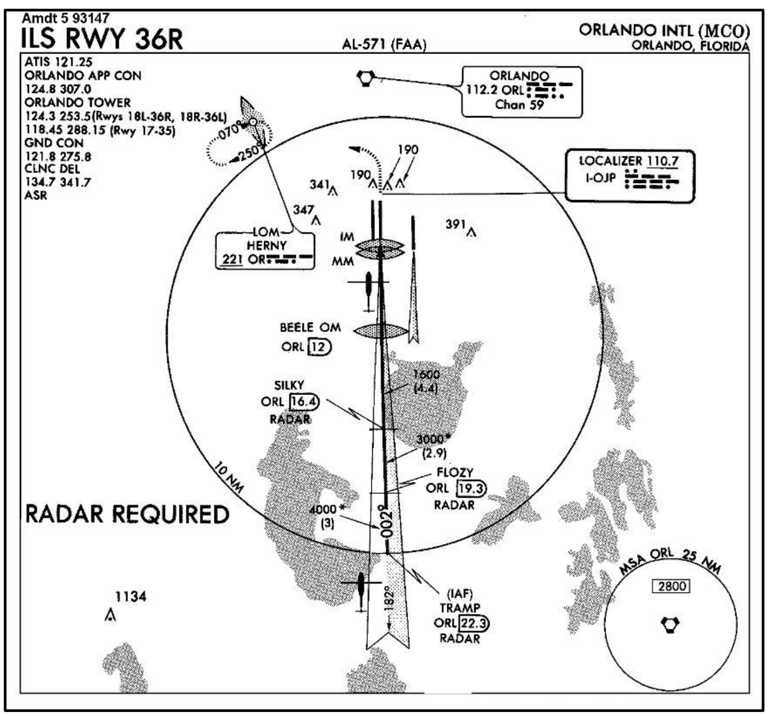


Figure 6-18 ILS RWY 36R

REVIEW QUESTIONS

1. What does ILS stand for? ____

2. The purpose of the ILS is to allow the pilot to conduct an approach in conditions of low ceiling/visibility using only visual references inside the cockpit. _____________ (True/False)

3. The ILS is a precision approach because it provides ______________ and ______________ information.

4. The localizer transmits in the ________ to ________ MHz frequency range and provides ________________ information to the pilot.

5. The glideslope transmits in the UHF frequency of ________ to ________ MHz.

6. The outer, middle, and inner marker beacons have a rated power output of ___ watts. The outer marker normally indicates a position at which an aircraft at the appropriate altitude on the localizer course will intercept the ___________________.

7. The _______________________ is the position at which an aircraft on the glidepath will be at an altitude of approximately 200 feet above the elevation of the touchdown zone (i.e., the point where the glide slope intercepts the decision height, at or near the missed approach point).

8. The compass locator operates in the ____________ to _________ KHz frequency range and are often situated at the MM and OM sites.

9. ILS CAT I approaches provide for an approach to a height above touchdown or not less than ________ feet and RVR of not less than ________ feet.

10. CAT II ILS approaches provide for an approach to a height above touchdown of not less than ________ feet and RVR of not less than ________ feet if the aircraft is properly equipped IAW FAR Part 91.

11. When the pilot selects an ILS frequency on the NAV-1 (KLN-900 configured), the mode must be manually switched to ILS. _____________ (True/False)

12. The pilot uses the HSI and the copilot uses the CDI when executing an ILS approach. _____________ (True/False)

13. If both HSI and CDI are to be used during an ILS approach, then NAV-1 (KLN-900 configure) must be selected by both pilots. _____________ (True/False)

14. The pilot should make all glideslope corrections toward the _____________ on the HSI and all course corrections toward the _____________ on the HSI when executing an ILS approach with front course dialed in the HSI.

15. When executing a back course localizer approach, the pilot must make course corrections _______________ (towards/away from) the HSI lateral deviation bar, with the front course dialed in.

16. The KR-21 marker beacon receiver in the TH-57C gives the pilot which of the following?

    a. Outer and middle marker visual ident
    b. Outer and middle visual and aural ident
    c. Outer, middle and inner visual ident
    d. Outer, middle and inner visual and aural ident

17. The localizer is considered reliable when the aircraft is

    a. Within 10° of the localizer course and within 18 NM of the transmitter.
    b. Within 30 NM of the transmitter and within 30° of the localizer course.
    c. Within 35° of the localizer course and within 10 NM of the transmitter.
    d. Within 10° of the localizer course and within 30 NM of the transmitter.

18. The MAP (Missed Approach Point) on an ILS is the point where the aircraft is at _______________.

19. The MAP on a localizer approach is based upon _______________ from the FAF.

USE FIGURE 6-19 TO ANSWER QUESTIONS 20 THROUGH 26.

20. If the pilot filed to CADZU Intersection, upon arrival he would be expected to execute the

    a. holding pattern procedure turn.
    b. straight-in ILS with no procedure turn.

21. What ILS frequency would the pilot select in the NAV-1?

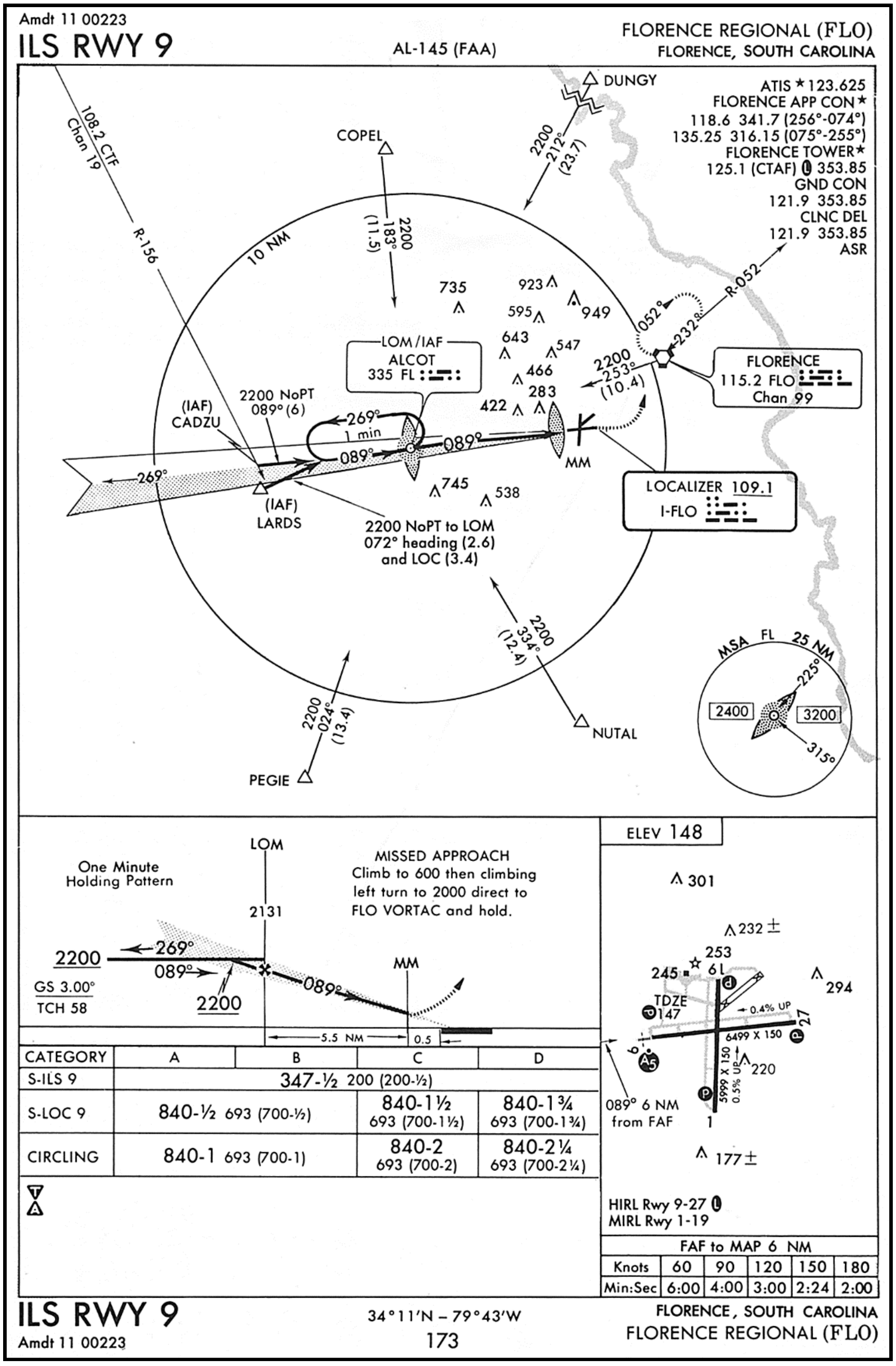
22. What frequency would the pilot select on the KR-87 (ADF) to receive the compass locator?

23. What is the glideslope angle on this approach?

24. To execute the missed approach procedure, the pilot must select the ____________ VORTAC on NAV-1.

25. The TH-57C pilot's decision height for this ILS approach is ___________.

26. What would your BAR ALT read upon crossing the threshold?

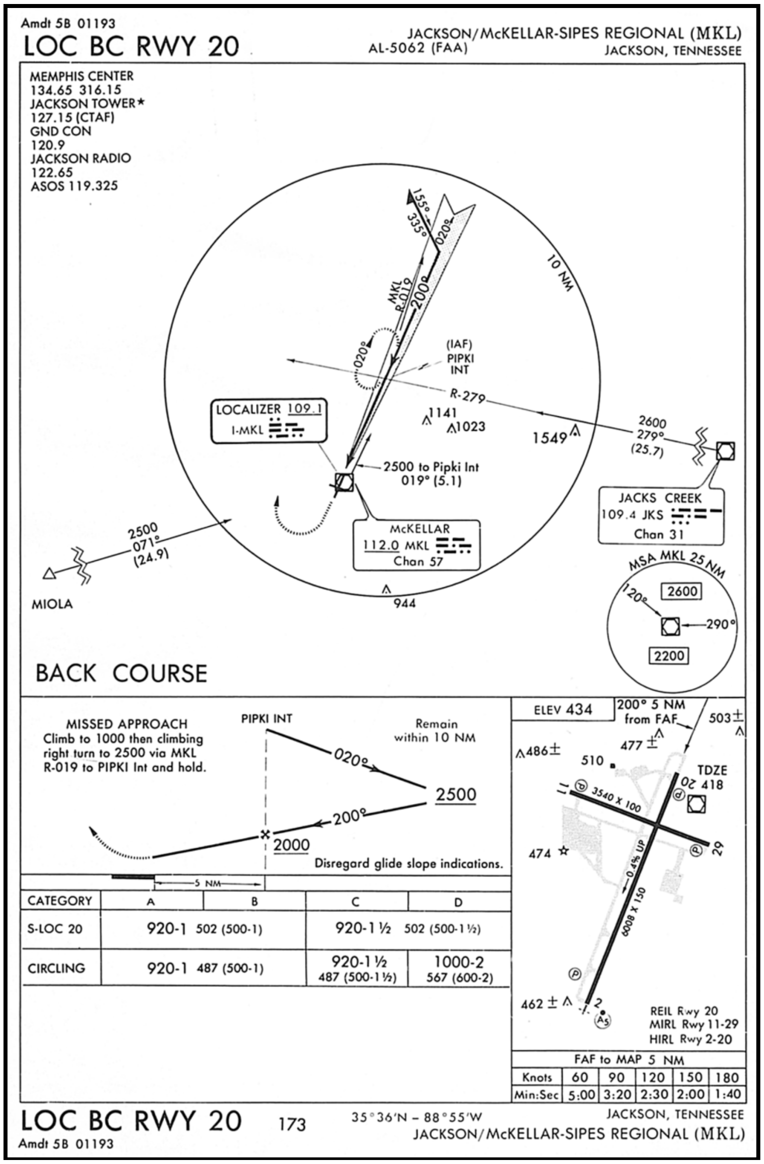


CATEGORY	A	B	C	D
S-ILS 9	347-½ 200 (200-½)			
S-LOC 9	840-½ 693 (700-½)		840-1½ 693 (700-1½)	840-1¾ 693 (700-1¾)
CIRCLING	840-1 693 (700-1)		840-2 693 (700-2)	840-2¼ 693 (700-2¼)

FAF to MAP 6 NM					
Knots	60	90	120	150	180
Min:Sec	6:00	4:00	3:00	2:24	2:00

Figure 6-19 ILS RWY 9

Use Figure 6-20 to answer questions 27 through 30.



CATEGORY	A	B	C	D
S-LOC 20	920-1 502 (500-1)		920-1½ 502 (500-1½)	
CIRCLING	920-1 487 (500-1)		920-1½ 487 (500-1½)	1000-2 567 (600-2)

FAF to MAP 5 NM					
Knots	60	90	120	150	180
Min:Sec	5:00	3:20	2:30	2:00	1:40

Figure 6-20 LOC BC RWY 20

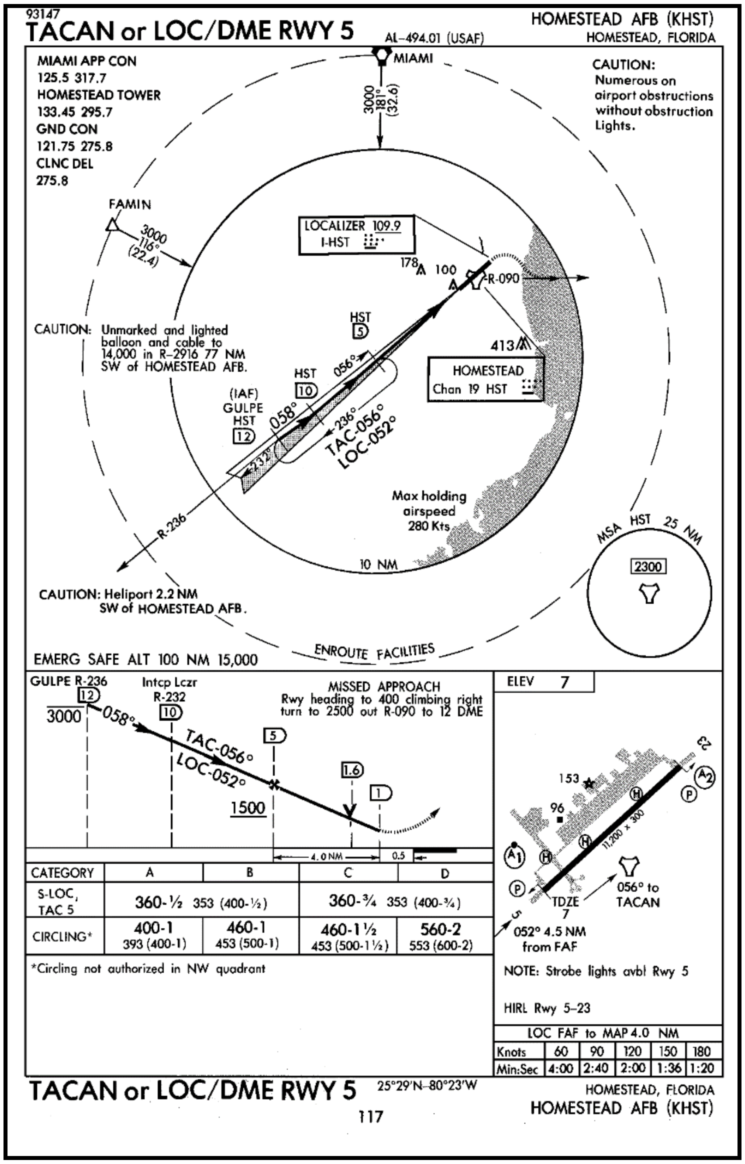
27. The IAF for this approach is _______________.

28. The 45-degree procedure turn is mandatory on this approach. ____________(True/False)

29. If the duty runway is 29, the TH-57C pilot's MDA is _______________.

30. The pilot identifies the MAP by ____.

Use Figure 6-21 to answer questions 31 to 35.



CATEGORY	A	B	C	D
S-LOC, TAC 5	360-½ 353 (400-½)		360-¾ 353 (400-¾)	
CIRCLING*	400-1 393 (400-1)	460-1 453 (500-1)	460-1½ 453 (500-1½)	560-2 553 (600-2)

*Circling not authorized in NW quadrant

LOC FAF to MAP 4.0 NM					
Knots	60	90	120	150	180
Min:Sec	4:00	2:40	2:00	1:36	1:20

Figure 6-21 TACAN or LOC/DME RWY 5

31. Can the TH-57C shoot the LOC/DME approach? _______________

32. The IAF on this approach is _______________.

33. When are you clear to descend below MDA when flying VMC? _____________________

34. The FAF is identified as _______________ when flying a TH-57C.

35. The pilot would execute the missed approach upon reaching _______________.

REVIEW ANSWERS

1. Instrument Landing System
2. True
3. glideslope . . . course
4. 108.10 . . . 111.95 . . . course
5. 329.15 . . . 335.00
6. 3 . . . ILS glide path
7. Middle Marker (MM)
8. 190 . . . 535
9. 200 . . . 2400 feet (1800 with touchdown zone and centerline lights)
10. 100 . . . 1200
11. False
12. True
13. True
14. glideslope pointer . . . lateral deviation bar
15. toward
16. d.
17. a.
18. decision height
19. timing
20. b.
21. 109.1
22. 335 KHz
23. 3.0º
24. Florence
25. 347 feet
26. 205 feet
27. PIPKI Int.
28. True
29. 920 feet
30. timing from the FAF (PIPKI Int.)
31. Yes, the localizer frequency and DME channel are paired.
32. Gulpe
33. at the visual descent point
34. 5 DME from HST
35. 1 DME from HST

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER SEVEN
ADF/NDB PROCEDURES

700. INTRODUCTION

This chapter will introduce the student to the characteristics and procedures of Nondirectional Beacon (NDB).

701. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

Upon completion of this chapter, the student will be able to state the use of nondirectional radio beacons, ADF procedures, and the TH-57C helicopter direction finding equipment.

Enabling Objectives

1. State the following characteristics common to all nondirectional radio beacons.

2. Method of signal propagation.

3. Accuracy of azimuth derived from nondirectional radio beacons as compared to that derived from other navigational aids.

4. Normal navigational uses.

5. Compatibility with voice transmissions.

6. State the following characteristics peculiar to LF/MF nondirectional beacons.

7. Frequency range.

8. Maximum reception range.

9. Susceptibility to atmospheric interference.

10. Normal uses.

11. List the power output and operational range of NDBs by radio class code.

12. List ADF procedures.

13. State the characteristics and function of the loop antenna.

14. Define the terms ADF, Null, and Dip Error.

15. Identify and list the functions of the controls of the KR-87 ADF radio.

16. State the type of bearing information presented by the needle when the RMI operates properly and when the RMI malfunctions.

17. Define the terms "course to" and "bearing from" as they apply to direction finding navigation.

18. Name the FAA facilities which provide VHF/DF services.

19. List the uses of UHF NDBs.

20. List the primary function of the radar beacon system.

21. List the uses of NDBs.

22. List the frequency range of LF/MF NDBs.

23. List the characteristics and uses of NDBs as identified by the "Radio Class Code."

702. ADF/NDB

The group of navigational aids referred to collectively as nondirectional beacons transmits a continuous carrier wave signal, which is radiated equally around the station. Unlike VOR or TACAN stations, the signals transmitted by these stations have no directional properties themselves; thus, the name "nondirectional beacon" or NDB. The azimuth information presented by the NDB is relative to the ***nose of the aircraft***, unlike VOR or TACAN, which presents its information as a magnetic radial from the station.

Because of the nondirectional characteristics of their signals and other factors discussed later, azimuth information derived from an NDB is generally less accurate than information derived from a VOR or TACAN.

Aircraft need not be capable of navigating via NDB to fly within most of the contiguous United States Victor or Jet Route system. They serve as terminal approach NAVAIDs and additional means of identifying certain airways and approach fixes. These NDBs transmit a three-letter identifier continuously. It should be noted that when an NDB is used for an approach, the associated landing minimums will normally be higher than those for other types of NAVAIDs.

Low- or medium-frequency radio beacons transmit in the frequency band of 190 to 535 KHz. They transmit a continuous wave which can carry voice transmissions. Radio beacons are employed as additional NAVAIDs and fixes by which the pilot of an aircraft equipped with a Radio Compass receiver (e.g., KR-87) can determine his bearing and "home" to the station.

The power output of the facility, atmospheric conditions (thunderstorms, precipitation, and time of day), the surface over which the signal travels, and the sensitivity of the aircraft's receiver combine to determine the reception range of LF/MF NDB signals. Under ideal conditions, LF/MF NDB signals can be received from several hundred miles away, but the directional accuracy of signals at these ranges is very susceptible to atmospheric interference. In the vicinity of thunderstorms, LF/MF NDB signals may become totally unreliable.

Although they may sometimes be received from several hundred miles away, the power output and generally accepted ranges of the various classifications of LF/MF NDBs are as follows:

Radio Class Code	**Power Output**	**Operational Range**
HH	2000 watts or more	75 NM
H	50 to 2000 watts	50 NM
MH	50 watts or less	25 NM

This information is presented, for your reference, in the front of the IFR Supplement, in the table labeled ***Radio Class Code***.

The distances listed in the preceding paragraph should not be misconstrued to mean maximum reception ranges. These NAVAIDs are not limited to line-of-sight.

It is not expected that pilots carefully commit to memory the power output and the operational distance of the various class radio beacons. A general knowledge; however, will preclude the frustrating experience of trying to tune and receive a radio beacon classed as MH at, say, a distance of 100 miles.

Many instrument approach procedures listed in the FLIP Terminal use LF radio beacons. These are termed NDB approaches.

When a radio beacon is used with an ILS, it is called a Compass Locator and often situated at the Middle Marker and Outer Marker sites.

All radio beacons, except the Compass Locators, transmit a ***continuous*** three-letter identification in Morse code. (The identification of Compass Locators will be a two-letter Morse code group.)

If voice is not available on a radio beacon frequency, the symbol W will follow the "Radio Class" designator, e.g., NDB (HW).

To navigate by either LF/MF or UHF/NDB, the aircraft must be equipped with some type of direction-finding equipment (DF). Most Navy aircraft now have Automatic Direction Finding (ADF) equipment installed on board. This equipment automatically determines the bearing to any selected radio station within its frequency and sensitivity range. This equipment may also be used as an auxiliary receiver for weather or lost communications information.

The operation of DF or ADF equipment depends chiefly on the characteristics of a loop antenna. A loop-receiving antenna gives maximum reception when the plane of the loop is parallel to (in line with) the direction of wave travel. As the loop is rotated from this position, volume gradually decreases and reaches a minimum when the plane of the loop is perpendicular to the direction of wave travel.

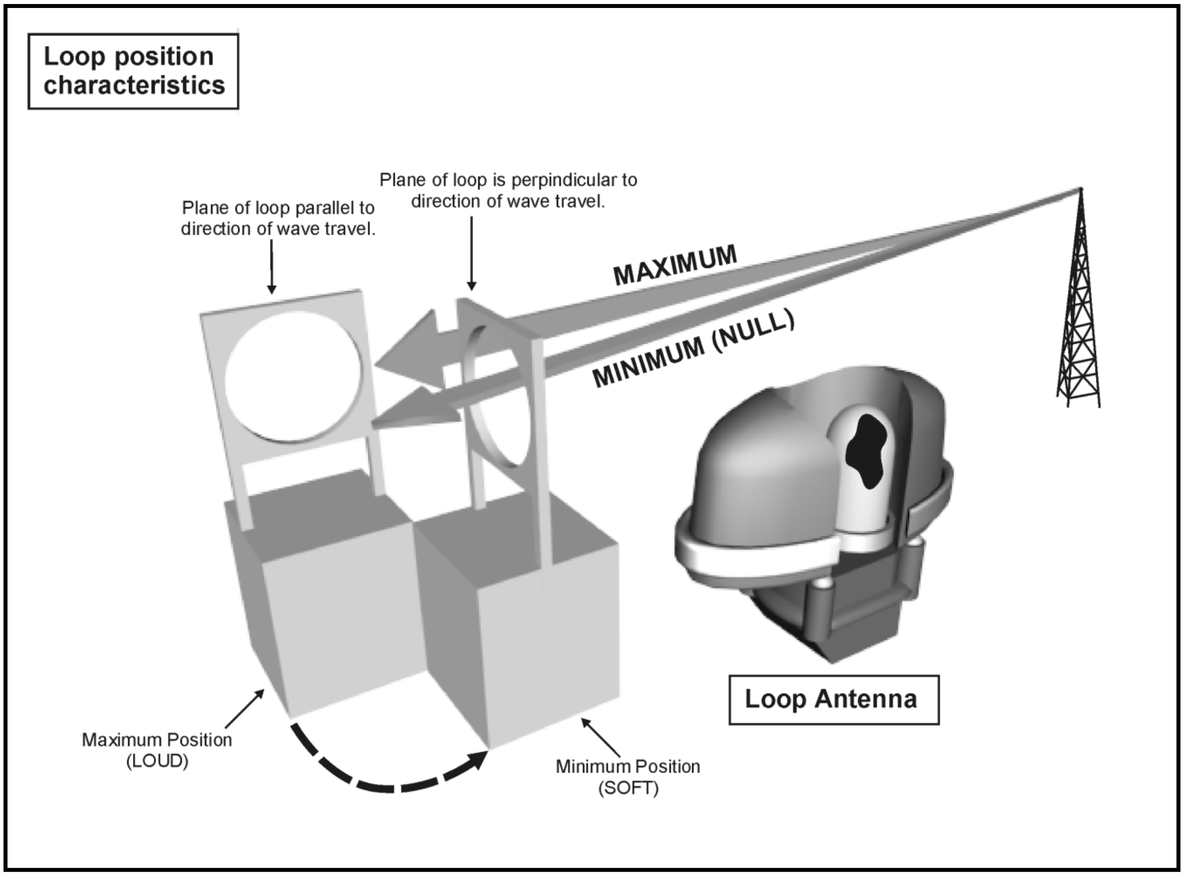


Figure 7-1 Loop Antenna

These characteristics occur in a loop antenna because the receiver input from a loop antenna is the resultant of opposing voltages in the two halves of the loop. When current flows in a looped conductor, it flows in opposite directions in each half of the loop. This occurs when the plane of the loop is in line with the station. Because one side of the loop is closer to the station, there is a slight delay between the time the signal reaches the closer side and when it reaches the farther one. This creates a phase difference between the voltages induced in each half of the loop. This causes a resultant current flow through the transformer, which creates a signal input to the receiver. As the antenna is turned perpendicular to the wave flow, this phase differential is reduced, thereby reducing the signal to the receiver, and reducing the volume. When the loop antenna is exactly perpendicular to the station, the induced voltage is theoretically zero, and the receiver strength is at a minimum. This position of the antenna is called the NULL position.

The null position of the loop antenna, rather than the maximum position, is used for direction finding; that is, a bearing is obtained when the plane of the loop is perpendicular to the line on which the radio waves are traveling when they strike the antenna. The null position is preferred because it can be determined more accurately than the maximum. A 25° rotation away from the maximum position causes a signal strength reduction of about 10%, while a 25° rotation away from the null position causes a 50% change in the signal strength.

With the loop antenna rotated to the null position, the radio station being received is on a line perpendicular to the plane of the loop; however, this still leaves two possible directions, 180° apart from each other. The inability of the loop antenna to determine which of the two possible directions is correct is called the 180° ambiguity of the loop. This 180° ambiguity is eliminated with a sensing antenna, when automatic direction-finding equipment is used.

The loop antenna of the radio compass is automatically rotated to the null position when signals are being received over both the sensing and loop antennas, providing you have selected automatic direction finding as your mode of operation. The combination of signals energizes a phasing system which operates a motor attached to the loop antenna. Anytime the loop antenna is turned away from the null position, the phasing system activates the motor to return the loop to the null position. The bearing pointer on the RMI is electrically synchronized and turned with the loop, thus indicating the direction from which the radio waves are coming.

When using ADF equipment, the loop antenna is automatically positioned to the null position; however, the antenna can only rotate about the vertical axis (in relation to the aircraft) and cannot tilt. Anytime the antenna is tilted, as when the aircraft is banked, the loop is tilted away from the null, and the motor is not capable of correcting for this error. This is called "dip error," and is present anytime the aircraft is not in level flight. The magnitude of this error depends upon the position of the aircraft from the station, altitude, range from the station, and the angle of bank used. "Dip error" is most noticeable when the aircraft is banked, and the station is on the nose or tail. ***The ADF bearings should be considered accurate only when the aircraft is in level flight.***

In the TH-57C, the KR-87 is the radio receiver for LF/MF reception. It is capable of receiving signals in the frequency range of 200-1799 kHz. This allows the pilot to select LF/MF NDBs and commercial broadcast stations (550-1700 kHz). It should be noted that commercial broadcast stations are not under FAA jurisdiction nor are they part of the airway system. They do not necessarily operate continuously, their signals are often highly directional, and the station does not identify itself often enough for airborne use. Even though not compatible with IFR operations, commercial stations can be used as a backup NAVAID, especially with flying off airways.

703. LF AUTOMATIC DIRECTION FINDER KR-87

Automatic direction finder set KR-87 is an airborne low frequency radio compass which provides bearing information and audio information in the 200-1799 kHz range. This receiver enables the pilot to identify stations and listen to transcribed weather broadcasts or commercial radio stations in the AM broadcast band. It may also be used for aircraft homing and position fixing. Control is accomplished from the ADF control panel mounted on the pedestal. Navigational information received on the KR-87 is displayed by the selected ADF needle on the RMI. Power to the KR-87 ADF is supplied from the #1 essential bus.

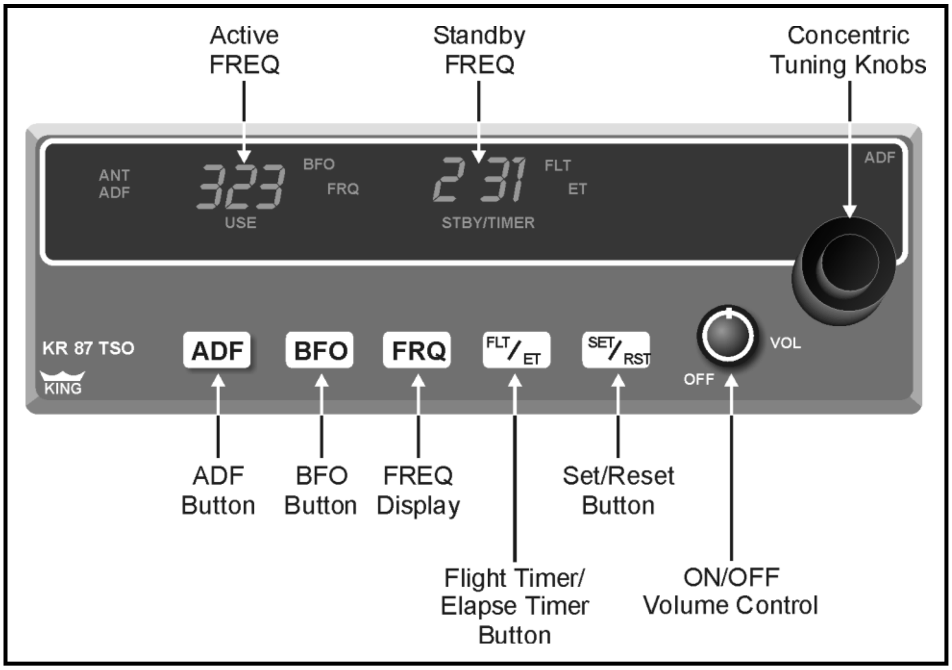


Figure 7-2 KR-87 Automatic Direction Finder

The KR-87 Automatic Direction Finder has two operational modes. In the ANT (Antenna) mode (ADF button out) the loop antenna is disabled, and the unit simply acts as a receiver, allowing audio reception through the headphones. The indicator needle selected for ADF use will remain parked at the 90° relative position and the "ANT" message on the left side of the display will be lighted. This mode provides slightly clearer audio reception and is used for station identification. In various parts of the world, some LF/MF stations use an interrupted carrier for identification purposes. A Beat Frequency Oscillator (BFO) function is provided to permit these stations to be more easily identified. Pushing the BFO switch will cause a 1000-Hz tone to be heard whenever there is a radio carrier signal present at the selected frequency. It will also light the "BFO" message in the center of the display.

With the ADF button depressed, the unit is placed into the ADF mode and the loop antenna is enabled. The "ADF" message on the left side of the display will be lighted and the indicator needle will point to the relative bearing of the selected station. To tell if there is a sufficient signal for navigational purposes, the pilot should place the KR-87 back into the ANT mode, parking the indicator needle at 090°. When the unit is then switched to the ADF mode, the needle should point to the station bearing in a positive manner, without excessive sluggishness, wavering, or reversals.

The standby frequency is displayed in the right-hand window when the "FRQ" message is lit in the center of the display. This frequency may be changed with the concentric knobs. To set the "tens" digit, push the small inner knob and rotate it. Clockwise rotation increases the digit; counterclockwise rotation decreases the digit. The digit will roll over at 9 to 0 as the digit is increased and roll under at 0 to 9 as the digit decreases. With the small knob pulled out, the "ones" digit may be set.

Turning the large knob changes the "hundreds" digit and the "thousands" digit. The "hundreds" digit carries to the "thousands" digit from 9 to 10. The two digits roll over from 17 to 02 and under from 02 to 17, thus limiting the frequencies to the range of 200 kHz to 1799 kHz.

The active frequency is displayed in the left-hand window. This frequency may be changed in two ways. First, it may be changed with the concentric knobs when either time mode (FLT or ET) is being displayed in the right-hand window. The exception to this is when the "ET" message is flashing. Second, pressing the "FRQ" button when the standby frequency is being displayed causes the current standby and active frequencies to be exchanged.

The "FLT/ET" button serves two functions. If elapsed time ("ET") is currently displayed, pressing the "FLT/ET" button will cause the flight timer to be displayed. Pressing this button again will exchange the two timers in the display. If the standby frequency is displayed, pressing the "FLT/ET" button will cause the time which was last displayed to reappear in the window.

The flight timer is displayed in the right-hand window when the "FLT" message is lit. This timer will count up to 59 hours, 59 minutes, 59 seconds. When the unit is first turned on, this timer is automatically started at 0. Minutes and seconds will be displayed until a value of 59 minutes and 59 seconds is reached. On the next count, the display will shift to hours and minutes. The flight timer is reset to 0 only when the unit is turned off.

The elapsed timer has two modes: count up and count down. When power is applied it is in the count up mode starting on 0. As is true with the flight timer, the elapsed timer will count to 59 hours, 59 minutes, 59 seconds displaying minutes and seconds until one hour has elapsed, then displaying hours and minutes. When in the count up mode the timer may be reset to 0 by pressing the reset button.

NOTE

> Pressing the reset button will reset the elapsed timer regardless of what is currently being displayed.

To enter the countdown mode, the "Reset" button is held depressed for approximately 2 seconds until the "ET" message begins to flash. While the "ET" message is flashing, the timer is set in the ET Set mode. In this mode a number up to 59 minutes, 59 seconds, may be preset into the elapsed timer with the concentric knobs. The timer will remain in the ET Set mode for 15 seconds after a number is set in or until the "Reset," "FLT/ET," or "FRQ" button is pressed. The number preset will remain unchanged until the "Reset" button is pressed.

The timer will start when the "Reset" button is pressed. When the timer reaches 0 it changes to the count up mode and continues up from 0.

Automatic direction finding with the KR-87 is accomplished by tuning in the desired station and identifying it. The needle you have selected on your RMI to display the ADF information will home in on the station. The head of the needle always points toward the station, giving the course to the station, and the tail gives the bearing from the station. FAA controllers will use the phrase "course to" to denote a line of position (LOP) inbound to an NDB. They will also use the phrase "bearing from" to signify a line of position outbound from an NDB. The term "radial" ***shall not*** be used in a clearance relative to an NDB.

The compass card of the RMI rotates, so that aircraft heading is at the top of the card at all times if the RMI is functioning properly. The ADF needle (which moves independently in relation to the compass card) provides relative bearing/course all the time, and magnetic bearing/course anytime the compass card is working. The primary indication of the ADF needle is RELATIVE bearing/course.

Assuming normal operation of the RMI, the aircraft's heading will always be indicated beneath the heading index at the top of the RMI. This is the actual magnetic heading, regardless of which bearing or course the aircraft is on. Thus, an aircraft could be on the 270 bearing from a station but heading 360. In a short time, he will not be on the 270 bearing, as he is moving northward, toward the 280 bearing from the station. The RMI, however, only indicates the aircraft's present location and heading (Figure 7-3).

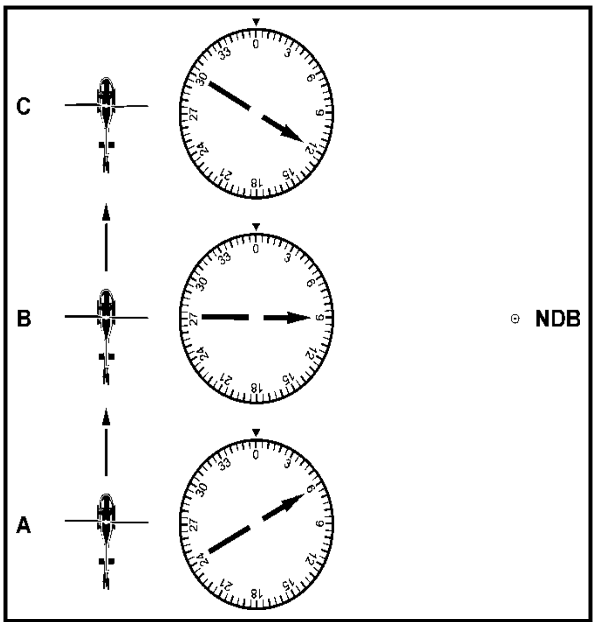


Figure 7-3 ADF Needle

Since the ADF needle provides relative bearings, the actions of the compass card do not affect it.

If the needle is 30° left of the nose of the aircraft (top of the RMI), then so is the station. It is just not necessary to know the magnetic heading to fly to get to the station; you just turn the aircraft until the ADF needle is on the nose and you will eventually arrive at the station. This procedure is known as HOMING.

If the compass card is functioning properly, then the ADF needle will also indicate the magnetic bearing to the station. Thus, if the head of the ADF needle is on 080, and you are heading 100, the needle is 20° left of the nose. You must turn left 20° to a magnetic heading of 080 to go to the station. To track a bearing to the station in a no-wind situation, you just keep the needle on the nose of the aircraft, just like homing. If there is a crosswind, you must apply a crosswind correction, or crab angle, to keep the aircraft on the desired bearing. The procedures are similar to those used for VOR or TACAN tracking, except that you do not have a course deviation indicator.

Since the ADF is for backup use, you will mainly use it for an occasional approach, or to assist in identifying a fix. This chapter will not discuss the NDB approach in depth but will deal with the other uses of the direction-finding equipment, such as identifying fixes. One common example of fix identification is when you are flying on an airway and need to locate an intersection. Since the TH-57C has TACAN, which includes DME, the normal procedure to identify an intersection is to locate it with TACAN radial and DME. If DME fails, you could use any LF/MF or commercial station that is nearby to give you a cross-bearing, showing your exact position (Figure 7-4).

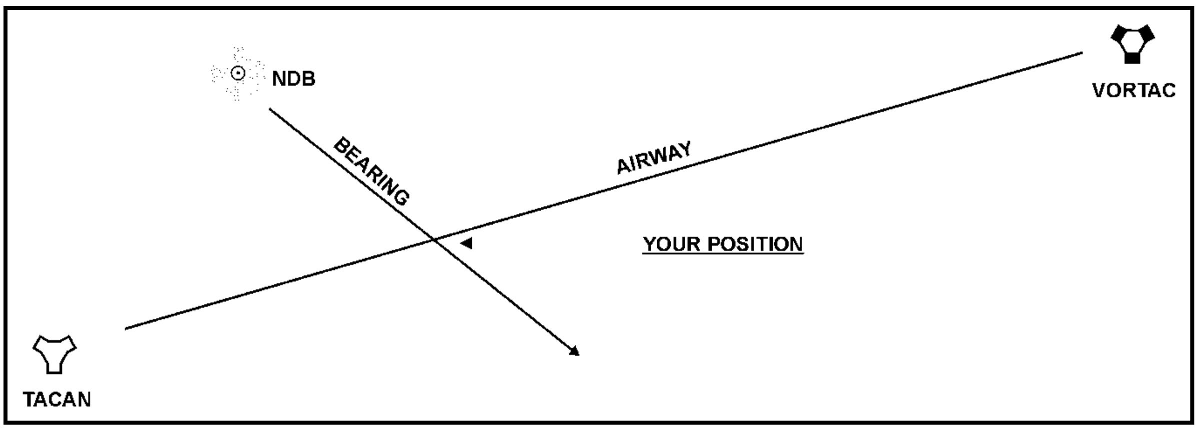


Figure 7-4 Identify Position

In addition to locating the intersection, the NDB would help you keep track of your position along the airway. Since you would keep yourself on the airway with the TACAN and CDI, the airway would constitute one line of position. Your bearing from the NDB would be the other LOP. Where the two LOPs cross is your position.

The aircraft's geographical position in relation to the station can be readily visualized if you use the RMI as a chart. On this chart, the station is always located at the center of the RMI. The airplane is always located on the tail of the ADF needle (bearing from) and the head of the needle indicates the course to the station. The various bearings "from" and courses "to" are also listed by the compass rose around the edge of the RMI.

Thus, if you were in the position indicated in Figure 7-4 and wanted to get to the 160 bearing from the NDB, you could do it three ways. First, you could turn right to intercept the 160 bearing from the station. Second, you could continue on the airway and, upon reaching the 160 bearing, execute an immediate right turn to intercept. Third, you could arc around the station to the proper bearing. The method you choose will normally depend upon how far away from the station you are and which new bearing you plan to intercept.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER EIGHT
GLOBAL POSITIONING SYSTEM

800. INTRODUCTION

Prior to conducting any Global Positioning System (GPS) training it is essential the student be thoroughly familiar with the components and operation of the GTN-650 system. When flying with the GTN-650 (TSO-C146c certified), an alternate source is not required by the FAA (**AIM 1-1-17.b.3**). See paragraph 703 for CNAF M-3710.7 restrictions.

Information in this chapter is provided to give the reader a sound understanding of the basics of GPS operations. Essential sections of the AIM and relevant GPS-related websites are referenced here, but it is incumbent on the pilot to be sufficiently familiar with these sources to operate safely and effectively in all phases of flight where GPS will be utilized.

801. LESSON TOPIC LEARNING OBJECTIVES

Terminal Objective

– Upon completion of this chapter, the student will recall elements of the GPS and state techniques and procedures as they apply to the TH-57C. To demonstrate mastery of the subject material, the student should be able to answer a minimum of 80% of the review questions successfully.

Enabling Objectives

1. Describe the GPS.

2. Describe the WAAS.

3. Describe RAIM and state its importance.

4. Describe ADS-B.

5. Describe the "Basic T" Terminal Arrival Area (TAA) configuration and how it is used for GPS approaches.

6. Understand the variations to the "Basic T" configuration.

7. Identify the GPS equipment installed in the TH-57C.

8. Identify the functions of the GTN-650.

9. State the procedures for inputting a flight plan.

10. State the procedures for inputting and flying a GPS approach.

11. Describe the sensitivity of the CDI for each step of the approach.

12. Describe the CDI sensitivity and airspeed required for a DP departure.

13. State the procedures for executing a GPS missed approach.

802. GLOBAL POSITIONING SYSTEM (GPS) OVERVIEW

GPS is a United States satellite-based radio navigational, positioning, and time transfer system operated by the Department of Defense (DOD). The 24-satellite constellation is designed to ensure at least five satellites are always visible to a user worldwide in order to provide highly accurate position and velocity information. The system is unaffected by weather and provides a worldwide common grid reference system based on the earth-fixed coordinate system. For its earth model, GPS uses the World Geodetic System of 1984 (WGS-84) datum.

GPS receiver accuracy continues to improve with technological advances. GPS satellites broadcast their signals in space with a certain accuracy, but what you receive depends on additional factors, including satellite geometry, signal blockage, atmospheric conditions, and receiver design features. As of 2017, the government has committed to broadcasting the GPS signal in space with a global average user range error (URE) of 25.6 feet, with 95% probability. Actual performance exceeds the specification, averaging an accuracy of 6.2 feet, 95% of the time.

GPS operation is based on the concept of ranging and triangulation from a group of satellites in space that act as precise reference points. A GPS receiver measures distance from a satellite using the travel time of a low-power radio signal via line of sight. Each satellite transmits a specific code, called a course/acquisition (CA) code, which contains information on the satellite's position, the GPS system time, and the health and accuracy of the transmitted data.

Knowing the speed at which the signal traveled (approximately 186,000 miles per second) and the exact broadcast time, the distance traveled by the signal can be computed from the arrival time.

The GPS receiver matches each satellite's CA code with an identical copy of the code contained in the receiver's database. By shifting its copy of the satellite's code in a matching process, and by comparing this shift with its internal clock, the receiver can calculate how long it took the signal to travel from the satellite to the receiver. The distance derived from this method of computing distance is called a ***pseudo-range*** because it is not a direct measurement of distance, but a measurement based on time. Pseudo-range is subject to several error sources such as ionospheric and tropospheric delays (satellite signals slow as they pass through the atmosphere) and signal multipath (signal may reflect off objects such as tall buildings, which will increase the travel time).

Using the calculated pseudo-range and position information supplied by the satellite, the GPS receiver mathematically determines its position by triangulation. The GPS receiver needs at least four satellites to yield a three-dimensional position (latitude, longitude, and altitude) and time solution. The GPS receiver computes navigational values such as distance and bearing to a waypoint, groundspeed, etc., by using the aircraft's known latitude/longitude and referencing these to a database built into the receiver.

The receiver uses data from a minimum of four satellites above the mask angle (the lowest angle above the horizon at which it can use a satellite).

The GPS receiver verifies the integrity (usability) of the signals received from the GPS constellation through ***receiver autonomous integrity monitoring*** (RAIM) to determine if a satellite is providing corrupted information. RAIM needs a minimum of 5 satellites in view, or 4 satellites and a barometric altimeter (baro-aiding) to detect an integrity anomaly. Some GPS receivers, such as the GTN-650, have a capability called fault detection and exclusion (FDE) that excludes a failed satellite from the position solution. GPS receivers with FDE require 6 satellites in view (or 5 satellites with baro-aiding) to isolate the corrupt satellite signal and remove it from the navigation solution. Baro-aiding is a method of augmenting the GPS integrity solution by using a non-satellite input source. GPS derived altitude should not be relied upon to determine aircraft altitude since the vertical error can be quite large. To ensure baro-aiding is available, the current altimeter setting must be entered into the receiver as described in the operating manual.

Generally, there are two types of RAIM fault messages, although it can vary somewhat between receivers. One type indicates there are not enough satellites available to provide RAIM integrity monitoring and another type indicates the RAIM integrity monitor has detected a potential error exceeding the limit for the current phase of flight. ***Without RAIM capability, the pilot has no assurance of the accuracy of the GPS position***.

The Department of Defense declared initial operational capability (IOC) of the U.S. GPS on December 8, 1993. The Federal Aviation Administration (FAA) has granted approval for U.S. civil operators to use properly certified GPS equipment as a primary means of navigation in oceanic airspace and certain remote areas. Properly certified GPS equipment may be used as a supplemental means of IFR navigation for domestic enroute, terminal operations, and certain instrument approach procedures (IAP).

803. GPS NAVIGATION PROCEDURES

Authorization to conduct any GPS operation under IFR requires that:

1. Aircraft using GPS navigation equipment under IFR must be equipped with an approved and operational alternate means of navigation appropriate to the flight. Active monitoring of alternative navigation equipment is not required if the GPS receiver uses RAIM for integrity monitoring. Active monitoring of an alternate means of navigation is required when the RAIM capability of the GPS equipment is lost. Although an alternate source of navigation is not required by the FAA for WAAS (TSO-C146) equipped aircraft, CNAF M-3710.7 currently states "During pre-flight planning, when an alternate is required,

equipment used to navigate the non-GPS route and non-GPS approach procedure for the alternate airport shall be installed and operational (5.3.3 RNAV/GPS Navigation 7)."

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

3. The GPS operation must be conducted in accordance with the FAA-approved aircraft flight manual (AFM) or NATOPS flight manual. Pilots must be thoroughly familiar with the particular GPS equipment installed in the aircraft, the receiver operation manual, the AFM or flight manual supplement. Unlike ILS and VOR, the basic operation, cockpit display presentation to the pilot and capabilities of GPS equipment can vary greatly. Due to these differences, operation of different brands, or even models of the same brand, of GPS receiver under IFR should not be attempted without thorough study of the operation of that particular receiver and installation. Most receivers have a built-in simulator mode which will allow the pilot to become familiar with operation prior to attempting operation in the aircraft. Using the equipment in flight under VFR conditions prior to attempting IFR operation will allow further familiarization.

4. Prior to any GPS IFR operation, the pilot must review appropriate NOTAMs and aeronautical information.

5. If radar contact is lost, RNAV aircraft may be cleared back to the airway because of the inability to maintain radar separation. If an RNAV aircraft is vectored off the planned random RNAV route, it shall be cleared direct to the next flight plan waypoint or issued a revised clearance. If, at any point, GPS avionics become inoperative, the pilot should advise ATC and amend the equipment suffix.

Use of GPS for IFR Domestic Enroute and Terminal Area Operations

Published RNAV routes, (T-Routes (low altitudes) and Q-Routes (high altitude)), are depicted in blue on low and high altitude charts and can be flight planned for use by aircraft with RNAV capability, subject to any limitations or requirements noted on enroute charts or by NOTAM.

The GPS Approach Overlay Program is an authorization for pilots to use GPS avionics under IFR for flying designated existing instrument approach procedures. Overlay procedures are identified by the "name of the procedure" and "or GPS" (e.g., VOR/DME or GPS RWY 15) in the title. Only those approaches included in the receiver database are authorized. Overlay approaches are predicated upon the design criteria of the ground-based NAVAID used as the basis of the approach. As such, they do not adhere to the design criteria described later for the stand-alone GPS approaches (Figure 8-2.)

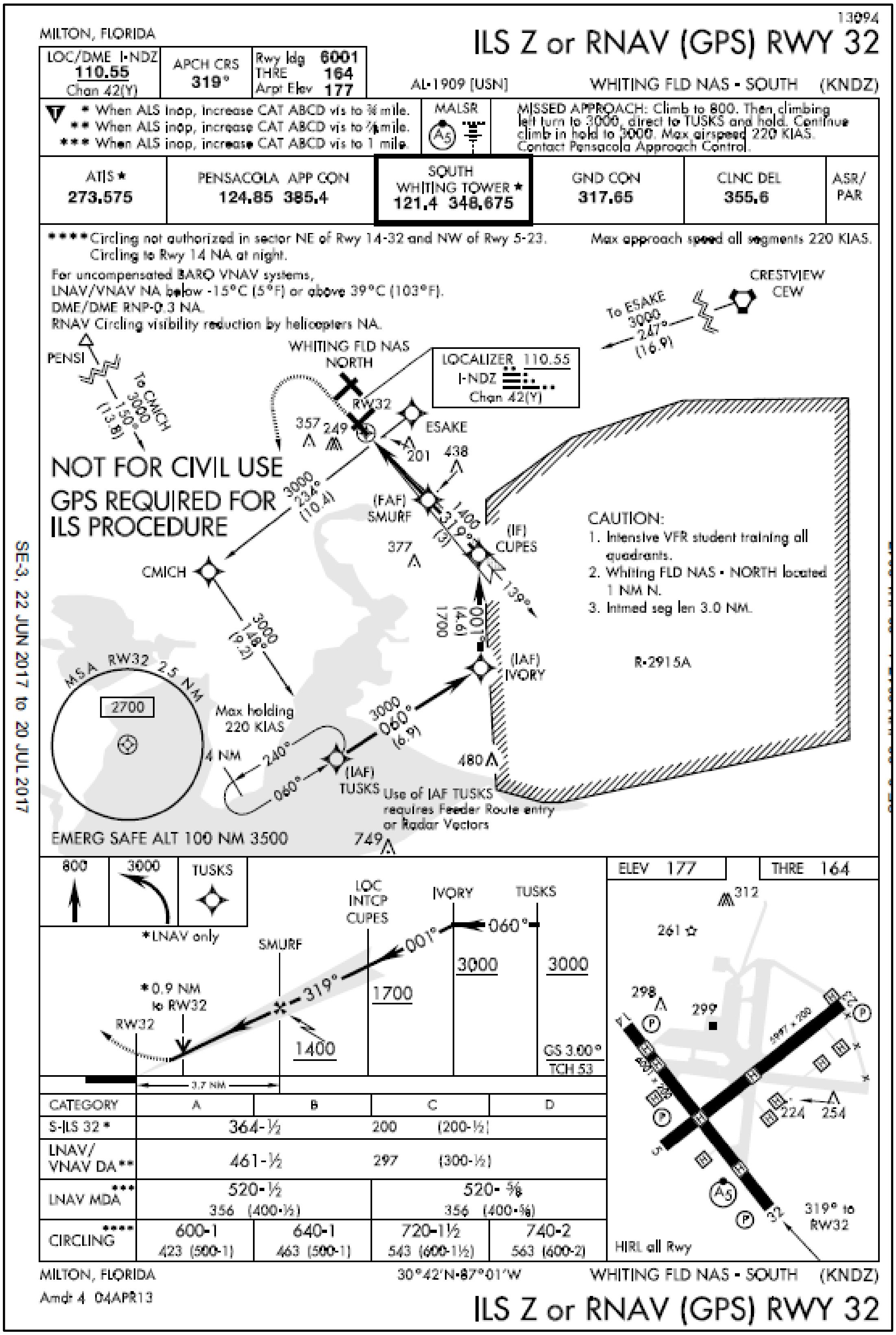


Figure 8-1 ILS Z or RNAV (GPS) RWY 32 as Whiting Field NAS-South

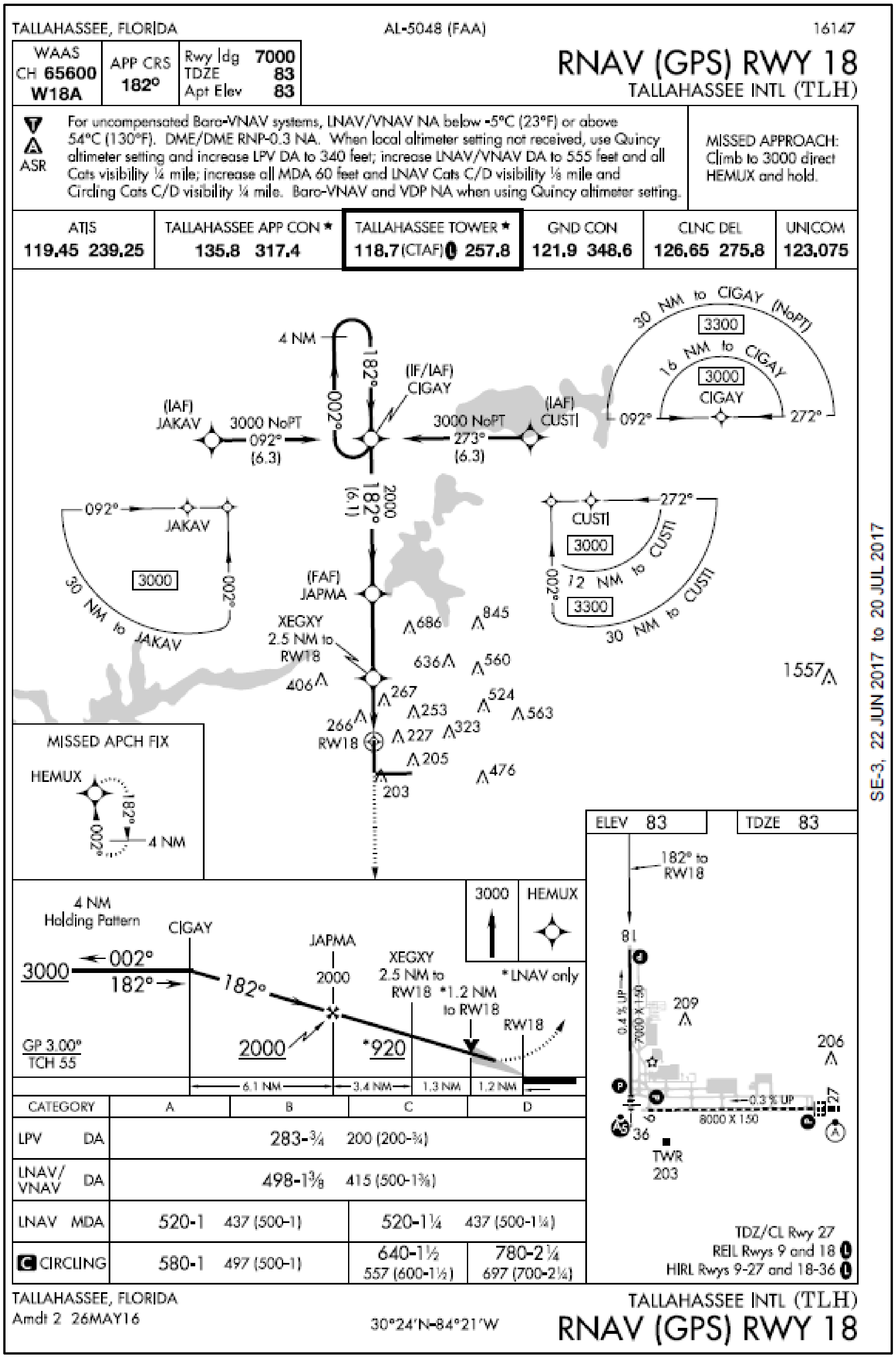


Figure 8-2 RNAV (GPS) RWY 17

GPS may be used in lieu of NAVAIDs on conventional procedures and routes in the following ways (ref: **AIM 1-2-3**):

1. Determine aircraft position relative to, or distance from a VOR, 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

GPS may not be utilized for lateral guidance for the final approach segment unless one of the following conditions are satisfied:

1. The IAP includes “or GPS” in the title and the pilot is using GPS.

2. For IAPs based on VOR, TACAN, or NDB, the underlying NAVAID must be operational and monitored for the final segment course alignment.

NOTE

GPS may be substituted for NAVAIDs as described above even when a facility is identified as required on a procedure (example: “Note ADF required”).

NOTE

GPS may not be utilized as substitution for lateral navigation on localizer-based courses (including back-course guidance) without reference to raw localizer data.

NOTE

Unless otherwise specified, a suitable RNAV system cannot be used for navigation procedures that are identified as “not authorized” (“NA”) without exception by a NOTAM.

804. WIDE AREA AUGMENTATION SYSTEM (WAAS)

The FAA developed the WAAS to improve the accuracy, integrity, and availability of GPS signals. WAAS corrects for GPS signal errors caused by ionospheric disturbances, timing, and satellite orbit errors, and it provides vital information regarding the health of each GPS satellite. The GTN-650 uses WAAS in addition to GPS signals to provide navigational information.

WAAS consists of multiple precisely surveyed wide-area ground reference stations (WRS) positioned across the United States that monitor GPS satellite data, with one master station on each coast. The WRS network monitors and collects satellite clock and ephemeris correction data that is then relayed to the master station where correction information is computed. A correction message is prepared and uplinked to a geostationary satellite, a satellite with a fixed position over the equator, via a GEO uplink station. The message is then broadcast on the same frequency as GPS to WAAS receivers within the broadcast coverage area, which means any WAAS-enabled GPS receiver can read the signal. The correction signal provided by the WAAS thus improves the real-time monitoring and accuracy of GPS by providing corrections to reduce errors. GPS position accuracy with WAAS is less than 3 meters as compared to GPS-only position accuracy of about 15 meters.

Instrument Approach Capability with the WAAS

A class of procedures with vertical guidance, which do not meet precision approach requirements as described in ICAO Annex 10, have been developed to support satellite navigation use for aviation applications worldwide. These procedures do not meet the stringent standards of precision approaches and are referred to as an Approach with Vertical Guidance (APV), which includes Localizer Performance with Vertical Guidance (LPV) and Lateral Navigation and Vertical Navigation (LNAV/VNAV). Aircraft with properly certified WAAS receivers will be able to fly to LPV minima and LNAV/VNAV minima, using an approved electronic glidepath, which eliminates errors that can be introduced by using barometric altimetry. LPV approaches take advantage of the refined accuracy of WAAS lateral and vertical guidance to provide an approach very similar to a Category I ILS. Like an ILS, an LPV has vertical guidance and is flown to a Decision Altitude (DA). LPV minima have Decision Altitudes (DA) as low as 200 feet height above touchdown with visibility minimums as low as ½ mile. An LNAV/VNAV approach also incorporates approved vertical guidance but at a less accurate sensitivity than LPV. Despite the presence of electronic vertical guidance, these APV approaches are still considered non-precision approaches. Localizer Performance (LP) approaches also take advantage of the improved accuracy of WAAS. LPs are non-precision approaches with WAAS lateral guidance. They are added in locations where terrain or obstructions do not allow publication of vertically guided LPV procedures. Lateral sensitivity increases as an aircraft gets closer to the runway (or PinS type approaches for helicopters). LP is not a fail-down mode for an LPV. LP and LPV are independent. LP minimums will not be published with lines of minima that contain approved vertical guidance (LNAV/VNAV or LPV). LP approaches are flown to an MDA rather than a DA. LP approaches are not common, but do exist throughout the U.S. LPV, LNAV/VNAV, and LP minima are published on the RNAV (GPS) approach charts (see Figure 8-3 and Figure 8-4 for examples). Pilots with WAAS receivers may plan flights to use any instrument approach procedure authorized for use with their WAAS avionics.

Pilots with WAAS receivers may also plan flights to use any instrument approach procedure authorized for use with their WAAS avionics as the planned approach at a required alternate, with the following restrictions. When using WAAS at an alternate airport, flight planning must be based on flying the RNAV (GPS) LNAV or circling minima line, or minima on a GPS approach procedure, or conventional approach procedure with "or GPS" in the title. Upon arrival at an alternate, when the WAAS navigation system indicates that LNAV/VNAV or LPV service is available, then vertical guidance may be used to complete the approach using the displayed level of service (see **AIM 1-1-18**). According to CNAF 3710, "During pre-flight planning, when an alternate is required, equipment used to navigate the non-GPS route and non-GPS approach procedure for the alternate airport shall be installed and operational" (CNAF M-3710.7 5-26)

CATEGORY	A	B	C	D
LPV DA	314-¾ 200 (200-¾)			
LNAV/ VNAV DA	364-¾ 250 (300-¾)			
LNAV MDA	440-1 326 (400-1)			
CIRCLING	560-1 439 (500-1)	720-1 599 (600-1)	720-1½ 599 (600-1½)	720-2 599 (600-2)

PENSACOLA INTL (PNS)

30°28′N-87°11′W RNAV (GPS) RWY 26

Figure 8-3 RNAV Minimums Example with LPV, LNAV/VNA, and LNAV Minima

CATEGORY	A	B	C	D
LP MDA	1640-1 361 (400-1)			
LNAV MDA	1700-1 421 (500-1)		1700-1¼ 421 (500-1¼)	
C CIRCLING	1740-1 444 (500-1)	1760-1 464 (500-1)	1960-1¾ 664 (700-1¾)	2000-2¼ 704 (800-2¼)

OKLAHOMA CITY, OKLAHOMA

Figure 8-4 RNAV Minimums Example with LP Minima

805. RECEIVER AUTONOMOUS INTEGRITY MONITORING (RAIM)

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.

If RAIM is not available, another type of navigation and approach system must be used, another destination selected, or the trip delayed until RAIM is predicted to be available on arrival. On longer flights, pilots should consider rechecking the RAIM prediction for the destination during the flight. This may provide early indications that an unscheduled satellite outage has occurred since takeoff.

If a RAIM failure/status annunciation occurs prior to the final approach waypoint (FAWP), the approach should not be completed since GPS may no longer provide the required accuracy. The receiver performs a RAIM prediction by 2 NM prior to the FAWP to ensure RAIM is available at the FAWP as a condition for entering the approach mode. When flying with the GTN-650, the avionics unit continually monitors RAIM and will provide an indication of a fault by flashing the Message key on the screen.

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

A GPS integrity warning occurring after the FAWP is a serious situation and pilots must be prepared to take immediate action. Transition to your backup approach (if available) or proceed to the MAP along the final approach course and execute the missed approach via the route and altitudes specified in the published missed approach procedure or comply with ATC instructions (NATOPS IFM).

806. GPS AND WAAS NOTAMS/AERONAUTICAL INFORMATION

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

Civilian pilots may obtain GPS RAIM availability information for non-precision approach procedures by specifically requesting GPS aeronautical information from a Flight Service Station during preflight briefings. GPS RAIM aeronautical information can be obtained for a period of 3 hours (ETA hour and 1 hour before to 1 hour after the ETA hour) or a 24-hour time frame at a particular airport. FAA briefers will provide RAIM information for a period of 1 hour before to 1 hour after the ETA unless a specific time frame is requested by the pilot. If flying a published GPS departure, a RAIM prediction should also be requested for the departure airport.

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

GPS and WAAS NOTAMS may be viewed on the Defense Internet NOTAM Service (DINS) website: https://www.notams.jcs.mil/dinsQueryWeb/. GPS/WAAS NOTAMs can be found here for applicable notices along the route of intended flight (Figure 8-5). The DINS website also provides a tool which can be used to graphically view RAIM outage predictions for specific equipment configurations (Figure 8-5).

Figure 8-5 DINS Website

In addition to this GPS/WAAS NOTAMS and RAIM prediction information, database suppliers supply their own database alerts. These alerts are available for aircrew to check as part of preflight planning. The Jeppesen alerts can be found on the DINS website (Figure 8-5) and the Garmin alerts can be found at www.flygarmin.com (Figure 8-6).

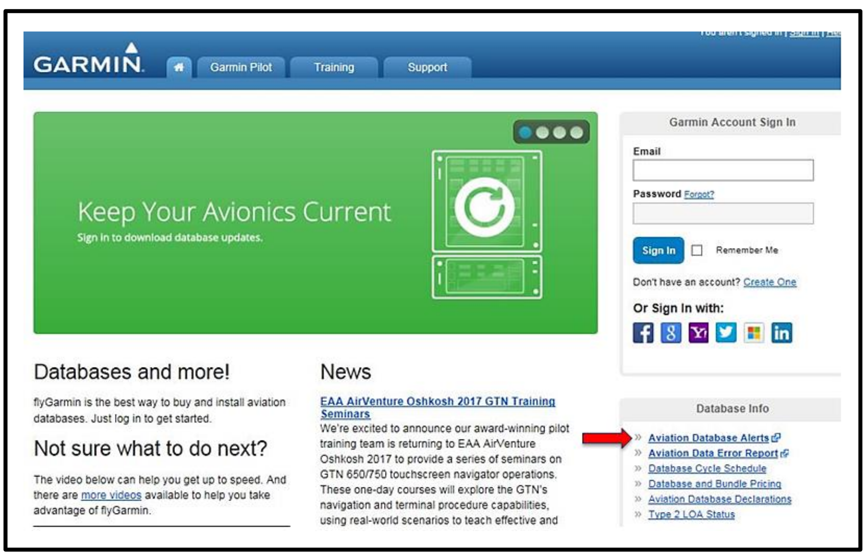


Figure 8-6 Garmin Website

In addition to the DINS website, pilots may also call the Flight Service Station for WAAS status and levels of service available. In flight, Air Traffic Control will not advise pilots of "WAAS MAY NOT BE AVBL" NOTAMs which indicate a loss or malfunction of the WAAS system.

"WAAS MAY NOT BE AVBL" NOTAMs are predictive in nature and published for flight planning purposes. Upon commencing an approach at locations NOTAMS 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.

When the approach chart is annotated with the W symbol in the notes section, site−specific WAAS MAY NOT BE AVBL NOTAMs or Air Traffic advisories ***are not provided*** for outages in WAAS LNAV/VNAV and LPV vertical service. Vertical outages may occur daily at these locations due to being close to the edge of WAAS system coverage. Use LNAV or circling minima for flight planning at these locations, whether as a destination or alternate. For flight operations at these locations, when the WAAS avionics indicate that LNAV/VNAV or LPV service is available, then the vertical guidance may be used to complete the approach using the displayed level of service. Should an outage occur during the procedure, reversion to LNAV minima may be required. (**AIM 1-1-18**)

807. GPS STANDARD INSTRUMENT APPROACH PROCEDURE (SIAP) DESIGN CONCEPTS & TERMINAL ARRIVAL AREAS (TAA)

The objective of the TAA design is to provide a transition from the enroute structure to the terminal environment with little required pilot/ATC interface for arriving aircraft equipped with Area Navigation (RNAV) equipment. The TAA contains within it a "T" structure that normally provides an arrival without a procedure turn (NoPT) for aircraft using the approach

The basic "T" contained in the TAA is based on the civilian box pattern. It normally aligns the procedure with runway centerline. 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), where the MAP is located at the runway threshold. A Hold-in-Lieu-of-PT is often anchored at the IF/IAF and depicted on approach procedure publications. The two-base leg IAFs are typically aligned in a straight-line perpendicular to the intermediate course connecting at the IF/IAF. The missed approach segment is ideally aligned with the final approach course and terminates in a direct entry into a holding pattern. Conditions may require a different routing (ex: turn left and proceed direct to the IAF for the "left base" segment). (See Figures 8-7 and 8-8)

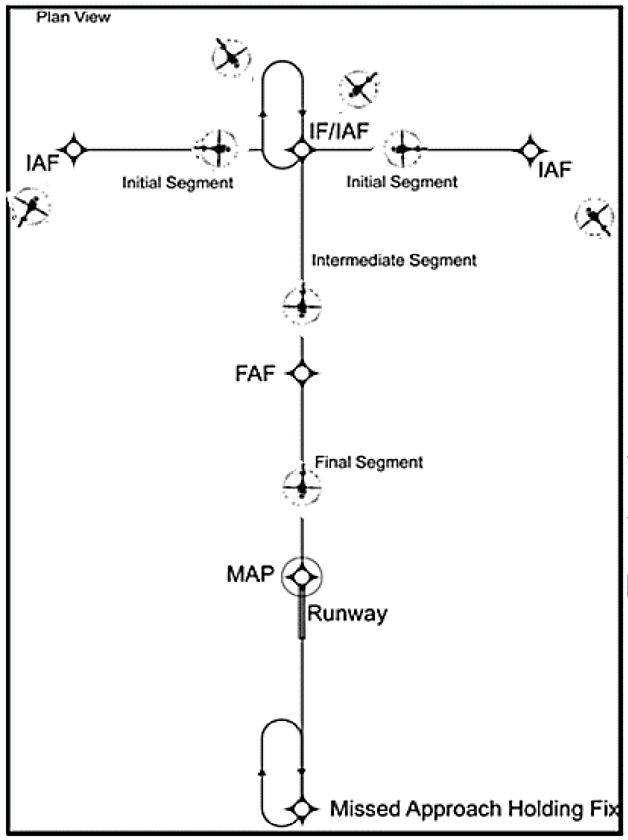


Figure 8-7 Basic "T" Design #1

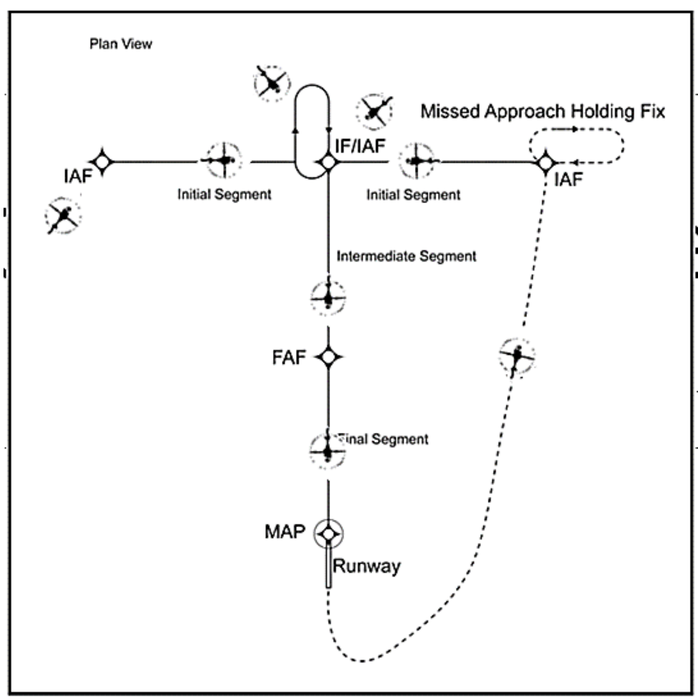


Figure 8-8 Basic "T" Design #2

In order to accommodate descent from a high enroute altitude to the initial segment altitude, the basic "T" configuration may be modified. When this occurs, a PT holding pattern provides aircraft an extended distance for the necessary descent gradient. The holding pattern constructed for this purpose is always established on the IF (IAF) waypoint (Figure 8-7/8).

The standard TAA consists of 3 areas established by the extension of the legs of the basic "T." These areas are the straight-in, left base, and right base. The 30-nautical-mile arc boundary of each area is equivalent to a feeder fix. When crossing the boundary of each of these areas or when released by ATC, within the area, the pilot is expected to proceed direct to the appropriate waypoint IAF for the approach area being flown via NoPT routing or a course reversal. The published procedure will be annotated to indicate when the course reversal is not necessary when flying within a particular TAA area (labeled "NoPT"). Otherwise, the pilot is expected to execute the course reversal under the provisions of the 14 CFR Section 91.175. The pilot may elect to use the course reversal pattern when it is not required by the procedures but must inform air traffic control and receive clearance to do so (**AIM 5-4-5d4**). Area boundaries are magnetic course lines to the IF/IAF. The charted altitudes within the TAA are maintained by aircraft that traverse these areas (see Figure 8-9) unless cleared otherwise by ATC.

ATC should not clear an aircraft to the left or right base leg IAF with an intercept angle greater than 90 degrees. Do not execute a HILPT course reversal in a sector labeled "NoPT." ATC may clear aircraft direct to the fix labeled IF/IAF if it is a straight-in approach and the intercept angle does not exceed 90 degrees.

Altitudes published within the TAA replace Minimum Safe/Sector Altitudes (MSA); however, unlike MSA altitudes, the TAA altitudes are operationally usable altitudes, providing at least 1,000 feet of obstacle clearance, more in mountainous areas. ***An ATC clearance direct to an IAF without approach clearance does not authorize a pilot to descend to a lower TAA altitude. A pilot must request the lower TAA altitude from ATC or wait for approach clearance.***

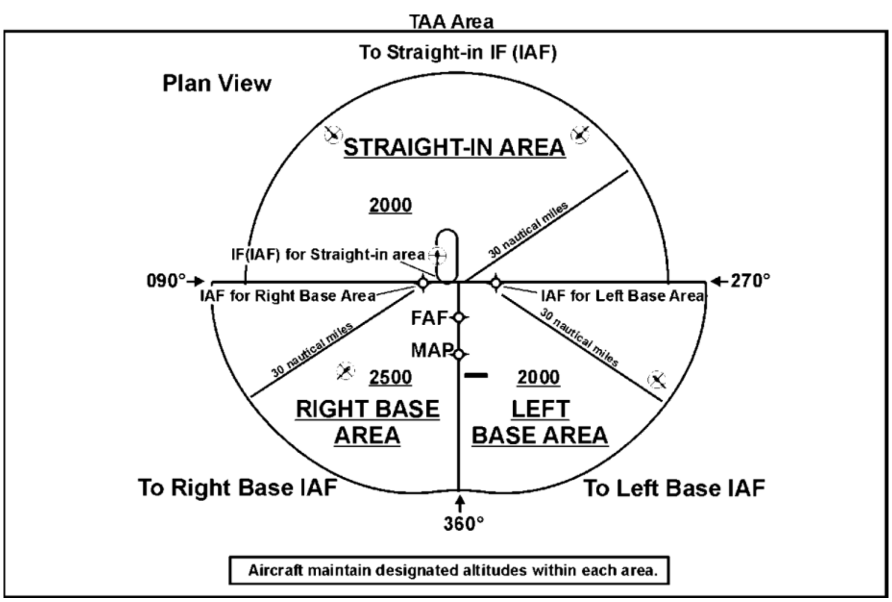


Figure 8-9 TAA Area

Normally, the minimum altitudes specified in the TAA and PT holding pattern are the same; however, there may be locations where terrain or operational situations require minimum altitudes to maintain within a sector of an area. In Figure 8-10, pilots flying into the right or left base areas are expected to maintain a minimum altitude of 6000 feet MSL until within 17 NM of the appropriate IAF and then descend to the lower charted altitudes. Pilots approaching from the northwest are expected to maintain a minimum altitude of 6000 feet MSL until within 22 nautical miles of the IF (IAF) then descend to an altitude not lower than 2000 feet MSL until reaching the IF (IAF).

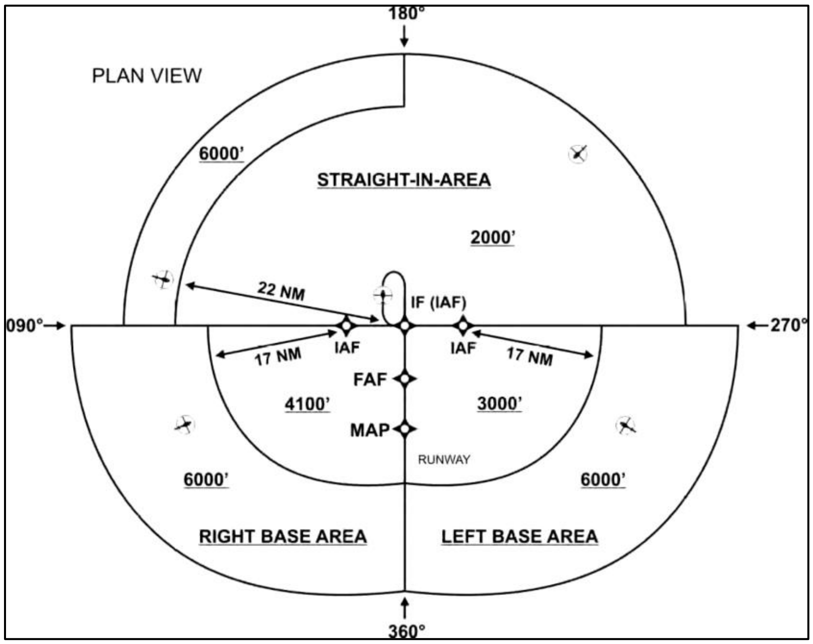


Figure 8-10 Sectored TAA Areas

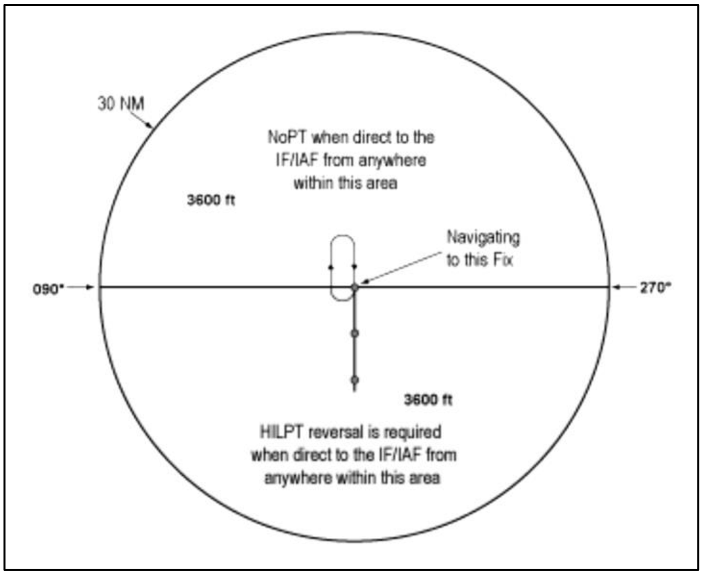


Figure 8-11 TAA with Left and Right Base Areas Eliminated

There may be modifications to the area of the standard TAA because of operational or ATC requirements. For example, the right or left base areas may be modified or eliminated. For example, Figure 8-11 shows a TAA where there are no left or right base legs so any approach from 271 to 089 degrees will be a straight-in while any approach from 270 to 090 will require a course reversal. In these cases, it is common to see a conventional MSA circle vice TAA segments.

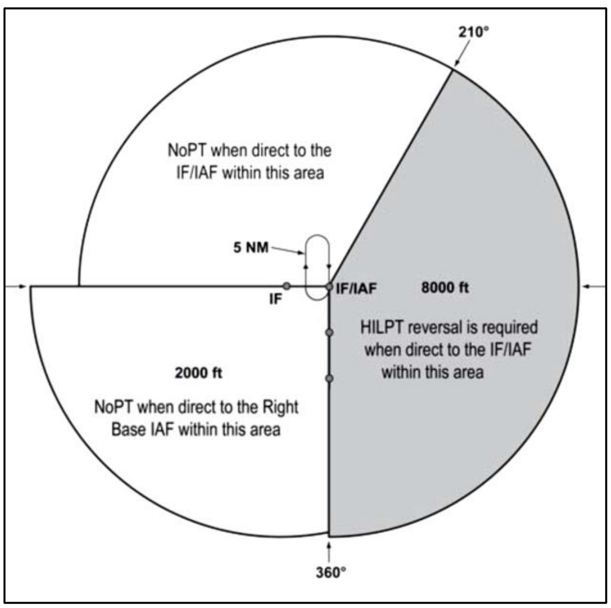


Figure 8-12 TAA with Right Base Eliminated

Figure 8-12 shows a TAA with no right base leg. Any approach from a heading of 360 to 210 degrees will require a HILPT to safely navigate to the final approach course.

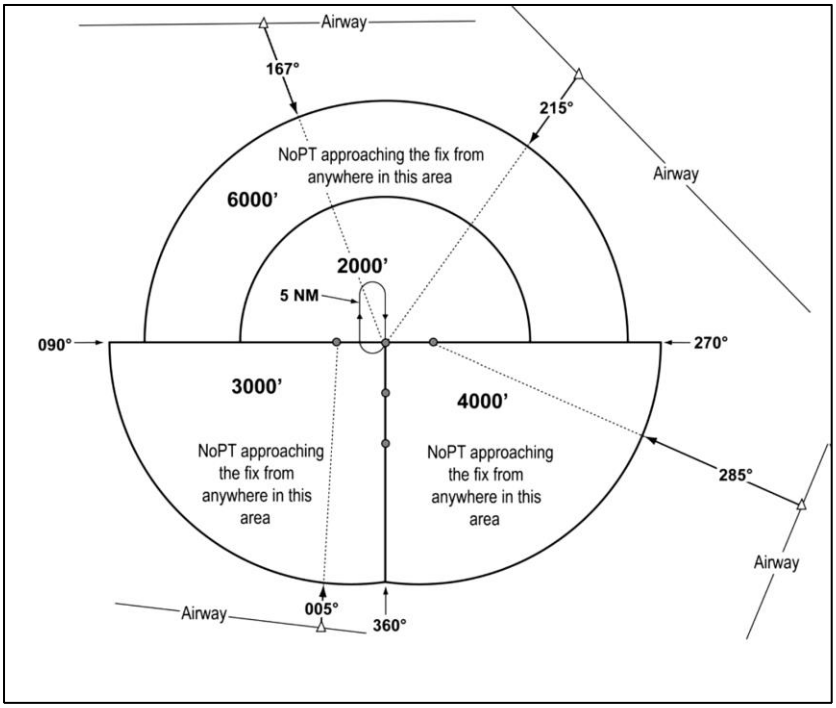


Figure 8-13 TAA with Feeders from an Airway

When an airway does not cross a lateral boundary of the TAA, a feeder route will be established from an airway fix or NAVAID to the TAA. This provides a transition from the enroute structure to the appropriate IAF. The feeder will terminate at the TAA boundary, aligned with the associated IAF. Figure 8-13 shows several examples of feeder routes and their intended transition to the TAA. The airway to the northwest requires a 167 degree heading to intercept the IF/IAF with NoPT.

808. GPS APPROACHES

Determining which area of the TAA the aircraft will enter when flying a "T" with a TAA must be accomplished using the bearing and distance to the IF /IAF. This is most critical when entering the TAA in the vicinity of the extended runway centerline and determining whether you will be entering the right or left base area. Once inside the TAA, all sectors and stepdowns are based on the bearing and distance to the IAF for that area, which the aircraft should be proceeding direct to at that time, unless on vectors (see Figures 8-14).

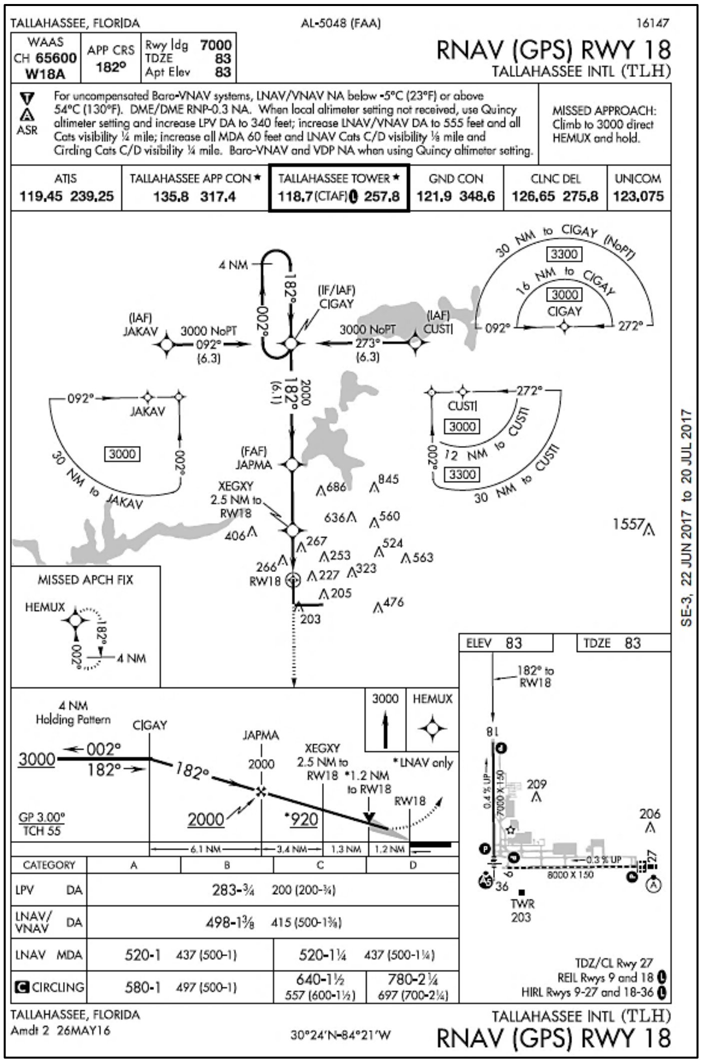


Figure 8-14 RNAV (GPS) RWY 17

Pilots should fly the full approach from an Initial Approach Waypoint (IAWP) or feeder fix unless specifically cleared otherwise. Randomly joining an approach at an intermediate fix does not assure terrain clearance.

When an approach has been loaded in the flight plan, GPS receivers will arm the approach 30 NM straight line distance from the airport/heliport reference point. With the approach armed (some receivers arm automatically), CDI and RAIM sensitivity will change from +/- 2 NM enroute (GTN 650) to +/- 1NM (terminal). 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, CDI sensitivity will not change until the aircraft is within 30 miles of the airport/heliport reference point even if the approach is armed earlier. 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) no later than the 30 NM.

When within 2 NM of the FAWP with the approach mode armed, the GPS will switch to an active mode, which results in RAIM changing to approach sensitivity and a change in CDI 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 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.

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.

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.

Do not attempt to fly an approach unless the procedure is contained in the current GPS 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.

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 (e.g., IAWP, FAWP, MAHWP on a procedure turn). Care must be exercised to ensure the receiver is sequenced to the appropriate waypoint for the segment of the procedure being flown, especially if one or more flyovers are skipped (e.g., FAWP rather than IAWP if the procedure turn is not flown). The pilot may have to sequence past one or more flyovers of the same waypoint in order to start GPS automatic sequencing at the proper place in the sequence of waypoints.

Copter only GPS approaches are limited to 90 KIAS or less while flying any segment of the procedure, except ***GPS Copter approaches at civilian fields are designed to be flown at a maximum speed of 70 KIAS on final and through the missed approach segments***. Copter approaches at military fields are designed to be flown at a maximum speed of 90 KIAS.

If a Visual Descent Point (VDP) is published, it will not be included in the waypoint sequence. Pilots are expected to use normal piloting techniques for beginning the visual descent.

Impact of Magnetic Variation on Performance-Based Navigation (PBN) Systems (AIM 1-1-17)

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.

Regarding this situation, CNAF M-3710.7 (5.3.2.2) provides the following guidance:

> "Any discrepancy between the charted approach and the database approach shall require compliance with the charted approach."

809. GPS WAYPOINTS

GPS receivers navigate from one defined point to another retrieved from the aircraft's onboard GPS database. These points are waypoints with 5-letter pronounceable names, existing VHF intersections, DME fixes with 5-letter pronounceable names and 3-letter NAVAID identifiers. Each waypoint is a geographical location with latitude and longitude

GPS approaches make use of both fly-over and fly-by waypoints (Figure 8-15). Fly-by waypoints connect two route segments by allowing the aircraft to turn prior to the current waypoint in order to roll out on course. This is known as turn anticipation and is compensated for in the airspace and terrain clearances. Approach waypoints, except for the MAWP and the missed approach holding waypoint (MAHWP), are normally fly-by waypoints. Fly-over waypoints are used when the aircraft must fly over the point prior to starting a turn (waypoint symbol with a circle around it). Overlay approach charts and some early stand-alone GPS approach charts may not reflect this convention.

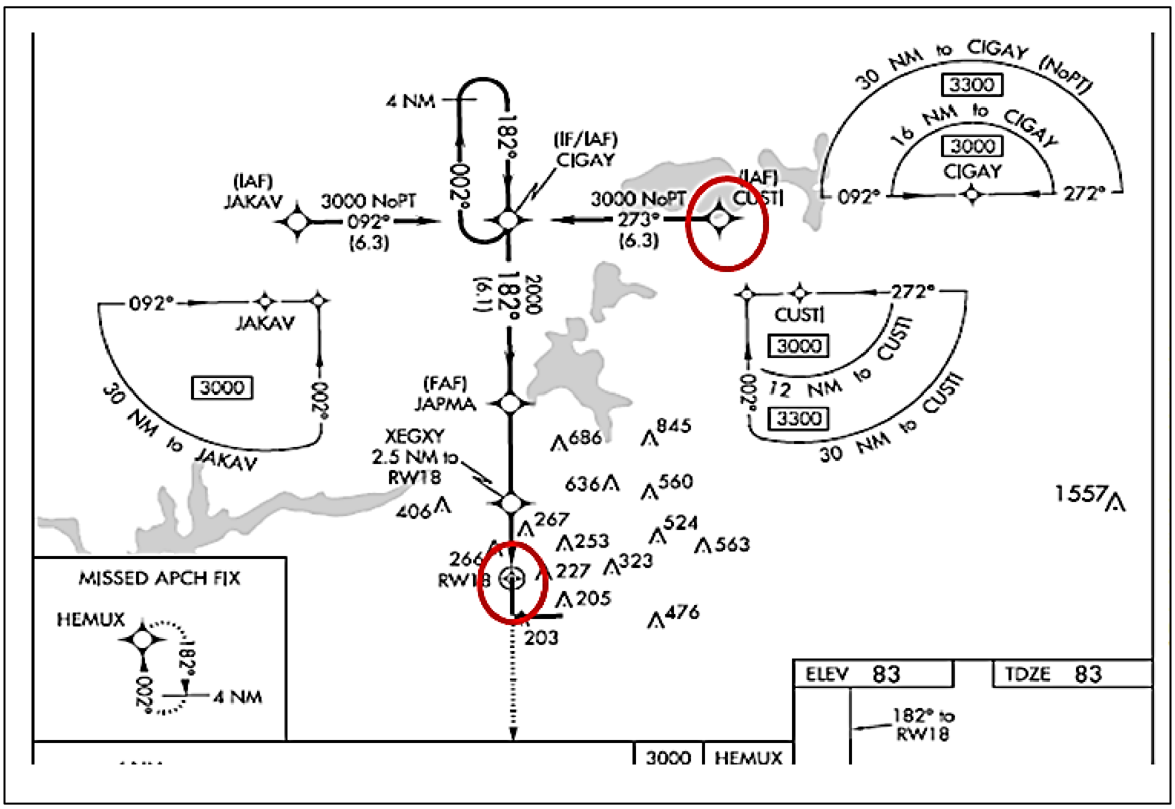


Figure 8-15 Example RNAV Approach with Fly-by and Fly-over Waypoints

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

The runway threshold waypoint, which is normally the MAWP, may have a five-letter identifier (e.g., SNEEZ) or be coded as RW## (e.g., RW36, RW36L). Those thresholds which are coded as five-letter identifiers are being changed to the RW## designation. This may cause the approach chart and database to differ until all changes are complete. The runway threshold waypoint is also used as the center of the MSA on most GPS approaches. MAWPs not located at the threshold will have a five-letter identifier.

Position Orientation

Pilot 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.

Conventional Versus GPS Navigation Data

There may be slight differences between the heading information portrayed on navigational charts and the GPS navigation display when flying an overlay approach or along an airway. All magnetic tracks defined by a VOR radial are determined by the application of magnetic variation at the VOR; however, GPS operations may use an algorithm to apply the magnetic variation at the current position, which may produce small differences in the displayed course. Both operations should produce the same desired ground track. Due to the use of great circle courses, and the variations in magnetic variation, the bearing to the next waypoint and the course from the last waypoint (if available) may not be exactly 180° apart when long distances are involved.

Variations in distances will occur, since GPS distance-to-waypoint values are along track (straight-line) distances (ATD) 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

810. DEPARTURES AND DEPARTURE PROCEDURES (DP)

It is possible to load instrument Departure Procedures that are available in the GPS database. The GPS receiver must be set to terminal (+1 NM) CDI sensitivity and terminal RAIM should be automatically provided (as long as the waypoints are part of the active flight plan rather than proceeding direct to the first destination). Certain segments may require manual pilot intervention, 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. Also, be aware ***helicopter departure procedures should be flown at 70 KIAS or less, since helicopter departure procedures and missed approaches are based on a much steeper obstacle clearance surface (OCS) gradient than fixed-wing procedures (20:1 vice 40:1).***

811. MISSED APPROACH

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 (+1 NM) sensitivity and the receiver will continue to navigate to the MAWP. The receiver will not sequence past the MAWP. Turns should not begin prior to the MAWP. If the missed approach is not activated, the GPS receiver will display an extension of the inbound final approach course and the ATD will increase from the MAWP until it is manually sequenced after crossing the MAWP.

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.

812. THE GTN-650 GPS

The Garmin GTN-650 is TSO-C146c certified and supports airway navigation and flexible flight planning, including arrival and departure procedures and GPS approaches. All features are accessed with a touchscreen display that provides a visual display of both controls and functions. The VHF radio, LOC/VOR and glideslope receivers, and transponder are also controlled through the GTN-650. The LOC/VOR and glideslope receiver can also be controlled through the KNS-81. The GTN-650 uses a Secure Digital (SD) card to load and store various types of data. The datacard is required for Terrain, FliteChart, and Chartview database storage and all database updates.

The GTN-650 is capable of non-precision LPV and LNAV/VNAV APV approaches, as well as LP and LNAV approaches without approved vertical guidance. See paragraph 803 for a discussion of APV approaches (LPV and LNAV/VNAV) and LP approaches that use WAAS position data.

The GTN-650 is also capable of displaying “advisory vertical guidance” when LPV DA or LNAV/VNAV DA minima is not available at select airports. The notation LNAV+V is displayed when advisory vertical guidance is being provided. The system includes an artificially created advisory glide path from the final approach fix to the touchdown point on the runway. The intent is to aid the pilot in flying constant descent to the MDA. LNAV+V is not the same as LNAV/VNAV or LPV. Pilots must use the barometric altimeter as the primary altitude reference to meet all altitude restrictions (stepdowns and MDA). ***The advisory glideslope does not always ensure obstacle clearance.***

LNAV approaches are based on satellite position information and are not dependent on ground-based navigation aids. LNAV approaches are flown to an MDA and the vertical guidance is advisory only. The GTN will store up to 1,000 user-defined waypoints, up to six characters long. It is possible to build up to 99 reversible flight plans with up to 100 waypoints each.

The WAAS-certified, 15-channel GPS receiver generates five position updates per second. The GTN-650 will preload NAV frequencies for you to manually switch to and can auto-select the VHF NAV source for ILS approaches when you load procedures. When a VOR is selected, it displays the radial and distance to the VOR.

It is possible to create user waypoints within the GTN-650 using latitude/longitude, radial/DME, or the Mark-on-Target (MOT) functionality. The MOT pushbutton on the center console will create a new user-defined waypoint at the selected location, which can be edited from the Waypoint Info Page.

Figure 8-16 GTN 650 Interface

The GTN-650 System is integrated with the aircraft electrical system and receives power from the Essential #1 Bus. The GTN-650 and supporting sub-systems include both power-on and continuous built-in test features that exercise the processor, memory, external inputs, and outputs to ensure safe operation.

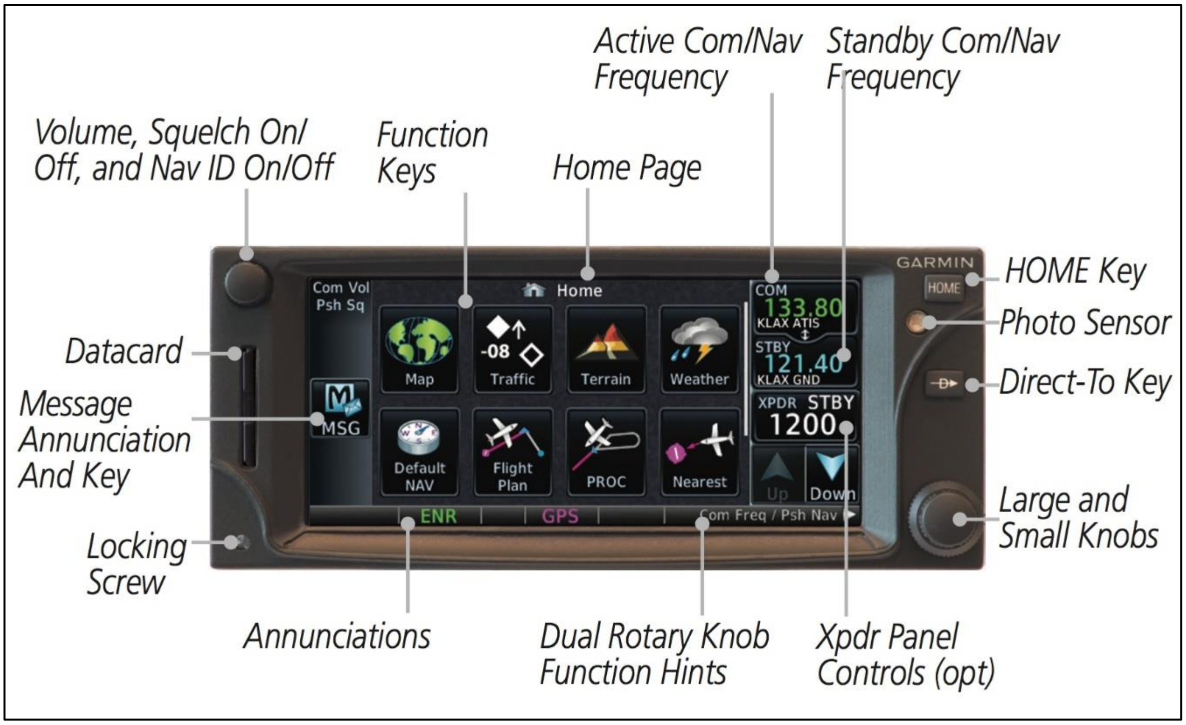


Figure 8-17 GTN-650 Home Page

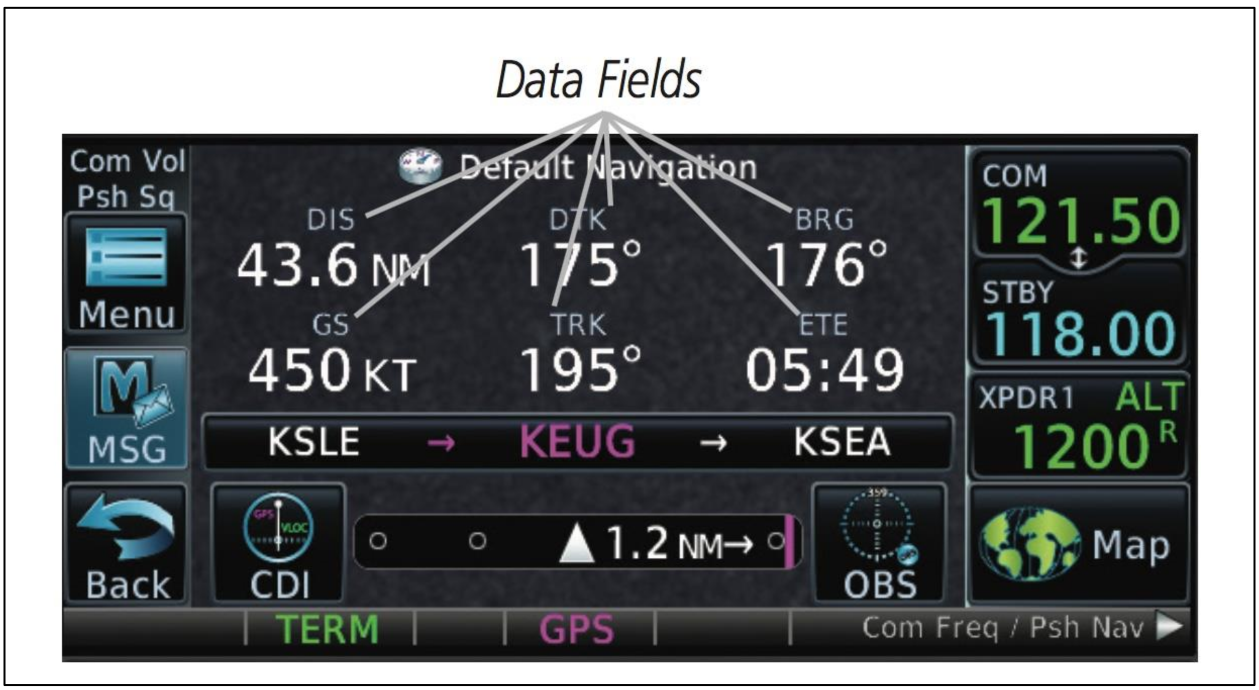


Figure 8-18 GTN-650 Default Navigation Page

GTN-650 Important Messages and Failure Modes

There are a number of messages that are specific to the GTN-650, and pilots must be completely familiar with them prior to flying. Selected messages and the appropriate pilot actions are listed below:

Message and Meaning	Description	Pilot Action
ABORT APPROACH GPS approach no longer available.	This message is triggered outside the MAP if the GTN cannot provide approach level of service. Vertical guidance will be removed from the external CDI/HSI display.	Abort the approach, initiate a climb to the MSA, and execute a non-GPS based approach.
APPROACH DOWNGRADE Approach downgraded. Use LNAV minima.	Approach has been downgraded from LPV or LNAV/VNAV to an LNAV approach. Vertical guidance will be removed from the external CDI/HSI display.	Continue to fly the approach using published LNAV minima.
APPROACH NOT ACTIVE Do not continue GPS approach.	GPS approach could not transition to active (GTN did not have the required horizontal and vertical positional accuracy to reach at least LNAV, so receiver is still in TERM mode).	Abort the approach, and execute a non-GPS based approach.
CDI SOURCE Select appropriate CDI source for approach.	Aircraft is on a GPS approach but CDI is set to VLOC, or aircraft is on VLOC approach and CDI is set to GPS *and* aircraft is less than 2nm from the FAF.	Select appropriate CDI source for the approach.
DATALINK	Multiple causes, specific message will reference an ADS-B or GDL-88 error.	Further flight allowed if flight can be continued with remaining navigational equipment. Contact Maintenance after landing.
GPS RECEIVER	Multiple causes, specific message will reference precise failure mode.	Use a non-based GPS receiver for continued flight. Contact Maintenance after landing.

This list is not all-inclusive. Reference the Garmin Pilot's Guide and Cockpit Reference Guide for a full list of GTN-650 error messages and appropriate actions.

Figure 8-19 GTN-650 Important Messages and Failure Modes

813. INPUTTING AND FLYING GPS APPROACHES

Once a flight plan is entered, it is possible to input the approach desired. The general procedures to input and shoot a GPS approach are as follows. Reference the P-425 FTI for complete GPS approach procedures.

1. **Select and load the approach into the flight plan.** Can be done at any time but must be completed by the Final Approach Fix. If aircraft is greater than 30 NM from the airport, then the CDI scale factor will remain at 2 NM for the GTN-650.

   a. Approaches can be selected via the "PROC" key from the Home page or selecting the airport from the flight plan.

   b. Select the "Approach" key, find the desired approach, and select via the touchscreen.

   c. Select the "Transitions" key. Find the desired IAF listed or "Vectors" if receiving Radar Vectors to Final and select via the touchscreen.

   d. Select "Preview" to ensure the appropriate transition appears for the approach.

   e. Select "Load Approach" to place the approach at the end of the flight plan or "Load Approach and Activate" to activate a leg Direct-to the selected transition point.

2. **Transition to the approach arm mode**. Terminal mode will occur automatically in the GTN 650 within 30 NM of both the departure and destination airports in the flight plan, whether or not an approach is loaded. The CDI scale will smoothly change to Terminal deviation of 1 NM.

   – Annunciator on bottom of touchscreen will change from ENR to TERM. Failure of this to occur will be accompanied by an error message.

3. **Get established on the final approach course.** This can be via NoPT arrival route, Radar Vectors (select "Vectors to Final" transition on the procedure page, as required), Procedure turn or holding pattern. GPS should transition the approach to active mode.

   a. The change will be automatic within 2 NM from the FAF (with a final integrity check 60 seconds prior to the FAF) and can be verified on the bottom of the GTN screen which will transition from TERM to the approach selected, e.g., LPV, LNAV, L/VNAV, etc. CDI scaling for LPV approaches will shift from 1 NM to an initial angular full-scale deflection of 2 degrees so that the total width of the FAC is 700 feet at the runway threshold. CDI scaling for other than LPV approaches will shift from 1 NM to either 2 degrees or 0.3 NM full-scale deflection, whichever is smaller.

   b. With "Vectors to Final" selected, the HSI/CDI needle remains off center until established on the final approach course. With the approach activated, the Map Page displays an extension of the final approach course in magenta.

c. If the GTN-650 is unable to continue the GPS approach, a message will appear (see Figure 8-19). Crews shall be vigilant for messages once on the final approach course, and it is recommended the PNAC immediately read any messages that appear.

d. If an ILS approach was loaded using the GTN-650, when the ILS approach is activated and the correct ILS frequency is active in the NAV window, the GTN-650 will automatically switch to VLOC when within 1.2 NM left or right of the final approach course. This switch can take place anywhere from 2-15 NM from the FAF. The CDI Auto-Switch feature can be selected from the CDI Setup Page. Figure 8-20 shows multiple locations along the approach path and the CDI selection that you can expect the automatic switch to occur. Within the area of the shaded box, the automatic switch from GPS to VLOC will occur; however, if the “Vectors to Final” transition is selected and the approach is activated, the GTN will immediately switch from GPS navigation to VLOC.

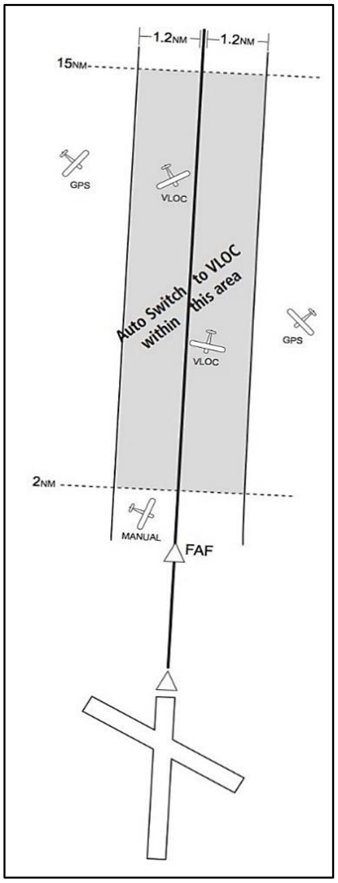


Figure 8-20 GTN-650 GPS to VLOC Transition Illustration

4. **At the FAF**.

– GTN-650: For LPV approaches, as you approach the FAF, the GTN will begin to automatically rescale in an angular fashion from TERM deflection of 1 NM to 2 degrees, allowing the LPV approach to be flown in an identical fashion to a standard ILS. At 2 NM from the FAF, scaling is tightened from 1 NM to the angular full-scale deflection of 2 degrees. 60 seconds prior to the FAF, the GTN will ensure GPS position integrity is within limits to continue the LPV approach. Capture the glideslope as you would an ILS glideslope. If LPV accuracy cannot be verified, the GTN-650 will downgrade to an LNAV approach and the approach may be continued to LNAV minimums. CDI scaling for other than LPV approaches will shift from 1 NM to either 2 degrees or 0.3 NM full-scale deflection, whichever is smaller.

5. **Flying to the Missed Approach Point**. The GPS will not automatically sequence to the next waypoint. Pilot action is required to sequence to the appropriate waypoint according to the situation.

– GTN-650: Upon reaching the MAP, automatic sequencing will be suspended and an option on the touchscreen will appear to either activate the missed approach procedure or continue to suspend waypoint sequencing. Select the appropriate option.

Figure 8-21 GTN-650 Missed Approach Message

814. GDL-88 ADS-B TRANSCEIVER CAPABILITIES

The Garmin GDL-88 is an Automatic Dependent Surveillance-Broadcast (ADS-B) transceiver which provides ADS-B Out functions to meet FAR 91.227 requirements and ADS-B In functions to provide traffic and datalink weather data. The GDL-88 transmits ADS-B Out data on the 978 MHz (UAT) frequency to be received by other aircraft, vehicles, and ATC. The GDL-88 receives ADS-B data transmitted by other ADS-B-equipped aircraft on the 1090 MHz frequency and displays traffic information on the GTN-650’s display screen. The GDL-88 also receives additional TIS-B traffic information and FIS-B weather information from ground radio stations on the 978 MHz UAT link (figure 7-X). ADS-B, TIS-B, and FIS-B information are displayed and controlled via the GTN-650’s display and touchscreen menus. The following is a brief description of ADS-B, TIS-B, and FIS-B services.

Automatic Dependent Surveillance-Broadcast (ADS-B) Services

ADS-B is a surveillance technology composed of aircraft avionics and a ground infrastructure. Onboard avionics determine the position of the aircraft using the GPS and transmit its GPS-derived position and other information such as velocity over a data link, which is received by a ground-based transmitter/receiver for processing and display at ATC ground-based facilities.

This information is transmitted at a rate of approximately once per second. All TH-57s with the GTN-650 and GDL-88 installed have ADS-B capability to be in compliance with FAR 91.225. FARs require that after January 1, 2020, all aircraft must have ADS-B Out capability in order to legally operate within the national airspace system. In the United States, ADS-B equipped aircraft exchange information via 978 and 1090 MHz. ADS-B-In equipped aircraft receive traffic proximity information air-to-air from ADS-B-Out equipped aircraft.

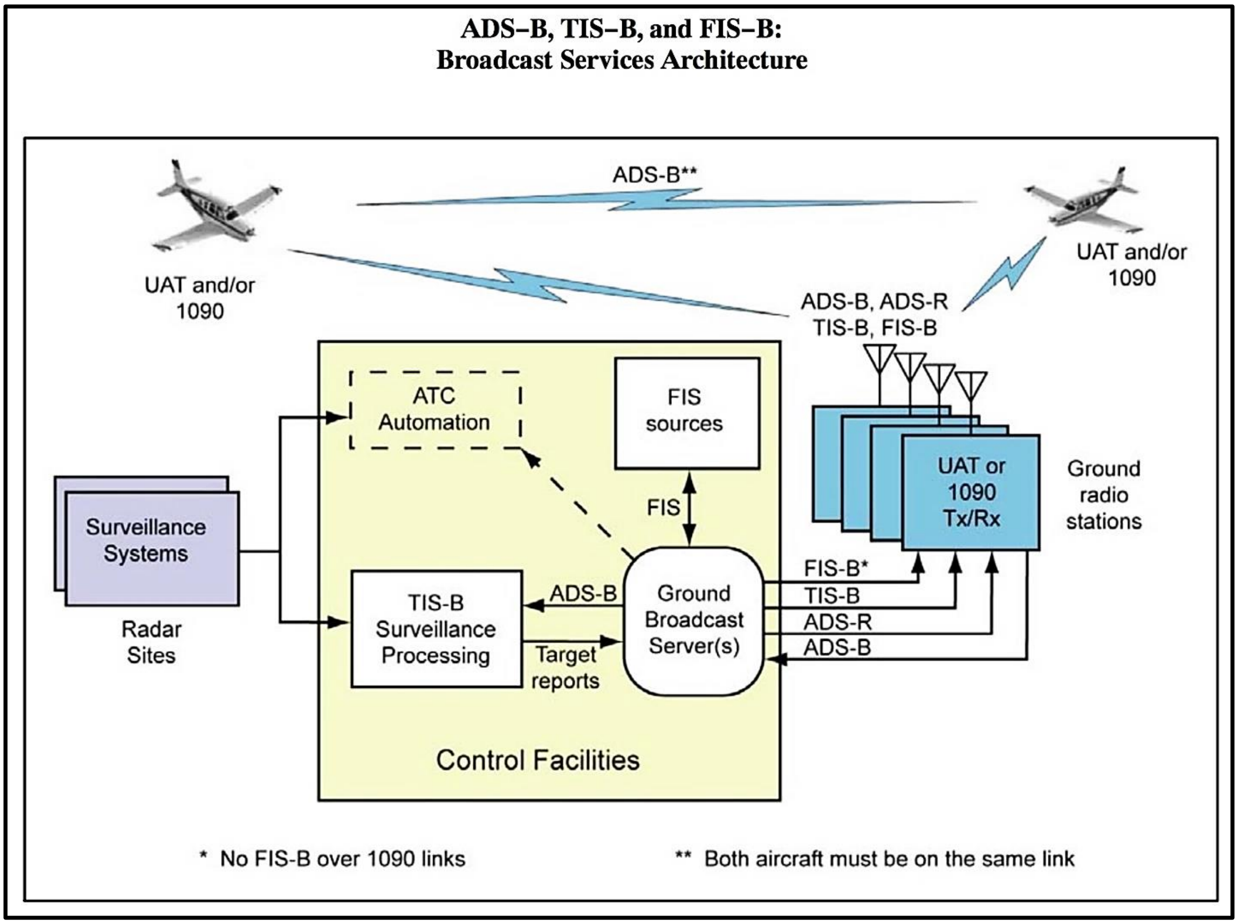


Figure 8-22 ADS-B, TIS-B, FIS-B Broadcast Services Architecture

ADS-B enables improved surveillance services, both air-to-air and air-to-ground, especially in areas where radar is ineffective due to terrain or where it is impractical or cost prohibitive. The traffic display in the cockpit is not intended as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" while VFR.

The following ADS-B Out data is transmitted: GPS position, altitude, position integrity, ground track and/or heading, groundspeed, velocity integrity, air/ground state, and identifying information (transponder squawk code, call sign, registration number, and Flight Identification). An aircraft's Flight Identification (Flight ID) is comprised of a maximum seven alphanumeric characters and also corresponds to the aircraft identification annotated on the ATC flight plan. For example, a general aviation aircraft may have a FLT ID N235RA which matches their registration number. ATC systems use transmitted FLT IDs to uniquely identify each aircraft within a given airspace and correlate then to a filed flight plan. This allows for better service, providing surveillance and appropriate airspace separation. ***It is imperative that the correct Flight ID is entered before flight to prevent any delays in traffic services provided by ATC.***

ADS-B systems are integrated with the aircraft transponder and will automatically set the applicable emergency status, e.g., 7700 or 7600, if it is entered into the transponder. ADS-B is intended for in-flight and surface use. ADS-B systems should be turned ON (and remain ON) whenever operating in the air or moving on airport surfaces. Civil and military Mode A/C transponders and ADS-B systems should be adjusted to the ON or normal operating position as soon as practical unless the change to standby is requested by ATC.

Traffic Information Service-Broadcast (TIS-B)

TIS-B is the broadcast of ATC derived traffic information to ADS-B equipped aircraft from ground radio stations. It 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. The quality level of traffic information provided by TIS-B is dependent upon the number and type of ground sensors available and the timeliness of the reported data. 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. 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. The GTN-650 will display up to eight traffic targets within a 7.5 NM radius, from 3000 feet below to 3500 feet above the aircraft. TIS-B (and ADS-B traffic) is not intended to be used as a collision avoidance system and does not relieve the pilot's responsibility to "see and avoid" other aircraft, in accordance with FAR 91.113.

It is important to understand that TIS-B (and ADS-B) traffic information is not a TCAS system. Only transponder-equipped targets are transmitted through the ATC ground system architecture. Non-ADS-B equipped aircraft may trigger a traffic alert if the aircraft is equipped with a transponder and they are received by a ground radar surveillance site which will transmit it to a TIS-B control station and then to the Ground Broadcast Server(s), which transmit information via TIS-B to our GTN-650 via the GDL-88 (Figure 8-24). A non-ADS-B equipped aircraft out of range of a ground radar surveillance site will not be identified and will not trigger a traffic alert on the GTN-650. Aircraft that do not have either a transponder or ADS-B capability will not be detected by the ground site, and will not be visible via ADS-B or TIS-B.

Flight Information Service-Broadcast (FIS-B)

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 with graphical representations of NEXRAD imagery, NOTAM/TFRs, and other weather information. FIS-B reception is line-of-sight within the service volume of the ground infrastructure. FIS-B is supplemental only and does not replace a preflight weather briefing, or inflight updates from an FSS or ATC.

NOTE

The 12 September 2019 update to the GP requires that ADS-B capability be noted in the REMARKS box of the DD-1801. The correct entry for the TH-57/GTN-650 is: * SRV/U2 SUR 282B

REVIEW QUESTIONS

1. A minimum of _____ satellites are always observable anywhere on Earth.

    a. 24
    b. 12
    c. 10
    d. 5

2. Aircraft equipped with GTN-650 require an alternate source of navigation.

    a. True   b. False

3. GPS systems like the GTN-650 use WAAS ground reference stations to correct for GPS signal errors caused by _________.

    a. Satellite transmission errors
    b. ionospheric disturbances, timing and satellite orbit errors
    c. User interface and satellite orbit errors
    d. Ionospheric disturbances and satellite failures

4. GPS position accuracy with WAAS is less than ___ meters as compared to GPS-only position accuracy of about ___ meters.

    a. 10, 100
    b. 3, 30
    c. 3, 15
    d. 5, 13

5. Which Approach Procedures with Vertical Guidance (APV) are flown to a DA?

    a. LPV
    b. LNAV
    c. LNAV/VNAV
    d. LPV and LNAV/VNAV

6. RAIM is not required to perform a GPS approach.

    a. True   b. False

7. If a RAIM flag/annunciation appears after the FAWP, you should _____.

    a. Notify ATC
    b. Turn RAIM back on
    c. Proceed to MAWP along FAC and execute missed approach
    d. continue on with the approach

8. ADS-B and TIS-B serves as a TCAS system in GTN-650/GDL-88 equipped aircraft.

a. True b. False

9. ADS-B is intended for _____.

a. surface use only
b. in-flight use only
c. in-flight and surface use
d. flight at OLFs only

10. TIS-B position updates will occur approximately once every ____ seconds depending on the type of radar system in use within the coverage area.

a. 10-20
b. 3-13
c. 5-15
d. 1-2

11. The three areas for a standard TAA are:

a. Alpha, Bravo, and Charlie
b. Forward, Left, and Right
c. Bow, Starboard, and Port
d. Straight-in, Right Base, and Left Base

12. If cleared direct to an IAF without an approach clearance, the pilot may descend to the lower TAA altitude.

a. True b. False

13. GPS Helicopter DPs, when available, should be flown at what airspeed?

a. 65 KIAS
b. 70 KIAS
c. 90 KIAS
d. 50 KIAS

14. Slight differences between heading information portrayed on navigational charts and the GPS navigation display occur due to the fact that headings defined by a VOR airway apply magnetic variation at each individual VOR while GPS __________.

a. Applies magnetic variations stored in its database
b. References updated variations sent via satellite
c. Uses complex algorithms based on your current position
d. Does not take into account magnetic variation

15. At the FAWP, the CDI scale factor will be at _____ and will remain until manually canceling the approach, proceeding past the MAP, or sequencing to the missed approach.

a. +0.3 NM
b. +0.5 NM
c. +1 NM
d. +0.2 NM

16. The GPS (GTN-650) will automatically sequence to the missed approach upon reaching the MAWP.

a. True b. False

17. Activating the missed approach sequence prior to the MAWP will cause CDI sensitivity to immediately change to ___ NM.

a. 1.0
b. 0.5
c. 0.3
d. 3.0

REVIEW ANSWERS

1. d
2. b
3. b
4. c
5. d
6. b
7. c
8. b
9. c
10. b
11. d
12. b
13. b
14. c
15. a
16. b
17. a

CHAPTER NINE
GROUND CONTROLLED APPROACHES

900. INTRODUCTION

This chapter will introduce the student to characteristics and procedures of Radar Approaches.

901. LESSON TOPIC LEARNED OBJECTIVES

Terminal Objective

Upon completion of this chapter and in response to questions and examples given on the post test, the student will recall the procedures and general information required for executing Ground Controlled Approaches. To successfully complete the unit post test, the student should achieve a minimum score of 80%.

Enabling Objectives

1. List the two types of Ground Controlled Approaches.

2. Name the FLIP in which radar approach minimums and information is published.

3. List the differences between ASR and PAR approaches.

4. List CNAF restrictions for radar approaches.

5. Define the terms that apply to ASR and PAR approaches.

6. State the instructions repeated by the pilot during the transition to final approach.

7. State the function of an "x" following a frequency.

8. State the time limit between voice communications on final approach before assuming lost communications.

9. State the rate-of-turn restrictions for ASR/PAR approaches.

10. State the importance of glideslope and groundspeed in establishing a rate of descent.

11. State the absolute approach minima for a single-piloted aircraft executing a precision approach.

12. State the requirements for a PAR/ASR missed approach.

13. List the procedures by which a pilot may receive altitude information while on an ASR approach.

14. List the lost communications procedures for ASR/PAR approaches.

15. List the missed approach procedures for ASR/PAR approaches.

16. List the procedures for a "no-gyro" approach.

17. Name the controlling agency that grants clearances for aircraft to land at airports.

18. Write the example voice reports using the correct phraseology for ASR/PAR approaches.

19. Apply the correct procedures for radar approaches.

902. GROUND CONTROLLED APPROACHES

Radar control is one of the most precise methods for performing an instrument approach. Radar controllers interpret radar displays and transmit course and glideslope information to pilots. As directed, the pilot flies the aircraft down the glideslope until he establishes visual contact with the landing area and is in a position to make a safe landing or he executes missed approach.

A radar approach system may consist of an Airport Surveillance Radar (ASR) and/or Precision Approach Radar (PAR), plus the associated communications equipment.

Information such as radar availability, type of approaches, communication frequencies, minimums, and glideslope angles can be found in the FLIP Low Altitude Instrument Approach Procedures. The availability of the ASR/PAR approaches is sometimes listed beneath the communications section in the upper left-hand corner of each approach plate. The absence of the ASR and/or PAR lists does not mean radar approaches are not available at that aerodrome. You must check the Radar Instrument Approach Minimums section in the front of the approach plates.

Runway and airfield pictorial information (e.g., length and width of runways, approach lighting, obstructions, and the relative positions of navigational aids) can only be found in the FLIP Low Altitude Instrument Approach Procedures (approach plates). The pilot is responsible for this information although is receiving radar vectors for the approach.

Precision approach radar only looks at a very small section of airspace so there must be some means of vectoring aircraft into that section of the sky. This is normally accomplished with radar vectors from an ASR controller or Approach Control but can also be accomplished using other NAVAIDs. Once the aircraft has been "picked up" by the PAR controller, that controller can issue instructions for the descent and final approach course using the precision approach radar scopes. These scopes display course, range and glideslope information in a manner permitting a high degree of accuracy.

PAR weather minimums are frequently as low as 100 feet and ¼ mile visibility. This requires having several PAR installations if approaches to more than one runway are to be offered. Due to obstructions, etc., the minimums may be different for each approach.

The Surveillance Radar (ASR) scope depicts aircraft within the entire area around the airport and can be used to vector aircraft to the final approach course as well as to fly the approach. Since this radar only indicates an aircraft's bearing and range from the airport, the ASR controller is not able to provide glideslope information. The pilot must control his own rate of descent to arrive at the missed approach point at the proper altitude.

In addition to the absence of glideslope information, ASR equipment is less accurate than PAR for final approach. Thus, course corrections will not be as precise or timely. Because of this, ASR weather minimums are higher than PAR minimums.

A radar approach may be given to any aircraft upon the pilot's request and may be offered to aircraft in distress or to expedite traffic; however, the pilot must adhere to CNAF M-3710.7 minimums for the type of aircraft as well as any NATOPS or squadron limitations when accepting an approach clearance. For example, CNAF prohibits single-piloted aircraft from executing ***practice approaches*** (no landing intended) at the filed destination or alternate if the weather is below published minimums.

For the execution of this approach, the visibility minima may be reduced, per CNAF M-3710.7, to one-half the published visibility minimum for Category A (helicopters) aircraft, but in no case may it be reduced to less than one-fourth of a mile or 1200 feet runway visual range (RVR). Remember, however, ***single-piloted absolute minimums are 200 feet ceiling/height above touchdown.***

Radar approach minimums have been established to provide an adequate margin of safety for an aircraft making a radar approach. These minimums are established based on the electronic accuracy of the equipment, the safe clearance of terrain or obstructions in the approach area, the runway environment, and the aircraft approach category; therefore, these minimums should not be construed as an indication of the limitations of radar to assist a pilot in establishing visual contact with the landing area.

Two terms associated with approaches are "Decision Height" (DH) and "Minimum Descent Altitude" (MDA). DH applies to precision approaches; approaches with glideslope information such as PAR and ILS. DH is the altitude, specified in feet above MSL, at which a missed approach shall be initiated when either visual reference has not been established with the runway environment or the aircraft is not in a position to make a safe normal landing. MDA applies to non-precision approaches; approaches without glideslope information such as ASR, localizer, TACAN, VOR, and ADF. MDA is the altitude, specified in feet above MSL, below which descent will not be made until visual reference with the runway environment has been established ***and*** the aircraft is in a position to make a safe normal landing.

In summary - the pilot may not operate the aircraft below the prescribed MDA during an ASR approach, or continue a PAR approach below the DH unless:

1. 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 ***and***;

2. The aircraft is in a position from which a normal safe approach to runway of intended landing can be made.

PAR and ASR approaches are divided into two segments, the transition to final and the ***final approach***. The transition to final is supervised by radar controllers (Approach Control) and includes all maneuvering up to the point where the aircraft is inbound on the final approach course and about 5 to 9 miles from touchdown.

During the transition to final, the pilot must repeat all ***altimeter settings***. Unless otherwise advised, all other information may be simply acknowledged with a "Roger." Keep transmissions brief and specific, commensurate with safety of flight. During high density operations, a limiting factor is the communications time available (too many people on one frequency). Never sacrifice aircraft control to acknowledge receipt of instructions. Turns and descents should be initiated immediately after instructions are received.

To enable the controller to anticipate your position, all turns should be made at standard rate, but never more than 30° angle of bank. If aircraft or mission characteristics dictate very low turn rates, inform the controller and he will correct the instructions accordingly.

Because of the limited communication time available, there are special radio frequencies for radar approaches. If you wish to execute a radar approach you should contact Approach Control, and they will switch you over to an appropriate radar frequency. When a radio frequency is followed by an "x" (384.6x) it is available upon request. Many airports do not even list their radar frequencies because pilots calling to request an approach can disrupt approaches already in progress.

The following approach information will be transmitted to the pilot by the controller at some time before the final approach:

1. The latest altimeter setting.

2. The current weather and any subsequent changes.

3. The direction of landing and runway information.

The controller will advise the pilot to perform the landing check while the aircraft is on the downwind leg and in time to complete it before turning onto the base leg. If an incomplete pattern is used (modified base leg), the controller will issue this instruction before handoff to the final controller for a PAR approach, or before starting descent on the final approach for an ASR approach. The pilot should consider several factors before transitioning to the landing configuration: Fuel remaining, position in the approach, and possible aircraft emergencies.

The controller will inform the pilot of his position at least once before starting the final approach.

Example: Five miles south of the airport.
Downwind leg, eight miles north of the airport.

After the aircraft has been established inbound on the final approach, control will be transferred from the ASR controller to the final approach controller.

Example: "NAVY ONE ECHO ONE FIVE ONE, PENSACOLA APPROACH STAND BY FOR YOUR FINAL CONTROLLER."

On initial contact the final controller will ask for a communications check.

Example: "NAVY ONE ECHO ONE FIVE ONE, THIS IS YOUR FINAL CONTROLLER. HOW DO YOU HEAR ME?"

If communications are satisfactory, the controller will instruct the pilot not to acknowledge further transmissions while on the final approach.

Example: "DO NOT ACKNOWLEDGE FURTHER TRANSMISSIONS."

Before the aircraft begins the final descent, the controller will issue missed approach instructions according to the specific missed approach procedure approved for the radar approach in use if the procedure is different from the general rules found in the Flight Information Handbook.

Example: "IN THE EVENT OF MISSED APPROACH CLIMB STRAIGHT AHEAD TO ONE THOUSAND FIVE HUNDRED AND STAND BY FOR FURTHER INSTRUCTIONS."

Before the aircraft begins the descent on final, the controller will remind the pilot the wheels should be down.

If radar contact is lost during an approach and the aircraft has not started the final approach, the controller will clear the pilot to an appropriate NAVAID for an instrument approach. Once the aircraft has commenced the final approach, the pilot will be instructed to execute missed approach procedures.

Clearance to land can only be granted by the tower; however, to simplify the approach, the radar controller may obtain a landing clearance from the tower and relay it to the pilot. If this landing clearance cannot be obtained, or is canceled, the controller will inform the pilot and issue alternative instructions.

Example: "TOWER CLEARS YOU TO LAND ON RUNWAY ONE THREE LEFT; CONTACT GROUND CONTROL ON 341.0 AFTER LANDING."

Example: "LANDING CLEARANCE HAS BEEN CANCELED, EXECUTE MISSED APPROACH."

Compliance with a waveoff order from the tower is ***mandatory*** at all times. Consider that the tower may have knowledge of an obstruction on the runway (which the final controller may not know about) such as a crash truck or another aircraft. Only an inflight emergency in your aircraft can override the waveoff order.

903. LOST COMMUNICATIONS

Standard lost communications procedures are published in the Flight Information Handbook; therefore, if you do not receive additional lost communications procedures, be absolutely certain you understand the general rules. Do not hesitate to request additional information, if necessary.

As soon as practical after establishing the aircraft's identification, the controller will inform the pilot of the procedures to follow (if they are different from the general rules, usually the pilot will follow the lost communications procedure) if voice communications are lost for a specified amount of time, i.e., not more than ***one minute*** -- during the transition before final approach.

Example: IF NO TRANSMISSIONS ARE RECEIVED FOR ONE MINUTE IN THE PATTERN (alternative procedures)

If voice communications are lost during the ***final approach*** segment, the specified time is **15 seconds** on a surveillance approach or **5 seconds** on a precision approach.

ASR Example: IF NO TRANSMISSIONS ARE RECEIVED FOR ONE MINUTE IN THE PATTERN, OR FOR FIFTEEN SECONDS ON FINAL APPROACH, ATTEMPT CONTACT ON (frequency) AND if possibility exists, PROCEED VFR; IF UNABLE: if approved, PROCEED WITH (nonradar approach) or (alternative instructions)

In the arrival phase of flight, pilots shall read back all altimeter settings received from approach control agencies during instrument approaches, entering and departing holding patterns, and during all approaches to a landing. (Exception: When under the control of the final controller on a PAR approach and the pilot has been released from further transmission requirements.)

904. PRECISION FINAL APPROACH

The final approach starts when the aircraft is within range of the precision radar and voice contact is established with the final controller. The controller will issue final approach course guidance and altitude corrections as necessary. Before the aircraft intercepts the glideslope, the controller will provide the decision height to any pilot who requests it.

NOTE

The DH will only be provided if it is requested.

Before glideslope intercept, the pilot should slow to the appropriate approach airspeed. The controller will inform the pilot when the aircraft is approaching the glidepath (about 10 to 30 seconds warning). When the aircraft reaches the point where the final descent is to start, the controller will instruct the pilot to begin descent. When the controller advises the aircraft has ***intercepted the glidepath***, lower the collective to establish the predetermined rate of descent. The controller will inform the pilot when the aircraft is on glidepath and on course and frequently inform the pilot of any deviation from glidepath or course.

Example: "ASSIGNED HEADING 330. ON GLIDEPATH, ON COURSE."

Example: "SLIGHTLY ABOVE GLIDEPATH, SLIGHTLY LEFT OF COURSE. TURN RIGHT TO HEADING 335."

The controller will issue trend information as required to indicate target position with respect to the azimuth and elevation cursors on his scopes and to describe target movement as appropriate corrections are issued. Trend information may be modified by the terms "RAPIDLY" or "SLOWLY" as appropriate.

Example: "SLIGHTLY LEFT OF COURSE AND CORRECTING, GOING SLOWLY BELOW GLIDEPATH."

Maintain a ***constant airspeed*** throughout the approach by adjusting the attitude of the aircraft. Control the rate of descent with the collective. Once the desired airspeed and rate of descent have been obtained, note the torque, attitude, and VSI settings and use these as guides throughout the remainder of the approach.

Rate of descent on a PAR approach is dependent upon two factors, the glideslope's angle of elevation above the horizontal and the groundspeed of the aircraft. Most PAR approaches use a 3° glideslope. Glideslope information for individual approaches are found in the Low Altitude Approach Plates with the approach minimums (see Figure 9-1). Thus, the rate of descent should be about the same for most helicopters if all other factors are equal.

GLIDESLOPE

	RWY	GS/TCH/RPI	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS
PAR ⓐⓑ	4L	2.6°/35/767	ABCDE	338/16	100	(100-1/4)
	22R	2.8°/52/1072	ABCDE	341/16	100	(100-1/4)
	22L	3.0°/39/749	ABCDE	335/16	100	(100-1/4)
	4R	2.6°/34/752	ABCDE	337/16	100	(100-1/4)
ASR ⓐⓑ	22R		ABCD	660/40	419	(500-3/4)
			E	660/50	419	(500-1)
	4L		ABC	720/50	482	(500-1)
			D	720/60	482	(500-1 1/4)
			E	720-1 1/2	482	(500-1 1/2)
	22L		ABCD	660/40	425	(500-3/4)
			E	660/50	425	(500-1)
	4R		ABC	720/50	483	(500-1)
			D	720/60	483	(500-1 1/4)
			E	720-1 1/2	483	(500-1 1/2)
CIR	All Rwy		AB	800-1 1/4	559	(600-1 1/4)
			C	800-1 1/2	559	(600-1 1/2)
			D	840-2	599	(600-2)
			E	840-2 1/2	699	(700-2 1/2)

ⓐNo--NOTAM preventive maint sked: PAR-Mon-Fri 0930-1130Z ++, Sat-Sun 1500-1700Z++; ASR-Sat-Sun 1300-1500Z ++, Mon 0700-0900Z. ⓑWhen ASR is out, PAR not avbl unless acft has opr TACAN.

Figure 9-1 Glideslope Information

The groundspeed of the aircraft is just as important in determining the rate of descent as the glideslope angle. The glideslope is a fixed line in space which the aircraft should follow. Thus, the faster the aircraft moves over the ground the faster it must descend to remain on glideslope. Now you can see why it is so important to maintain a constant airspeed while on final. Each time you change your airspeed; you alter the groundspeed and must alter the rate of descent to remain on glideslope.

Accuracy of heading is most important during the final approach phase. When instructed to make heading changes, make them immediately. Instructions to fly a new heading will be preceded by the phrases "TURN LEFT" or "TURN RIGHT."

Example: TURN RIGHT TO HEADING 340.

To prevent overshooting, the angle of bank should approximate the number of degrees to be turned, but never more than a half-standard rate while on final. To turn 6°, use a 6° angle of bank. To turn 20°, use only a half-standard rate turn. After a new heading has been assigned, the controller will assume it is being maintained and will make new corrections (TURN LEFT 2°) in addition to the last assigned heading.

The controller will inform the pilot of the aircraft's distance from touchdown at least once each mile on final.

Example: "ON GLIDEPATH, ON COURSE, THREE MILES FROM TOUCHDOWN."

The controller will also inform the pilot when the aircraft reaches the published decision height.

Example: "DECISION HEIGHT, ON COURSE, ON GLIDEPATH."

This does not relieve the pilot of the responsibility of obeying CNAF M-3710.7 or NATOPS responsibility placed on his type of aircraft. For example, CNAF M-3710.7 approach minimums for a single-piloted helicopter executing a precision approach are 200 feet ceiling/height above touchdown or published minimums, whichever is higher, and ½-mile visibility or published minimums, whichever is higher. Remember, CNAF M-3710.7 authorizes the reduction of visibility to one-half the published minimums for Category A aircraft, and this reduction also applies to single-piloted helicopters; therefore, absolute single-piloted helicopter minimums are 200-1/4.

A pilot shall not descend below the MDA or continue an approach below the DH unless he has the runway environment in sight ***and***, in his judgment, there is no doubt a safe landing can be executed, either straight-in or from a circling approach, whichever is specified in the clearance. A missed approach shall be executed immediately upon reaching the missed approach point if the runway environment is not in sight or a safe landing cannot be made. For precision approaches, the point at which the glideslope elevation and the DH coincide shall be used to identify the missed approach point. On precision radar approaches, the pilot may expect instructions until over the landing threshold; however, course and glideslope information given after the aircraft has passed the DH shall be considered advisory in nature.

The controller will issue instructions to execute a missed approach, or climb and maintain a specific altitude and fly a specific course whenever the completion of a safe approach is questionable because of one or more of the following conditions:

1. Safe limits are exceeded, or radical aircraft deviations are observed.

2. Position or identification of the aircraft is in doubt.

3. Radar contact is lost, or malfunctioning radar is suspected.

4. The tower informs the controller that there are unsafe runway conditions which have forced the cancellation of the landing clearance.

Execution of the missed approach is ***not necessary*** for conditions 1, 2, and 3, ***if the pilot has the runway environment in sight.***

Example: "RADAR CONTACT LOST; IF RUNWAY OR APPROACH LIGHTS ARE NOT IN SIGHT EXECUTE A MISSED APPROACH."

In short, whenever the aircraft is in IFR conditions, an order by the controller to execute a missed approach shall be mandatory; however, under certain conditions, such as a malfunctioning radar, if you have established visual contact with the runway environment, the missed approach is optional. A missed approach because of reason 4 is always mandatory. If reasons 1, 2, or 3 apply, and the field is in sight, inform the controller you have the runway environment in sight, and he will clear you as necessary.

The control tower is not required to tell the GCA controller the reason for issuing a waveoff order; therefore, when you receive a tower-initiated waveoff, it is mandatory under all conditions.

905. SURVEILLANCE FINAL APPROACH

When the precision radar equipment is inoperative or not available for the landing runway, surveillance radar (ASR) can be used to furnish the information required to align the aircraft with the approach runway.

Surveillance approach instructions are similar to those received during the precision approach to the point of establishing the descent. Before starting final approach, the controller will inform the pilot of the runway to which the approach will be made. The controller will specify the name of the airport when the approach is to a secondary airport.

Example: "THIS WILL BE A SURVEILLANCE APPROACH TO RUNWAY ONE THREE AT NAVY JACKSONVILLE AIRPORT."

The controller will also specify the MAP in miles relative to the runway threshold.

If the pilot specifically requests it, the controller will give the recommended altitudes (MSL) each mile of the approach - down to the last mile, which is at or above the published MDA.

Example: "RECOMMENDED ALTITUDES WILL BE FURNISHED EACH MILE OF FINAL APPROACH EXCEPT THE LAST TWO MILES."

Recommended altitudes decrease 300 feet per mile (unless a level-off is directed). When instructed to descend, the pilot should establish a predetermined rate of descent based on 300 feet per mile, or approximately the same as for a 3° glideslope.

The rate of descent can be determined for an approach by consulting the RATE OF DESCENT TABLE in the back of any INSTRUMENT APPROACH PROCEDURES booklet. This table should be consulted before commencing the approach and is used primarily for ILS/PAR approaches where the glideslope is specifically stated. For ASR approaches, the glideslope is stated as 300 feet per mile. This is just a little less than 3°, so the table will not be exact for your desired rate of descent. For ASR approaches, the rate of descent can be found by multiplying the groundspeed by five.

Example: Indicated airspeed is 120 kts with a headwind of 15 kts. This equals a groundspeed of 105 kts. 105 times 5 equals 525. The correct rate of descent with 105 kts and groundspeed is 525 FPM.

Controllers will issue advance notice of where descent will begin and issue the straight-in MDA before issuing final descent instructions for a straight-in approach.

Example: "PREPARE TO DESCEND IN TWO MILES. PUBLISHED MINIMUM DESCENT ALTITUDE IS 1290."

If the pilot requests it, the controller will issue the circling MDA. When requesting the circling MDA, the pilot is expected to provide the approach category of his aircraft. The MDA for a particular runway is the same for all aircraft categories on a straight-in approach but varies with different aircraft categories on a circling approach.

When the aircraft reaches the point where descent on an ASR final approach begins, the controller will advise the pilot to start the descent.

Example: "SIX MILES FROM THE RUNWAY, BEGIN DESCENT TO YOUR MINIMUM DESCENT ALTITUDE."

The controller will specify any altitude restrictions prescribed in the approach procedure.

Example: "FIVE MILES FROM THE RUNWAY, DESCEND AND MAINTAIN 1200 FEET."

After the aircraft has passed the altitude limiting obstruction, the controller will advise the pilot to continue the descent to the MDA.

The controller will issue course guidance and inform the pilot of the aircraft's distance each mile from the landing threshold. The controller will inform the pilot when the aircraft is on course and will frequently inform the pilot of any deviation from course. Recommended altitudes will be furnished if requested. If the aircraft altitude is other than that given at these checkpoints, the rate of descent should be adjusted accordingly.

The controller will issue trend information as required to indicate aircraft position with respect to the extended runway centerline and to describe aircraft movement as appropriate corrections are issued. These course corrections are not as accurate as those on a PAR approach because of the less precise radarscope presentations; however, by accurately following the controller's directions, the aircraft should be within 500 feet left or right of the runway at one mile.

The controller will request the pilot to report sighting the runway, approach runway lights, or airport as appropriate at the missed approach point. Unlike a PAR approach where the final controller will key down the microphone so that the pilot cannot transmit voice, on an ASR approach there may be intervals of silence lasting up to 15 seconds where the pilot does have the opportunity to transmit voice. Once the pilot reports the runway environment in sight, the surveillance approach guidance may be discontinued, and the pilot instructed to take over visually.

906. MISSED APPROACH

The controller will discontinue approach guidance and instruct the pilot to execute a missed approach if the pilot has not sighted the runway environment when the aircraft is at the missed approach point (usually one mile from the landing threshold).

Example: "ONE MILE FROM RUNWAY, IF RUNWAY LIGHTS NOT IN SIGHT EXECUTE MISSED APPROACH."

The missed approach procedures must be executed when:

1. PAR - The runway environment is not in sight upon reaching the DH.

2. ASR - The runway environment is not in sight upon reaching the missed approach point.

3. Instructed by the final controller and the pilot is still in IFR conditions.

4. A safe landing is not possible.

5. Directed by the control tower.

WARNING

> The missed approach is a most critical maneuver. Although the controller will render all possible assistance, it is the pilot's prime responsibility to have the aircraft safely under control (stop the sink rate and regain a safe altitude before attempting to comply with an issued heading). It is ***not*** expected that the pilot should attempt a turn at low altitude. Usually, missed approach instructions provide for a climb straight ahead to about 400 feet before a heading change of over 15º is directed.

If the heading indicator fails in flight, advise the radar controller and request a "no-gyro" approach. This approach may be either PAR or ASR, as previously discussed. Before issuing a vector, the controller will inform the pilot of the type of approach and the manner in which turns are to be made.

Example: "THIS WILL BE A NO-GYRO APPROACH TO RUNWAY 13. MAKE ALL TURNS STANDARD RATE."

If unable to comply with this turn rate, alert the controller and he will use this information to help in determining different lead points for turns and heading corrections. The controller will instruct the pilot when to start and stop the turns.

Example: "TURN RIGHT . . . STOP TURN."

Turns should be executed immediately upon receipt of the instruction to turn left or right.

After the aircraft has turned onto the final approach, the controller will instruct the pilot to make half-standard rate turns for the duration of the approach. The approach will be performed just like a regular approach, except you will not be told to turn to a particular heading, and you will not be told to turn a certain number of degrees, but rather to start turns and stop turns.

907. SUMMARY OF VOICE PHRASEOLOGY FOR RADAR-CONTROLLED APPROACHES

General

This section promulgates basic voice procedures for the control of air traffic during radar approaches. This section is further divided into three subsections: Basic Pattern, Surveillance Final Approach, and Precision Final Approach.

Pattern Controller

THIS IS PENSACOLA GCA (Radar identification or reidentification).

PERFORM LANDING CHECK (on downwind in time for the pilot to complete it before base leg).

Inform the aircraft of its position at least once before starting final approach.

DOWNWIND/BASE LEG (number of miles) MILES (direction) OF AIRPORT.

ASR ONLY -- If the pilot requests recommended altitudes:

RECOMMENDED ALTITUDES WILL BE FURNISHED EACH MILE ON FINAL APPROACH EXCEPT THE LAST MILE.

If the pilot requests a low approach, DO NOT DESCEND BELOW 200 OR CLIMB ABOVE 700 UNTIL TWO MILES OUT.

If applicable -- AFTER COMPLETING TOUCH AND GO/LOW APPROACH MAINTAIN 700 UNTIL TWO MILES OUT.

YOUR MISSED APPROACH PROCEDURE IS CLIMB STRAIGHT AHEAD TO 1500 AND STAND BY FOR FURTHER INSTRUCTIONS (ONLY GIVEN IF NECESSARY).

Surveillance Final Approach

THIS IS YOUR FINAL CONTROLLER; HOW DO YOU HEAR ME?

DO NOT ACKNOWLEDGE FURTHER TRANSMISSIONS.

(Before aircraft descent)

WHEELS SHOULD BE DOWN.

HEADING ____________, ____________ MILES FROM RUNWAY, PREPARE TO DESCEND IN ONE MILE, PUBLISHED MINIMUM DESCENT ALTITUDE ____________.

HEADING ____________, ____________ MILES FROM RUNWAY, DESCEND TO YOUR MINIMUM DESCENT ALTITUDE.

Ranges and headings should be given each mile on final.

If the pilot requests recommended altitudes:

5 MILES FROM RUNWAY, ALTITUDE SHOULD BE 1500 FEET.

4 MILES FROM RUNWAY, ALTITUDE SHOULD BE 1200 FEET.

3 MILES FROM RUNWAY, ALTITUDE SHOULD BE 900 FEET.

2 MILES FROM RUNWAY, ALTITUDE SHOULD BE 600 FEET.

1 MILE FROM RUNWAY, MINIMUM DESCENT ALTITUDE (MDA) - (not spoken).

TWO AND ONE-HALF MILES FROM RUNWAY, WIND ______ DEGREES AT ________. CLEARED TO LAND/TOUCH AND GO/LOW APPROACH (specify runway number left/right).

1 MILE FROM RUNWAY (see below)

VFR Conditions --full stop or touch and go

TAKE OVER VISUALLY.

Low approach

LEVEL OFF, TAKE OVER VISUALLY, AND COMPLETE YOUR LOW APPROACH.

IFR Conditions -- issue only if pilot has not previously reported either runway or approach/runway lights in sight. (Distance) MILE(S) FROM RUNWAY. IF RUNWAY ENVIRONMENT NOT IN SIGHT, EXECUTE MISSED APPROACH. (Alternative instructions.)

Precision Final Approach

THIS IS YOUR FINAL CONTROLLER; HOW DO YOU HEAR ME?

Provide the decision height to any pilot who requests it.

THE PUBLISHED DECISION HEIGHT IS (number of feet).

DO NOT ACKNOWLEDGE FURTHER TRANSMISSIONS.

WHEELS SHOULD BE DOWN.

APPROACHING GLIDEPATH.

BEGIN DESCENT.

Issue trend information.

SLIGHTLY LEFT OF COURSE, ON GLIDE PATH; ON COURSE, ON GLIDE PATH; ON COURSE, BELOW GLIDE PATH.

Inform the aircraft of its distance from touchdown at least once each mile on final approach:

THREE MILES FROM TOUCHDOWN, ON COURSE, ON GLIDE PATH

TWO AND ONE-HALF MILES FROM TOUCHDOWN, WIND ______ DEGREES AT ________ KNOTS, CLEARED TO LAND (or LOW APPROACH or FOR TOUCH AND GO) (depending on what the pilot has requested and Tower has authorized.) If the pilot has requested a touch and go or low approach, specific climb-out procedures will normally be issued for rejoining the GCA pattern, separate from the missed approach instructions.

Approximately one-half to one mile from touchdown expect the decision height call:

AT DECISION HEIGHT, PROCEED VISUALLY, IF RUNWAY NOT IN SIGHT EXECUTE MISSED APPROACH.

Depending on when the pilot acquires visual reference to the runway, he may be directed to contact the Tower before landing or be told:

"CONTACT NORTH WHITING TOWER (frequency) AFTER LANDING." GCA will sometimes continue trend calls until the aircraft is over the landing threshold.

THIS PAGE INTENTIONALLY LEFT BLANK

REVIEW QUESTIONS

1. The two radar approach systems are ___________.

    a. VOR and TACAN
    b. PAR and ILS
    c. ASR and PAR
    d. GCA and LOC

2. The weather minimums for radar approaches are found in FLIP ____________.

    a. Enroute (VFR) Supplement
    b. Enroute (IFR) Supplement
    c. Approach Plates
    d. AP-1

3. Unless otherwise instructed, pilots must read back all ____________ instructions during the transition to final approach.

    a. Heading, altitude and missed approach
    b. Missed approach
    c. Altimeter, heading and altitude
    d. Altitude and heading

4. If a pilot requests a circling radar approach and requests MDA information from the controller, the pilot must provide the controller

    a. the approach category of his aircraft.
    b. the weather minima for his category of aircraft.
    c. the duty runway he desires.

5. Precision approaches do not provide ____________ information.

    a. final approach course
    b. final approach glideslope
    c. distance from landing threshold
    d. groundspeed

6. During a PAR RWY 32 approach to Beaufort MCAS (Vol 18) the DH for a single-piloted aircraft is 223 feet MSL.

    a. True   b. False

7. Which FLIP publication, normally available to a pilot in flight, lists the lost communication procedures for radar approaches at each airport?

   a. Enroute (IFR) Supplement
   b. Approach Plates
   c. Area Charts
   d. FIH

8. A pilot may not descend below the DH or MDA until visual reference has been established with the ___________ and the aircraft is in position to execute a ____________.

   a. Runway environment, normal landing
   b. Airport, missed approach
   c. VORTAC, normal landing
   d. Field boundary, missed approach

9. A frequency for a radar approach, as listed in the Enroute (IFR) Supplement, followed by an "x" means ____________.

   a. For use by aircraft in the high-altitude airway structure only
   b. The frequency is continuously monitored
   c. That a facility can only transmit on that frequency
   d. The frequency is available upon request

10. A pilot on final for a radar approach at an airport with an operating control tower would be granted clearance to land from ____________.

   a. ASR controller
   b. PAR final approach controller
   c. Approach control
   d. Tower

11. If a headwind decreases while on a radar final approach, the rate of descent must be ____________ to stay on glideslope.

   a. Decreased
   b. Increased
   c. Constant

12. A controller may issue a clearance for an approach regardless of an airfield's actual weather at the time the clearance is issued.

   a. True b. False

13. The rate of descent table can be found in FLIP

    a. Enroute (VFR) Supplement.
    b. Enroute (IFR) Supplement.
    c. Approach Plates.
    d. FIH.

14. During the transition to final approach on a "no-gyro" approach, all turns should be made using _____________ rate turn, while on final _____________ rate turns should be used.

    a. Half-standard, standard
    b. Standard, half-standard
    c. Standard, quarter-standard
    d. Half-standard, quarter-standard

15. At pilot request, recommended altitudes will be provided each _____________ approach.

    a. ¼ mile
    b. ½ mile
    c. 1 mile
    d. 2 miles

16. A radar controller will assume the pilot is flying the _____________ heading when given a course correction and "trend" information.

    a. Final approach
    b. Course intercept
    c. Teardrop
    d. Last assigned

17. The rate of descent or glideslope of an ASR approach is _____________.

    a. 300 feet per minute
    b. Listed in the Enroute (IFR) Supplement
    c. 300 feet per mile
    d. Equal to 3°

18. A pilot would consult the FLIP _____________ for information such as length and width of runways, approach lighting, and obstructions at IFR airports.

    a. Enroute (VFR) Supplement
    b. Enroute (IFR) Supplement
    c. Low Altitude Instrument Approach Procedures
    d. Low Altitude Enroute Charts

19. Military pilots of single-piloted aircraft may not accept a clearance for a practice approach when the weather is below the published minimums

a. at any airport.
b. if no landing is intended
c. at the filed destination.
d. at the departure airfield.

20. To enable the controller to anticipate your position during the transition to final, all turns should be made at ____________, but never more than _______________.

a. 30-degree angle of bank, half-standard rate
b. 15-degree angle of bank, standard rate
c. Standard rate, 30 degree angle of bank
d. Standard rate, 20 degree angle of bank

21. During the transition to final, if voice communications are lost for more than ____________, the pilot should execute lost communication procedures

a. 2 minutes
b. 1 minute
c. 30 seconds
d. 15 seconds

22. Once the aircraft is on final approach, if voice communications are lost for more than ____________ for an ASR approach and ____________ for a PAR approach, the pilot should execute lost communication procedures.

a. 30 seconds, 15 seconds
b. 15 seconds, 5 seconds
c. 5 seconds, 15 seconds
d. 10 seconds, 5 seconds

23. If radar contact is lost during a radar approach during the transition to final, the controller will:

a. Clear the aircraft to an appropriate NAVAID for an instrument approach.
b. Expect the pilot to continue VFR.
c. Expect the pilot to execute lost communication procedures.
d. Instruct the pilot to execute missed approach procedures.

24. Glideslope information for individual PAR approaches can be found in the FLIP ____________.

a. Enroute (IFR) Supplement
b. Approach Plates
c. Low Altitude Enroute Charts
d. FIH

25. Absolute minima for a single-piloted Helicopter, executing a precision approach are ______ feet ceiling and ______ -mile visibility or published minima, whichever is higher.

a. 300, One
b. 1000, 3
c. 200, ½
d. 100, ¼

26. A missed approach order from the final controller because the position or identification of the aircraft is in doubt is ____________ if the pilot has the field in sight.

a. Mandatory
b. Optional
c. Predictable
d. Mandatory during a "no-gyro" GCA

27. The MDA for a straight-in ASR approach to a particular runway is the same for _______________.

a. all standard card pilots
b. all special card pilots
c. all aircraft categories
d. all other runways at that airport

28. Unlike a PAR approach, the controller will request the pilot executing an ASR approach to report

a. beginning descent to MDA.
b. final approach fix inbound.
c. level at the MDA.
d. field/runway in sight.

29. During a "no-gyro" radar approach, a pilot would disregard his

a. attitude gyro.
b. heading gyro.
c. turn needle.
d. torque meter.

REVIEW ANSWERS

1. c.
2. c.
3. c.
4. a.
5. d.
6. a.
7. d.
8. a.
9. d.
10. d.
11. b.
12. a.
13. c.
14. b.
15. c.
16. d.
17. c.
18. c.
19. c.
20. c.
21. b.
22. b.
23. a.
24. b.
25. c.
26. b.
27. c.
28. d.
29. b.

APPENDIX A
GLOSSARY

A100. NOT APPLICABLE

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B
LIST OF PUBLICATIONS

The naval aviator should be familiar with the following list of publications.

		Publication Cycle
1.	Low Altitude Instrument Approach Procedures (Vols. 1 - 22)	8 weeks
2.	Enroute Low Altitude Charts (L-1 to L-36)	8 weeks
3.	Area Charts (A-1 and A-2)	8 weeks
4.	IFR Enroute Supplement	8 weeks
5.	VFR Enroute Supplement	24 weeks
6.	Area Planning (AP/1, AP/2, AP/3, AP1A, and AP1B)	8 & 16 weeks
7.	VFR Sectional Charts	8 weeks
8.	General Planning (GP)	32 weeks
9.	Flight Information Handbook	32 weeks
10.	Airman's Information Manual	2 years
11.	CNAF M-3710.7	As needed
12.	NATOPS Instrument Flight Manual	As needed
13.	Foreign Clearance Guide	Quarterly

THIS PAGE INTENTIONALLY LEFT BLANK