FLIGHT TRAINING INSTRUCTION

PRIMARY INSTRUMENT NAVIGATION T-6B

2016

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
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CORPUS CHRISTI TX 78419-5041

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22 Aug 23

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Encl: (1) Change 4 pages iii through xii, 5-18, 9-1, 9-18, 9-20, 9-33, 10-9, and 10-10.

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b. Record Change 4 on the Summary of Changes page.

3. Future printing of this Flight Training Instruction will incorporate the change. Chief of Naval Air Training POC is LCDR Adam J. Hutchinson, N716. He can be reached via phone or email at DSN 861-3903 or adam.j.hutchinson2.mil@us.navy.mil.

T. P. ATHERTON
By direction

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CNATRA P-765 (REV. 08-16)

Subj: FLIGHT TRAINING INSTRUCTION, PRIMARY INSTRUMENT NAVIGATION, T-6B

1. CNATRA P-765 (Rev. 08-16) PAT, "Flight Training Instruction, Primary Instrument Navigation, T-6B" is issued for information, standardization of instruction, and guidance to all flight instructors and student military aviators in the Naval Air Training Command.

2. This publication is an explanatory aid to the T-6B Joint Primary Pilot Training 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 TCR form located on the CNATRA website.

4. CNATRA P-765 (REV. 04-11) PAT is hereby cancelled and superseded.

M. B. TATSCH
By direction

Distribution:
CNATRA Website

FLIGHT TRAINING INSTRUCTION
FOR
PRIMARY INSTRUMENT NAVIGATION
T-6B

SAFETY/HAZARD AWARENESS NOTICE

This course does not require any safety precautions other than those normally found on the flightline.

FORWARD

Terminal Objective:

Upon completion of this course, the student will be able to safely pilot a T-6B, to include all phases of instrument flight from takeoff and departure, through instrument approaches and missed approaches.

Standards:

Conditions and standards are defined in CNATRAINST 1542.166C.

Instructional Procedures:

1. This is a flight training course and will be conducted in the aircraft and the Unit Training Device (UTD)/Operational Flight Trainer (OFT) flight simulators.

2. The student will demonstrate a functional knowledge of the material presented through successful completion of the flight maneuvers.

Instructional References:

1. T-6B NATOPS Flight Manual

2. NATOPS Instrument Flight Manual

3. Local Standard Operating Procedures Instruction

4. Aeronautical Information Manual/Federal Aviation Regulations

5. OPNAVINST 3710.7V

LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original…0…15 Dec 09 (this will be the date issued)
Revision…1…08 Jun 11
Revision…2…08 Aug 16
Change Transmittal…1…02 Feb 18
Change Transmittal…2…22 Jan 20
Change Transmittal…3…28 Oct 20
Change Transmittal…4…23 Aug 23

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 234 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
COVER	0	8-35 – 8-36	0
CHANGE LETTER	4	9-1	4
CHANGE LETTER	3	9-2 – 9-9	0
CHANGE LETTER	2	9-10	1
CHANGE LETTER	1	9-11 – 9-13	0
LETTER	0	9-14	1
iii – xii	4	9-15 – 9-17	0
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1-4 (blank)	0	9-19	0
2-1 – 2-4	0	9-20	4
2-5	2	9-21 – 9-32	0
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8-23	1	C-4 – C-5	1
8-24 – 8-33	0	C-6 – C-30	0
8-34	1		

INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE
1	Changes made per change transmittal letter (02 Feb 18)
2	Changes made per change transmittal letter (22 Jan 20)
3	Changes made per change transmittal letter (28 Oct 20)
4	Changes made per change transmittal letter (23 Aug 23)

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

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

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CHAPTER ONE
PRIMARY INSTRUMENT NAVIGATION

100. INTRODUCTION

This Flight Training Instruction (FTI) is a Naval Air Training Command directive published by Chief of Naval Air Training (CNATRA). The information and instructions are relative to all instructors and students operating T-6B aircraft in the Primary Phase of training in the Naval Air Training Command. It is very important that the factual material contained herein be thoroughly studied and retained.

This FTI does not contain all the information necessary for a student pilot to become a professional aviator. Rather, this instruction provides a focal point and reference manual for all other sources of technical information, outlining and amplifying the flight procedures where necessary. This manual is designed as a training tool and is not meant to establish policy concerning fleet operations. It is important to note that the emergency procedures shown are to aid in the topic discussion. For all emergencies, the NATOPS is the final authority. Through this cross-referencing and organization of information, the student pilot should be able to develop a thorough understanding of the manual and flight procedures that form the backbone of an aviation career.

101. INAV OVERVIEW

In the INAV (Instrument Navigation) Stage of Navy flight training, you will be introduced to the elements of flight under Instrument Flight Rules (IFR). The Contact Stage of training equipped you with basic flying skills. In INAV, these skills are further refined and built upon to enable you to accomplish a specific objective – to safely navigate from one point to another in Instrument Meteorological Conditions (IMC).

102. SCOPE OF INSTRUCTION

So far as is practical, all information and instructions governing T-6B aircraft procedures and the execution of curriculum maneuvers will be published for inclusion in this manual. Procedures peculiar to Whiting Field (TW-5) and Corpus Christi (TW-4) may be found in the TW-5 Fixed Wing Operating Procedures (FWOP) Manual or TW-4 Standardization Notes/NAS Corpus Christi Course Rules.

Terms that would be included ordinarily in a glossary for T-6B INAV training are defined as they are used throughout the text.

103. CURRICULUM RESOURCES

1. **JOINT PRIMARY PILOT TRAINING (JPPT) SYSTEM CURRICULUM CNATRAINST 1542.166(SERIES)**. This pocket guide is the curriculum outline. It describes what the student aviator will do in the Primary phase of training. The maneuvers and exercises in the syllabus are described, as well as the standards of performance to be achieved. Each event lists all of the maneuvers to be performed. When there is no task listing in the description of an event, then another publication describes the conduct of that event.

2. **NATOPS PROGRAM**. Every student naval aviator (SNA) becomes familiar with Naval Air Training and Operating Procedures Standardization (NATOPS) early in their career. Each student will be issued a T-6B NATOPS Flight Manual before starting ground school. The NATOPS program is the responsibility of all who use it. NATOPS only works if everyone is involved. Even students have the responsibility to originate changes when errors or ambiguities are found in the NATOPS manual. See the squadron NATOPS officer regarding the correct procedure to submit a NATOPS change recommendation.

3. **T-6B NATOPS FLIGHT MANUAL AND POCKET CHECKLIST**. The T-6B NATOPS Flight Manual is the definitive instruction on the operation of the aircraft. The Pocket Checklist (PCL) is a convenient pocket sized listing of those items in the NATOPS Flight Manual that would be of particular concern while airborne or at a remote location. No student or flight instructor has the authority to deviate from NATOPS without specific written authority (except in specific situations). The NATOPS also lists the crew requirements for flying the aircraft. Both the NATOPS and the PCL list emergency procedures. Some of these procedures are listed in Boldface or with asterisks next to them. These items are memory items, and the student shall be able to recall and apply these procedures correctly. In addition to the emergency procedures, a pilot should be able to recall the Before Landing Checklist from memory. Other than these, checklists should be performed with the aid of the PCL or appropriate guide. Familiarity with the PCL should be acquired to ensure efficient use while airborne.

4. **FLIGHT INFORMATION PUBLICATIONS (FLIP)**. Safely executing flight in Instrument Meteorological Conditions (IMC) requires superb knowledge, understanding, and utilization of numerous Department of Defense (DOD), US Navy, and civilian publications.

a.	Instrument Approach Plates	IAP (GPS, VOR, ILS, etc.)
b.	Standard Instrument Departure Procedure Plates	DP (contained in IAP book)
c.	Standard Terminal Arrival Plates	STAR (separate document)
d.	IFR Supplement	DOD Airport Directory
e.	Flight Information Handbook	FIH
f.	OPNAVINST 3710.7	Navy Rulebook

g.	US Navy Instrument NATOPS	Navy IFR Handbook
h.	FAR/AIM	FAA Rulebook & Handbook
i.	IFR Low Altitude Enroute Charts	Victor Airways
j.	IFR High Altitude Enroute Charts	Jet Airways (FL180)
k.	FAA Instrument Flying Handbook	FAA-H-8083-15
l.	FAA Instrument Procedures Handbook	FAA-H-8261-1A
m.	FAA Aviation Weather Services	AC 00-45E
n.	FAA Aviation Weather	ASA-AC00-6A

5. **CFR PART 91 – FAR / AIM (FEDERAL AVIATION REGULATIONS / AIRMAN'S INFORMATION MANUAL).** Part 91 contains some applicable flight rules not specifically addressed in OPNAVINST 3710.7. Naval Aviators must be thoroughly familiar and MUST COMPLY with this document.

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CHAPTER TWO
FUNDAMENTAL INAV CONCEPTS

200. INTRODUCTION

Prior to the first instrument flight in the T-6B, there are several fundamental topics the student should review and understand. The procedures and concepts in this chapter provide students with essential tools required for Instrument Navigation.

201. T-6B COCKPIT INSTRUMENTATION

Instrument interpretation is one of the most important basic skill sets required for instrument flight. It begins with understanding how each instrument works, then applying this knowledge to: the performance of the aircraft, the particular maneuvers to be executed, the scan and control methods, and the operating conditions. For each maneuver, the student will learn what performance to expect and the combination of items that must be interpreted in order to control aircraft attitude during the maneuver.

202. REAR COCKPIT DIFFERENCES

Students will fly most Instrument Stage sorties from the rear cockpit, and will therefore be required to familiarize themselves with the differences outlined in the T-6B NATOPS Flight Manual. The most important one worth noting is the ISS Mode Selector, located in the rear cockpit, left console, just behind the CFS handle. Prior to flying the student's first Instrument flight, the instructor should give the student a rear cockpit differences familiarization to include the hazards of accidental CFS actuation while manipulating the ISS Mode Selector.

203. PAT PRINCIPLE

The concept of attitude flying is based upon the fact that a specific power setting when combined with a specific attitude will result in a specific aircraft performance.

Power + Attitude = Performance

To change the aircrafts performance the pilot will adjust the ***Power*** control lever to a setting that will support the new desired performance. Simultaneously, using the ADI as a reference, the elevator and aileron will be adjusted to the required ***Attitude*** (pitch and bank angle). An initial rudder input will also be made to offset changes in power and airspeed. Once this has been accomplished the aircraft ***Trim*** controls will be used to remove control pressures required to hold the new attitude. A mnemonic for this process is; ***PAT*.**

Power
Attitude
Trim

204. SCAN PATTERNS

Once ***PAT*** is accomplished, ***SCAN*** to ***maintain*** the desired performance.

Scan is the systematic process of monitoring the crosscheck/performance instruments to detect deviation from desired flight parameters (error detection), then applying the proper controls to make an appropriate timely correction.

The goal is:

Early Error Detection and Correction!

In any scan method there are two basic groups of instruments:

Power/Control Instruments: The four ***basic*** inputs that the pilot can make in the aircraft are:

1. PITCH
2. ROLL
3. POWER
4. YAW

Initial ***Power*** and ***Attitude*** inputs are made referencing the Power/Control Instruments:

1. ADI
2. TORQUE

Crosscheck/Performance Instruments: These instruments are used to detect deviations from required performance and inform you of the inputs required to regain the desired flight parameters.

1. ALTIMETER
2. VSI
3. AIRSPEED
4. ANGLE OF BANK (ROLL POINTER)
5. TURN NEEDLE
6. HSI

7. SIDESLIP INDICATOR

An active scan will let you know which control needs adjusted, the direction it needs to be moved, and a sense of how much it should be moved.

HUB and SPOKE Method:

The ***Hub*** is the Attitude Gyro (ADI). The ***Spokes*** are the crosscheck/performance instruments. A basic instrument scan sequence consists of:

GYRO - Set required Attitude for desired performance

NOSE - Crosscheck nose instrument(s)

GYRO - Adjust ***Pitch*** to keep or return to desired parameters

WING - Crosscheck wing performance instrument(s)

GYRO - Adjust ***Roll*** to keep or return to desired parameters

PERFORMANCE/PROGRESS - Crosscheck aircraft performance/maneuver progress

GYRO - Stabilize attitude

ADDITIONAL - Fine tune the rudder for ***Yaw*** (sideslip) and ***Power*** for needed changes in torque

NOTE

Approximately 50% of the time the pilot should be looking at the ADI. This will aid in preventing unintended inputs while insuring desired inputs are appropriate and controlled. ADI is big picture, crosscheck/performance instruments are for fine tuning.

The crosscheck/performance instruments for ***Pitch***, ***Roll***, and ***Power*** depend upon the maneuver being conducted. The crosscheck for ***Yaw*** is always the sideslip indicator.

The following table outlines the different flight maneuvers you will encounter in this stage of training and the appropriate crosscheck/performance instruments.

MANEUVER	NOSE CROSSCHECK	WING CROSSCHECK	PERFORMANCE/ PROGRESS INSTRUMENT	ADDITIONAL INSTRUMENTS
STRAIGHT AND LEVEL	ALTIMETER, VSI	HSI	AIRSPEED	SIDESLIP, TORQUE
CONSTANT ANGLE OF BANK TURNS	ALTIMETER, VSI	AOB	HSI AIRSPEED	SIDESLIP, TORQUE
CONSTANT AIRSPEED CLIMBS & DESCENTS	AIRSPEED	HSI	ALTIMETER	SIDESLIP, TORQUE
CONSTANT RATE TURNS	ALTIMETER, VSI	TURN NEEDLE AOB	HSI CLOCK AIRSPEED	SIDESLIP, TORQUE
CONSTANT RATE CLIMBS & DESCENTS	AIRSPEED	HSI	ALTIMETER VSI CLOCK	SIDESLIP, TORQUE
CLIMBING OR DESCENDING TURN AT CONSTANT ANGLE OF BANK & AIRSPEED	AIRSPEED	AOB	HSI AIRSPEED	SIDESLIP, TORQUE

Figure 2-1 Crosscheck/Performance Instruments

205. SPATIAL DISORIENTATION

Spatial disorientation can be defined simply as a body sensation which tells the aviator that his aircraft is in a particular attitude, when the aircraft is actually in an entirely different position relative to the horizon. This false sensation is derived from a number of sources: the inner ear and vestibular stimulation are the most common.

Spatial disorientation usually does not occur when a pilot has visual reference to the horizon, or at least, the pilot pays little attention to his body feelings, since his sight simply overcomes them. Disorientation occurs when there is no reference to the horizon; however, this does not necessarily limit vertigo to flying in the clouds. It can occur when the aircraft is flying in visual meteorological conditions (VMC), on a day when there are large buildups, when flying above a layer of clouds, when flying in and out of a broken layer, or when launching at night with no clear horizon. Vertigo or the disorientation sensation is, and always will be, a factor in aviation, but is dangerous only when the pilot believes and flies his senses instead of the reliable instruments.

The spatial disorientation training in the T-6B will demonstrate and emphasize three specific facts:

1. A pilot’s attitude sensations are generally unreliable.

2. The pilot cannot recover to straight and level flight using these sensations.

3. Instruments are the only way to recognize and recover from unusual attitudes in Instrument Meteorological Conditions (IMC).

206. VERTIGO DEMONSTRATION

The instructor will fly the aircraft through a series of smooth, easy maneuvers while the student closes his eyes. The student gives a running commentary of his sensations over the ICS. When disorientation is evident, the student will be informed to open his eyes and check his attitude. This will vividly emphasize the unreliability of body senses.

It should be noted that "eyes closed" simulates inattention to the instruments, which may occur any time a pilot is tuning radios, checking charts, or attempting to maintain VFR scan in marginal conditions. The maneuvers performed are smooth and constant, producing the typically smooth, insidious vertigo. They are not the accustomed violent maneuvers usually associated with unusual attitudes, which produce an immediate indication of abnormal flight. Instead, the simulated inattention induces real disorientation. The vertigo demonstration will not be graded. All aviators are susceptible to vertigo, and this demonstration is intended to emphasize that. Fatigue, turbulence, dim lighting, and IFR conditions all contribute to the onset of vertigo.

207. THE SIX Ts

The 6 Ts are a mnemonic for the pilot to aid in task management for various procedures and operations during flight. Some examples include the Initial Approach Fix (IAF), station passage, Final Approach Fix (FAF), and Holding Fix. The 6 Ts are:

1. **TIME** - note time/start clock as required.

2. **TURN** - to heading as required.

3. **TIME** - note time/start clock as required.

4. **TRANSITION** - to appropriate speed and or configuration/descend as required.

5. **TWIST** - set CDI to desired course and establish intercept as required.

6. **TALK** - report to ATC position/time/intentions/configuration as required.

208. T-6B CONFIGURATIONS / SPEEDS

CRUISE CLIMB	**180 KIAS/Clean** **MAX Power (100%) / ≈8° Nose High**
MAX RATE CLIMB	**140 KIAS/Clean** **MAX Power (100%) / ≈15° Nose High**
TERMINAL DESCENT	**200 KIAS/Clean** **Power as required (≈20%) / ≈5° Nose Low**
ENROUTE DESCENT	**200-250 KIAS/Clean** **Refer to pages 8-2 thru 8-3.**
FAST CRUISE	**240 KIAS/Clean** **Power as required (80%) / ≈1° Nose Low**
NORMAL CRUISE	**200 KIAS/Clean** **Power as required (50% + ALT) / ≈0° Nose High**
HOLDING AIRSPEED	**150 KIAS/Clean** **Power as required (33%) / ≈3° Nose Up**
BASIC APPROACH CONFIGURATION (BAC)	**120 KIAS/Gear down and Flaps to takeoff** **Power as required (42%)**

Figure 2-2 Configurations/Speeds

NOTE

1. When mandated by a procedure to establish a specific power setting, being within 3% of that setting is acceptable. The one exception to this tolerance is when setting 4-6% torque to achieve propeller feathered performance when the engine is running.

2. The exact power needed to maintain a desired performance changes with density, pressure, aircraft weight and altitude. The above settings are good ball-park numbers but will have to be refined to obtain exact performance. ***For most requirements*** these will be very small changes (just a few % of torque). The exception to this rule is NORMAL CRUISE 200 KIAS. A good rule of thumb for the ***approximate*** power needed for 200 KIAS is; Torque for 200 KIAS = 50% + altitude in thousands of feet.

EXAMPLE:

@ 4 thousand feet-	50% + 4 =	54%
@ 10 thousand feet-	50% + 10 =	60%
@ 15 thousand feet-	50% + 15 =	65%

209. THE ONE-THIRD RULE

Since the airplane will continue turning as long as there is any bank, the rollout must be started before reaching the desired heading. The amount required to lead the heading will depend on the rate of turn and the rate at which the rollout will be made; however, a good rule of thumb is to start the rollout one-third the number of degrees of angle of bank in use. Example: If a 30º angle of bank turn was being used, the rollout would be started 10º prior to the desired heading. To avoid a ballooning tendency when rolling out of a level turn, power and nose attitude should be gradually and smoothly returned to level settings for straight-and-level flight. As the rollout is being completed, attention should be given to the PFD to determine that the wings are being leveled precisely and the turn stopped.

210. USE OF THE SPEED BRAKE

The speed brake is available for use during all instrument flights. Many times in flight pilots will find themselves high on energy with little time or distance left to correct the problem.

Examples include:

1. A late let down from ATC.

2. ATC requests to “keep the speed until the FAF.”

3. Lapse in situational awareness leading to the aircraft being fast on final with little or no time to configure the aircraft.

211. STANDARD CALLOUTS

Standard callouts may be pre-briefed or executed in accordance with local Standard Operating Procedures (SOP). Examples might include the pilot flying or pilot monitoring calling out over the ICS: 1000’ prior to level-off, 200’ prior to level-off, reaching decision altitude (DA) or minimum descent altitude (MDA), CDI or glideslope alive, and Basic Airwork deviations outside the Course Training Standard (CTS).

212. VOR Principles of Operation

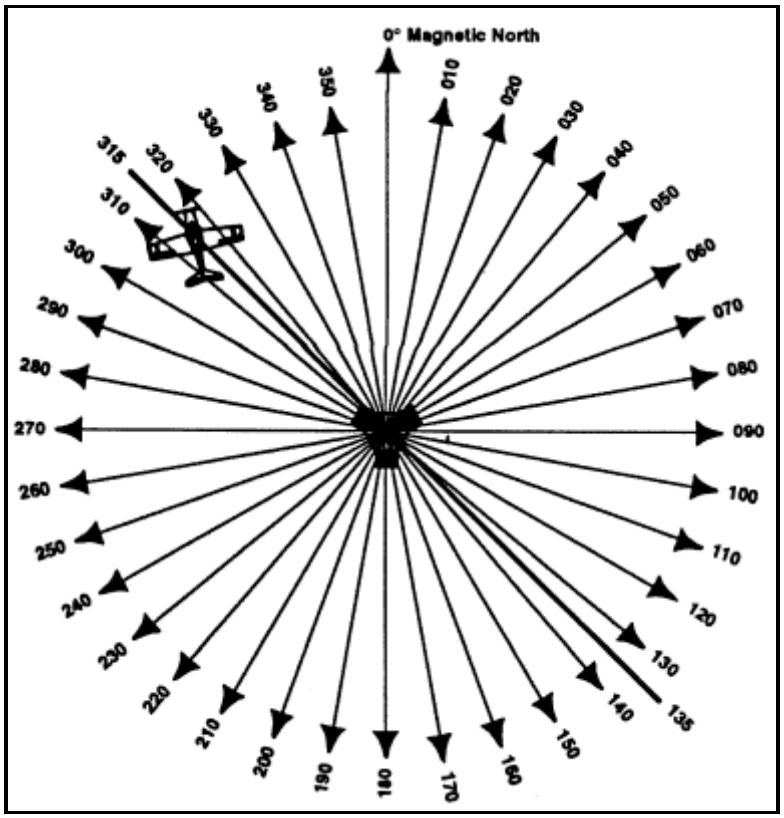

Figure 2-3 VOR Radials

The lower half of the VHF band is used in the VOR airway navigation system; the frequency range is from 108.00 to 117.95 MHz. The present system of federal low altitude airways in the United States is based on a network of VOR stations (commonly referred as "Victor" Airways). VOR stations provide the pilot magnetic bearing information and are capable of transmitting voice communications. This bearing information is displayed on the bearing pointer.

VOR operation is based on the phase difference between two signals from a VOR facility. Magnetic North is used as a baseline for electronically measuring the phase relationship between the two signals. At Magnetic North, the signals are in phase; however, a phase difference exists at any other point around the station and is electronically measured by the aircraft's VOR receiver. The VOR provides 360 magnetic courses called radials, which radiate ***from*** the station like spokes from the hub of a wheel. The VOR system is limited to line of sight reception which varies with the altitude of the aircraft and elevation of the transmitter. Normal range is 40 Nautical Miles (NM) at 1000 feet Above Ground Level (AGL); this range increases with altitude.

The line of sight transmission pattern from a VOR facility creates an area directly over the facility where signal reception is weak or impossible. This area where navigation information is unreliable is called the cone of confusion.

CHAPTER THREE
FLIGHT PLANNING PROCEDURES

300. INTRODUCTION

It is important to not focus solely on the FTI, but incorporate information from all available sources, both military and civilian. For example: OPNAVINST 3710.7, FAR/AIM, FIH, GP, Area Planning (AP), etc. Review NATOPS for servicing, local SOPs, Wing Stan Notes, and cross- country (CCX) instructions. All of these resources contain information which you will need to be familiar with in order to have a successful event.

Many students will be afforded the opportunity to go cross-country during Instrument Navigation training. This can be one of the more enlightening and enjoyable aspects of training. During cross-country planning and execution, you will acquire a more thorough and accurate picture of Instrument Navigation Procedures outside of the local area training environment.

301. WEATHER MINIMUMS

See OPNAVINST 3710.7 series, along with applicable SOPs/Stan notes.

302. FUEL PACKETS (GAS CARD)

Prior to departing on a cross-country or "out-and-in," pick up a fuel packet. In the fuel packet there is a credit card to purchase fuel from contract fuel suppliers. Additionally, there are various government forms that can be utilized for maintenance services and other bona fide official business expenses. At the completion of your CCX, be sure to turn in your fuel packet with receipts.

303. FLIP PUBLICATIONS

Make sure to bring the necessary FLIP publications to cover the entire route of flight and any possible contingencies. Possible considerations include, but are not limited to, low and high altitude enroute charts, high and low altitude approach plates, the IFR Supplement, SID/STARs and area charts. Check all pubs to ensure they will be current for the entire time span of the CCX. It is possible to take off on a three-day CCX and have some of your pubs expire before the end of your mission. Review or print out applicable NOTAMS, ARTCC NOTAMS, FDC NOTAMS, TFR's etc.

304. ROUTE OF FLIGHT

This will probably be the first time you fly a significant distance from homefield. No longer will you be operating in an area where you are familiar with area landmarks, suitable fields, radio and navigational aid (NAVAID) frequencies, etc. Mark your route of flight on your navigational charts. Note suitable emergency or divert fields near your route.

Be aware of which VORs along your route have voice capability in the event you lose both your

UHF and VHF radios. ATC may attempt to contact you via a voice capable VOR. Additionally, certain VORs conduct scheduled weather broadcasts; utilize these to update and verify your formal weather briefing.

305. JET LOGS

Complete a Jet Log for all events required in the syllabus notes section of the Joint Primary Pilot Training (JPPT) master curriculum guide (a copy should be made for the instructor as well). During flight, compare estimated values for times, groundspeed, fuel flow, etc., with the actual values observed. Modify your jet log as necessary.

306. PPR

To land, refuel, or remain overnight at certain fields, prior arrangements must be made. This will be indicated in the IFR Supplement (or AP1) in the aerodrome remarks section. If permission is required, you will see a reference to PPR, which indicates "prior permission required." Assist your instructor as directed in securing this permission. Base Operations at your destination field is normally your point of contact for obtaining permission. Some fields require specific PPR arrival times and are strictly enforced. Very few civilian fields require PPRs, however a phone call prior to launching is recommended.

307. NON-MILITARY AIRFIELD OPERATIONS

On CCX, you may be operating from non-military fields. Be aware that certain procedures and services may vary from local operations (e.g., availability of fire guards, follow-me trucks, Base Operations, and the weather office).

Keep in mind that your flight plan may not be closed automatically as it would be at a military field. The aircraft commander is still required to confirm the closeout via Tower, Ground, Base Operations, or a Flight Service Station (FSS). At non-military fields, you may have to file your flight plan with a Flight Service Station (FSS). For filing, request an ICAO flight plan and provide the FSS briefer with your information as prompted.

For weather services, OPNAVINST 3710.7 states:

"For flights where any portion of the intended route is forecast to be under IMC, naval aviators shall obtain a flight route weather brief from a DoD-qualified forecaster or approved forecasting service.

a. The primary method for requesting and obtaining flight route weather briefings ashore is online through the Web-enabled 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.

b. 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 an FSS or through Air Force Weather and Marine Corps Services, where available."

Military weather and NOTAM briefing facilities are listed in the FIH and are just a phone call away. For more information, refer to the FIH Section C.

If the FSS is not at the field, the above procedures may be accomplished over the telephone. When filing via telephone, provide the necessary information by using the format on the back cover of the IFR Supplement entitled "Filing Flight Plans in Flight." The phone number for the nearest FSS is 1-800-WXBRIEF.

NOTAM information can be obtained from the FSS. If information obtained via the FSS is insufficient, contact the nearest suitable military base.

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CHAPTER FOUR
INAV DEPARTURE PROCEDURES

400. INSTRUMENT TAKEOFF (ITO) AND CLIMB

General

To safely transition to instrument meteorological conditions (IMC) following a normal takeoff from visual meteorological conditions (VMC).

Procedure

Perform a normal takeoff. After liftoff, use outside references and the attitude indicator to control attitude. Make a transition to an instrument scan at the same rate in which visual cues are lost. Initially raise the nose to approximately 8-10° nose high on the attitude indicator to establish a definite rate of climb. Trim and verify climb with altimeter and VSI, then raise the gear and flaps. Maintain initial attitude until reaching target climb speed (180 KIAS). Non-standard climb gradients on published departures may require adjustments to the climb profile.

Common Errors

1. Failure to maintain directional control on takeoff roll through improper use of rudder.

2. Swerving or skipping on takeoff roll due to improper use of crosswind correction.

3. Applying insufficient rudder on liftoff and attempting to correct with wing low.

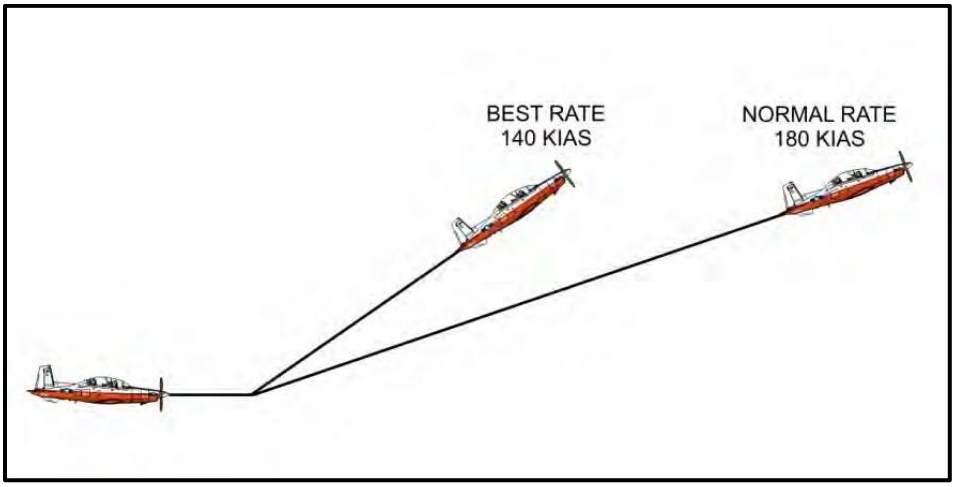


Figure 4-1 Climb Rate

NOTE

More efficient climbs may be required for obstacle clearance or specific flight planning requirements. The T-6B best rate of climb speed is 140 KIAS and 15º nose high (Figure 4-1).

401. LEVEL-OFF

General

Smoothly level-off at desired altitude with power set to attain or maintain desired airspeed.

Description

Change of pitch to reduce vertical speed at a specific altitude combined with power adjustment to meet desired airspeed.

Procedure

To level-off at an airspeed below climb speed, lower the nose to level flight and reduce power below the setting required to maintain the lower airspeed. To level-off at a higher airspeed, leave the PCL at maximum allowable to accelerate to the greater airspeed. Adjust power approaching the target airspeed and trim. Use similar procedures for a level-off from a descent. One method is to use 10 percent of vertical speed (from the VSI) as a lead point to begin level-off. For example, begin level-off 200' below the desired altitude when the VSI indicates 2000 feet per minute (FPM). At the lead point, cut the pitch in half, and then continue pitch change to smoothly level-off. If intermediate level-offs are required, it is permissible to maintain climb airspeed or accelerate to the appropriate cruise speed for that altitude.

IFR Departure methods

An instrument departure is a procedure used to ensure a safe climb out from an airport and to provide safe separation between aircraft. There are four common types of departures listed below.

NOTE

The Trouble T: An Obstacle Departure Procedure (ODP) that has been developed solely for obstacle avoidance will be indicated with the symbol **"*T*"** on IAP charts (approach plates) and Departure Procedure (DP) charts, ODP or Standard Instrument Departure (SID) plates. The user of these should refer to the front section of his approach plate for specific information pertaining to the obstacle, and climb out required. Refer to the AIM for more information. OPNAVINST 3710.7 defines takeoff weather minima for Naval Aircraft.

1. **Instrument Departure Procedures (DPs)**

DPs are preplanned instrument flight rule (IFR) procedures which provide obstruction clearance from the terminal area to the appropriate enroute structure. There are two basic types of DPs.

a. **Obstacle Departure Procedures (ODPs)** provide obstruction clearance from the terminal area to the appropriate enroute structure. Found in DOD FLIP approach plates, ODPs will be labeled with the word "OBSTACLE" in the title.

Example: GEYSER THREE DEPARTURE (OBSTACLE)

b. **Standard Instrument Departures (SIDs)** are air traffic control procedures printed in graphic form for pilot use. SIDs will provide obstruction clearance and a transition from the terminal area to the appropriate enroute structure and can be found in DOD FLIP approach plates.

2. **Radar Departure**

Many military and civilian fields have no published DPs. A radar departure is a procedure used in the absence of a DP, or if the pilot elects not to fly the published DP. The radar departure utilizes radar vector instructions to guide the aircraft from departure to a point along the flight plan route. The pilot can request a radar departure in the remarks section of the flight plan; otherwise, a DP may be assigned by ATC if available.

3. **Diverse Departure**

The most basic of the four, you are cleared as filed on your flight plan. For example, you file from Grand Junction CO to Salt Lake City Intl via Direct GJT V134 to FFU, then V21 to SLC direct KSLC.

a. Diverse Departures, unless specified otherwise, require a climb to 400' AGL and then an initial turn can be made, but a minimum of 200 feet per nautical mile (FPNM) climb rate is required until the minimum IFR altitude is reached.

– To convert FPMN to VSI:

(a). A climb out speed of 180 KIAS = 3 nautical miles (NM) per minute.

(b). 3 NM/min X 200'/NM = 600'/min or 600 on the VSI at 180 KIAS.

b. Upon contact with clearance, you are cleared "as filed, to 15,000 feet."

c. In this case, takeoff, passing 400' AGL, fly in shortest direction direct to GJT maintaining a minimum of 600 FPM, then V134 to FFU, etc.

4. Visual Climb over the Airport (VCOA)

In a VCOA, the pilot is responsible for climbing VFR above the airport to a predetermined altitude before proceeding outbound on an IFR flight plan. These clearances are given from smaller airports where neither radar nor a DP is available and terrain is such that a Diverse Departure direct on course is not feasible.

Example: "*Navy 10, climb in visual conditions so as to cross the Beatty airport Southbound at or above 6000', then climb via the Beatty Three, Three, Zero, to the Beatty VOR, then as filed, climb and maintain 15,000 feet*."

402. FLYING THE DEPARTURE

General

Make a safe transition to enroute flight.

Procedure

It is important to stress proper preflight planning. The time to research a departure is not in the air (or even in the plane on the ground). This research should be performed prior to leaving Base Operations, or the Fixed Based Operator (FBO).

1. Review the entire departure procedure to include surrounding terrain, hazards and climb gradient requirements during preflight planning.

2. Set NAVAIDs and displays as required for execution of the departure. If the FMS is being used to fly the SID, the procedure must be retrieved from the FMS database.

3. Develop a plan for emergency return. Have an instrument approach plate open with the primary recovery approach displayed, just in case an immediate return to the departure field is required.

Common Errors

1. Failure to understand required actions needed for the departure.

2. NAVAIDs not set as required for the departure.

CHAPTER FIVE
BASIC INSTRUMENT MANEUVERS

500. INTRODUCTION

In order to maintain the precise control required during instrument flight one must master basic instrument skills.

501. AIRSPEED CHANGES

General

Smooth, controlled, deliberate change of airspeed is an integral part of instrument flying.

Description

Change airspeed while maintaining heading and altitude. Power is used to initiate the change. At the completion of the change, power is set to maintain the new airspeed. Aircraft should be trimmed during airspeed changes and then fine-tuned once the target airspeed is achieved. This maneuver is normally practiced between 150-200 KIAS. The **P**ower-**A**ttitude-**T**rim (P.A.T.) principle applies.

Procedure

<u>Accelerations:</u>

To increase airspeed in straight-and-level flight, advance the **P**ower to maximum allowable (anticipate the need for right rudder with power addition). As airspeed increases, lift increases, so there is a tendency to climb (anticipate the need for left rudder as airspeed increases). Adjust pitch **A**ttitude to maintain altitude and **T**rim out control pressures. Approaching target airspeed, reduce power as required to maintain the new airspeed (anticipate the need for left rudder with power reduction).

<u>Decelerations:</u>

To reduce airspeed in straight-and-level flight, reduce **P**ower to 15% torque (anticipate the need for left rudder with power reduction). As airspeed decreases, lift decreases, so there is a tendency to descend (anticipate the need for right rudder as airspeed decreases). Adjust pitch **A**ttitude to maintain altitude and **T**rim out control pressures. Approaching target airspeed, advance power to a setting to maintain the new airspeed (anticipate the need for right rudder with power addition).

NOTE

Speed brake may be used for rapid airspeed reductions. Late speed brake retraction near target airspeed may result in an overshoot of the targeted airspeed. Trim requirements and the

possibility for spatial disorientation increase with use of the speed brake.

Common Errors

1. Loss of heading control due to insufficient rudder, and/or rudder trim.

2. Loss of altitude control due to slow crosscheck.

502. CONSTANT ANGLE OF BANK TURNS (CABT)

General

The ability to turn to a predetermined heading while maintaining altitude and airspeed is a necessary skill in an instrument environment.

Description

Turn to a specific heading while maintaining altitude, airspeed and a constant angle of bank. These turns will normally be practiced at 15 and 30 degrees of bank at 150 KIAS, but other airspeeds and angles of bank are permissible.

Procedures

1. Establish the required AOB on the attitude indicator and maintain that AOB throughout the turn. Crosscheck the nose position with the altimeter and VSI (anticipate a loss of lift as bank angle is increased). Corrections to maintain altitude and airspeed are made in the same manner as in straight and level flight.

2. Approaching the assigned heading use the one-third rule to start the rollout. For example, if the AOB is 30º, the rollout should be commenced 10º prior to the assigned heading.

3. At the lead-point use the ADI to ensure nose and wing attitudes are returned to level flight (anticipate a return of lift as bank angle is decreased).

Common Errors

1. Over-rotating the nose as the AOB is increased resulting in a climb. Some pilots have a tendency to pull back stick while rolling into a turn.

2. Allowing the nose to drop as AOB is increased resulting in a descent. Most students fail to compensate for the loss of lift as AOB is increased.

3. Looking away from the attitude indicator before the AOB is set, resulting in overbanking as the wings continue to roll.

4. Overshooting the assigned heading due to slow or improper scan.

5. Ballooning during rollout. This error is often caused by fixating on the HSI, thereby missing the needed nose and attitude adjustments on the ADI.

503. STEEP TURNS

General

Maintain smooth, coordinated flight in turns to specific headings at steeper than normal bank angles.

Description

These turns will normally be practiced at 45 and 60 degrees of bank and 150 KIAS, but other airspeeds and angles of bank are permissible.

Procedure

Enter a steep turn in the same manner as a normal turn. Anticipate the addition of power to maintain a constant airspeed. The pitch required during steep turns is notably higher than those associated with the smaller angles of bank. Use a constant angle of bank during steep turns, and attempt to correct altitude deviations by adjusting the pitch attitude. During 60° angles of bank with a loss of altitude and a VSI rate in excess of 1000 FPM, a momentary decrease in bank angle may be needed correct the pitch attitude.

For turns conducted at 150 KIAS the approximate pitch and power settings in Figure 5-4 will aid in establishing the new power and attitude. Anticipate adding power approaching 30° AOB. To roll out on the desired heading, use the one-third rule (15° for a 45° AOB turn and 20° for a 60° AOB turn).

Common Errors

1. Loss of altitude control.

2. Unable to maintain desired angle of bank.

3. Slow to set or inability to set desired power setting.

504. RATE TURNS

General

A timed turn (maintaining a specific rate of turn in degrees per second) to an assigned heading maintaining altitude and airspeed.

Description

During normal IFR flight, turns will generally be performed at either standard or half standard rate. The Standard Rate Turn (SRT) is 3º per second. At 3º per second, a turn of 180º will take one minute and a 360º turn will take two minutes. Figure 5-1 shows the AOB necessary to produce a 3º per second turn rate at various airspeeds. From the chart, notice that an aircraft operating at high airspeeds requires a steep AOB to produce a 3º per second turn rate. Steep turns are more difficult to fly than shallow turns, since they result in heavy load factors. For example, a 60º angle of bank turn applies a force of two "Gs" to the aircraft and pilot. To avoid these "G" forces and provide better control, FAA publications recommend using either a ***SRT or 30º AOB turn, whichever occurs first in IMC.***

Rate turns are practiced initially in level flight, crosschecking the nose with VSI and altimeter, and the wings on the turn needle. A one needle width deflection produces a ½ SRT and a two needle width deflection produces a full SRT. Performance for SRTs will be 30° heading change every 10 seconds. Performance for ½ SRTs will be 30° heading change every 20.

The AOB required to produce a constant rate turn will vary with airspeed and altitude. A rule of thumb to estimate the approximate AOB needed for proper turn needle deflection is 10% of the indicated airspeed for a ½ SRT and 20% of the indicated airspeed for an SRT.

The above method is known as the "10% or 20% rule." It is valid only during balanced flight and will provide a fair starting point to use during the initial roll into the turn. The turn needle always shows the exact rate of turn (even in an unbalanced condition) but lags (in some aircraft) significantly behind during the initial transition into a turn.

TEMP °C ALTITUDE	IAS (KTS)	TAS (KTS)	AOB ½ SRT	AOB SRT
13	120	122	10	19
	150	152	11	22
	180	183	13	25
1000	200	203	14	27
5	120	129	10	20
	150	162	12	23
	180	194	13	26
5000	200	215	14	29
-5	120	140	11	21
	150	174	12	24
	180	209	14	28
10000	200	233	15	30
-15	120	151	11	22
	150	189	13	26
	180	227	15	30
15000	200	252	16	32
-25	120	164	12	23
	150	205	14	28
	180	246	16	32
20000	200	274	17	34
-35	120	179	12	25
	150	224	15	29
	180	269	17	34
25000	200	298	18	37
-45	120	196	13	27
	150	245	16	32
	180	294	18	36
35000	200	327	20	40

Figure 5-1 Standard Rate Turn Chart

Procedure

For practice, timed turns will be started at 150 KIAS on a cardinal heading. The turn will be initiated three seconds prior to the clock indicating 00 or 30 seconds. This lead will compensate for time needed to establish the desired angle of bank.

1. **Half SRT**

   a. For the timed ½ SRT, roll into a turn on the attitude indicator using the 10 percent rule to establish the approximate bank. Once the attitude is set on the attitude indicator, crosscheck the turn needle for an exact one needle width deflection and

adjust AOB as required. Crosscheck altimeter and VSI for nose attitude.

b. When the HSI is 30º past the cardinal heading (next numbered heading), check for 20 seconds of elapsed time on the clock. The next checkpoint is 60º of turn and 40 seconds of elapsed time (and so forth). During the scan it is recommended that you check the clock after reaching a 30 degree checkpoint on the HSI. The instruments are arranged on the panel in groups. With the attitude indicator, altimeter, airspeed and VSI grouped together and the HSI nearby, scanning these instruments does not require you to shift your point of vision very far to check for errors and make corrections. If the clock is checked only once every 30 degrees of heading change rather than four or five times, you will be able to devote more time to maintaining altitude, airspeed and bank angle.

c. When checking the HSI and clock, if the turn is less than ½ SRT (behind the clock), increase the AOB and check the turn needle for a greater deflection in order to catch up with the clock. If the turn is more than ½ SRT (ahead of the clock), decrease the AOB and check the turn needle for less deflection in order to allow the clock to catch up with the heading. When back on time and heading, the AOB must be readjusted to maintain ½ SRT. To roll out on the desired heading, use the one–third rule.

d. For ½ SRTs, ***never use more than 20º of bank to increase rate of turn or less than 10º of bank to slow the rate of turn***. If corrections outside these limits are used it usually results in overcorrection of the rate. Have patience, catch up slowly and deliberately.

2. **Standard Rate Turns (SRT)**

a. Timed SRTs are accomplished in much the same manner as timed ½ SRTs. Roll into the turn on the attitude indicator, using the 20% rule and crosscheck the turn needle for two needle width deflection, but do not exceed 30º AOB. Since the aircraft is turning twice as fast (3º per second), it will be necessary to check the clock after every 30º of heading change for ten seconds of elapsed time. The scan pattern, corrections for desired rate of turn and the procedure for leading the rollout on the desired heading are the same as the ½ SRT.

b. A more vigilant crosscheck of the nose attitude, altimeter and VSI during power and attitude adjustments is necessary due to the resultant decrease in vertical lift (more notable at steeper AOBs).

c. For the SRT ***never use more than 30º of bank to increase the rate of turn or less than 15º of bank to slow the rate of turn.***

Common Errors

1. Not using a three second lead.

2. Improper rate analysis (confusing ahead with behind) resulting in improper correction.

3. Unbalanced flight.

4. Overcorrecting AOB.

5. Improper nose attitude resulting in altitude loss.

505. CONSTANT AIRSPEED CLIMBS AND DESCENTS

General

Practice maintaining heading and airspeed during climbs and descents.

Description

This maneuver will be flown using the same airspeed, power settings and nose attitudes as the Vertical S-1 Pattern. The objective is to stress the concept of using nose attitude to control airspeed during climbs and descents while practicing basic scan and trim skills.

Procedure

For a Constant Airspeed Descent:

1. Establish the aircraft in a clean configuration at 150 KIAS on any numbered or cardinal heading.

2. Reduce power to 15% while simultaneously lowering the nose to 0 degrees, anticipating a small amount of left rudder for the power reduction.

3. Use nose attitude as required to control the airspeed.

4. Approximately 50’ prior to level off add power to 33% while simultaneously raising the nose to 3.5 degrees nose high anticipating a small amount of right rudder for the power addition.

For a Constant Airspeed Climb:

1. Establish the aircraft in a clean configuration at 150 KIAS on any numbered or cardinal heading.

2. Add power to 55% while simultaneously raising the nose to 6 degrees nose high, anticipating a small amount of right rudder for the power addition.

3. Use nose attitude as required to control the airspeed.

4. Approximately 50’ prior to level off reduce power to 33% while simultaneously lowering the nose to 3.5 degrees nose high, anticipating a small amount of left rudder for the power reduction.

NOTE

Nose attitude is primarily used to control airspeed during climbs and descents, however, with a given power setting changes in pitch will also impact (VSI) vertical speed.

Common Errors

1. Loss of heading control due to poor rudder trim.

2. Over controlling nose inputs during corrections for airspeed.

506. VERTICAL S-1 PATTERN

General

Maintain heading and airspeed throughout a series of constant rate descents and climbs.

Description

This pattern is flown at 150 KIAS and on any numbered or cardinal heading. It consists of a timed 1000 FPM descent for 1000 feet, followed by a timed 1000 FPM climb for 1000 feet. This series (descent and climb) is performed twice.

Procedure

1. Establish the aircraft in a clean configuration at 150 KIAS on any numbered or cardinal heading.

2. Three seconds prior to “00” seconds on the clock, reduce the ***P***ower to approximately 15%, (anticipate the need for left rudder due to power reduction) while simultaneously lowering the nose ***A***ttitude to approximately 0º. Re-***T***rim.

3. After each 250’ of altitude change, crosscheck the clock for 15 seconds of elapsed time.

4. Adjust nose attitude to maintain 150 KIAS. Use power to adjust rate of descent as required.

NOTE

With airspeed held constant, an ***increase in power will reduce the rate of descent*** *and a* ***decrease in power will increase the rate of descent***. Keep in mind that while we use nose attitude to control airspeed and power to control rate of descent, changes to one has an effect on the other.

POWER + ATTITUDE = PERFORMANCE

5. Three seconds prior to the end of one minute or 50' prior to the end of the 1000 foot descent (whichever occurs first), add ***P***ower to approximately 55% torque (anticipate the need for right rudder for power addition) while simultaneously raising the nose ***A***ttitude to approximately 6º nose up. Re-***T***rim.

6. After each 250' of altitude change, crosscheck the clock for 15 seconds of elapsed time.

7. Adjust nose attitude to maintain 150 KIAS. Use power to adjust rate of climb as required.

NOTE

With airspeed held constant, a ***decrease in power will reduce the rate of climb*** *and an* ***increase in power will increase the rate of climb***. Keep in mind that while we use nose attitude to control airspeed and power to control rate of climb, changes to one has an effect on the other.

POWER + ATTITUDE = PERFORMANCE

8. The transition to the second descent is made three seconds prior to the end of one minute or 50 feet prior to the end of the 1000 foot climb, whichever comes first. The procedures for the second descent and climb are the same as noted above.

9. Approximately 50 feet prior to the end of the second (and final) climb, transition to level flight at 150 KIAS on the original altitude (regardless of rate).

Common Errors

1. Loss of heading control due to lack of rudder trim.

2. Slow or incorrectly setting required power during transitions and corrections.

3. Improper use of power or nose attitude during rate/airspeed corrections.

4. Improper rate analysis (confusing ahead with behind) resulting in improper correction.

507. UNUSUAL ATTITUDES

General

Recognize and recover from an unusual attitude with reference to instruments only.

Description

An unusual attitude is any unexpected or inadvertent attitude encountered during normal instrument flight. To avoid this situation during IMC conditions, roll should normally be limited to 30° AOB and nose attitude limited to 10° nose low and 15° nose high. Possible causes of unusual attitudes include; slow scan, spatial disorientation, fixation on a subtask, and transition from VFR to IFR. The recovery is complete when the desired attitude for normal instrument flight is attained.

Use the attitude indicator as the main recovery instrument after its proper operation is verified and an unusual attitude is confirmed. Compare the PFD indication with the backup flight instrument (BFI), and performance instruments to confirm an unusual attitude.

While the horizon bar is always visible in extreme nose high or nose low attitudes it may be very near the bottom or top of the attitude indicator. In these cases, recovery chevrons point to the horizon and may be used to aid in determination of attitude.

Procedure

Perform recoveries as described below. For Nose High and Nose Low recovery, steps one and two are the same.

1. Recognize - Identify potential unusual attitude with attitude indicator and aircraft performance.

2. Confirm - Verify actual attitude with the BFI and performance instruments.

<u>Nose High</u> (Steps three through five should be performed almost simultaneously.)

3. Relax back stick pressure, allowing the nose of the aircraft to fall to the horizon (maintain positive G).

4. Roll the aircraft towards, but not past, 90º of bank. (Use only as much bank as needed to recover; 90° may not be necessary in all recoveries.)

5. If the aircraft is climbing, use power as required to maintain airspeed above stall.

6. As the fuselage dot of the miniature aircraft approaches the horizon bar, adjust bank to establish a wings-level attitude. If airspeed is low (below 100 KIAS), the nose may continue below the horizon until a safe flying speed is achieved.

Nose Low (Steps three and four should be performed sequentially.)

3. Roll wings level.

4. Start pull up when the wings are level. Approaching 200 KIAS or greater, adjust power and extend the speed brake if required to insure recovery below maximum allowable airspeed.

Common Errors

Nose High

1. Not rolling towards 90º of bank as needed in a nose high situation.

2. Pushing over in order to reach the horizon in a nose high situation (negative G).

3. Not adding power as needed.

Nose Low

1. Not establishing wings level prior to pulling the nose toward the horizon (rolling pull-out).

2. Forgetting to reset power and/or speed brake after recovery to normal airspeed (if used).

508. BACKUP FLIGHT INSTRUMENT (BFI) FLIGHT

General

Maneuver the aircraft by means of the Backup Flight Instrument (BFI) only.

Description

With a loss of inputs from the Air Data Computer (ADC), the Internal Reference Unit (IRU) or, in the event of a Dual Integrated Avionics Computer (IAC) failure (total loss of all MFDs), the Primary Flight Display (PFD) may be lost or rendered unusable; however, flight may be continued and aircraft attitude controlled by referring to the BFI.

Procedure

After noting partial or total loss of the PFD, proceed as follows:

1. Referencing the BFI, smoothly level the wings with coordinated rudder and aileron and reposition the nose to the straight and level flight attitude.

2. Complete the appropriate NATOPS emergency procedures as required.

Common Errors

Over correcting or rushing into an emergency procedure prior to stabilizing the aircraft in straight and level flight on the BFI.

509. GCA MANEUVER

General

In addition to developing basic airwork scan and trim skills, the GCA maneuver incorporates many of the basic skill sets required during execution of a Radar Ground Controlled Approach (GCA).

Procedure

1. Establish the aircraft at 200 KIAS, clean, on a cardinal heading and base altitude to simulate the radar downwind.

2. Make a SRT (not to exceed 30°AOB), in either direction for 90º of heading change while maintaining altitude. Lead the rollout using the one-third rule.

3. Slow towards 150 KIAS by reducing power to 15% torque. With the power reduction, anticipate the need for slight left rudder. As speed decreases, trim right rudder and up elevator to relieve control pressures required for level flight. Stabilize at 150 KIAS, power as required (approximately 33%).

4. Make a SRT (not to exceed 30°AOB), in the same direction as the previous turn for 90º of heading change. Lead the rollout using the one-third rule.

5. Maintaining heading and altitude, transition to the Basic Approach Configuration (BAC):

   a. Reduce power to 15% torque (anticipate slight left rudder pressure to compensate for the power reduction).

   b. Check airspeed below 150 KIAS, lower the landing gear and set the flaps to take-off (T/O). As the flaps are lowered, the aircraft will have the tendency to gain altitude. To compensate for this added lift, pitch slightly nose down in order to maintain level flight. As the airspeed slows, trim right rudder and up elevator as required to relieve control pressures and to maintain heading and altitude.

   c. Perform the Before Landing Checklist.

   d. Maintain 120 KIAS. Adjust power as required (approximately 42% torque). Re-trim as required.

6. Stabilize momentarily, then reduce power to approximately 24% torque, allow the nose to fall in order to maintain 120 KIAS, and descend for 2000 feet. Establish a 600 FPM rate of descent on the VSI by adjusting power. Remember, nose controls airspeed, power controls rate of descent. Re-trim.

7. During the descent, the instructor will give heading changes of 3° to 10°.

8. After 2000' of descent, execute a Missed Approach:

   a. Advance power to MAX, (anticipate the need for right rudder pressure for power addition).

   b. Simultaneously raise the nose of the aircraft to 10-15° nose-high.

   c. Check for a positive rate of climb on the VSI and the altimeter. Report "*Two positive rates, gear"* then raise the gear.

   d. Check airspeed above 110 KIAS and report, *"Above 110, flaps"* then raise the flaps. When gear and flaps are completely retracted report *"Gear and flaps up at ___ kts"* (prior to 150 KIAS).

9. Set 8-10° nose high and accelerate towards 180 KIAS while climbing for 2000' on the last assigned heading. Re-trim.

10. Approximately 200' prior to level-off, commence a transition to 200 KIAS cruise. Maneuver is complete when the aircraft is back at the original altitude, at 200 KIAS, and on last assigned heading.

Common Errors

1. Not coordinating power and nose to obtain 120 KIAS and 600 FPM in the descent.

2. Over rotating the nose on the Missed Approach.

3. Slow to raise gear and flaps on missed approach, resulting in over-speed.

4. Lack of rudder trim, leading to loss of heading control.

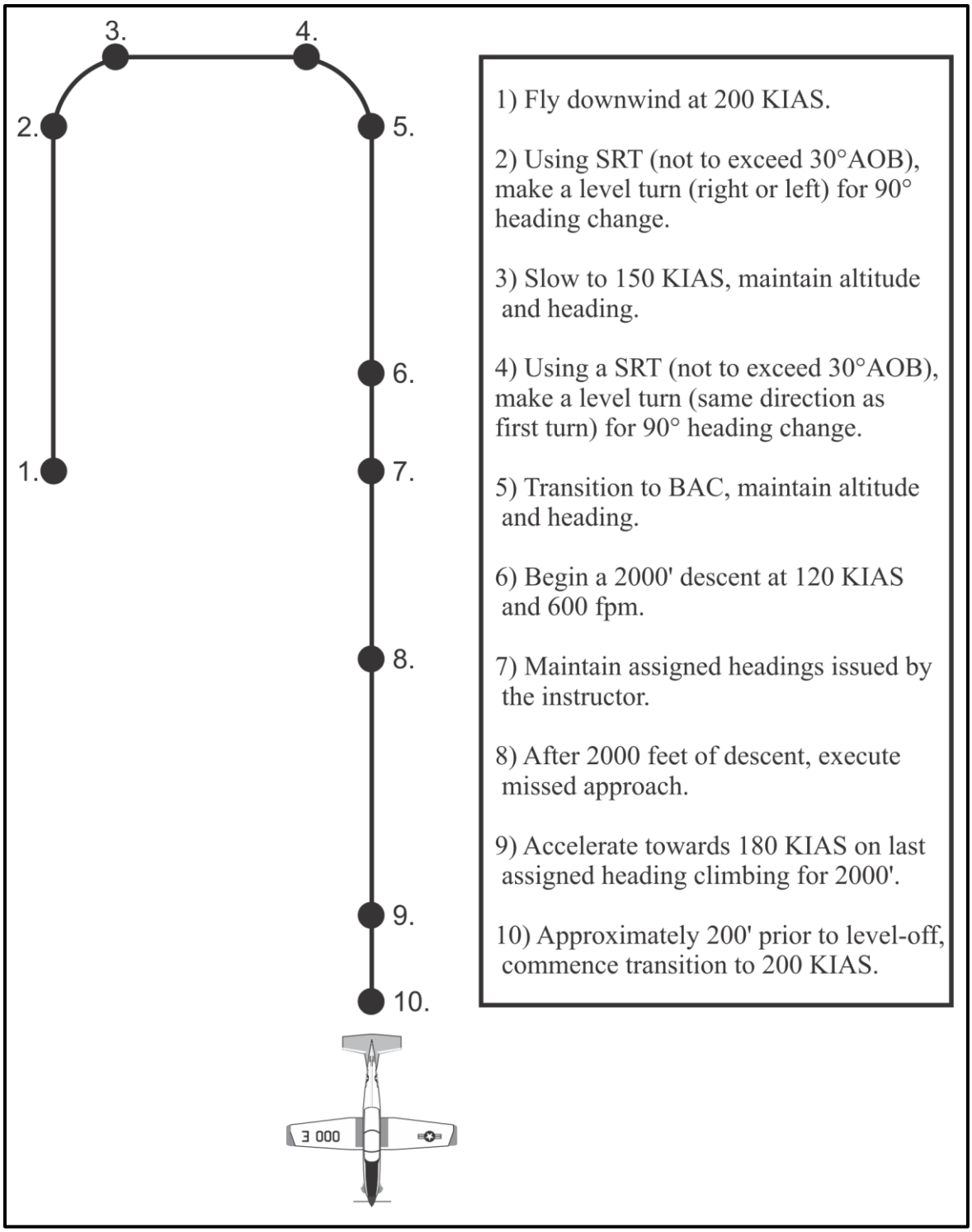


Figure 5-2 GCA Pattern

510. APPROACH PATTERN

General

In addition to developing basic airwork scan and trim skills, the Approach Pattern incorporates many of the basic skill sets required during execution of a Low Altitude Instrument Approach from over a NAVAID.

Procedure

1. Establish the aircraft at 200 KIAS, straight and level flight on a cardinal heading.

2. Slow toward 150 KIAS by reducing power to 15% torque. With the power reduction, anticipate a need for slight left rudder pressure. As the airspeed slows, trim right rudder and up elevator as required to relieve control pressures while maintaining heading and altitude.

3. Approaching 150 KIAS, add power (approximately 33% torque) to maintain 150 KIAS in level flight. Re-trim.

4. Make a SRT (not to exceed 30° AOB) to the right for 90° of heading change while maintaining altitude. Lead the rollout using the one-third rule.

5. After completing the turn, start the clock and begin timing for two minutes.

6. Reduce power to 15% torque and descend for 1000’ maintaining 150 KIAS and approximately 1000 FPM.

7. Approximately 100’ prior to level-off altitude, slowly add power (approximately 33% torque) to maintain 150 KIAS at the level-off altitude.

8. At the end of two minutes timing, begin a left SRT (not to exceed 30° AOB) for a heading change of 210°. Anticipate a small need for power and back-stick pressure to maintain level flight at 150 KIAS.

9 Using the one-third rule, roll wings level after 210° of heading change, commence a descending transition to BAC (***slow down* first *then go down***):

   a. Reduce power to 15% torque. Anticipate the need for slight left rudder pressure to compensate for the power reduction. Maintain altitude in order to expedite deceleration to 120 KIAS.

   b. Check airspeed below 150 KIAS, lower the gear, set flaps T/O and perform the Before Landing Checklist. As the flaps are lowered, the aircraft will have the tendency to gain altitude. To compensate for this added lift, pitch as required to maintain level flight.

c. As the airspeed decreases, trim right rudder and nose up as needed to relieve control pressures required to maintain heading and altitude.

d. At 120 KIAS, lower the nose to maintain a 120 KIAS descent for 1000 feet.

e. Approximately 100’ prior to level-off altitude, add power (approximately 42% torque) to maintain 120 KIAS at the level-off altitude.

10. Stabilize on altitude and heading. Reset and start the clock, re-set 15% torque and lower the nose to maintain 120 KIAS and descend for another 1000’ at approximately 1000 FPM. Re-trim.

11. Approximately 100’ prior to level-off altitude, smoothly add power (approximately 42% torque) to maintain 120 KIAS at the level-off altitude.

12. At the end of two minutes timing, execute a Missed Approach:

a. Advance the power to MAX, coordinated right rudder pressure will be required to maintain balanced flight.

b. Simultaneously raise the nose of the aircraft to 10-15° nose-high.

c. Check for a positive rate of climb on the VSI and the altimeter. report *“Two positive rates, gear”* then raise the gear.

d. Report *“Above 110 flaps”* then raise the flaps. Report *“Gear and flaps up at ___ kts”* (prior to 150 KIAS).

13. Set nose attitude 8-10° high and accelerate towards 180 KIAS while climbing for 2000’ on the heading used in the descent. Re-trim.

14. Approximately 200’ prior to level-off, commence a transition to 200 KIAS cruise. The maneuver is complete when the aircraft is at 200 KIAS, on the heading used after the 210° turn, and 1000’ below the original starting altitude.

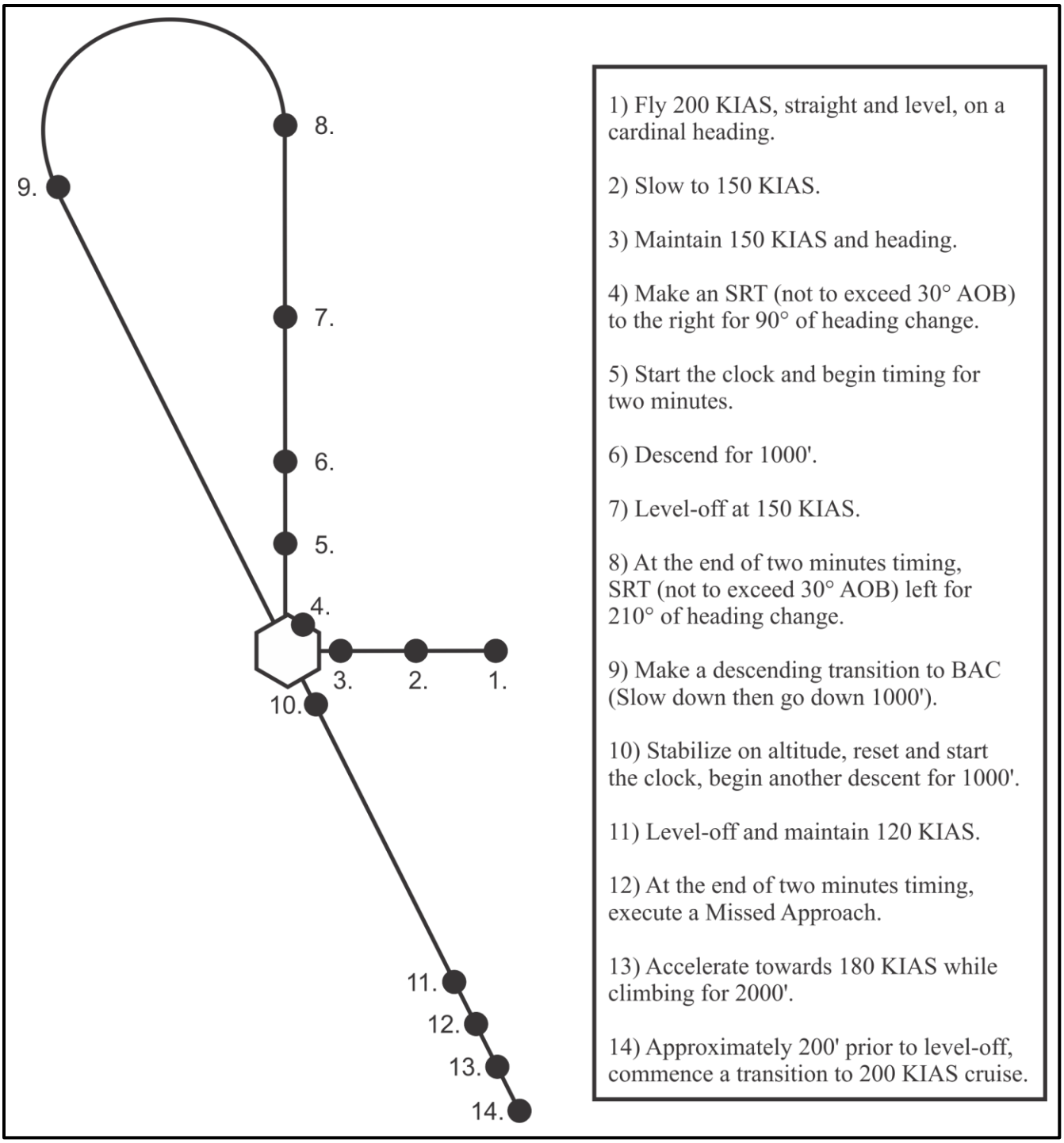


Figure 5-3 Approach Pattern

Maneuver	Airspeed (KIAS)	Gear	Flaps	Pitch (degrees)	Torque (approx.)	VSI (FPM)
Vertical-S Up	150	Up	Up	6° NH	55%	1000
Vertical-S Down				0°	15%	
45° steep turn				3° NH	45%	
60° steep turn				4° NH	60%	
Penetration	200-250	UP	UP	As Required	As Required	2000-4000
Terminal Descent	200	UP	UP	5° NL	20%	2000
Enroute Descent	220	UP	UP	10° NL	10%	4000
Basic Approach (level/configured)	120	DOWN	T/O	3° NH	42%	
Precision final				0°	24%	600
Nonprecision final				1° NL	20%	800-1000
Holding	150	UP	UP	3° NH	33%	

LEGEND

NL: Nose low

NH: Nose high

Figure 5-4 Configuration Chart

CHAPTER SIX
ENROUTE PROCEDURES

600. DIRECT TO A VOR OR FMS WAYPOINT

Description

The process used to proceed from your current position direct to a VOR or FMS waypoint.

Procedure

Direct to a VOR

1. Tune, Identify and monitor the station.

2. Select PFD SOURCE to VOR.

3. Select Bearing Pointer #1 to VOR.

4. Turn shortest direction to place the head of Bearing Pointer #1 under the heading index on the HSI.

5. Set a course in the CDI that centers the CDI with a "TO" indication.

NOTE

This can be accomplished using the "PRESS and HOLD" function at LSK LL on the PFD.

6. Track the new course, flying a heading that keeps the CDI centered, (see Section 601).

Direct to a FMS Waypoint

1. Load the desired waypoint into the FMS and select it as the "Active" waypoint.

2. Select PFD SOURCE to FMS.

3. Select Bearing Pointer #2 to FMS.

4. Turn to place the head of Bearing Pointer #2 under the heading index on the HSI.

5. Track the new course, flying a heading that keeps the CDI centered, (see Section 601).

Common Errors

1. Not verifying the ID of the VOR (for Direct to a VOR).

2. Having the wrong waypoint active in the FMS (for direct to a FMS Waypoint).

601. TRACKING

Description

Tracking is the process of flying direct to a station or waypoint, correcting for winds, such that the aircraft track over the ground is the most direct route.

1. Establish the aircraft on the desired course.

2. Maintain HEADING = COURSE until deviation is noted on the CDI and bearing pointer.

3. Determine the general direction of the wind.

TAIL-RADIAL-WIND is a method used to picture where the wind is ***from*** when referencing the bearing pointer. To visualize this, draw a line from the ***tail*** of the bearing pointer, towards the desired ***radial***. This line will point in the direction that the ***wind*** is coming ***from***.

For overall orientation, consider the VOR station always located at the center of the HSI card and the aircrafts position on the TAIL of the bearing pointer.

Figure 6-1 On-Course

Figure 6-2 5° Left of Course

Figure-6-1 depicts the aircraft inbound to a VOR on the 210 Radial with the selected course of 030.

Figure 6-2 depicts the tail of the bearing pointer deflected to the left of the desired radial (the aircraft has drifted left of the selected course). Drawing a line from the ***tail*** of the bearing pointer (215°) to the desired ***radial*** (210°) creates a line that points to the direction the ***wind*** is coming ***from*** (winds are ***from*** the right).

Another method is to reference the CDI. It will be deflected to the side that the winds are from. Understanding and employing both methods will greatly improve your overall orientation and situational awareness.

4. Turn to re-intercept the desired course.

TAIL-RADIAL-TURN is a method to visualize the direction of turn needed to get back on the desired ***radial***. Drawing a line from the ***tail*** of the bearing pointer (where you are now), towards the desired ***radial*** (where you want to be), creates a line that points in direction of the required ***turn*** (right turn needed for example in Figure 6-2).

When set correctly, referencing the CDI is an easy method to visualize the required turn direction. In Figure 6-2 the miniature aircraft (where you are), appears to the left of the course deviation bar (where you need to be), requiring a right turn to re-establish the course.

Understanding and employing both methods will greatly improve your overall orientation and situational awareness.

NOTE

Distance from the NAVAID and wind strength will dictate the ***angle of intercept*** needed to re-establish the aircraft on-course. (Other than for extreme situations, 45° degrees should be the maximum amount of intercept needed to get back on course in a timely manner.)

Angle of intercept is defined as the number of degrees between ***aircraft heading*** and ***desired course***.

Figure 6-3 Intercept to return to course

Figure 6-3 depicts a heading of 050° (20° intercept) being used to re-establish the aircraft back on course.

Another important orientation concept with regard to the bearing pointer is that unless it is on the heading index, as the aircraft moves forward, ***"Heads will fall"*** and ***"Tails will rise."***

In Figure 6-3 note that on the current heading, as the ***tail rises***, it will return to the 210 radial.

As the ***head falls***, it will return to the ***inbound course*** of 030.

Using the CDI method, the aircraft depicted in the center of the HSI now appears on an intercept towards the DEVIATION BAR.

5. Once established back on the desired course, select a heading (crab into the wind) that will hold the aircraft on course. When unsure of the amount of crab required a recommended method is to start with 5°.

After applying your correction there are three possible outcomes:

a. Drift occurs in the same direction as before indicating the crab angle is insufficient.

b. Drift occurs in the opposite direction indicating the crab angle is too great.

c. CDI remains centered indicating a good ***Wind Corrected Heading (WCH)***.

6. Repeat steps 4 and 5 as needed to establish a ***WCH***.

Keep working to maintain the desired course. If unintended heading changes occur that result in drift, using small heading changes off the WCH can be used to return to course. As you approach a conventional NAVAID the spacing between radials gets proportionally smaller. This will be noted by increased CDI and BEARING POINTER sensitivity. A recommended method to avoid chasing the needles (overcorrecting) is to keep heading changes when in close to the NAVAID within 10° of the ***WCH***. Making heading changes larger than WCH +/- 10° in close to the NAVAID during course corrections is generally *considered* ***"chasing the needles."***

1. ***Do*** continue to ***track.***

2. ***Don't chase*** the needles in close to the NAVAID.

(If the CDI moves, go after it but don't chase it).

602. STATION PASSAGE

Description

Station passage is defined as the moment the aircraft passes directly over or abeam the radio facility. VOR station passage is primarily noted on the CDI as the ***first*** positive change of the TO/FROM indicator to "FROM" on the CDI.

603. OVER-THE-STATION INTERCEPT

Description

An over-the-station intercept is a procedure used to intercept and fly outbound on a specific radial immediately after station passage. This procedure is appropriate during airways navigation and instrument approaches that use VOR facilities for enroute navigation, initial approach fixes (IAFs), or final approach fixes (FAFs).

Procedure

Upon station passage, perform the following procedures (***6 Ts***) as appropriate.

1. **TIME -** Depending on the situation, time will either be:

   a. Noted, if needed for a future report.

   b. Clock started, if needed for timing requirements.

   c. Not required.

2. **TURN** - In the shortest direction to a heading that will parallel or intercept the outbound course. Turning to parallel is acceptable for small course changes while waiting for the bearing pointer to stabilize; however, when the new course is more than 90° different from the course used inbound to the NAVAID, turn to an intercept heading to expedite the course intercept. Consider the effects of airspeed, wind and magnitude of the turn when choosing an intercept heading. To prevent overshooting the new course, do not turn more than 45° beyond the heading required to parallel the new course.

3. **TIME -** Depending on the situation, time will either be:

   a. Clock started, if needed for timing requirements.

   b. Not required.

4. **TRANSITION** - Initiate speed, configuration or altitude transitions as required by the situation (once the transition is initiated, move on to the next step while completing the transition).

NOTE

Multiple “transitions” may be required depending on circumstances.

5. **TWIST /** Intercept - Set the new course in the CDI and check for ***“from”*** indication. At this point, the bearing pointer should be stabilized, turn to an intercept heading (if not previously

accomplished). Use the Double-the-Angle method, not to exceed 45°. To determine the Double-the-Angle intercept heading, note the number of radials between the tail of the bearing pointer and the new course (head of the course arrow). Move from the tail of the bearing pointer to the head of the course arrow, continue moving to a heading that is "Double" the amount past the course arrow (not to exceed 45°). This is the intercept heading **(**Figure 6-4**)**. Maintain the intercept heading until able to make a SRT onto the new course.

6. **TALK** - Make voice reports as required.

Common Errors

Excessive delay in establishing aircraft on the desired course due to:

1. Using too much intercept resulting in overshooting the new course.

2. Taking too long to set an appropriate intercept.

3. Using an insufficient amount of intercept.

Figure 6-4 Double-the-Angle Intercept Outbound

604. RADIAL / RADIAL INTERCEPTS

General

When flying a course using a NAVAID, the pilot is tracking on a radial inbound ***"to"*** the NAVAID or outbound ***"from"*** the NAVAID. When outbound, the course is the same as the radial being used. When inbound, the course is the reciprocal of the radial being used. A radial intercept is a procedure used to position the aircraft on a nearby radial with a new course inbound or outbound when not over the station.

Description

Radial / Radial intercepts are performed in training to practice orientation around a NAVAID. These intercepts may be used when navigating on airways and during some instrument approaches. The objective is to establish an intercept heading that will result in an appropriate angle and rate of intercept to the new radial/course.

Procedure

1. Tune, Identify and monitor the NAVAID.

2. Set the new course in the CDI - The new course will be either:

   a. The same as the radial for outbound intercepts.

   b. The reciprocal of the radial for inbound intercepts ("inbound turn it around").

3. Turn to an intercept heading – Look at the aircraft symbol in the center of the CDI and turn towards the CDI deviation bar to place the head of the course arrow in the top half of the HSI. This will prevent intercept angles that exceed 90°. The angle of intercept should be greater than the number of radials off the new course (not to exceed 90°). The bearing pointer should also be used to determine the direction of turn (***Tail-Radial-Turn***). After the turn, ensure that the head of the bearing pointer is in a position to fall to the new course during inbound intercepts and the tail of the bearing pointer is in a position to rise to the new radial for all intercepts (***"Heads will fall, tails will rise"***).

<u>Outbound Intercepts</u>

1. A 45 degree intercept is usually sufficient for most intercepts. Establish a 45 degree intercept by turning to place the new course (head of the course arrow) on the appropriate 45° tick mark on the HSI compass rose (Figure 6-5).

Figure 6-5 45° Intercept Outbound

2. If during the turn to set a 45 degree intercept the Bearing Pointer/CDI is within 10 radials of the desired course ***and*** rapidly moving towards an on course indication, use a Double-the-Angle intercept. To determine the intercept heading, note the number for radials between the tail of the bearing pointer and the new course (head of the course arrow). Move from the tail of the bearing pointer to the head of the course arrow, continue moving to a heading that is "Double" that amount past the course arrow (not to exceed 45°). This is the intercept heading.

Inbound Intercepts

1. A 45 degree intercept is usually sufficient for most intercepts. Establish a 45° intercept by turning to place the head of the course arrow on the appropriate 45° benchmark on the HSI compass rose (Figure 6-6).

Figure 6-6 45° Intercept Inbound

2. If during the turn to set a 45 degree intercept the Bearing Pointer/CDI is within 10 radials of the desired course ***and*** rapidly moving towards an on course indication, use a Double-the-Angle intercept. To determine the intercept heading, note the number for radials between the head of the bearing pointer and the new course (head of the course arrow). Move from the head of the course arrow toward the bearing pointer, to a heading that is "Double" that amount from the head of the course arrow (not to exceed 45°). This is the intercept heading (Figure 6-7).

Figure 6-7 Double-the-Angle Intercept Inbound

<u>Outbound/Inbound Intercepts</u>

1. Turn onto new course/radial. Maintain the intercept heading until able to make a SRT onto the new course. The rate of bearing pointer and CDI movement will increase close to the station due to radial spacing.

2. Track on the desired course/radial.

Common Errors

1. Setting the wrong course into the CDI.

2. Turning in wrong direction.

605. RADIAL / ARC INTERCEPTS

Description

On some approaches, missed approaches and departure procedures, you will be required to transition from a radial onto an arc. In these situations a lead point will be calculated to determine when to start your turn off of the radial onto the arc.

Procedure

In the following example, consider an aircraft tracking outbound from a station, flying at 180 knots groundspeed, and turning onto an arc.

Determining Lead Point DME

1. Determine the turn radius of the aircraft (for 90° of turn). This is 0.5% of the groundspeed.

In this example: 0.5% of 180 = 0.9 NM

2. In this case, required Lead Point DME is 0.9 NM prior to reaching the arcing DME.

NOTE

1. If groundspeed is not available or cannot be computed in time for the turn, indicated airspeed may be used in the computation. This it is a ***no-wind*** lead point and should be adjusted for any known winds.

2. When intercepting an arc at speeds that preclude the use of a full SRT, using 1.0% of groundspeed will allow for a ½ SRT.

606. ARCING

Description

Arcing is defined as flying at a constant distance from a NAVAID by referencing DME from that station. Arcing about a NAVAID may be required to comply with an ATC clearance and is an integral part of many approaches, departure procedures, and arrivals. In practice, you do not actually fly a "perfect arc," but by varying AOB and heading, a close approximation of an arc can be achieved.

Procedure

1. Proceed direct to the arc entry point (radial and DME that defines the beginning of the arc).

2. Calculate the lead-point.

3. Determine the direction of turn at the lead-point.

4. At the lead-point, start a SRT in the appropriate direction. Continue the turn to place the head of the bearing pointer on the 90º benchmark.

5. Check DME.

   a. If ***DME is less*** than desired, the aircraft is inside the arc. To correct back to the arc, simply maintain the heading. If excessively inside the arc (0.5 DME or more inside the arc), make a turn to place the head of the bearing pointer up to 15º below the 90º benchmark to return the aircraft back to the arc. Approaching the arc, lead the turn onto the arc and resume Arcing Procedures.

   b. If ***DME is greater*** than desired, the aircraft is outside the arc. To correct, turn to place the head of the bearing pointer up to 15º above the 90º benchmark.

6. Once established on the ARC in a no-wind situation, remain on the arc by altering aircraft heading and/or bank to maintain the head of the bearing pointer on or near the 90° benchmark. When altering aircraft heading, consider the position of the bearing pointer relative to the 90° benchmark. In a no-wind situation:

a. Head of the bearing pointer ***on*** 90° benchmark…DME constant (Figure 6-8).

b. Head of the bearing pointer ***below*** 90° benchmark…DME increases (Figure 6-9).

c. Head of the bearing pointer ***above*** 90° benchmark…DME decreases (Figure-6-10).

Figure 6-8 DME Constant

Figure 6-9 DME Increasing

Figure 6-10 DME Decreasing

Common Errors

1. Inadequate lead for heading corrections, (overshooting the arc).

2. Turning in the wrong direction to correct for arc deviations.

607. ARC / RADIAL INTERCEPTS

General

Turn off an arc to establish the aircraft on a radial (inbound or outbound) to the NAVAID.

Description

During some approaches, missed approaches and departure procedures, you will be required to fly an arc and then intercept a radial (inbound or outbound) from that arc. In this situation, you need to calculate a Lead Radial (LR) at which to start your turn off the arc to intercept the radial.

Procedure

In the following example, consider an aircraft on the 12 DME ARC flying at 180 knots groundspeed, turning onto an inbound course to the NAVAID.

Determining Lead Radial

1. Determine the number of radials per mile. Based on the 60-1 rule (at 60 DME each radial is 1 NM apart), 60 divided by the arcing DME equals the number of radials in one mile.

In this example: 60/12 = 5 radials per mile on the 12 DME arc.

2. Determine the turn radius of the aircraft for a 90° turn. This is 0.5% of the groundspeed.

In this example: 0.5% of 180 = 0.9 NM.

3. Multiply the turn radius by the number of radials per mile.

0.9 NM X 5 radials /NM = 4.5 radials.

This number of radials prior to the desired radial is the Lead Radial.

4. At the Lead Radial start a SRT onto new course/radial.

NOTE

1. If groundspeed is not available or cannot be computed in time for the turn, KIAS may be used in the computation. This is a No-Wind lead point and should be adjusted for any known winds.

2. When intercepting a radial from an ARC at speeds that preclude the use of a full SRT, using 1.0% of the groundspeed will allow for a ½ SRT

608. INTERSECTIONS

General

An intersection is a navigational fix that can be defined in the T-6B using VOR/DME, VOR ONLY (the intersection of two or more radials from two or more NAVAIDs) or GPS. Intersections are used to identify significant points along departure procedures, airways, arrivals, holding areas, approach procedures, and missed approaches. When referencing two or more NAVAIDs, the PRIMARY NAVAID is the one used navigate a track to the intersection. A SECONDARY NAVAID is one that provides a crosscut to identify the intersection along the primary track.

Description

Tasks that may be required at an intersection include:

1. Noting the time of arrival for a required report.

2. Turning onto a new course/airway.

3. Passing through the intersection (maintaining the same course outbound).

4. Transitions (changes in airspeed, configuration or altitude).

5. Holding entry.

Procedure

VOR/DME INTERSECTIONS

To Identify and Pass Through a VOR/DME Intersection:

1. Establish aircraft on course to the intersection using the primary NAVAID.

2. Track the primary course until the indicated DME reaches published fix DME.

3. Note time, if required for reporting purposes.

4. Continue tracking outbound from the fix on the same course used inbound.

To Identify and Turn Onto a New Course at a VOR/DME Intersection:

1. Establish aircraft on course to the intersection using the primary NAVAID.

2. Track the primary course until within 10 NM of the intersection.

3. Tune the secondary NAVAID used to navigate the next route section.

4. Set new course into the CDI.

5. Maintain the wind corrected heading for the primary course until starting a turn onto the new course.

NOTE

It is not required ***nor desired*** to hit the actual intersection. The turn should be commenced such that a constant SRT will establish the aircraft on the new course. If the turn is misjudged (turn commenced too early or late), roll out of the turn with an appropriate intercept to establish the aircraft on course in a timely manner.

6. If time is required for reporting purposes, note the time when the aircraft is wings level out of the turn, on course, or with an appropriate intercept established.

VOR ONLY INTERSECTIONS

To Identify and Pass Through a VOR Only Intersection:

1. Establish aircraft on course to the intersection using the primary NAVAID.

2. Approximately 3 minutes prior to your ETA at the intersection, tune the secondary NAVAID.

   a. If the ***tail*** of the bearing Pointer is not yet 10 radials or less ***prior*** to the secondary radial:

      i. Retune the primary NAVAID and continue to track the primary course.

      ii. Wait a maximum of one minute.

      iii. Retune the secondary NAVAID and recheck position. (Repeat step 2.a. until the ***tail*** of the bearing pointer is 10 radials or less ***prior*** to the intersection.)

   b. Once the ***tail*** of the bearing pointer is 10 radials or less ***prior*** to the secondary radial, maintain the wind corrected heading for the primary course until the TAIL of the bearing pointer rises to the secondary radial.

3. Note the time, if required, and retune the Primary NAVAID to continue tracking the primary course.

4. If already passed the intersection, estimate the time you passed the intersection (if required for a report).

NOTE

For general orientation keep in mind that, ***"Tails will rise."*** If the tail of the bearing pointer has already risen past the desired secondary radial you have passed the intersection.

To Identify and Turn Onto a New Course at a VOR Only Intersection:

1. Establish aircraft on course to the intersection using the primary NAVAID.

2. Approximately 3 minutes prior to your ETA at the intersection, tune the secondary NAVAID.

   a. If the ***tail*** of the bearing Pointer is not yet 10 radials or less ***prior*** to the secondary radial:

      i. Retune the primary NAVAID and continue to track the primary course.

      ii. Wait a maximum of one minute.

      iii. Retune the secondary NAVAID and recheck position. (Repeat step 2.a. until the ***tail*** of the bearing pointer is 10 radials or less ***prior*** to the intersection.)

b. Once the ***tail*** of the bearing pointer is 10 radials or less ***prior*** to the secondary radial, set the course required to be flown after the intersection into the CDI.

3. Maintain the wind corrected heading for the primary course until commencing the turn onto the new course.

NOTE

It is not required ***nor desired*** to hit the actual intersection. The turn should be commenced such that a constant SRT will establish the aircraft on the new course. If the turn is misjudged, (turn commenced too early or late) roll out of the turn with an appropriate intercept to establish the aircraft on course in a timely manner.

4. If time is required for reporting purposes, note the time when the aircraft is wings level out of the turn, on course, or with an appropriate intercept established.

NOTE

For general orientation keep in mind that, ***"Tails will rise."*** If the tail of the bearing pointer has already risen past the desired secondary radial you have passed the intersection.

5. If already passed the intersection, make the turn to the new course and set up an intercept to establish the aircraft on course in a timely manner. Estimate the time you passed the intersection (if required for a report).

GPS INTERSECTIONS

General

There are two types of GPS waypoints***. "Fly-over"*** and ***"Fly-by."*** A fly-over waypoint is depicted by a waypoint symbol with a circle around it. A fly-by waypoint is depicted with the basic waypoint symbol (see Figure 6-11).

On the **FMS LEGS PAGE** a fly-by waypoint will be annotated with just the five letter identifier (example: ALPHA). A fly-over waypoint will have the five letter identifier followed by a "/O" suffix (example: ALPHA/O).

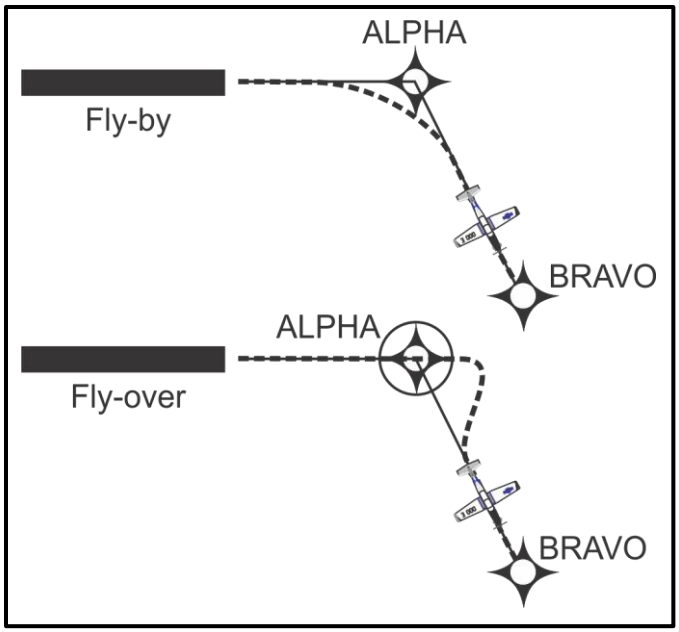


Figure 6-11 Charted GPS Fly-By/Fly-Over Waypoints

Procedures

1. Ensure the next GPS waypoint is loaded in the flight plan and appears beneath the ***active*** waypoint on the LEGS PAGE.

2. Approaching the waypoint, on the NAV page, the waypoint name (letters) will change colors from magenta to white and become superimposed over a magenta background.

3. As ATD (Along Track Distance) approaches 0.0 the FMS bearing pointer will begin to fall off. ***Continue tracking the CDI***.

NOTE

The ATD will count down to 0.0 NM only if the aircraft is flown directly over the waypoint.

<u>For Fly-Over Waypoints</u>

4. At the intersection, the FMS bearing pointer will lock on and point to the next waypoint in sequence on the LEGS PAGE. The new active waypoint name and ATD will appear on the PFD and NAV displays.

   a. Note the time (if required) that the new waypoint becomes active.

   b. Turn to establish an intercept to the new course using the FMS CDI.

   c. Once established on the new course, tack to maintain a centered CDI.

For Fly-By Waypoints

5. The FMS provides turn anticipation for fly-by waypoints. It is not required ***nor desired*** to hit a fly-by waypoint. The FMS CDI will automatically reset to the next/new course listed on the LEGS PAGE and the CDI's deflected deviation bar will begin to flash. At this time a SRT turn should be commenced. This will provide an adequate lead point to establish the aircraft on the new course. If the turn is misjudged, (turn commenced too early or late) roll out of the turn with an appropriate intercept to establish the aircraft on course in a timely manner.

a. For time/reporting purposes, note the time when the aircraft is wings level, out of the turn, on course or with an appropriate intercept established.

b. Track the new CDI course.

609. POINT TO POINT

General

If a NAVAID (station) transmits both radial and DME information and the aircraft equipment is capable of processing that information, it can be used to navigate from present position to a specific RADIAL and DME from that station via the most direct path.

Description

If cleared direct to a RADIAL/DME fix, the pilot may be radar vectored or employ Point to Point (PTP) navigation. For PTP navigation, the turn to an initial heading should be initiated as soon as possible once cleared. One method of determining this initial turn is to plot both points on a suitable chart and connect them with a straight line. The initial no-wind heading to fly is along this line towards the new fix.

Another method, which eliminates cumbersome charts, is to visualize the aircraft's present position and the new desired fix on the compass card of the HSI. This method may be used to navigate directly to any RADIAL/DME fix within reception range of the associated NAVAID. The following concepts will aid in developing this ability.

1. The station is always at the center of the compass card. The compass card is merely a compass rose around the station.

2. The fix having the greater distance is always established on its radial at the outer edge of the compass card.

3. The remaining fix is established along its radial at a proportional distance from the center of the compass card.

When applying the above concepts, the compass card can be thought of as a chart. On this chart, the aircraft's present position, the desired fix, and the station (at the center) can be plotted. With

an actual chart, draw a line between the two fixes to determine the no–wind heading. Using the compass card, visualize this line between fixes.

NOTE

The T-6B requires a VOR/DME or VORTAC facility for this type of navigation

Procedure

The following example (Figure 6-12) demonstrates the procedures for flying from one fix to another fix. The aircraft is on the 180º radial at 20 NM and you want to navigate to the 90º radial at 10 NM.

1. Tune and identify the NAVAID.

2. Set the desired (new) radial in the CDI.

3. Turn to a heading approximately between the ***head*** of the bearing pointer and the ***head*** of the Course Pointer (CDI). ***"Split some heads."***

   – Adjustments may be made to the rollout heading. If going to a smaller DME, favor the head of the bearing pointer. If going to a larger DME, favor the head of the course pointer (desired radial).

4. Update the heading enroute and apply appropriate corrections (pencil method).

<u>The Pencil Method</u>

When using the HSI card, keep scale in mind:

NOTE

The center is always zero DME.

NOTE

The outer edge of the HSI card is the larger of present DME or desired fix DME.

1. Establish the fix with the greater distance (20 NM) at the edge of the compass card on its radial (180º).

2. Establish the remaining fix (90º radial/10 NM) along its radial at a proportionate distance from the center of the card (halfway).

3. Draw an imaginary line with the aid of a pencil, finger, etc., ***from*** the aircraft's present position ***through*** the next fix. Move the "line" to the center of the card and read the no-wind heading to the desired fix (approximately 030º in this case).

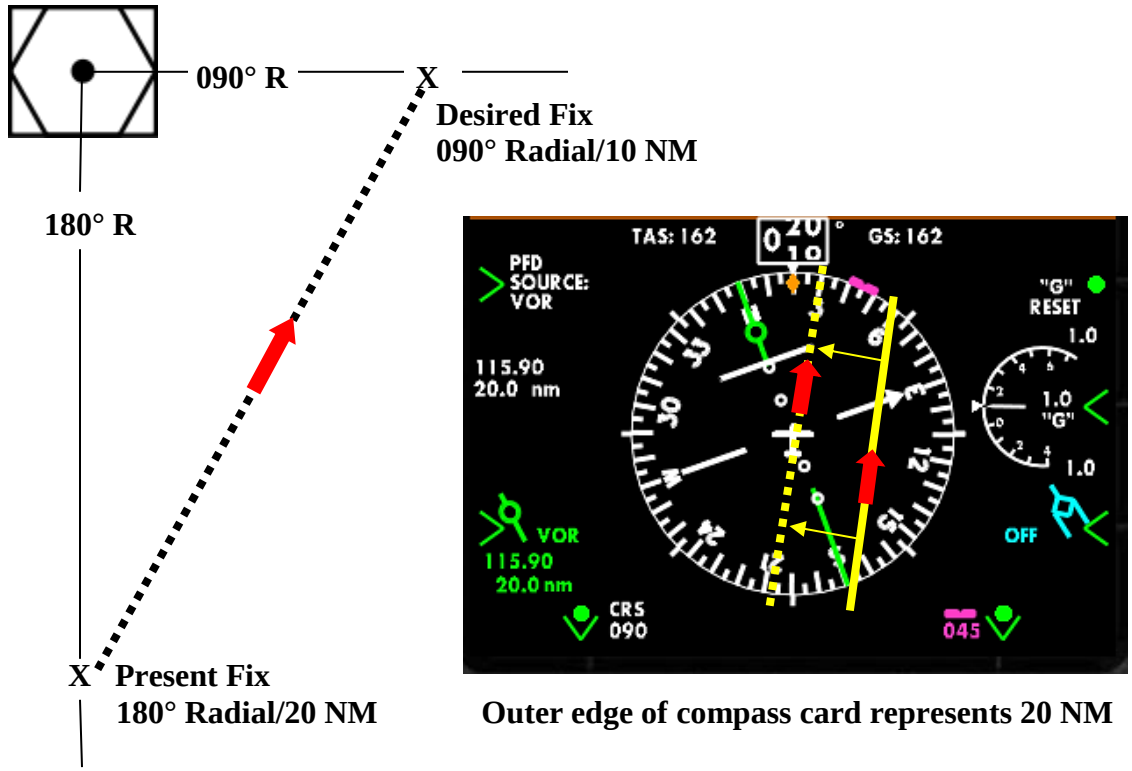


Figure 6-12 Point to Point

NOTE

The Instrument Approach Plate may be used as an aid to visualize present position and the initial heading required to fly to the fix.

4. Turn to the updated heading.

5. Visually determine if the line that connects the two fixes is now vertical. This line represents the desired track. If it is vertical, you are on the correct no-wind heading at that instant. Apply wind corrections as required to maintain the track.

6. If the line is not vertical, turn the aircraft to make it so. This can be done without the aid of a straightedge. If the line tilts right, turn right to make the line vertical. If the line tilts left, turn left to make the line vertical.

7. Check/update the pencil solution enroute to the new fix.

Corrections to the New Fix

As the aircraft nears the new fix, determine which will be reached first, the radial, or the DME. To come as close as possible to the new point, judge the rate at which the DME is moving with the rate at which the aircraft is crossing radials. If it is determined that the aircraft will reach the DME or radial first, rather than simultaneously, adjustments can be made to the no-wind heading to impact the DME rate of change in relation to the rate in which radials change. Keep the following in mind when trying to fine tune the heading to hit the new fix:

1. If arriving at the DME first, use the 90° benchmark as a reference to split the needle and the desired radial. Arriving at the specified DME prior to the desired radial and then arcing to the radial is not the correct method as you are not flying directly at the point and not complying with ATC instructions.

2. If arriving at the radial first, turn to track inbound or outbound as required towards the fix.

DME/Radial Rate of Change

When the bearing pointer is closer to the heading index (the 45º benchmark being halfway) ***DME will change faster than radials***. The opposite is true when the bearing pointer is nearer the 90º benchmark.

NOTE

> Barring strong winds, when the head of the bearing pointer is above the 90º benchmark, the DME will get smaller. When it is below the 90º benchmark, the DME will get larger.

You will not necessarily be able to determine the exact heading to roll out on as you are adjusting heading, but that is not as important as altering heading before it is too late. Once on the new heading, let things settle down (e.g., cross a few radials; let a few tenths of DME pass) then update again by trying to determine if the aircraft will hit the radial or DME first.

The goal is getting as close as possible to the point. Continually update until crossing the point.

Common Errors

1. Slow setting initial heading towards the new fix.

2. Turning to incorrect initial heading (not splitting the heads).

3. Incorrect pencil method solution.

4. Not updating solution as the aircraft gets closer to the desired fix.

5. Proceeding to the reciprocal of the radial/DME instead of the radial/DME.

6. Attempting to arc to the fix.

7. Intercepting the new radial and turning in wrong direction to track to the fix.

CHAPTER SEVEN
HOLDING

700. HOLDING DEFINITION AND TERMS

GENERAL

Holding is a predetermined maneuver that keeps aircraft within a specified airspace until further clearance is received from ATC. It can be accomplished at an intersection, GPS Waypoint, Radial/DME fix, or at a navigation facility. When ATC clears you to hold, a specified airspace oriented around the holding fix has been reserved, clear of other traffic. The extent of the cleared airspace is based on maximum holding airspeed as listed in the FLIP GP and FAA AIM.

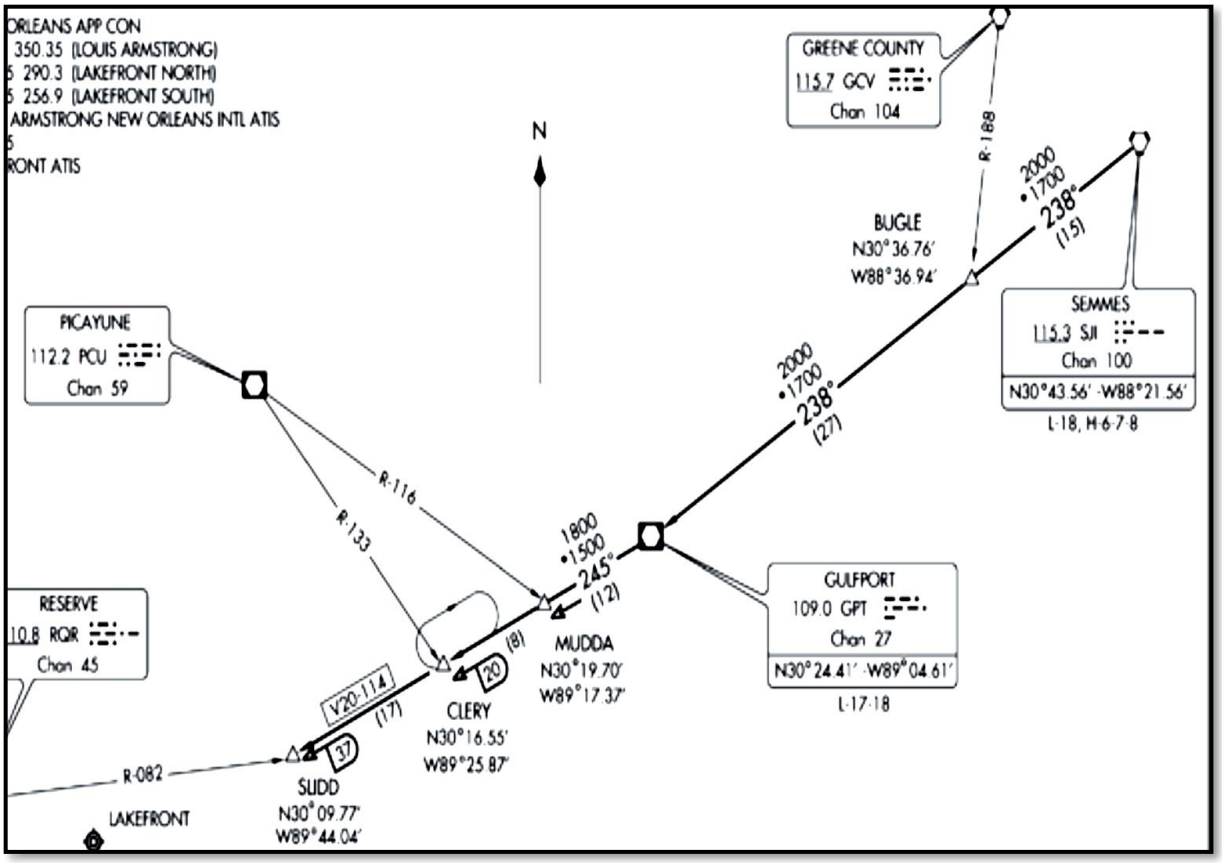


Figure 7-1 Holding at an Intersection/Radial DME Fix

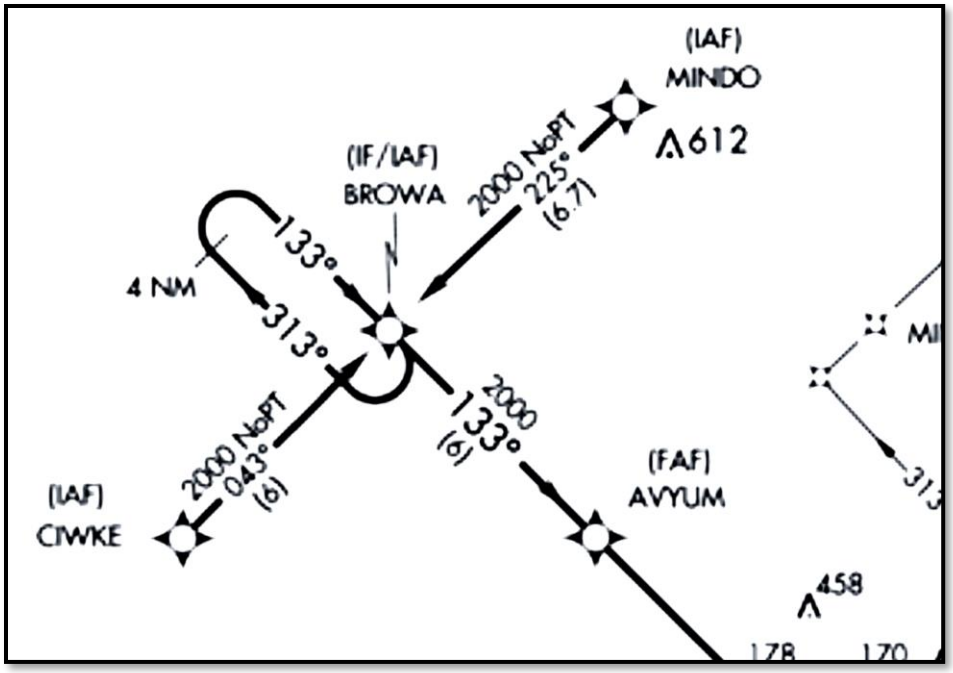


Figure 7-2 Holding at a GPS Waypoint

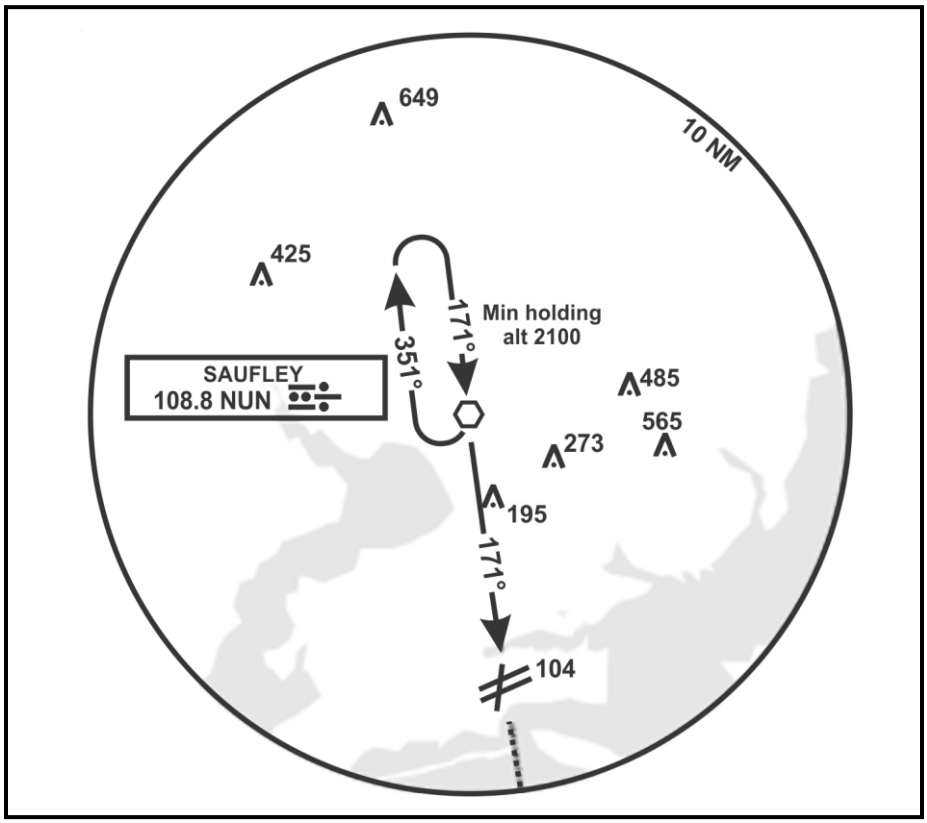


Figure 7-3 Holding at a VOR NAVAID

7-2 HOLDING

TERMINOLOGY

1. **Standard Pattern:** Right turns

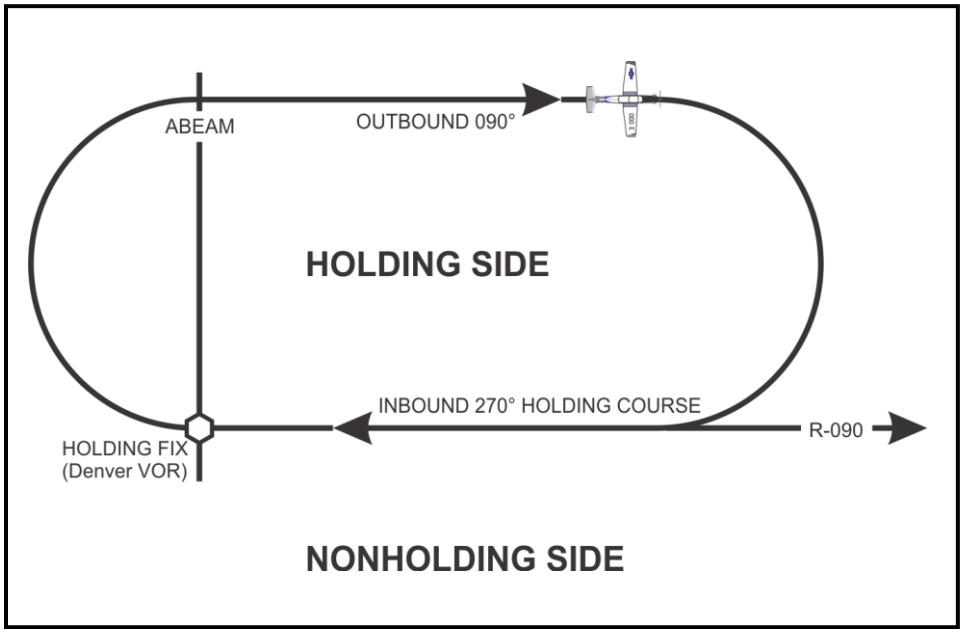


Figure 7-4 Standard Holding Pattern

2. **Nonstandard Pattern:** Left turns

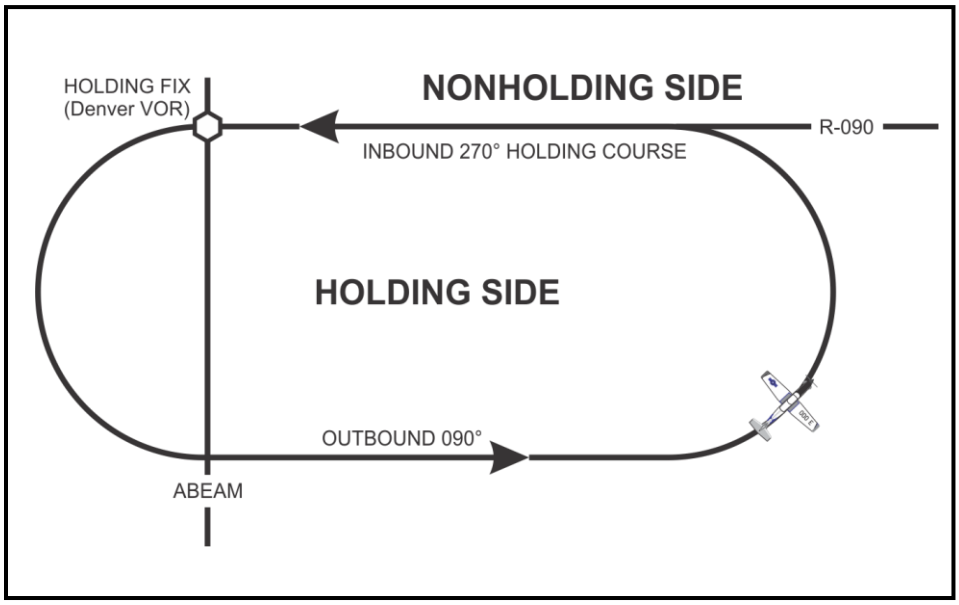


Figure 7-5 Non-Standard Holding Pattern

3. **Holding course:** The magnetic course used to track inbound to the holding fix.

NOTE

Courses are ***tracked*** when ***inbound*** to the holding fix.

4. **Outbound Leg:** The portion of the pattern flow outbound from the holding fix.

NOTE

Headings are ***flown*** during the ***outbound*** leg.

5. **Holding side:** The side of the holding course about which the holding pattern is oriented.

NOTE

The holding side contains the majority of the protected airspace.

6. **Non-Holding side:** The side of the holding course opposite the holding side.

NOTE

While not to the degree of the holding side, this area provides some protected airspace.

7. **Abeam Position:** A position directly abeam the holding fix on the outbound leg.

NOTE

1. When the holding fix is defined by a VOR station, the best indicator of the "abeam" position is the TO-FROM indicator. With the ***correct holding course*** set into the CDI, the abeam position occurs when the CDI TO indicator changes to a ***FROM*** indication. Another indication of abeam the station is the bearing pointer passing through a radial 90° from the holding course.

2. When the holding fix is defined by RADIAL/DME, the "abeam" position is the DME for the holding fix.

3. When the holding fix is defined by a RNAV/GPS waypoint, abeam will occur along the outbound leg when the GPS Along-Track Distance (ATD) is at minimum distance (ATD has stopped decreasing and has begun to increase).

4. If the abeam position cannot be determined, start any required timing when wings level after the outbound turn.

7-4 HOLDING

8. **No Wind Heading**: A magnetic heading flown during the outbound leg equal to the reciprocal of the holding course.

701. HOLDING AIRSPEEDS

When the aircraft is within 3 minutes or 5 nm from a clearance limit and clearance beyond the fix has not been received, the pilot is expected to start a speed reduction so that the aircraft will cross the fix initially at or below the maximum holding speed. All aircraft may hold at the following ***maximum*** airspeeds associated with the assigned holding altitude:

Altitude (MSL)	Airspeed (KIAS)
Minimum Holding Altitude - 6000'	**200**
6,001' - 14,000'	**230**
14,001 - and above	**265**

Exceptions to the holding airspeed limits are:

1. Holding patterns from 6001 feet to 14,000 feet may be restricted to a maximum airspeed of 210 KIAS. A note on the approach plate will depict this nonstandard pattern.

2. Holding patterns at USAF airfields may be flown up to 310 KIAS, unless otherwise depicted.

3. Holding patterns at USN fields may be flown up to 230 KIAS, unless otherwise depicted.

NOTE

The normal holding airspeed for the T-6B is 150 KIAS. If fuel endurance is a factor, fly the maximum endurance airspeed or AOA (reference T-6B NATOPS, Appendix A).

702. HOLDING CLEARANCES

ATC should issue a holding clearance at least five minutes before the aircraft reaches a clearance limit. A full clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information, either stated or implied:

1. Direction of the holding from the fix, in terms of the eight cardinal compass points (N, NE, E, SE, S, SW, W, NW).

NOTE

This will be the general direction of all outbound turns (including the entry turn).

2. The name of the holding fix. (This may be omitted if included at the beginning of the transmission as the clearance limit).

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

4. Leg length in miles, if DME or GPS Along Track Distance (ATD) is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary). If leg length is not stated, it is implied that timing is to be used.

NOTE

When used, timing is adjusted on the outbound leg of each correction orbit to maintain the following leg lengths ***inbound*** to the holding fix:

Inbound leg length when timing is used:

a. At or below 14,000 feet MSL - 1 minute.

b. Above 14,000 feet MSL - 1 1/2 minutes.

5. Direction of turn (type of pattern). Left turns (non-standard pattern) are made if depicted, the pilot requests it, or the controller considers it necessary.

NOTE

If not stated, right turns are implied (Standard Pattern).

6. Time to Expect Further Clearance (EFC) and any pertinent additional delay information (times are given in GMT).

NOTE

1. If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions except the charted holding direction and the statement "as published" (e.g., hold east as published). Controllers must always issue complete holding instructions when pilots request them.

2. If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching any enroute clearance limit.

3. If not automatically provided by ATC, request expected further clearance time (EFC). ***This time will only be used*** to depart the holding pattern to proceed enroute (or to commence the approach if holding in the destination terminal area) ***in the event of communications failure***.

703. HOLDING ORBITS

For training purposes, the holding pattern will be broken down into three types of orbits, which are accomplished sequentially:

1. **Entry Orbit:**

The Entry Orbit begins at first passage of the holding fix with an initial turn to an outbound heading that will ensure the aircraft remains within protected airspace. At the end of the outbound leg, a turn is executed to establish the aircraft on the holding course, inbound to the holding fix.

2. **No-wind Orbit:**

The no-wind orbit is flown to determine wind direction and calculate the heading/timing corrections needed to compensate for winds effects.

3. **Correction Orbit(s):**

The correction orbit applies calculated heading and/or time adjustments to the outbound leg(s) such that upon completion of the inbound turn, the aircraft is an appropriate distance from the holding fix, established on course and tracking inbound to the holding fix. All orbits used after the initial correction orbit will be used to further refine the original solution.

NOTE

In most cases the pilot should have a general understanding of the current wind effects prior to the entry orbit. ATC will expect you to correct for winds immediately upon entering holding. However, this three orbit procedure is used to simplify the learning process. For training, you should accomplish each of the above orbits sequentially. ***If the required correction is determined prior to the third orbit, it may be applied at instructor discretion***.

704. HOLDING ENTRY

GENERAL

Upon arrival at the holding fix, the entry turn will be made towards the general direction given in the holding clearance (N, NE, E, SE, S, SW, W, or NW). The specific heading needed to establish the aircraft in the designated holding airspace is determined by the type of holding pattern being used **(*Standard Pattern*** or ***Non-Standard Pattern*)**, and by comparing ***aircraft heading*** with the ***reciprocal*** of the holding course (no-wind outbound heading). There are three basic types of entry turns:

- Parallel Entry
- Teardrop Entry
- Direct Entry

1. **Standard Pattern Entries**

The following examples for Standard Pattern Entries are based on a holding clearance of:
"HOLD EAST of XXX on the 090 Radial, Expect further clearance time 1245."
(All outbound turns will therefore be in an "easterly" direction).

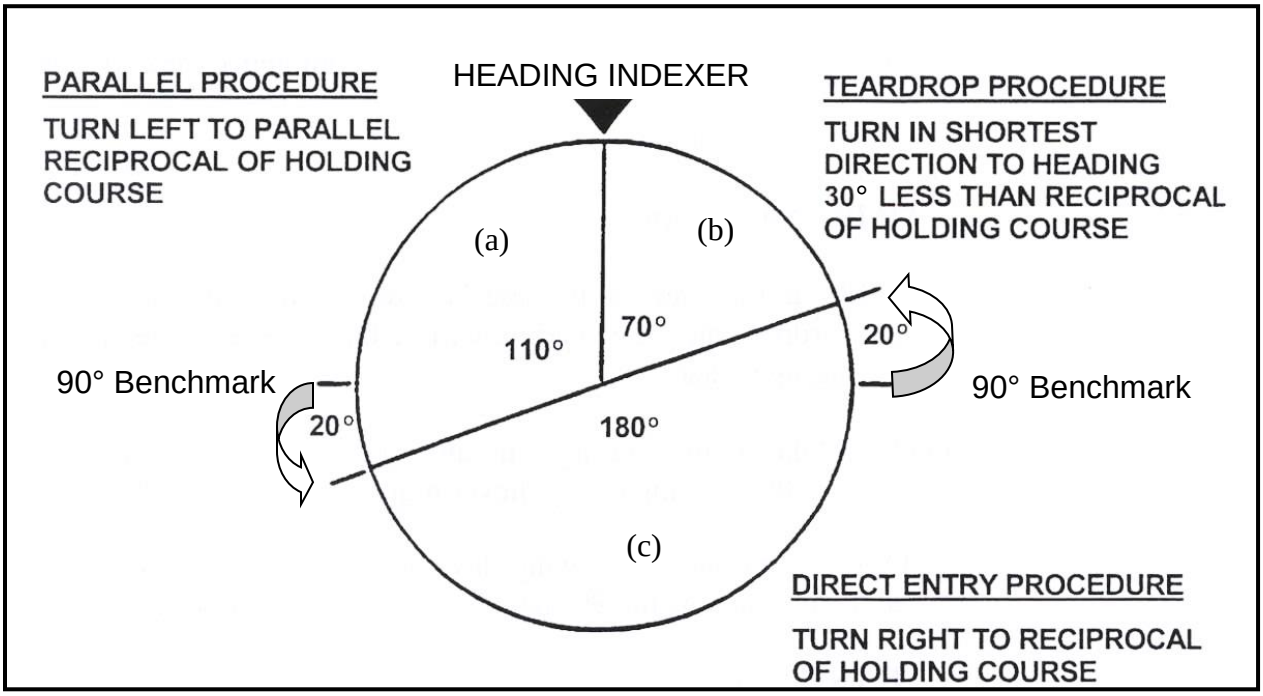


Figure 7-6 Standard Entry Diagram

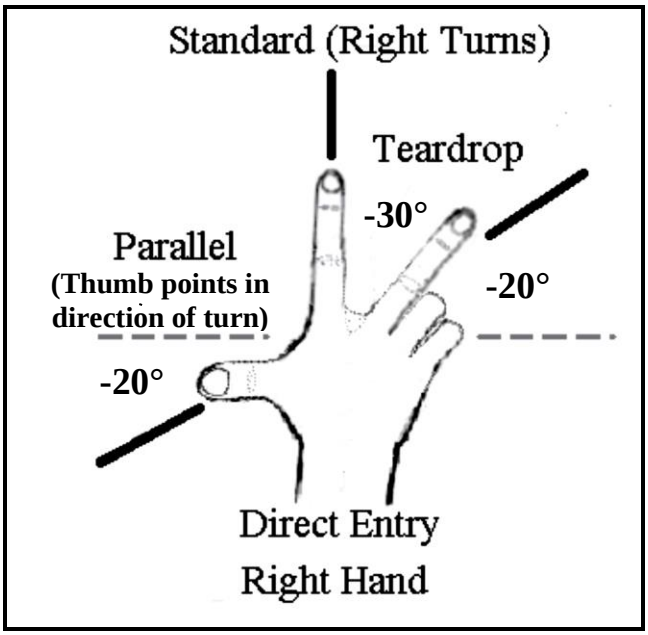


Figure 7-7 Visual Memory Aid for Standard Entry (Right Hand) Pattern

Figure 7-8 Standard Entry Diagram on HSI Display

a. **Standard Parallel Entry**. Figure 7-9 shows the aircraft arriving at the holding fix from area (a): With the ***reciprocal*** of the holding course (090°) between the heading index and 110° to the left of the heading index, turn left to parallel the ***reciprocal*** of the holding course (090°).

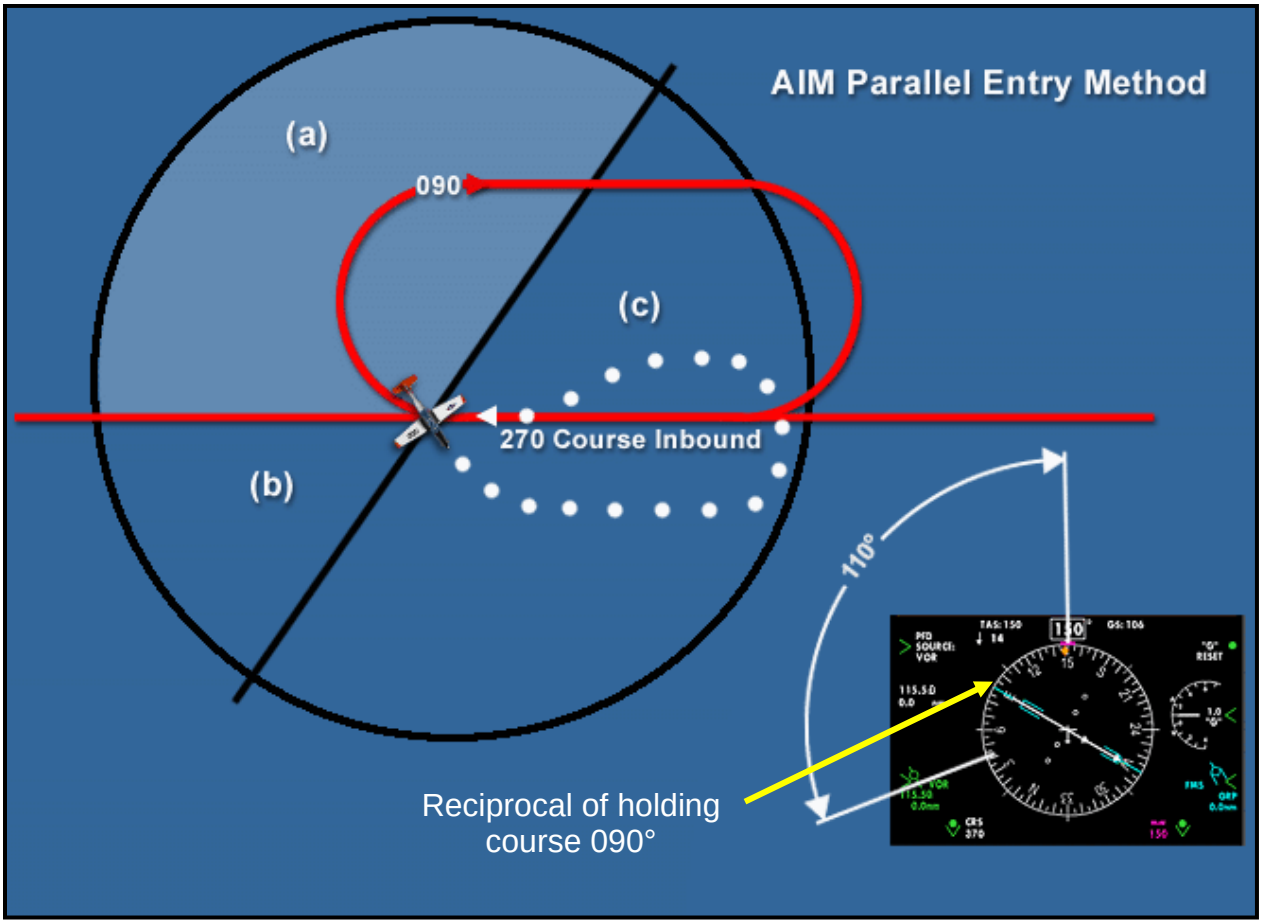


Figure 7-9 Standard Holding Parallel Entry

b. **Standard Teardrop Entry.** Figure 7-10 shows the aircraft arriving at the holding fix from area (b): With the ***reciprocal*** of the holding course (090°) between the heading index and 70° to the right of the heading index, turn in the shortest direction to a heading ***30° less*** than the ***reciprocal*** of the holding course (060°).

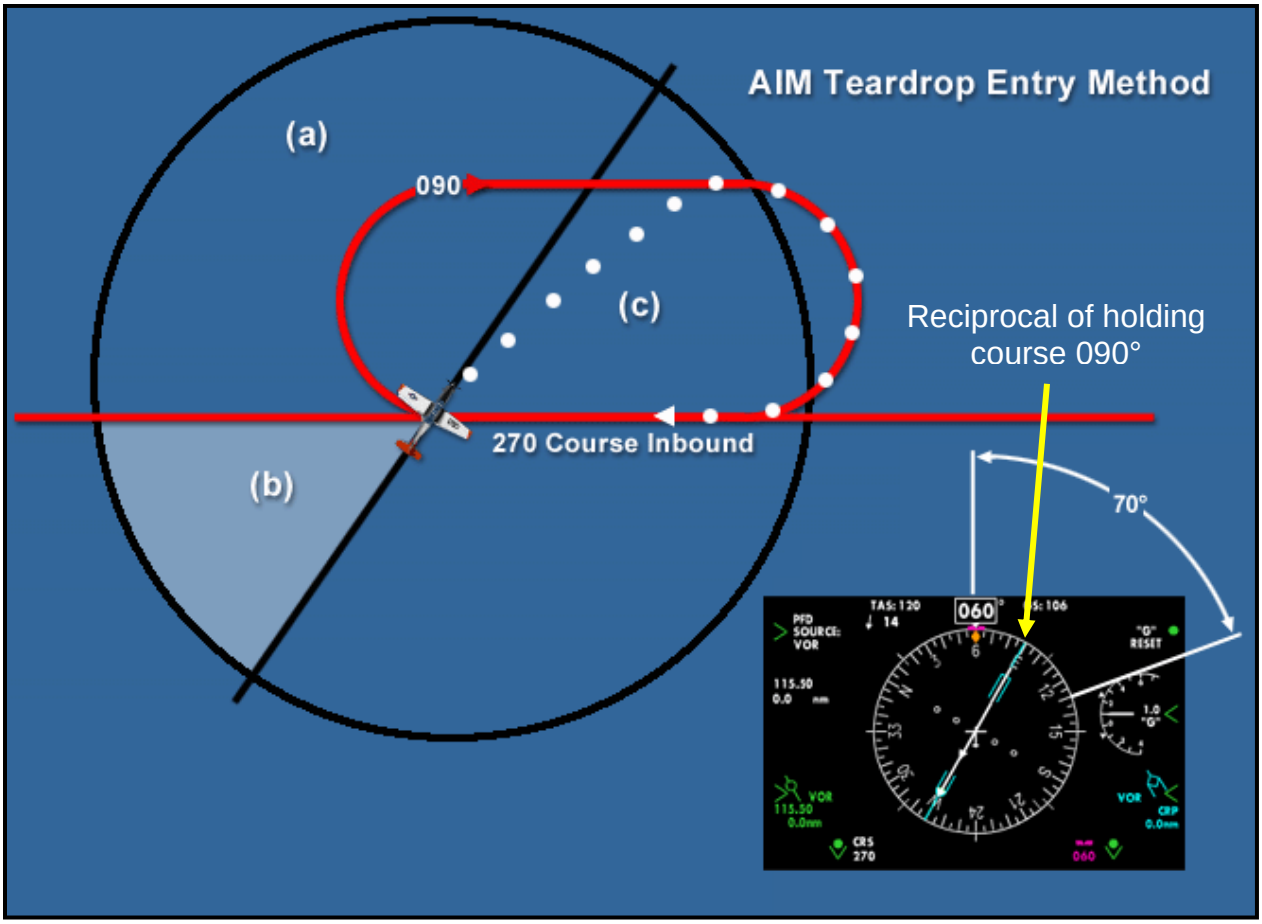


Figure 7-10 Standard Holding Teardrop Entry

NOTE

During teardrop entries where DME or ATD is available and the outbound legs are 4 NM or more, a turn to parallel the holding course after 4 NM is recommended to avoid excessive lateral displacement from the holding course.

c. **Standard Direct Entry.** Figure 7-11 shows the aircraft arriving at the holding the fix from area (c): When the ***reciprocal*** of the holding course (090°) does not meet the criteria listed in (a) or (b) above, turn right to the ***reciprocal*** of the holding course(090°).

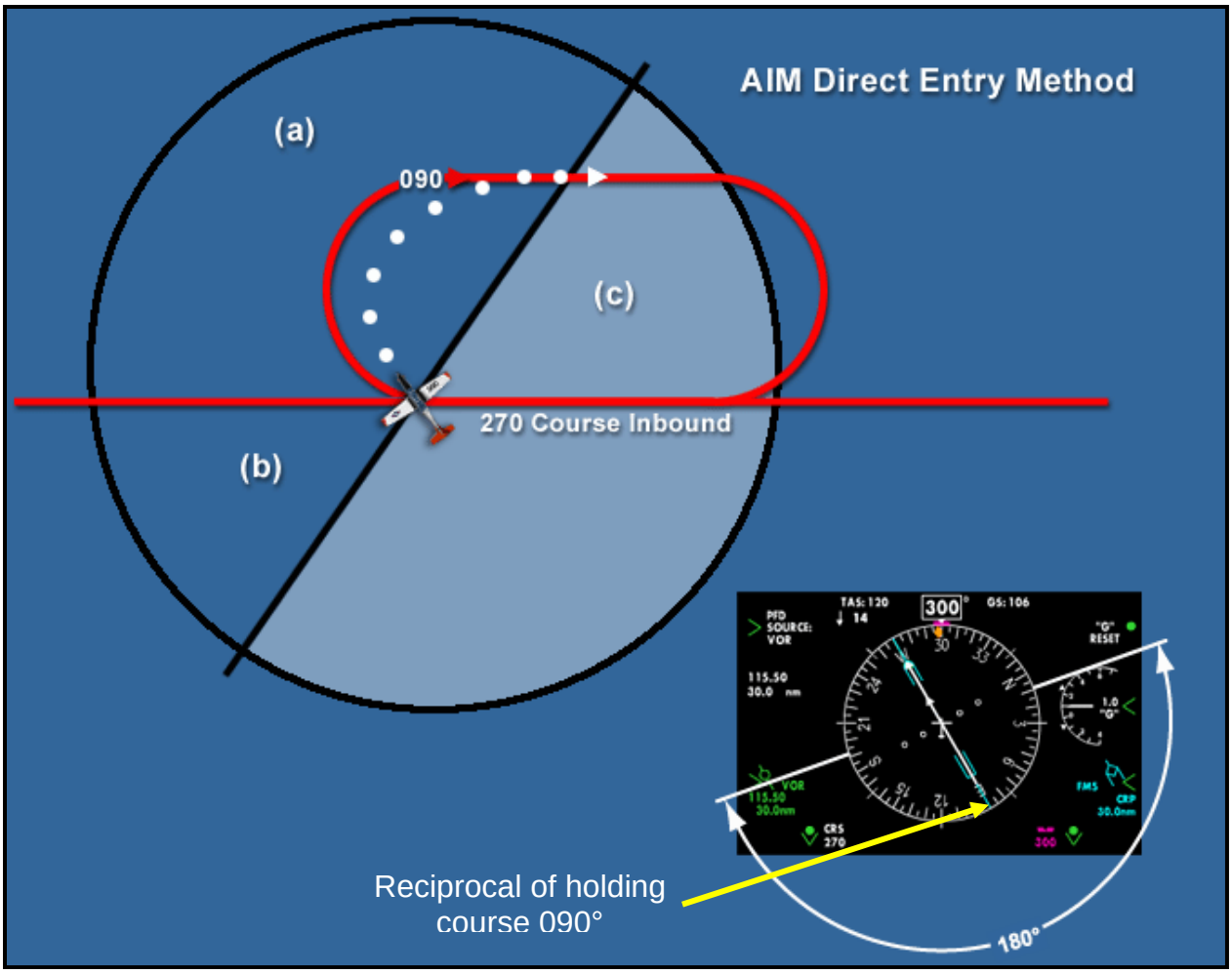


Figure 7-11 Standard Holding Direct Entry

d. **Boundary Area Entry.** Upon arrival at the holding fix, if the ***reciprocal*** of the holding course is within 5° of a boundary, the entry procedures for either section are acceptable. This rule applies to both Standard and Non-Standard Entries.

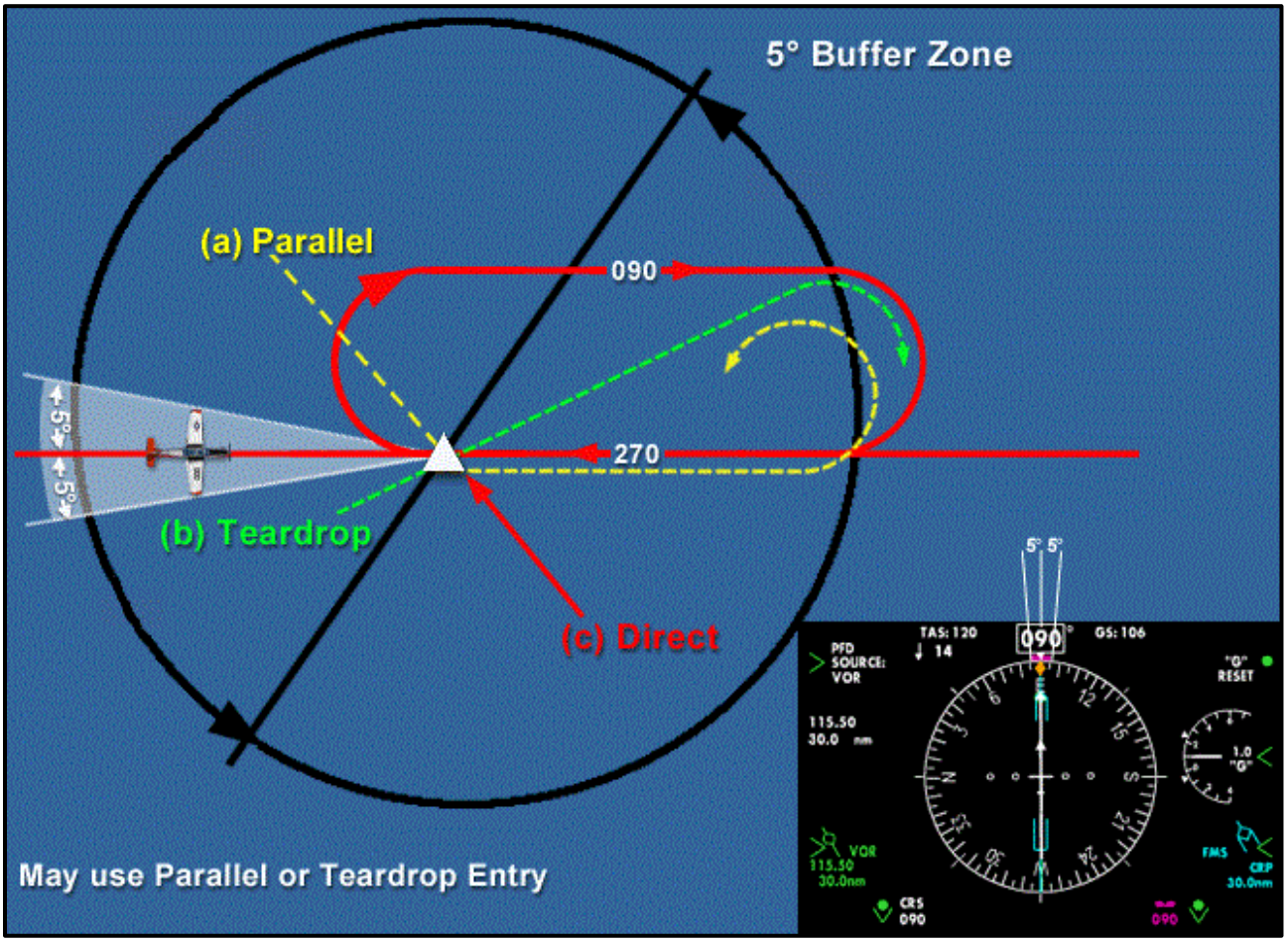


Figure 7-12 Boundary Area Entry

2. **Non-Standard Pattern Entries**

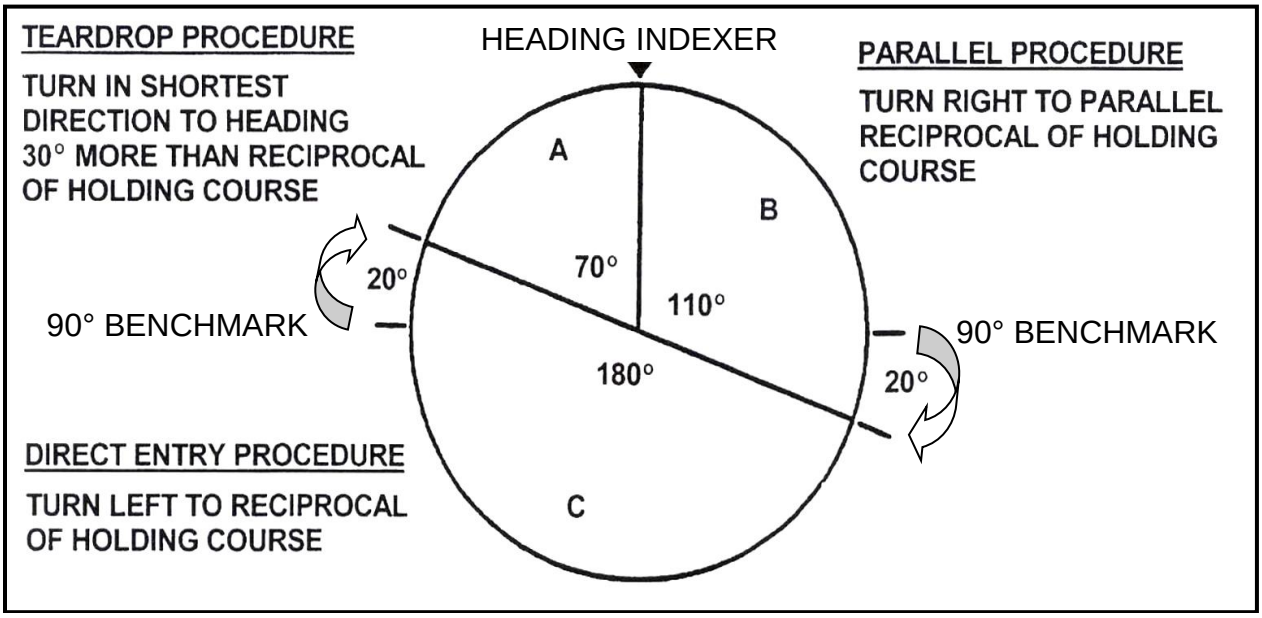


Figure 7-13 Non-Standard Entry Diagram

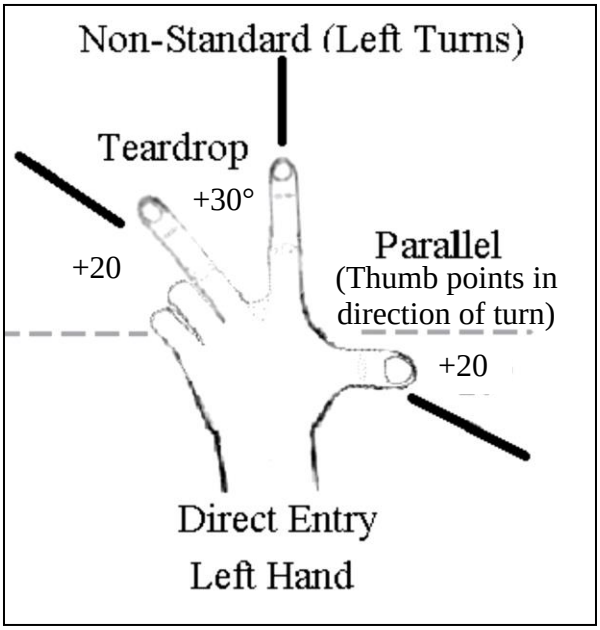


Figure 7-14 Visual Memory Aid for Non-Standard Entry (Left Hand) Pattern

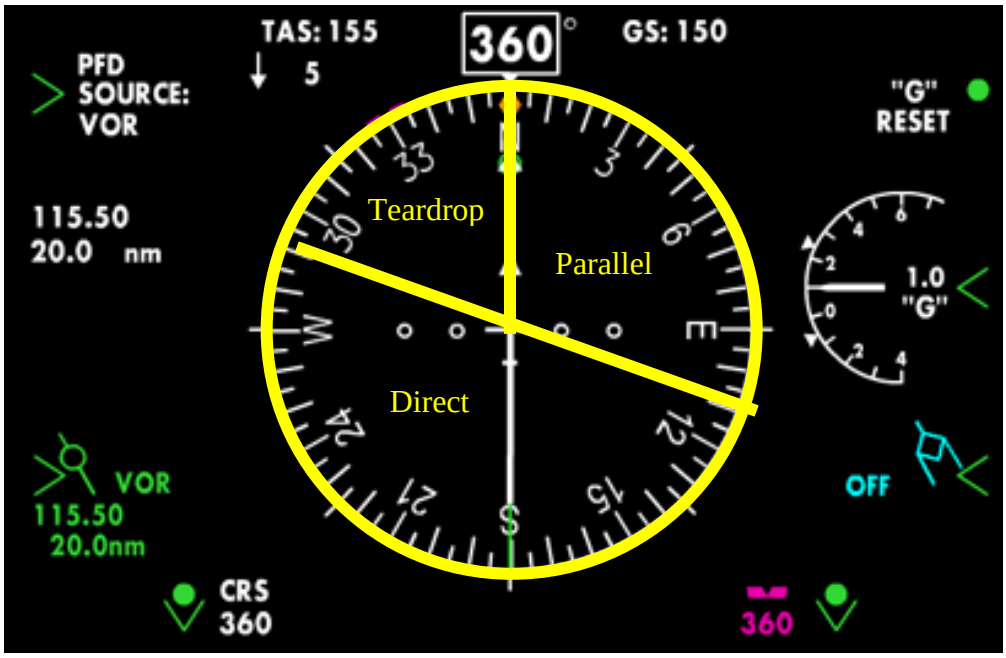


Figure 7-15 Non-Standard Entry Diagram on HSI Display

a. **Non-Standard Parallel Entry**. If the ***reciprocal*** of the holding course is between the heading index and 110° to the right of the heading index, turn right to parallel the ***reciprocal*** of the holding course.

b. **Non-Standard Teardrop Entry**. If the ***reciprocal*** of the holding course is between the heading index and 70° to the left of the heading index, execute a teardrop entry. This is accomplished by turning in the shortest direction to a heading ***30° more*** than the ***reciprocal*** of the holding course.

NOTE

During teardrop entries where DME or ATD is available and the outbound legs are 4 NM or more, a turn to parallel the holding course after 4 NM is recommended to avoid excessive lateral displacement from the holding course.

c. **Non-Standard Direct Entry**. If the ***reciprocal*** of the holding course does not meet the criteria listed in (a) or (b) above, turn left to the ***reciprocal*** of the holding course.

3. **Inbound Turns**

At the end of the outbound leg, turn inbound to intercept and track the holding course. Figure 7-16 depicts three aircraft at the end of their outbound leg, ready to turn inbound to the holding fix and illustrates the Tail-Radial-Turn visualization:

Aircraft A is on the 070° radial, the Holding course is on the 090° radial. Drawing an arrow on the HSI from the ***Tail*** of the bearing pointer at 070°, towards the holding ***Radial*** 090°, depicts a right ***Turn***.

Aircraft B is on the 090° holding radial. In this case the turn should be made towards the holding side of the radial (the side that contains the majority of the protected airspace).

Aircraft C is on the 110° radial, the Holding course is on the 090° radial. Drawing an arrow on the HSI from the ***Tail*** of the bearing pointer at 110°, towards the holding ***Radial*** 090°, depicts a left ***Turn***.

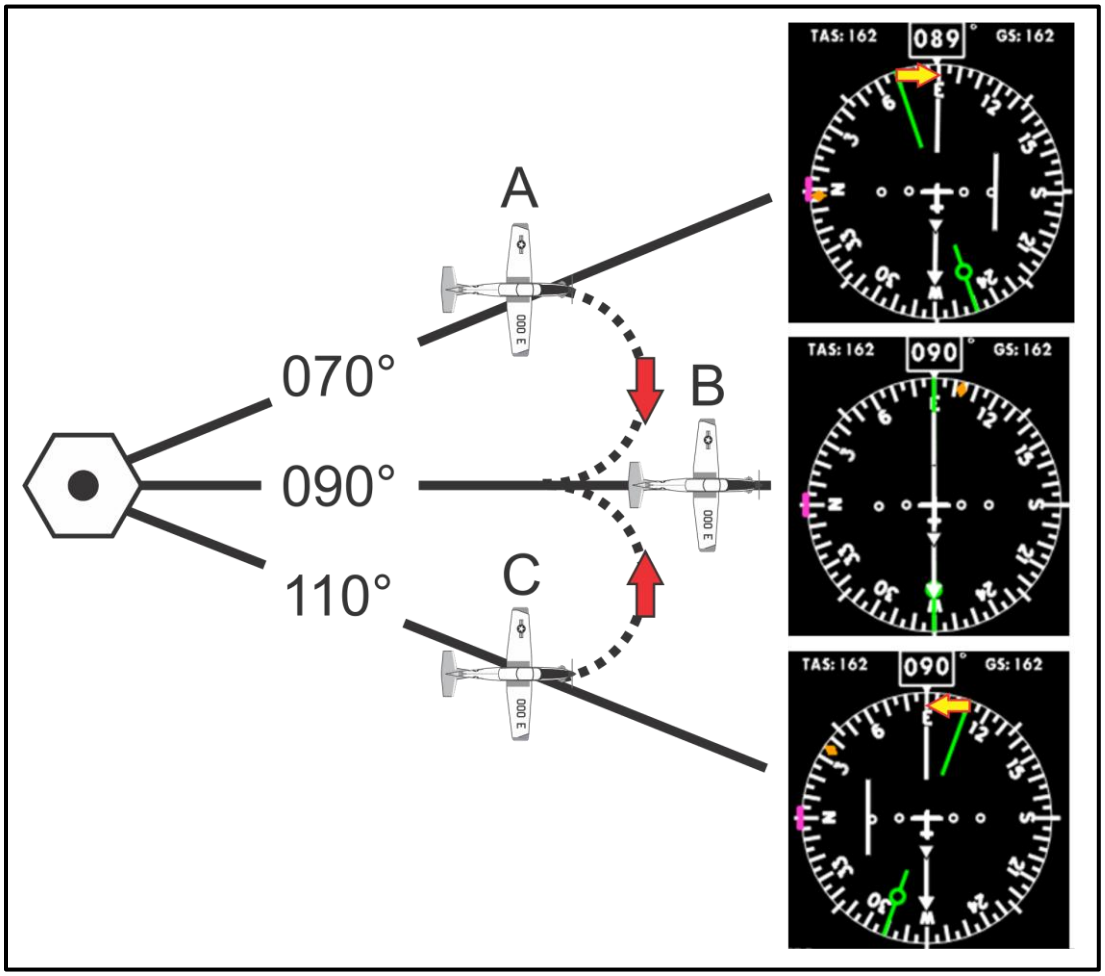
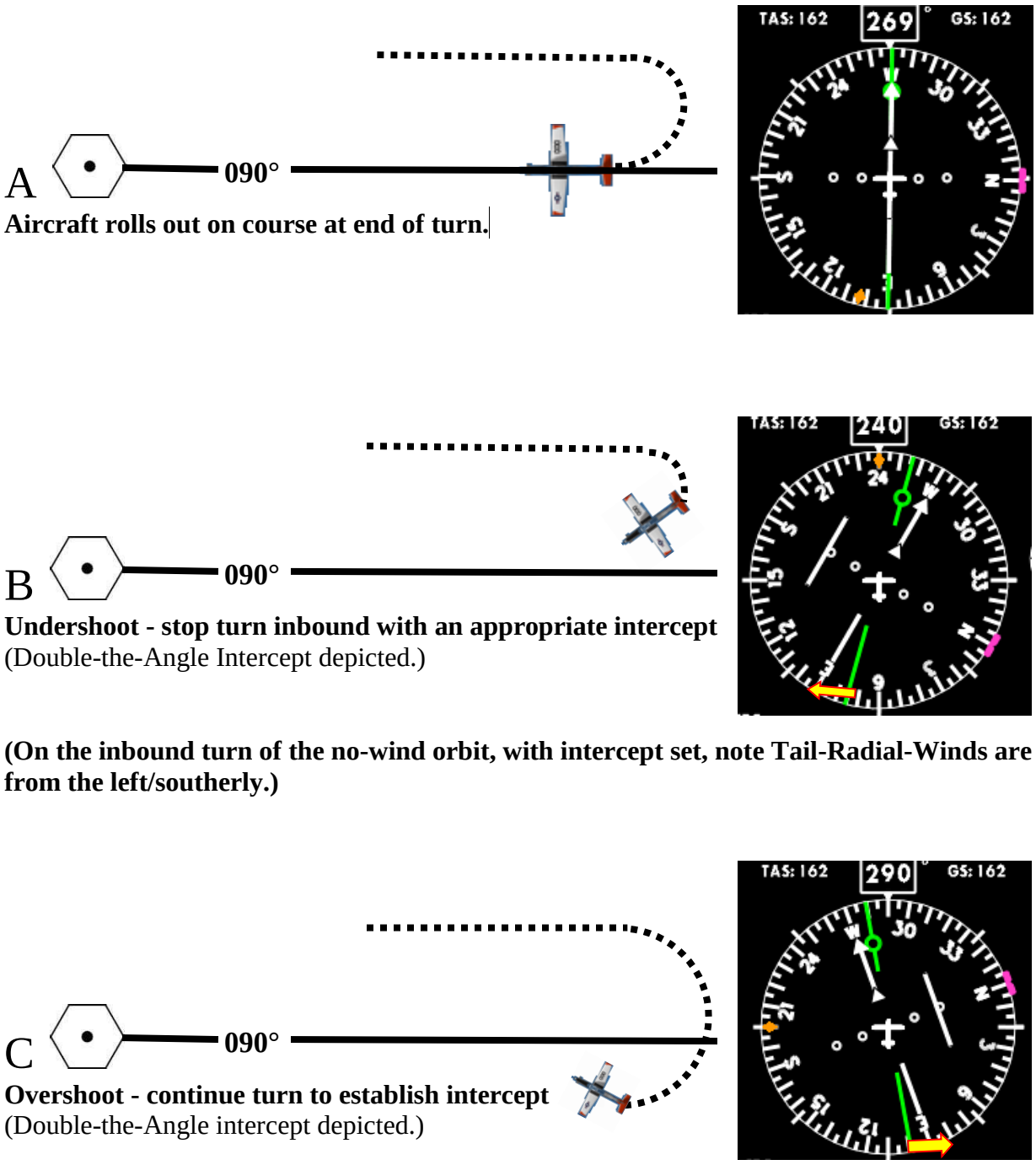


Figure 7-16 Determining Inbound Turn Direction (Tail-Radial-Turn)

Roll out of the inbound turn on course or with an appropriate intercept established to the inbound course (double-the-angle will be sufficient if holding close to a VOR; see Figure 7-17).



Aircraft rolls out on course at end of turn.

Undershoot - stop turn inbound with an appropriate intercept
(Double-the-Angle Intercept depicted.)

(On the inbound turn of the no-wind orbit, with intercept set, note Tail-Radial-Winds are from the left/southerly.)

Overshoot - continue turn to establish intercept
(Double-the-Angle intercept depicted.)

(On the inbound turn of the no-wind orbit, with intercept set, note Tail-Radial-Winds are from the Right/northerly.)

Figure 7-17 Setting Inbound Intercept/Tail-Radial-Wind Depiction

NOTE

It is important to establish the aircraft "on-course inbound" in a timely manner to ensure sufficient time to determine the drift correction. If winds are significant or distance from the holding course is excessive, use of an intercept greater than "Double-The-Angle" may be required. Do not exceed a 45° intercept unless extreme wind speed/angle requires more.

705. NO-WIND ORBIT

General

The second passage of the holding fix commences the No-Wind orbit. A No-Wind orbit is used to determine the general wind direction and any heading/timing adjustments that will be needed to offset their effects.

1. The turn outbound at the holding fix will be made in the pattern direction to roll out on a heading parallel to the holding course (outbound ***heading*** equal to the reciprocal of the holding course).

2. If timing is required to establish the leg lengths, it is started when wings level or abeam the holding fix (whichever occurs last).

NOTE

If unable to determine an abeam position, start timing when wings level.

3. At the end of the outbound leg the turn inbound is made towards the holding radial (see Figure 7-16), using the Tail-Radial-Turn method.

4. The turn inbound is considered complete when the aircraft is wings level on the holding course or with an appropriate inbound intercept established.

5. Timing (if required) will be commenced ***immediately*** when wings are level.

The turn inbound will result in one of three outcomes:

– On course (no crosswind component).

– Undershoot (crosswind from the non-holding side of the pattern).

– Overshoot (crosswind component from the holding side of the pattern).

Tail-Radial-Wind is a useful method to visualize the general direction of any crosswind component (see Figure 7-17).

6. When established inbound on the radial, use normal tracking procedures to determine the wind corrected heading needed to track the holding course. Note the direction and number of degrees difference between the wind-corrected heading and the holding course. This is also referred to as your "Crab Angle."

7. Upon reaching the holding fix, note the inbound time if needed.

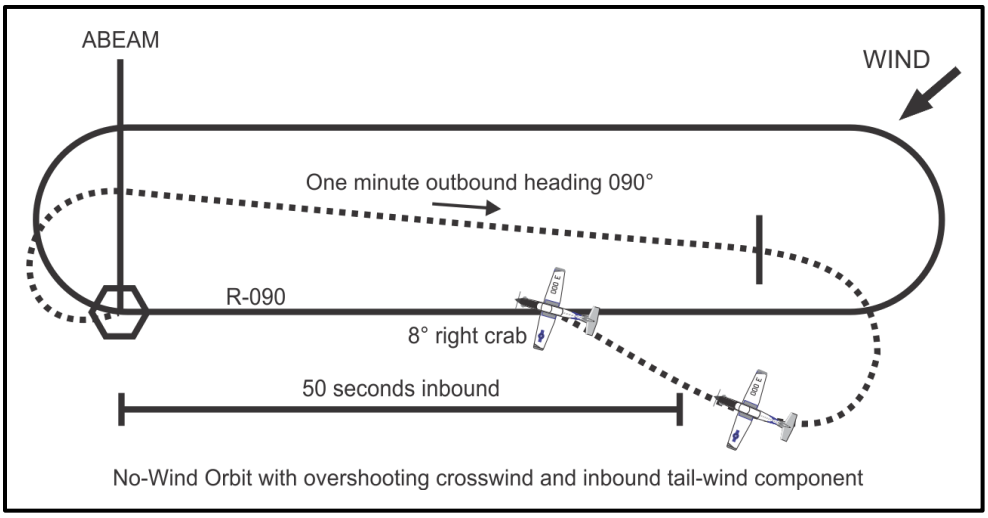


Figure 7-18 No-Wind Orbit

706. CORRECTION ORBIT(S)

General

Compensate for wind effects by flying drift corrected headings on the inbound and outbound legs while making appropriate timing adjustments.

Description

Adjust outbound heading/time to compensate for wind so that the turn inbound will place the aircraft on the holding course and where leg lengths are established by timing, with an appropriate amount of ***inbound*** time.

1. When outbound, triple the inbound drift correction to avoid major turning adjustments; e.g., if correcting right by 8 degrees when inbound, correct left by 24 degrees when outbound. This is known as the ***"Triple Drift"*** method.

2. Adjust outbound timing as needed to attain the required inbound time; e.g., if the previous orbit required inbound time was 10 seconds too short, then your outbound time should be increased by ten seconds (see Figure 7-18).

NOTE

If the No-Wind inbound timing is in excess of 90 seconds, the first wind corrected outbound time should be no less than 30 seconds. Subsequent orbits may be reduced if a high inbound headwind component necessitates.

3. Hold the Triple-Drift correction for no more than one minute on the outbound leg. At the end of that time, the aircraft is in a position such that a standard rate turn inbound to the holding fix would place the aircraft on (or very near) the holding course inbound (see Figure 7-19).

4. If leg lengths require more than one minute outbound, the remaining portion of the outbound leg should be flow with a Single-Drift heading correction (see Figure 7-19).

5. Make adjustments (fine tune) as necessary on each subsequent pattern.

NOTE

Situations where rolling out on the outbound leg with a triple-drift heading established prior to passing abeam the holding fix (where normal timing is commenced) can result in the triple-drift correction being established for longer than one minute; however, the difference in timing should be minimal and have little effect on your holding corrections. Any errors caused by this difference can be compensated by adjusting the outbound heading during subsequent correction orbits.

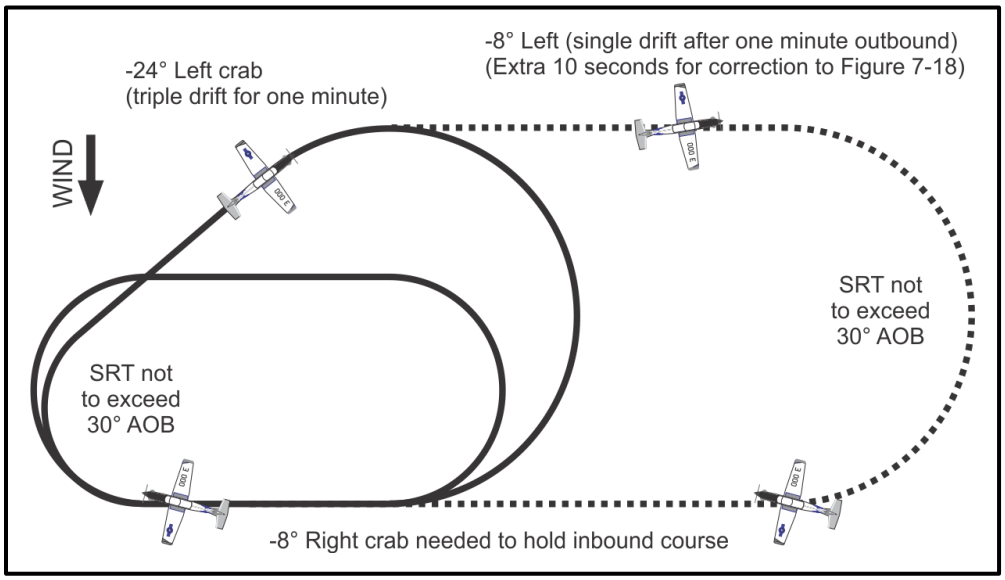


Figure 7-19 Triple Drift Heading Correction

707. HOLDING COMMUNICATIONS

Entry into Holding

In accordance with the FIH, pilots should report the time and altitude/flight level upon reaching a holding fix or point to which cleared***. This report may be omitted by pilots of aircraft involved in instrument training at military terminal-area facilities when radar service is being provided and the holding was requested by the pilot.***

You are considered established in holding when you cross the holding fix for the first time. An example of this report is:

"Houston Center, Navy 3E100, established in holding at ***OYSTY***, ***FOUR FIVE, 6000****."* (Use current GMT time in minutes past the hour - NOT the elapsed time.)

A mnemonic for this call is ***"PTA"*** (***P***osition, ***T***ime, ***A***ltitude).

Confirming an EFC time

Confirm your Expected Further Clearance time (EFC) with ATC at least five minutes prior to the EFC time.

Receipt of an EFC time is ***not*** a clearance to proceed on course or commence an approach at that time ***unless*** you have lost communications with ATC.

"Houston Center, Navy 3E100, Confirm EFC time FIVE-FIVE."

Departing Holding

In accordance with the FIH, pilots should report leaving any assigned holding fix or point. This report does not require the altitude or time in the report. ***This report may be omitted by pilots of aircraft involved in instrument training at military terminal-area facilities when radar service is being provided and the holding was requested by the pilot.***

Examples:

"Houston Center Navy 3E100, departing holding, cleared for the VOR RWY 14."

"Houston Center Navy 3E100, departing holding, proceeding on course."

708. CLEARANCE FOR AN APPROACH WHILE IN HOLDING

If established in a ***Published Holding Pattern*** and subsequently cleared for the approach, you may commence the approach from within the holding pattern.

It is very important to listen to the "tense" of the approach clearance once established in holding. Listed below are possible types of clearances that may be received:
*"Navy 3E100, **at the completion of this turn** in holding, you are cleared for the VOR-RWY 14 approach."*

or

*"Navy 3E100, **at (IAF name),** you are cleared for the approach."*

The two cases above are examples of a "***future tense*** clearance." The pilot would complete his turn in holding and commence the approach at the IAF. Listen for any altitude restrictions from ATC.

*"Navy 3E100, **you are cleared** for the VOR-RWY 14 approach."*

This case represents a "***present tense*** clearance." The pilot is ***not*** required to complete the turn in holding and ***may***:

1. ***Turn*** immediately towards the IAF.

2. ***Descend*** to the published ***Minimum Holding Altitud***e ***(MHA).*** For those holding patterns where there is no published minimum holding altitude, the pilot, upon receiving an approach clearance, must maintain the last assigned altitude until leaving the holding pattern and established inbound on a ***published segment of the approach.*** Thereafter, the published minimum altitude of the route segment being flown will apply.

If holding at the IAF, ***not in a published holding pattern***, and subsequently cleared for the approach. The pilot may:

1. ***Turn*** to the IAF.

2. ***Do not descend*** until on a published segment of the approach.

709. SHUTTLE DESCENT

General

A shuttle descent is a procedure used in holding to position the aircraft at a lower altitude.

Discussion

Descents in holding are normally initiated by ATC. If several aircraft are in holding at the same fix, they will be placed in a "stack" with a minimum altitude separation of 1000'. Shuttles will be used to descend each aircraft to the next lower stack altitude after the bottom aircraft in the stack has commenced the approach.

Procedure

1. Report leaving current altitude for assigned altitude.

2. Reduce power to approximately 15% torque.

3. Lower the nose to maintain 150 KIAS.

4. Re-trim.

To level-off:

5. Approximately 50' prior to level-off altitude, begin the transition by resetting power to 33% torque.

6. Raise the nose to set level flight.

7. Re-trim.

Common Errors

1. Fixating on altitude, thereby failing to maintain the holding pattern corrections.

2. Fixating on the holding pattern and neglecting level off.

3. Failure to maintain 150 KIAS in the descent.

710. HOLDING PROCEDURES

General

While the holding airspace allotted by ATC will provide ample lateral airspace, the vertical clearance between aircraft can be as little as 1000'. Maintaining orientation and situational awareness while keeping up with the holding procedures requires constant vigilance and solid task management skills. The six 'T's" will aid in task management.

Holding Basics

To avoid some the common pitfalls in holding, adhere to the following precepts:

1. ***Make all turns at a standard rate.*** (not to exceed 30° AOB)

2. ***Maintain good basic air work!*** (Any deviations on your part will add to or subtract from the actual wind effect).

3. ***Outbound legs - fly headings!***

4. ***Inbound legs - track the holding course!***

5. ***Keep an eye on the fuel and EFC time***!

6. ***Turns inbound are made in the direction of the holding radial*** (Tail-Radial-Turn)!

7. ***In a stacked pattern, altitude control is crucial!***

8. The key to successfully implementing Triple Drift is intercepting the holding course inbound as soon as possible to determine a good wind corrected heading. Use an appropriate inbound intercept to accomplish this objective.

Procedures

Pre-Entry

1. Copy and readback the holding clearance.

2. Determine the required direction and heading for the entry turn.

3. Slow to 150 KIAS within 3 minutes (or 5 NM) of the Holding Fix.

Entry Orbit

1. **TIME**- Note (write it down if you need to) the GMT time you crossed the Holding Fix (needed for the entering holding report).

2. **TURN**- Turn to the appropriate entry heading.

3. **TIME**- Start outbound timing if required.

4. **TRANSITION**- Ensure you are established at 150 KIAS, comply with any altitude changes as directed.

5. **TWIST**- Set the Holding Course into the CDI.

6. **TALK**- Report entering holding (PTA report).

Upon completion of the outbound leg:

7. **TIME**- Outbound time/DME/ATD completed.

8. **TURN**- Inbound to intercept the Holding Course (Tail-Radial-Turn).

9. **TIME**- Start timing inbound (if required).

10. **TRANSITION**- If required to comply with ATC instructions.

11. **TWIST**- Ensure the Holding Course is set in the CDI and track the Holding Course.

12. **TALK**- If you didn't get the entry report accomplished on the outbound leg, do it now.

No-Wind Orbit

1. **TIME**- Reset elapsed time to zero.

2. **TURN**- Turn in the pattern direction to a no-wind outbound heading.

3. **TIME**- Start outbound timing if required (wings level or abeam the Holding Fix, whichever occurs last).

4. **TRANSITION**- As required to comply with ATC instructions.

5. **TWIST**- Confirm Holding Course has been set in the CDI.

6. **TALK**- Good time for an OPS check or to confirm EFC if needed.

Upon completion of the outbound leg:

7. **TIME**- Outbound time/DME/ATD completed.

8. **TURN**- Inbound to intercept the Holding Course.

9. **TIME**- Start timing inbound if required (wings level, on course, or with an appropriate intercept to the holding course).

10. **TRANSITION**- As required to comply with ATC instructions.

11. **TWIST**- Confirm Holding Course is set in the CDI and track the Holding Course.

Determine the drift correction required to maintain the holding course.

12. **TALK**- Report the crab direction/angle required to maintain course. State intended 'Triple Drift" heading correction for the next orbit.

(***Example:*** "Using a 8° right crab inbound, will use 24° left crab outbound.")

NOTE

If you know the general wind direction (Tail-Radial-Wind), but had insufficient time to determine an exact crab angle, using 3-5° for the inbound crab as basis for the first correction will serve as an acceptable starting point.

Correction Orbit(s)

1. **TIME**- Note the inbound time (if required).

2. **TURN**- Turn in the pattern direction to set the Triple-Drift correction. Analyze inbound time and report outbound timing correction (if required) to the instructor.

(***Example***: *"Inbound was short 10 seconds. New outbound time will be 70 seconds."*)

3. **TIME**- Start outbound timing (wings level or abeam the Holding Fix, whichever occurs last).

4. **TRANSITION**- As required to comply with ATC instructions.

5. **TWIST**- Confirm Holding Course has been set in the CDI.

6. **TALK**- Good time for an OPS check or to confirm EFC if needed.

NOTE

Hold the Triple Drift correction until the end of outbound leg or for 1 minute of outbound timing, whichever occurs first. After 1 minute of outbound timing, if additional outbound time/distance is needed, set a single-drift correction for the remaining portion of the outbound leg.

Upon completion of the outbound leg:

7. **TIME**- Outbound time/DME/ATD completed.

8. **TURN**- Inbound to intercept the Holding Course.

9. **TIME**- Start timing inbound if required (wings level, on course, or with an appropriate intercept to the holding course established).

10. **TRANSITION**- As required to comply with ATC instructions.

11. **TWIST**- Confirm Holding Course is set in the CDI and track the Holding Course. Refine inbound drift correction as required to maintain the Holding Course.

12. **TALK**- Report the adjusted inbound crab direction/angle if required. State intended outbound heading correction for the next orbit.

Example: (where inbound heading correction is good, but Triple-Drift outbound was too much resulting in an undershooting inbound turn):

"Using 8° right crab inbound, will use 20° left crab outbound."

NOTE

All orbits used after the initial correction orbit will be used to further refine the original solution.

Departing Holding

1. **TIME**- Not required.

2. **TURN**- As required to comply with ATC clearance.

3. **TIME**- Not required.

4. **TRANSITION**- Speed/altitude as required to comply with ATC clearance.

5. **TWIST**- Set/check CDI for course required for holding departure.

6. **TALK**- Report departing holding if required.

Common Errors

1. Using incorrect entry turn.

2. Late/early starting outbound timing.

3. Attempting to intercept the holding course on the outbound leg.

4. Applying crosswind correction in the wrong direction.

5. Shortening/lengthening time adjustments in the wrong direction.

6. Failure to update/confirm EFC within 5 minutes of expiration.

7. Failure to transition back to an appropriate speed during departure from holding.

8. Failure to report entering/departing holding to ATC.

711. HOLDING DURING ADVERSE WIND CONDITIONS

It is not unusual for winds aloft to attain velocities well in excess of 20 knots. In these circumstances, modifications to the holding procedures discussed earlier may be necessary. How much you modify normal holding procedures will depend on wind speed and direction. If you feel you need to use modified procedures, be sure to discuss this with your instructor.

You should be able to predict high winds prior to entering the holding pattern. ***Pay attention to the forecasted winds aloft***. During the enroute phase, a high crosswind component would be indicated by the need for an abnormally large drift correction. A high head/tailwind component would be indicated by a groundspeed that differs grossly from TAS.

Use the Tail-Radial-Turn method to maintain aircraft position within the holding airspace. If wind speed and its angular relationship to the holding pattern make holding difficult, consider requesting a holding pattern better oriented with respect to winds.

712. UPDATING WEATHER DATA

Pilots shall periodically determine that their intended route of flight remains clear of aviation Severe Weather Watch Bulletins (WWs) and that weather forecasts for each successive intermediate destination and alternate (when required), continue to satisfy the minimums established for the aircraft and the filing status (IFR/VFR).

Updates are readily available from U.S. Navy, Marine Corps, and Air Force weather activities through use of the Pilot-to-Metro Service (PMSV), Automatic Terminal Information Service (ATIS) broadcasts, selected VOR and low-frequency NAVAIDs, and data provided by Air Route Traffic Control Centers (ARTCCs) and Flight Service Stations (FSSs) in the form of weather advisory broadcasts and Hazardous In-Flight Weather Advisory Services (HIWAS). The frequencies for these services can be found in the FIH or appropriate enroute charts.

When dealing with situations where adverse weather is involved, such as weather associated with Significant Meteorological Information (SIGMETs) or WWs, pilots need to obtain more specific guidance or further technical evaluation of meteorological conditions that could affect the flight. When faced with this situation, the pilot should initiate communications with one of the activities listed below (in order of preference):

1. Military Pilot-to-Metro Service (PMSV).

2. FAA Enroute Flight Advisory Service (EFAS).

3. The nearest FSS.

When utilizing full-service PMSV or EFAS, the pilot will have access to a qualified meteorological forecaster. Most PMSVs and FSSs are 24 hour facilities, but EFAS runs for specific daytime hours and pertains only to the enroute portion of flight. EFAS is the preferred method of obtaining enroute hazardous weather information ***if*** the pilot cannot utilize PMSV because, unlike FSSs, EFASs are dedicated specifically to weather updates.

CHAPTER EIGHT
TERMINAL PROCEDURES

800. INTRODUCTION

Due to the increasing complexity of the air traffic system, the terminal phase can be one of the more challenging phases of flight. To maintain constant situational awareness and avoid task saturation, the pilot must ***know the procedures*** and ***stay ahead of the aircraft***.

To aid in task management, as you approach and enter your terminal area, the mnemonic "***ABCD***" can be useful.

ATIS
BRIEF
COCKPIT SETUP
DESCENT CHECKLIST

The exact order and sequence of execution will depend on the situation, but all items should be completed prior to the IAF.

801. AUTOMATIC TERMINAL INFORMATION SYSTEM (ATIS)

About 100 NM away from the destination or drop-in airfield, get the current Automatic Terminal Information System (ATIS), Automated Surface Observing System (ASOS), or Automated Weather Observation System (AWOS) and check it against the approach weather minimums. Normally, you will check ATIS on one radio while monitoring the ATC frequency on the other radio (e.g., use VHF or the VOR for ATIS, and UHF or VHF for ATC).

802. DESCENT CHECKLIST

After initiating descent into the terminal area or establishing contact with the destination Approach Control, perform the Descent Checklist.

803. STANDARD TERMINAL ARRIVAL (STAR)

A Standard Terminal Arrival (STAR) is an Air Traffic Control (ATC) coded IFR arrival route established for application by arriving Instrument Flight Rules (IFR) aircraft destined for certain airports. RNAV STARs for arrivals serve the same purpose, but are only used by aircraft equipped with a Flight Management System (FMS). The purpose of both is to simplify clearance delivery procedures and facilitate transition between enroute and instrument approach procedures.

STARs/RNAV STARs may have mandatory speeds and/or crossing altitudes published. Other STARs may have planning information depicted to inform pilots what clearances or restrictions to "expect." "Expect" altitudes/speeds are not considered STAR/FMSP crossing restrictions until verbally issued by ATC.

NOTE

The "expect" altitudes/speeds are published so that pilots may have the information for planning purposes. These altitudes/speeds should not be used in the event of lost communications unless ATC has specifically advised the pilot to expect these altitudes/speeds as part of a further clearance.

Pilots navigating on a STAR/RNAV STAR shall maintain last assigned altitude until receiving authorization to descend so as to comply with all published/issued restrictions. This authorization will contain the phrase ***"descend via."***

NOTE

1. A "descend via" clearance authorizes pilots to navigate vertically and laterally, in accordance with the depicted procedure, to meet published restrictions. Vertical navigation is at pilot discretion; however, adherence to published altitude crossing restrictions and speeds is mandatory unless otherwise cleared. (Minimum Enroute Altitudes [MEAs] are not considered restrictions; however, pilots are expected to remain above MEAs.)

2. Pilots cleared for vertical navigation using the phrase "descend via" shall inform ATC upon initial contact with a new frequency.

Pilots of IFR aircraft destined to locations for which STARs have been published may be issued a clearance containing a STAR whenever ATC deems it appropriate.

Use of STARs requires pilot possession of at least the approved chart. As with any ATC clearance or portion thereof, it is the responsibility of each pilot to accept or refuse an issued STAR. Pilots should notify ATC if they do not wish to use a STAR by placing "NO STAR" in the remarks section of the flight plan or by the less desirable method of verbally stating the same to ATC.

804. ENROUTE DESCENT

Description

In the enroute structure, the FAA expects the pilot to ***descend at an optimum rate consistent with the operating characteristics of the aircraft to 1000 feet above the assigned altitude, and then attempt to descend at a rate of 500-1500 fpm until the assigned altitude is reached.*** If deemed necessary, advise ATC it is necessary to level off at an intermediate altitude, except when leveling off at 10,000 feet MSL to reduce speed to comply with the FAA speed restriction of 250 KIAS or when 2,500 feet above airport elevation (prior to entering a Class C or Class D surface area) to reduce speed to comply with the speed restriction of 200 KIAS.

Procedure

1. Report leaving the current altitude for the new assigned altitude.

2. Establish and maintain a descent at 200-250 KIAS and approximately 4000 FPM (fine tune power and nose attitude as required).

3. Commence the Descent Checklist.

4. Approximately 1000 feet prior to level-off, adjust pitch to slow rate of descent to between 500-1500 FPM.

5. Level off at assigned altitude and transition to desired Cruise Speed (adjust power as required).

NOTE

To comply with charted NATOPS enroute descent profile, lower the nose 10° nose down, approaching 220 KIAS set power to 10%. Fine tune power and nose to maintain approximately 220 KIAS and approximately 4000 FPM.

If the situation or ATC requires a greater rate of descent, power and/or speed brake may be adjusted as required until within 1000 feet of level off. Descent rates will increase significantly (to 8000-11,000 fpm) with idle power and speed brake extended. For NATOPS maximum range descent and other profiles, refer to NATOPS appendix A.

Common Errors

1. Not completing the Descent Checklist.

2. Loss of heading control due to lack of rudder input with changes to power/airspeed.

3. Not reducing rate of descent to between 500-1500 FPM during the last 1000’ of descent.

805. TERMINAL DESCENT

General

Transition the aircraft from an intermediate altitude to the approach phase of flight.

Description:

A terminal descent is a procedure used to descend to a lower altitude when in contact with the destination controller and in the terminal phase of flight. During descents in this possibly congested area, maintaining a constant speed makes you “predictable” and aids the controller in

providing adequate spacing between aircraft.

Procedure

1. Report leaving the assigned altitude.

2. Adjust power and speed brake as required to control desired rate of descent.

3. Lower the nose as required to ***maintain current speed***.

4. Trim (commence descent checklist if not previously completed).

5. Approximately 1000' prior to level off, (retract speed brake if used) adjust power as required to establish a rate of descent between 500-1500 FPM.

6. Level off at the assigned altitude, resetting power to maintain airspeed.

NOTE

Prior to commencing an approach, the most common terminal descent is conducted at 200 KIAS. Power set at 20% and nose 5° down will provide approximately 2000 fpm, which is an adequate rate of descent for most situations.

806. INSTRUMENT APPROACH BRIEF

Description

Upon being cleared for an approach, or having been advised (by the controller or ATIS) to expect a specific approach, the student will brief the instructor on the particulars for the approach. The brief should include all of the following that apply:

1. **Approach name**: Approach title, page number.

2. **Weather minimums**: For the applicable portion of the approach.

3. **NAVAID setup**: NAVAIDS required for the approach.

4. **IAF**: Name and/or radial/DME.

5. **Course(s)**: Initial and Final Approach Course and arc description (as applicable).

6. **Segment altitudes**: All applicable altitudes depicted on the approach.

7. **MDA/DA**: For the applicable portion of the approach.

8. **MAP**: How it will be identified (GPS, timing, DME, station passage or by the controller).

9. **Missed approach/Climb-out instructions**: Reviewed.

10. **Unusual or noteworthy items peculiar to the approach**: Reviewed.

NOTE

It is always preferred to have this brief completed prior to commencing the approach. In situations where there is insufficient time to complete all items prior to commencing an approach, it is acceptable to brief these items just prior to their execution. Bottom line, stay ahead of the aircraft.

807. INSTRUMENT APPROACH PLATES

General

The navigation equipment required to fly the ***final approach segment*** of an instrument approach procedure (that portion of the procedure between the FAF and MAP) is indicated in the title of the procedure.

Straight-in IAPs are identified by the navigational system providing the ***final approach*** guidance and the runway to which the approach is aligned (e.g., VOR RWY 13).

Circling only approaches are identified by the navigational system providing ***final approach*** guidance and a letter (e.g., VOR-A).

More than one navigational system separated by a slash indicates that more than one type of equipment must be used to execute the ***final approach*** (e.g., VOR/DME RWY 31).

More than one navigational system separated by the word “or” indicates either type of equipment may be used to execute the ***final approach*** (e.g., VOR or GPS RWY 15).

Each instrument approach plate consists of five sections:

1. Pilot Briefing Information.

2. Plan view.

3. Profile view.

4. Landing minima section.

5. Aerodrome sketch.

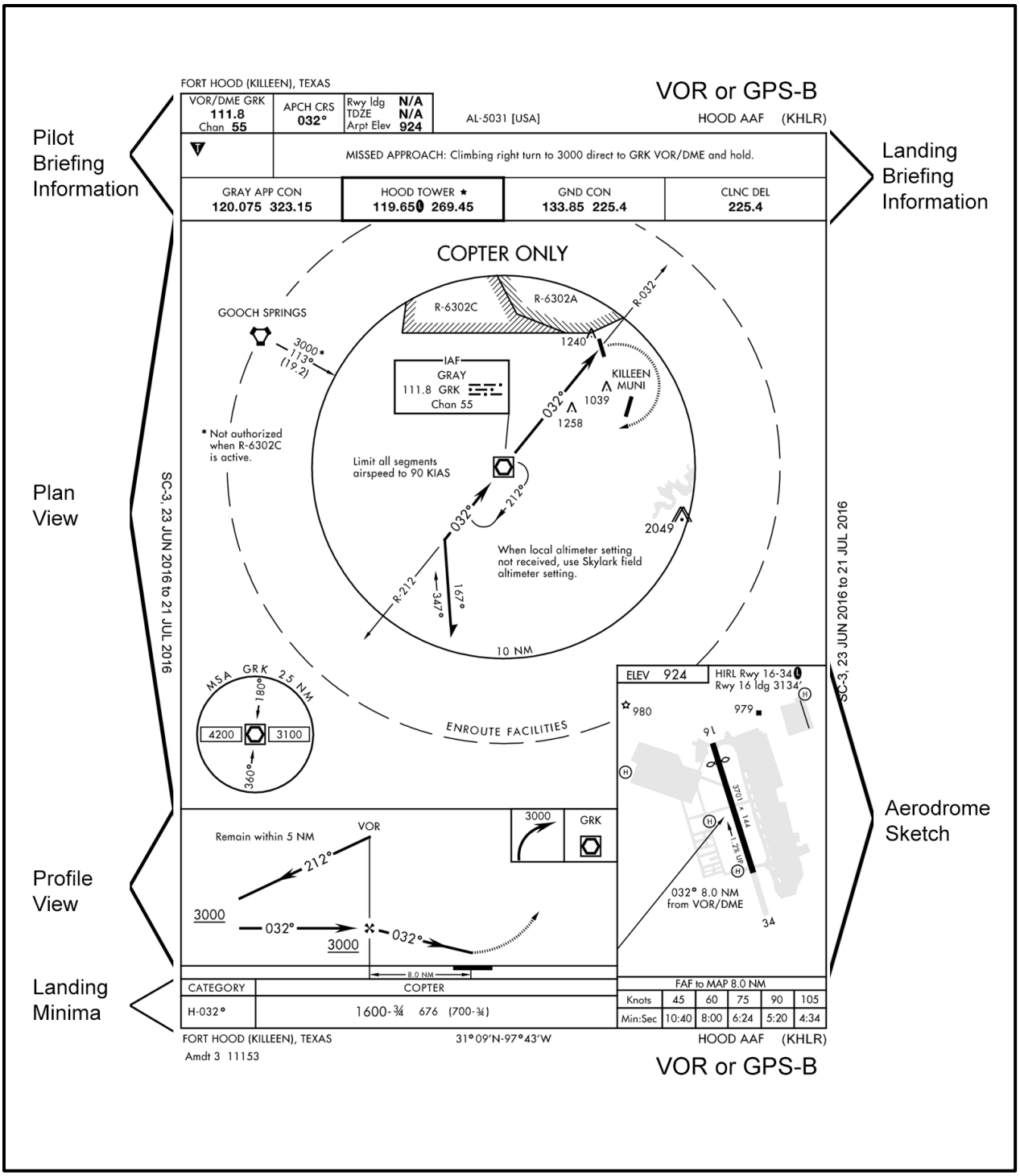


Figure 8-1 Approach Plate Sections

808. PILOT BRIEFING INFORMATION

The pilot briefing information format consists of three horizontal rows of boxed procedure-specific information along the top edge of the chart. Altitudes, frequencies/channels, course and elevation values are charted in bold type. The top row contains the primary procedure navigation information, final approach course, landing distance available, touchdown zone and airport elevations. The middle row contains procedure notes and limitations, icons indicating if non-standard alternate and/or take-off minimums apply, approach lighting, and the full text description of the Missed Approach procedure. The bottom row contains air to ground communication facilities and frequencies in the order in which they are used during an approach, with the tower frequency box bolded.

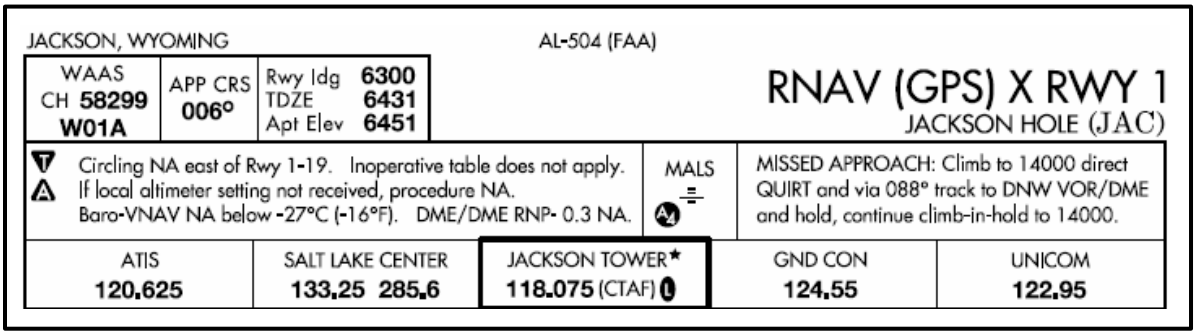


Figure 8-2 Pilot Briefing Information

809. PLAN VIEW

The majority of instrument flight procedure charts contain a reference or distance circle. In such cases, only the data within the reference circle is drawn to scale. This circle is centered on an approach fix and normally has a radius of 10 NM, unless otherwise indicated (Figure 8-3, note the 10 DME radius is in reference to the VORTAC, not the airfield). When a route segment, outside the circle, is not to scale the symbol interrupts the segment. Obstacles close-in to the airport that cannot be properly depicted in the plan view are shown on the airport sketch. Some of these obstacles could be controlling obstructions for instrument procedures.

NOTE

1. In some cases, other types of navigation systems, including radar, may be required to execute portions of the approach other than the final segment, or to navigate to the IAF (e.g., an NDB procedure turn to an ILS, a TACAN for the missed approach, or radar required to join the procedure or identify a fix).

2. When radar or other equipment is required for procedure entry from the enroute environment, a note will be charted in the ***plan view*** of the approach procedure chart (e.g., RADAR REQUIRED or TACAN REQUIRED).

3. When radar or other equipment is required on portions of the procedure outside the final approach segment, including the missed approach, a note will be charted in the ***notes box*** of the pilot briefing portion of the approach chart (e.g., RADAR REQUIRED or DME REQUIRED).

4. Notes are not charted when VOR is required outside the final approach segment. Pilots should ensure that the aircraft is equipped with the required NAVAID(s) in order to execute the approach, ***including the missed approach***.

5. Some military (e.g., U.S. Air Force and U.S. Navy) IAPs have these "additional equipment required" notes charted ***only in the plan view*** of the approach procedure and do not conform to the same application standards used by the FAA.

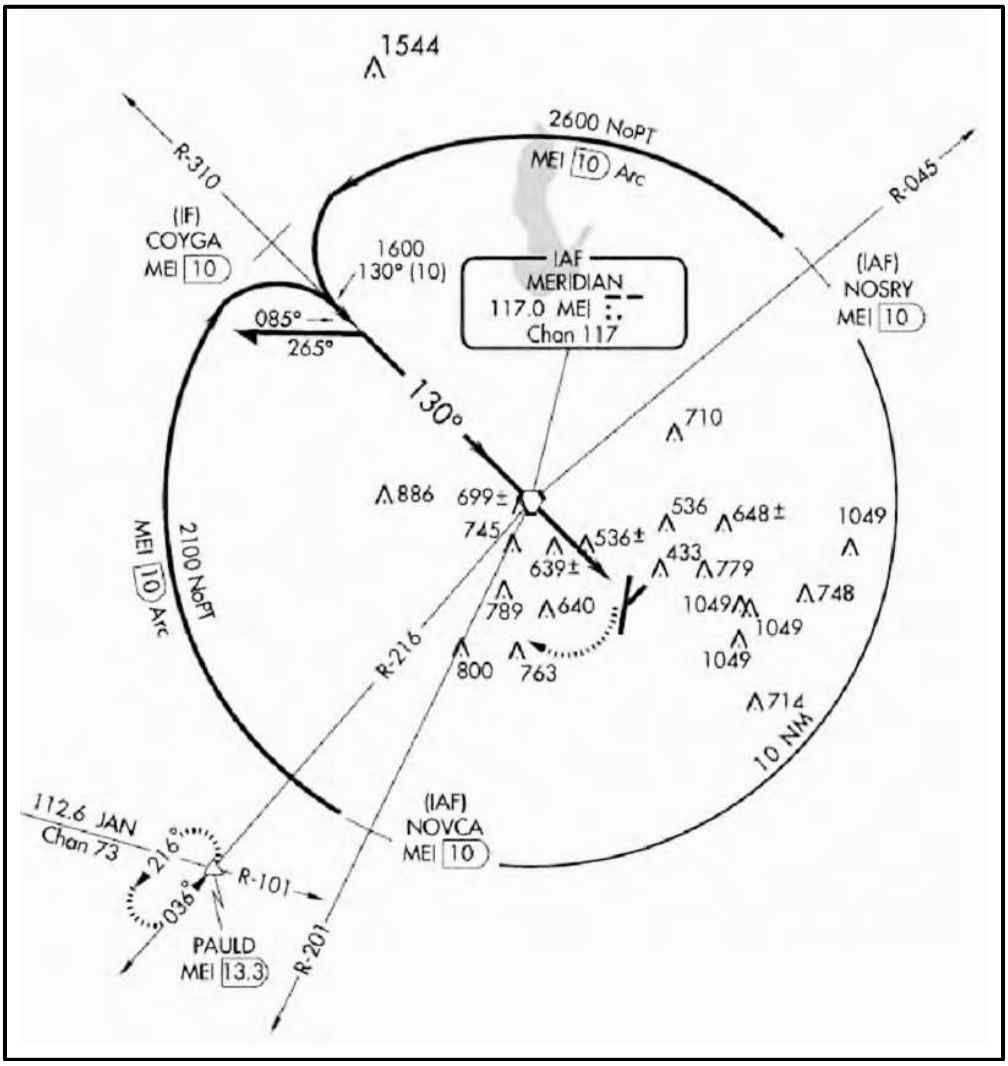


Figure 8-3 Plan View with 10 DME Radius

Terrain Depiction will be depicted in the plan view portion of all IAPs at airports that meet the following criteria:

1. If the terrain within the plan view exceeds 4,000’ above the airport elevation.

2. If the terrain within a 6.0 NM radius of the Airport Reference Point (ARP) rises to at least 2,000’ above the airport elevation.

810. PROFILE VIEW

The Profile View shows a side view of approach procedures (Figure 8-4). The profile view contains:

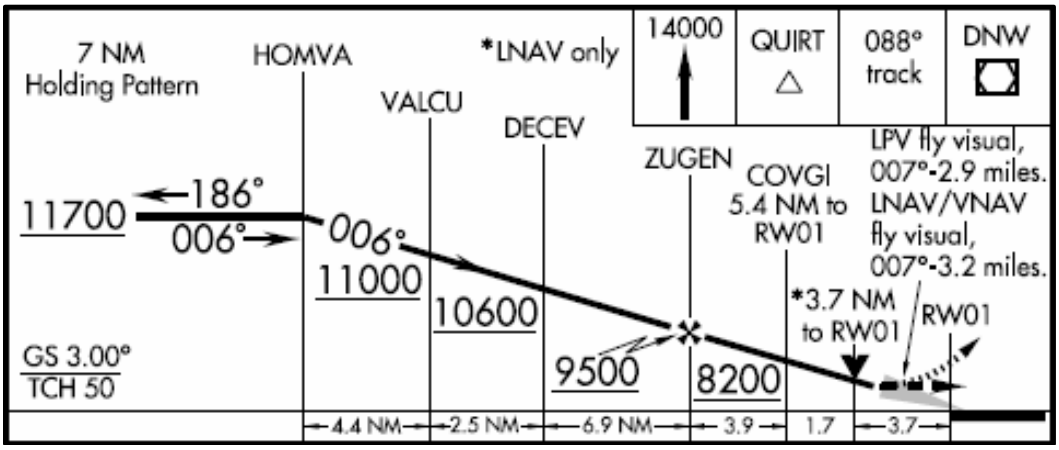


Figure 8-4 Profile View

1. IAF (altitude not specified for all approaches).

2. Course information.

3. Procedure Turn maneuvering area (Procedure Turn must be completed within this distance).

4. Procedure Turn altitude.

5. FAF altitude.

6. FAF symbol (denotes location of the Non precision FAF).

7. Visual Descent Point (VDP), if used.

8. Missed Approach Point (MAP).

In addition to the full text description of the Missed Approach procedure contained in the notes section of the middle-briefing strip, the steps (excluding holding) are charted as boxed icons in the chart profile view (Figure 8-5). These icons provide simple-to-interpret instructions, such as direction of initial turn, next heading and/or course, next altitude, etc.

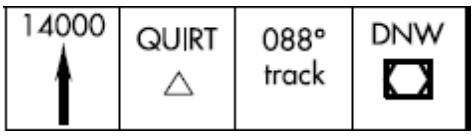


Figure 8-5 Missed Approach Procedure, Boxed Icons

811. LANDING MINIMA SECTION

Standard Landing Minimums: Located below the profile view, the minima section contains the following (Figure 8-6a):

1. Aircraft Approach Category (T-6B is a Category B aircraft if on-speed).

   a. Category A: Speed less than 91 knots.

   b. Category B: Speed 91 knots or more but less than 121 knots.

   c. Category C: Speed 121 knots or more but less than 141 knots.

   d. Category D: Speed 141 knots or more but less than 166 knots.

   e. Category E: Speed 166 knots or more

NOTE

> If it is necessary to maneuver at speeds in excess of the upper limit of a speed range for a category, the minimums for the next higher category should be used. For example, the T-6B is a Category B aircraft, but if circling to land at a speed of 121 knots or higher, use approach Category C minimum due to the possibility of extending the circling maneuver beyond the area for which obstruction clearance is provided.

2. Minimum Descent Altitude (***MDA***); expressed as an MSL altitude. ***Descent below this altitude is unauthorized until the runway environment is in sight and the aircraft is in a position to maneuver safely to land.***

3. Visibility required for the approach in statute miles. Runway visual range (RVR) in hundreds of feet may be used in place of visibility for Straight–in approaches only.

4. Height Above Touchdown (***HAT***); expressed as an AGL altitude. The height of MDA (or DH/DA) above the highest elevation in the touchdown zone (used with straight–in minimums).

5. Ceiling and visibility; used for filing purposes and commencing an approach.

6. Height Above Airport (***HAA***); expressed as an AGL altitude. The height of MDA above published airport elevation (used for circling minimums).

NOTES

1. In the landing minima section, large type altitudes are MSL and small type are AGL.

2. HAT is associated with Straight-in approaches. HAA is associated with Circling approaches. MDA is associated with Non-precision (no glideslope) approaches.

CATEGORY	A	B	C	D	E
S-ILS 13	* 243/24 200 (200-½)				
S-LOC 13	480/24 437 (500-½)		480/40 437 (500-¾)	480/50 437 (500-1)	
CIRCLING	500-1 457 (500-1)	520-1 477 (500-1)	580-1½ 537 (600-1½)	740-2¼ 697 (700-2¼)	860-3 817 (900-3)

Figure 8-6a Landing Minima

RNAV Landing Minimums: RNAV instrument approach procedure charts now incorporate all types of approaches using Area Navigation systems, both ground based and satellite based.

The standard format for RNAV minima (and landing minima) is as shown in Figure 8-6b.

RNAV minima are dependent on navigational equipment capability, as stated in the applicable NATOPS Flight Manual.

CATEGORY	A	B	C	D
LPV DA	7393-2 962 (1000-2)			
LNAV/ VNAV DA	7470-2 1039 (1100-2)		7470-3 1039 (1100-3)	
LNAV MDA	7640-1 1/4 1209 (1200-1 1/4)	7640-1 1/2 1209 (1200-1 1/2)	7640-3 1209 (1200-3)	
CIRCLING	7640-1 1/4 1189 (1200-1 1/4)	7640-1 1/2 1189 (1200-1 1/2)	7640-3 1189 (1200-3)	

Figure 8-6b IFR RNAV Landing Minima

NOTES

1. Aircraft approach categories are based on an approach speed of 1.3 times the stall speed in the landing configuration at maximum gross weight.

2. The T–6B is an Approach Category B aircraft based on approach speed of 91 to < 120 KIAS.

3. Each category provides 300’ of obstacle clearance at MDA within the circling radius.

4. If flying faster approach speeds, you can always go up a category, but never down.

5. The T-6B is certified to fly RNAV GPS approaches to LNAV MDA minimums.

812. USE OF RADAR ALTIMETER DURING INSTRUMENT APPROACHES

It is highly recommended to use the radar altimeter as a low altitude warning system (LAWS) to alert the pilot when reaching a DA/DH on a precision approach or when descending slightly below an MDA during a non-precision approach. The following guidelines are recommended:

Include ***“RAD ALT set to ___,”*** at the end of the landing checklist during the transition to BAC, prior to the FAF.

For precision approaches:

Set the radar altimeter to the appropriate ***HAT*** from the minima section of the approach plate (to comply with OPNAVINST 3710.7 single-piloted minimums, this will never be less than 200’).

For Non-Precision approaches:

Set the radar altimeter to the Height Above Touchdown (HAT) minus 10% for straight in non-precision approaches and Height Above Airport (HAA) minus 10% for circling non-precision approaches. Setting the radar altimeter slightly below HAT/HAA will allow the pilot to maintain the MDA without distraction, yet provide a warning if the MDA is unintentionally breached.

NOTE

The Radar Altimeter is used as a low altitude warning system. It is ***not*** the primary means of identifying the DA/DH or MDA during instrument approaches.

813. AERODROME SKETCH

The aerodrome sketch is provided on each approach plate in either the lower left–hand or right-hand corner. It shows the runways, taxiways, airport lighting, control tower, vertical obstructions, and the field elevation. All elevations are in feet above Mean Sea Level (MSL).

Note the timing "FAF to MAP" information at the bottom of the aerodrome sketch. This table is used to determine the timing from the FAF to the MAP, at various ***ground speeds***.

For example (see Figure 8-7), with an approach speed of 120 KIAS and 10 knots of headwind, groundspeed becomes 110 knots. The timing in this case must be interpolated: 110 knots = 2 min 23 seconds.

On approaches where the missed approach point is identified with DME and timing is also available, timing should be used as a back-up in event of DME failure.

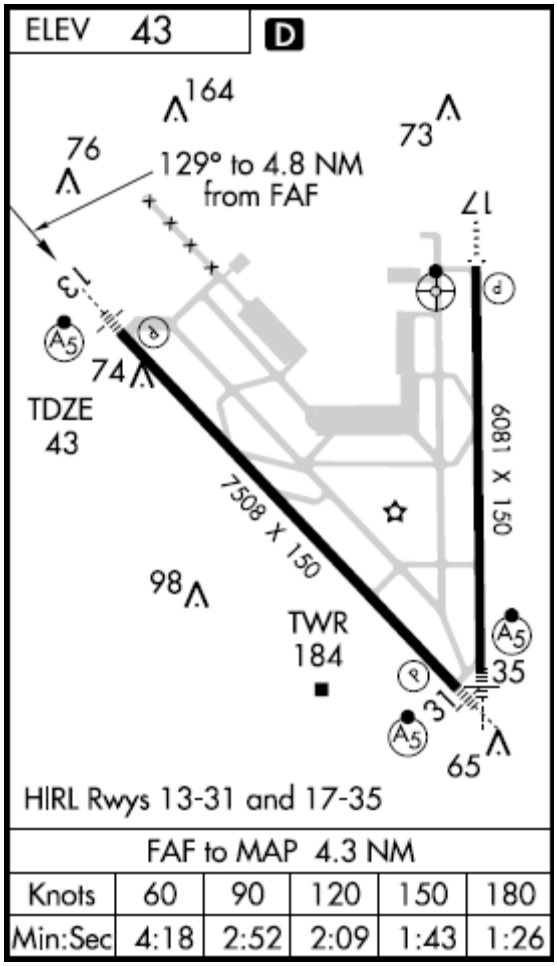


Figure 8-7 Aerodrome Sketch

814. PROCEDURE TURN APPROACH

General

Reverse the aircraft heading within assigned airspace in order to align it with the final approach course.

Description

The Procedure Turn Approach is an instrument maneuver used to reverse direction and establish the aircraft inbound on the intermediate or final approach course while insuring the "Remain Within" distance is observed. Procedure Turns are depicted by a "barb" symbol on the approach plate. The Barb indicates which side of the outbound course to complete the turn (Figure 8-8). Headings are provided to reverse course using a 45/180 degrees type maneuver. However, the point at which the turn may be commenced and the type and rate of turn, are left to the discretion of the pilot, as long as the Procedure Turn is executed on the proper side of the outbound course and the "Remain Within" distance (normally 10 NM) is not exceeded. Options for this type of maneuver include the 45/180 degrees course reversal, the racetrack pattern, or the 80/260 degree course reversal. During Primary training, only the 45/180 degrees course reversal will be practiced.

Do ***NOT*** execute a Procedure Turn when:

1. ATC clears you for a **S**traight-in approach.

2. Flying the approach via "**N**oPT" routing.

3. **E**stablished in a holding pattern aligned with the procedure turn course and subsequently cleared for the approach.

4. ATC **R**adar vectors you to final.

5. Cleared for a **T**imed approach.

"SNERT" is a useful mnemonic to aid in recall of these restrictions.

Procedure

The following procedures assume clearance for the DAYTONA BEACH INTERNATIONAL VOR RWY 16 approach (Figure 8-8) has been received and you are proceeding to the IAF.

1. Approximately 5 NM prior to the IAF, slow to 150 KIAS. At the IAF, indicated by station passage, execute the 6 Ts (Over-the-Station Intercept):

   a. **TIME** - Not required.

b. **TURN -** in the shortest direction to parallel the outbound course (336º). If the outbound course is more than 90° from the course used inbound to the IAF, turn to an intercept heading not to exceed 45°.

c. **TIME -** Start timing for one (1) minute outbound when wings level or abeam the station, whichever occurs last.

NOTE

Comply with the "remain within distance" if stated on the approach plate.

d. **TRANSITION -** If a descent is necessary at the IAF, set approximately 15% torque, lower the nose, and descend at 150 KIAS.

NOTE

Comply with any additional altitude restrictions imposed by ATC.

e. **TWIST**/ Intercept

i. Set CDI to the outbound course (336º).

ii. Use "Over-the-Station Intercept" procedures to establish the aircraft on course outbound. The objective is to be established on the outbound radial by the end of one minute.

f. **TALK -** Give an appropriate voice report if required.

2. ***Level-off*** at Procedure Turn altitude (1600').

a. Approximately 100' prior to the Procedure Turn altitude, add power smoothly towards 33% torque as you raise the nose to level flight attitude and re-trim.

b. Maintain Procedure Turn altitude until you are established on the inbound course.

NOTE

The aircraft is not considered "established on course" until the head of the bearing pointer is within five radials of the inbound course. With the CDI set correctly, the course deviation bar will be between the "one dot" and "centered" position.

3. At the end of outbound timing, execute the 45/180 degrees course reversal by turning 45° to the heading depicted on the "barb" symbol (291º). Start the clock as you roll wings level and maintain this heading for one (1) minute. Twist in the inbound course (156º) in the CDI.

4. At the end of one (1) minute timing, execute a 180º turn in a direction opposite the first turn (i.e., turn away from the station). Approaching the barb heading (111°), note the head of the bearing pointer.

a. If the head of the bearing pointer is not within 5° of the inbound course, stop the turn on the heading depicted on the barb (111°).

b. If the head of the needle is within 5° of the inbound course, continue the turn and roll out with a double-the-angle intercept. If you overshoot the inbound course, turn to establish an appropriate intercept.

5. As you intercept the inbound course, turn and track inbound.

6. Once established on the inbound course, and within 5 NM of the FAF (when DME is available), configure to BAC. Maintain altitude until reaching 120 KIAS then commence any descent required (***Slow Down, Then Go Down***). In this case maintain 1600' until the FAF.

7. Comply with the remainder of the Low Altitude Instrument Approach Procedures.

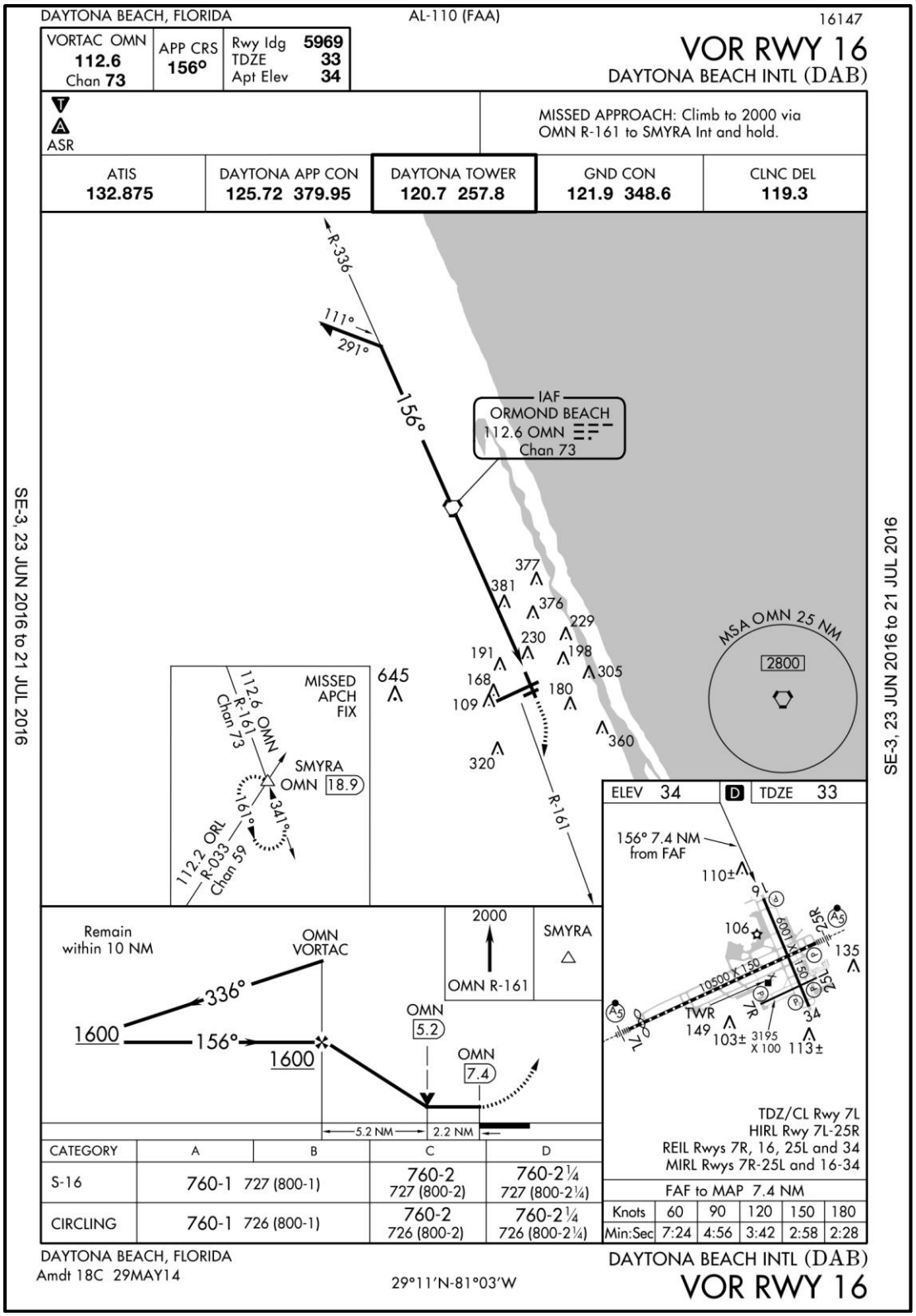


Figure 8-8 VOR RWY 16 (KDAB)

815. TEARDROP APPROACH

General

Reverse the aircraft heading in order to align it with the final approach course.

Description

A Teardrop approach makes use of an outbound to inbound radial intercept maneuver to reverse course and establish the aircraft inbound on the intermediate or final approach course while insuring the "Remain Within" distance is observed. A Non-Depicted Teardrop approach is an authorized variant to the Procedure Turn, and is flown by intercepting an outbound radial offset 20° to the protected "barb" side of the Procedure Turn Final Approach Course.

Procedure

The following procedures assume clearance for the ROBINS AFB VOR RWY 15 approach (Figure 8-9) has been received and you are proceeding to the IAF.

1. Approximately 5 NM prior to the IAF, slow to 150 KIAS. At the IAF, indicated by station passage, execute the 6 Ts (Over-the-Station Intercept):

a. **TIME** - Not required.

b. **TURN** - Turn in the shortest direction to parallel the outbound course (295º). If the outbound course is more than 90° from the course used inbound to the IAF, turn to an intercept heading not to exceed 45°.

c. **TIME** - Start timing for two (2) minutes outbound when wings level or abeam the station, whichever occurs last.

NOTE

In strong winds or at indicated speeds greater than 150 KIAS, you may have to adjust outbound timing to comply with any "Remain Within" distance associated with the approach. Normally, (2) two minutes timing outbound will be sufficient.

d. **TRANSITION** - If a descent is necessary at the IAF, set approximately 15% torque, and descend at 150 KIAS.

NOTE

Comply with any additional altitude restrictions imposed by ATC.

e. **TWIST** /Intercept

i. Set the outbound course (295º) into the CDI.

ii. Use "Over-the-Station Intercept" Procedures to establish the aircraft on course outbound. The objective is to be established on the outbound radial by the end of one minute.

f. **TALK -** Give an appropriate voice report if required.

2. ***Level-off*** at Procedure Turn altitude (2300').

a. Approximately 100' prior to the Procedure Turn altitude, add power and raise the nose to maintain 150 KIAS in level flight. Continue to re-trim.

b. Maintain Procedure Turn altitude until you are established on the inbound course.

NOTE

The aircraft is not considered "established on course" until the head of the bearing pointer is within five radials of the inbound course. With the CDI set correctly, the course deviation bar will be between the "one dot" and "centered" position.

3. After 1 ½ minutes of outbound timing, twist inbound course into the CDI (134º).

4. At two (2) minutes of outbound timing, execute a turn in the direction depicted (in this case, turn right). During the turn inbound note the position of the bearing pointer:

a. If the head of the bearing pointer is not within 5º of the inbound course, stop the turn with a 45º intercept.

b. If the head of the bearing pointer is within 5º of the inbound course, you should roll out with a double–the–angle intercept. If you overshoot the inbound course, turn to establish an appropriate intercept.

5. Once established on the inbound course, and within 5 NM of the FAF (when DME is available), configure to BAC. Maintain altitude until reaching 120 KIAS then commence any descent required (in this case descend to 1500' MSL, ***Slow Down, Then Go Down***).

6. Comply with the remainder of the Low Altitude Instrument Approach Procedures.

NOTE

To facilitate training, if local VOR approaches do not have a Teardrop procedure available, a procedure turn approach may be

used to substitute by intercepting an outbound radial offset 20º to the barb side of a depicted procedure turn Final approach course and continue with FTI procedures for a Teardrop procedure turn.

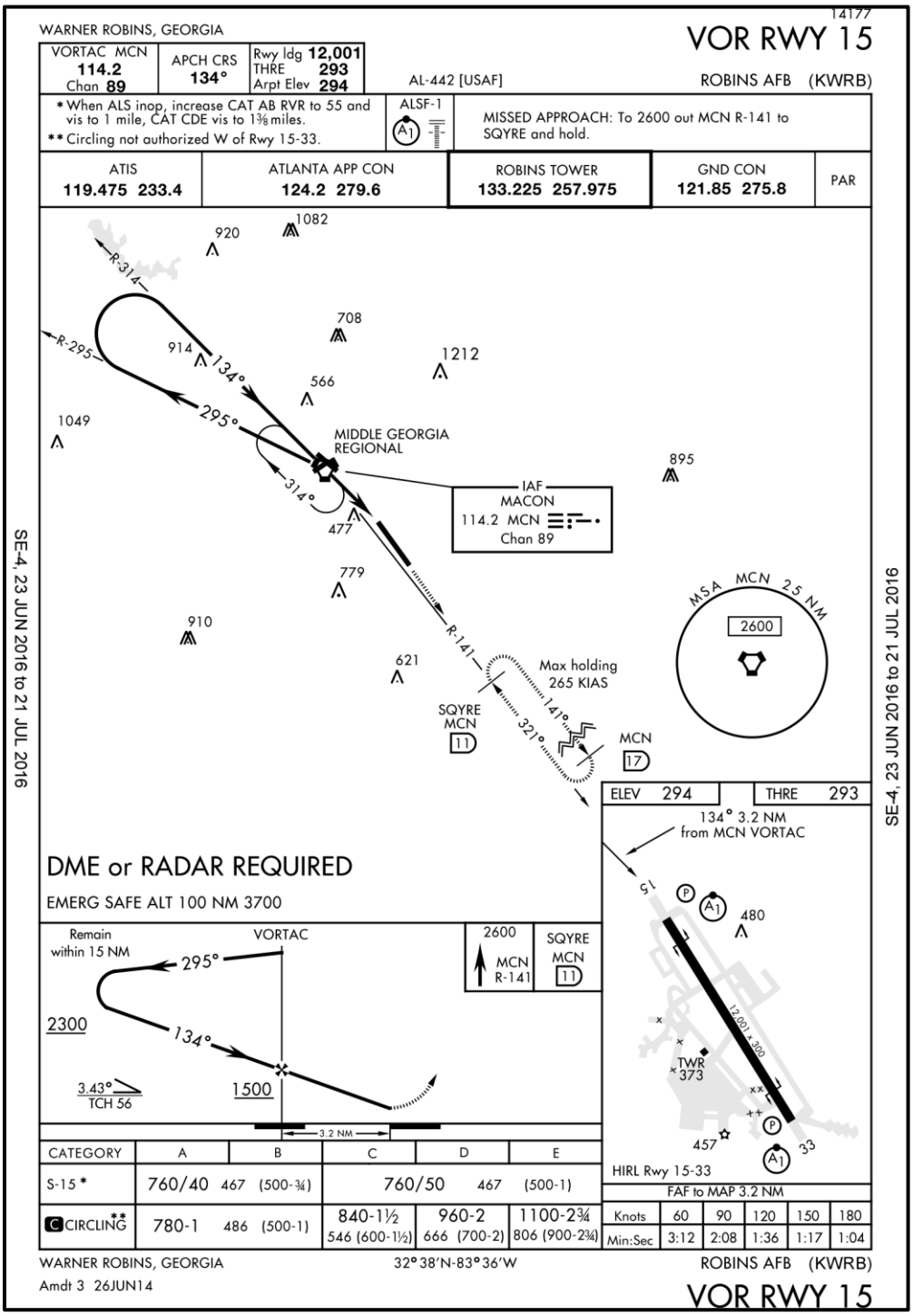


Figure 8-9 VOR RWY 15 (KWRB)

816. ARCING APPROACH

General

Establish the aircraft inbound on the final approach course.

Description

An Arcing approach makes use of an arcing maneuver to position the aircraft inbound on an intermediate or final approach course. Arcing approaches are normally identified by VOR/DME or TACAN in the approach plate margin, indicating DME is required.

Procedure

The following procedures assume clearance for the VOR/DME Z or TACAN Z RWY 13R (KNGP) approach (Figure 8-10) has been received and you are proceeding direct to the IAF.

1. Approximately 5 NM prior to the IAF and commencing the approach, slow to 150 KIAS. At the IAF, execute the 6 T's:

   a. **TIME** - Not required.

   b. **TURN** - To place the VOR bearing pointer at the 90º benchmark.

   NOTE

   Use Radial/Arc and Arc/Radial intercepts to make the turn onto and off of the arc.

   c. **TIME** - Not required.

   d. **TRANSITION** - Comply with altitude restrictions as required (no lower than 1600' inbound from RYNOL to FAF).

   e. **TWIST** - Ensure the inbound course (143º) is set in the CDI.

   f. **TALK** - Give an appropriate voice report if required.

2. Anticipate interception of the final approach course (reference the bearing pointer and CDI). Use an appropriate lead radial for the 90 degree turn.

NOTE

On some approach charts, a published lead radial (designated "LR-xxx") is provided as an advisory point for turning onto the inbound course. These designated lead radials are based on an aircraft groundspeed of 200 knots and using a ½ SRT. For normal approach speeds of 150 KIAS compute the lead radial based on an SRT.

3. When within 5 NM of the FAF, make a level or descending transition to BAC, as required.

4. Once established inbound, comply with the remainder of the Low Altitude Instrument Approach Procedures.

Common Errors

1. Overshooting the arc or final approach course due to insufficient lead or slow scan of instruments.

2. Failure to descend to minimum altitudes for the various approach segment

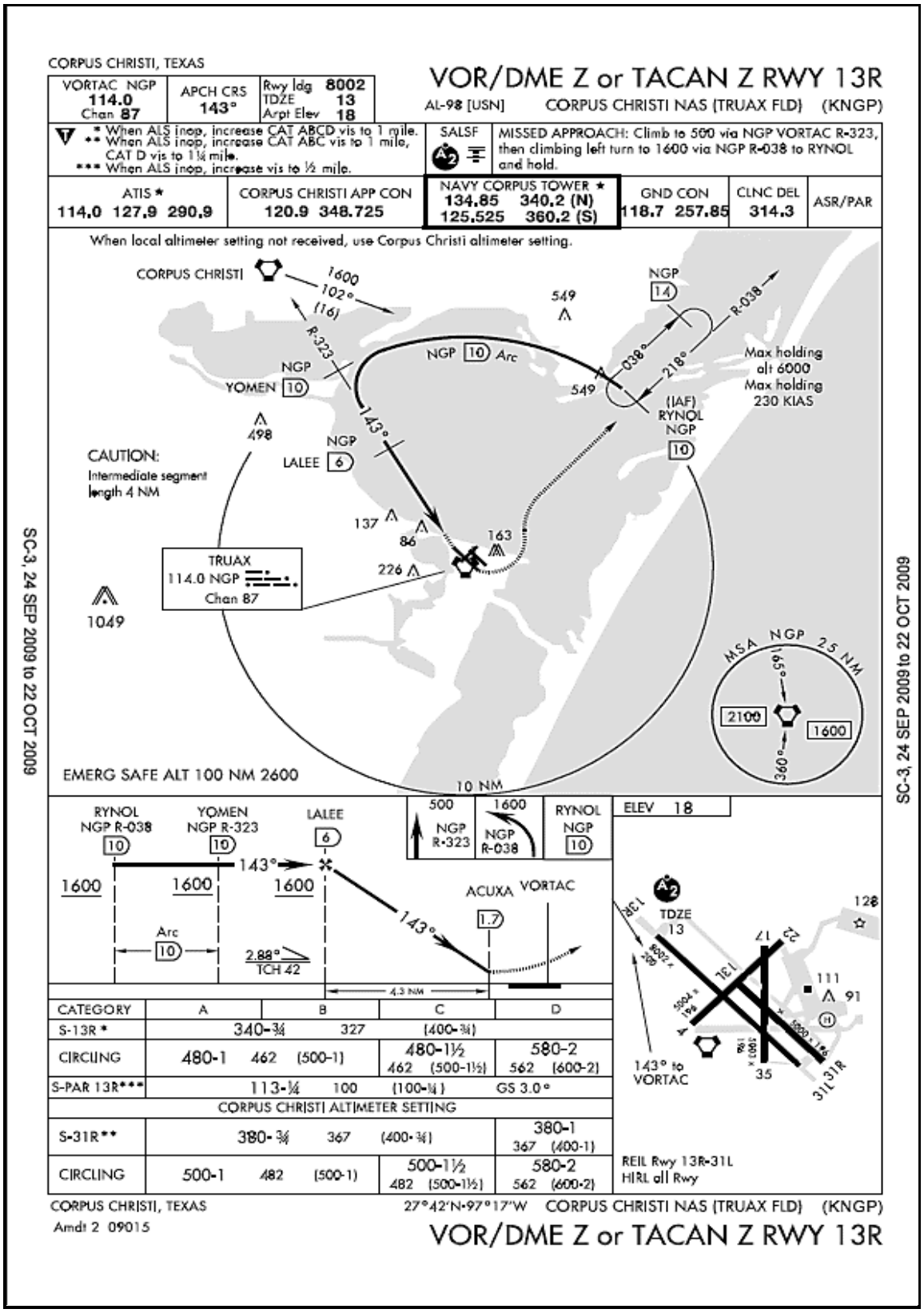


Figure 8-10 VOR/DME Z or TACAN Z RWY 13R (KNGP)

817. HOLDING PATTERN APPROACH (HILO)

General

The Holding Pattern Approach/Holding In Lieu Of (HILO) is a type of a procedure turn.

Description

The HILO approach uses a published holding pattern to reverse course and establish the aircraft inbound on the intermediate or final approach course. HILO approaches are printed using a normal holding pattern track with a heavy line indicating "In lieu of Procedure Turn." The entry maneuvering in the pattern utilizes normal holding procedures. ***Only one turn in the Holding Pattern is authorized***. If more turns are necessary to lose excessive altitude or to become better established on course, ATC clearance must be obtained.

In Figure 8-11 below, Case I allows for a descent to the initial published altitude (1600') during the entry orbit but no lower until crossing the FAF. Case II depicts a minimum holding altitude where a descent below the initial altitude (to 1300') may be conducted once established inbound.

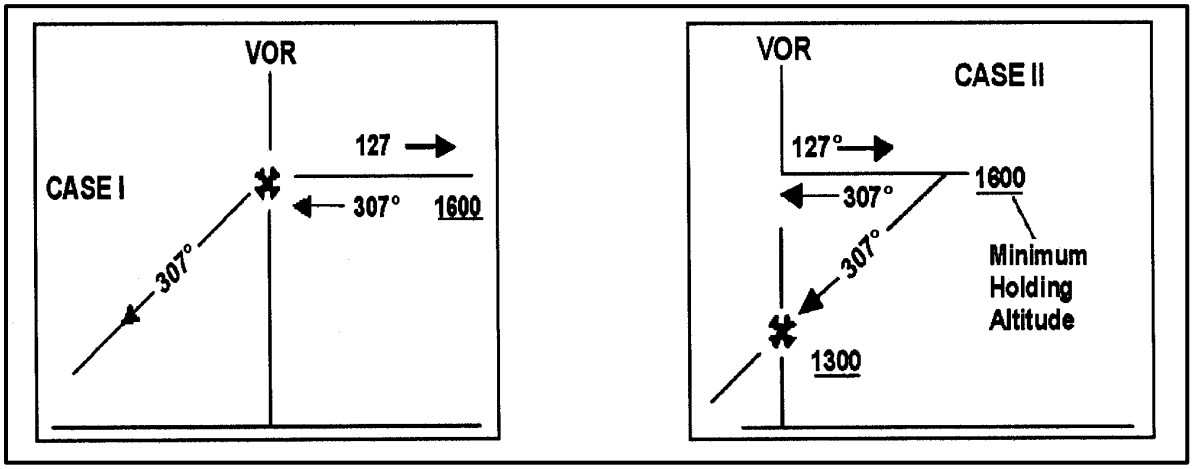


Figure 8-11 Holding Fix Descent

Unlike the Teardrop and Procedure Turn approaches, the Holding Pattern approach will always have a FAF depicted on the approach.

Procedure

The following procedures assume clearance for the MARIANNA MUNI VOR or GPS–A approach (Figure 8-12) has been received and you are proceeding to the IAF.

1. Approximately 5 NM prior to the IAF, slow to 150 KIAS. At the IAF, indicated by station passage, execute the 6 Ts.

   a. **TIME** - Not required

b. **TURN -** Use normal Holding Pattern entry procedures to determine the entry heading and turn direction. Turn in the shortest direction to your entry heading.

c. **TIME -** Start timing as required (one minute in this case) when wings level or abeam the station, whichever occurs last.

d. **TRANSITION -** If a descent is necessary at the IAF (2000'), set approximately 15% torque, lower the nose, and descend at 150 KIAS.

NOTE

Comply with any additional altitude restrictions imposed by ATC.

e. **TWIST** – Enter in the depicted inbound course (316º) into the CDI.

f. **TALK** – Give the appropriate voice report if required.

2. Determine direction for the turn to intercept the inbound course (316º). ***TAIL–RADIAL–TURN!***

3. At the completion of the outbound leg, turn inbound. Roll out of the turn with an appropriate intercept to establish the aircraft **on** the inbound course prior to crossing the holding fix (a double–the–angle intercept will normally suffice when over a VOR).

4. Once established inbound, and when within 5 NM of FAF (when DME is available), make a level or descending transition to BAC as required (descending transition down to 1700'in this case…***Slow Down, Then Go Down***).

5. Comply with the remainder of the Low Altitude Instrument Approach Procedures.

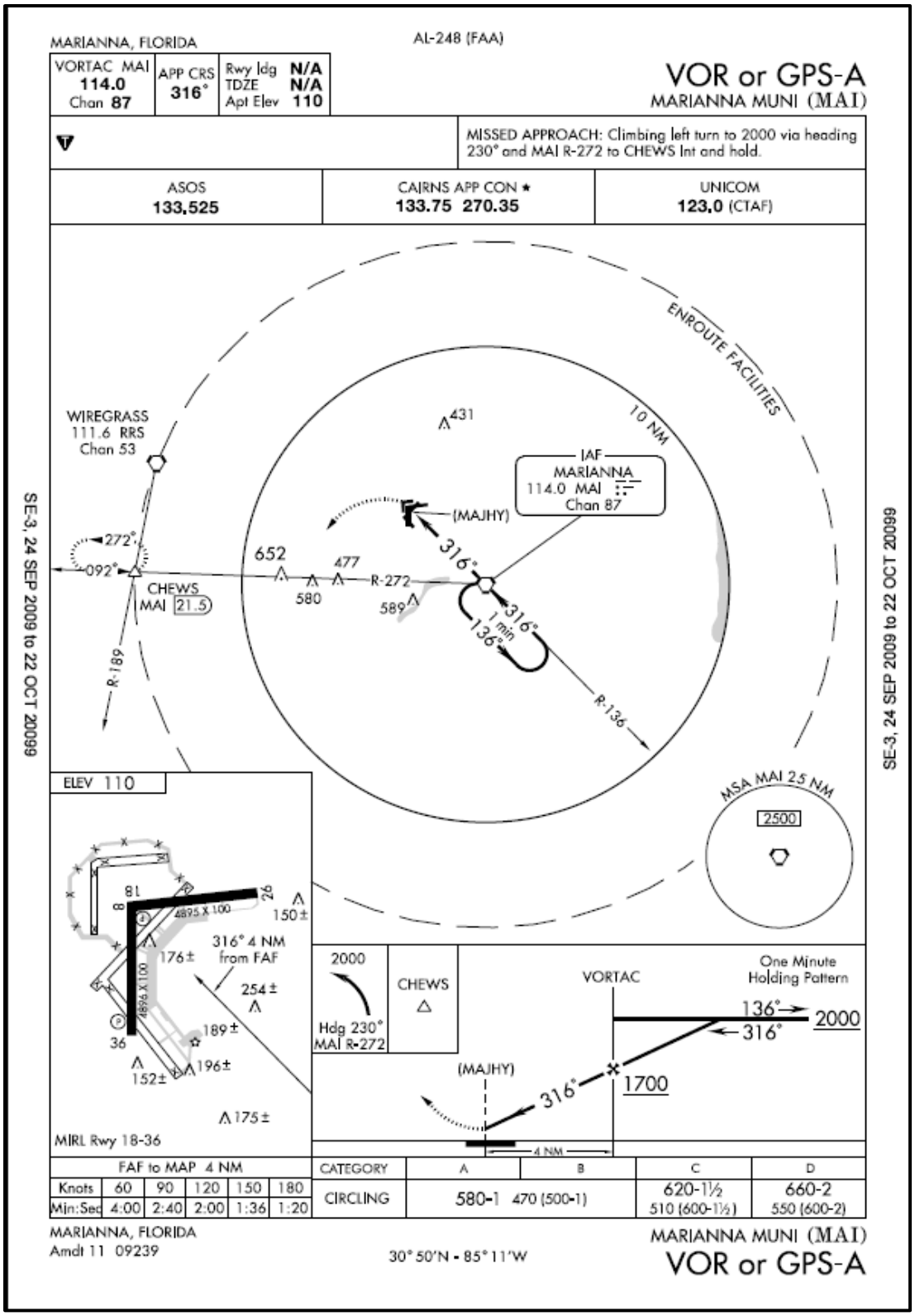


Figure 8-12 VOR or GPS-A (KMAI)

818. STRAIGHT-IN APPROACH

General

Establish the aircraft inbound on a Straight-in approach.

Description

A Straight-in approach is an Instrument approach conducted by proceeding from an IAF to the FAF at a prescribed altitude and continuing inbound on the final approach course to the airport without making a Procedure Turn. These approaches utilize intersections, VOR/DME fixes, and other NAVAIDs as IAFs that may or may not be aligned with the final approach course. IAFs may be located on airways to simplify the transition from the enroute phase to the terminal phase of flight.

NOTE

A Straight–in procedure ***does not*** mean the approach must be completed with a Straight–in landing or made to straight-in landing minimums.

Generally, there are two basic types of Straight-in approaches:

1. Approaches that have the IAF aligned with the final approach course (IAF "CSG" in Figure 8-13).

2. Approaches that do not have the IAF aligned with the final approach course. Where the term "No PT" is designated along a track arrow (thick arrow) from an IAF, you will not fly a Procedure Turn.

Examples:

1. IAF on an arc: "GIFLE" or "JEPED" in Figure 8-14

2. A feeder NAVAID: "TNV" in Figure 8-14

3. An Enroute feeder fix: "MINIM" in Figure 8-15

NOTE

The absence of the "NoPT" designation, at the enroute feeder fix or a feeder NAVAID, indicates that the feeder fix or NAVAID is solely used to direct the aircraft to an IAF along a designated track and altitude. If cleared for an approach while tracking inbound to the IAF from a feeder fix (***thin*** arrow, ***not*** designated "NO PT" or "IAF"), you may descend to the altitude depicted along the feeder,

or IAF crossing altitude, whichever is higher. Upon arrival at the IAF, perform the appropriate approach procedures.

Straight-in approaches may display an arrival holding pattern at the IAF. Fixes along the approach defined by distance will require TACAN, VOR/DME, or a GPS waypoint. Some approaches provide intersections formed by radial cuts from another facility to provide fix information. See SALEN or FACEN intersections on the VOR RWY 29 (KAUO), Figure 8-13.

Procedure

The following procedures assume that you arrived at the IAF "MINIM" and are cleared for the STARKVILLE/OKTIBBEHA VOR or GPS–B straight–in approach (Figure 8-15).

Approximately 5 NM prior to the IAF and commencing the approach, slow to 150 KIAS (see note for exception).

1. At the IAF (enroute feeder fix MINIM "NO PT"):

   a. **TIME** - Not required.

   b. **TURN** - Turn in shortest direction to intercept the initial approach course (258º).

   c. **TIME** - If required.

NOTE

If distance from the IAF to the Final Approach Fix is excessive (e.g., more than 10 NM), normal cruise airspeed should be maintained until 10 NM from the FAF before slowing to 150 KIAS.

   d. **TRANSITION**

      i. If a descent is required, establish the aircraft on course, and then use terminal descent procedures to descend to the altitude specified (1900' and level-off at normal cruise airspeed until within 10 NM of the FAF).

      When within 5 miles of the FAF:

      ii. Make a level or descending transition to BAC. If a descent is required ...***Slow Down Then Go Down***.

   e. **TWIST**/Intercept

      i. Twist the initial approach course (IAC) into the CDI (258º).

ii. Turn to intercept and track the initial approach course inbound to the FAF.

f. **TALK** - Give the appropriate voice report, if required.

2. Comply with any altitude restrictions on the approach.

3. Once established inbound, comply with the remainder of the Low Altitude Instrument Approach Procedures.

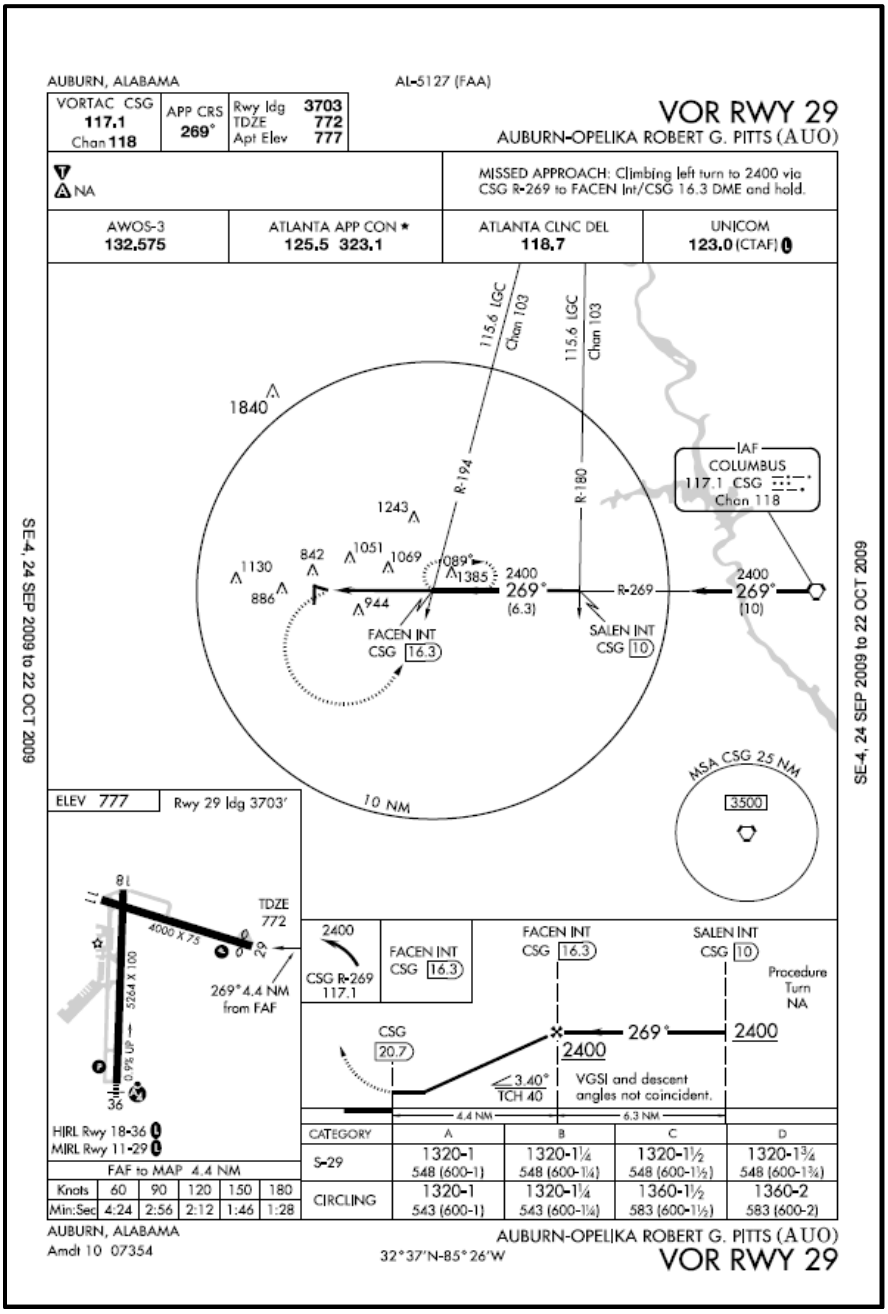


Figure 8-13 VOR RWY 29 (KAUO)

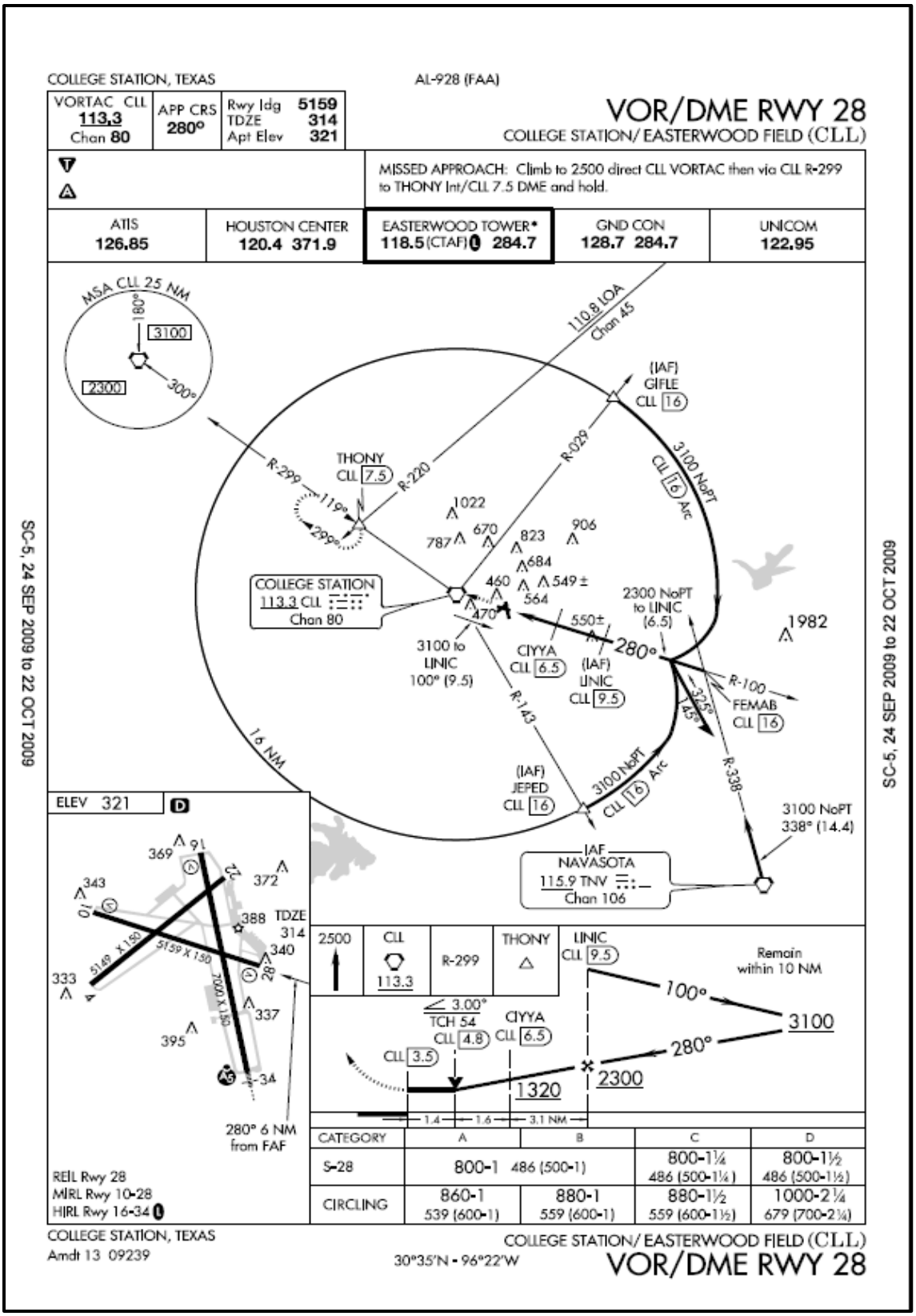


Figure 8-14 VOR/DME RWY 28 (KCLL)

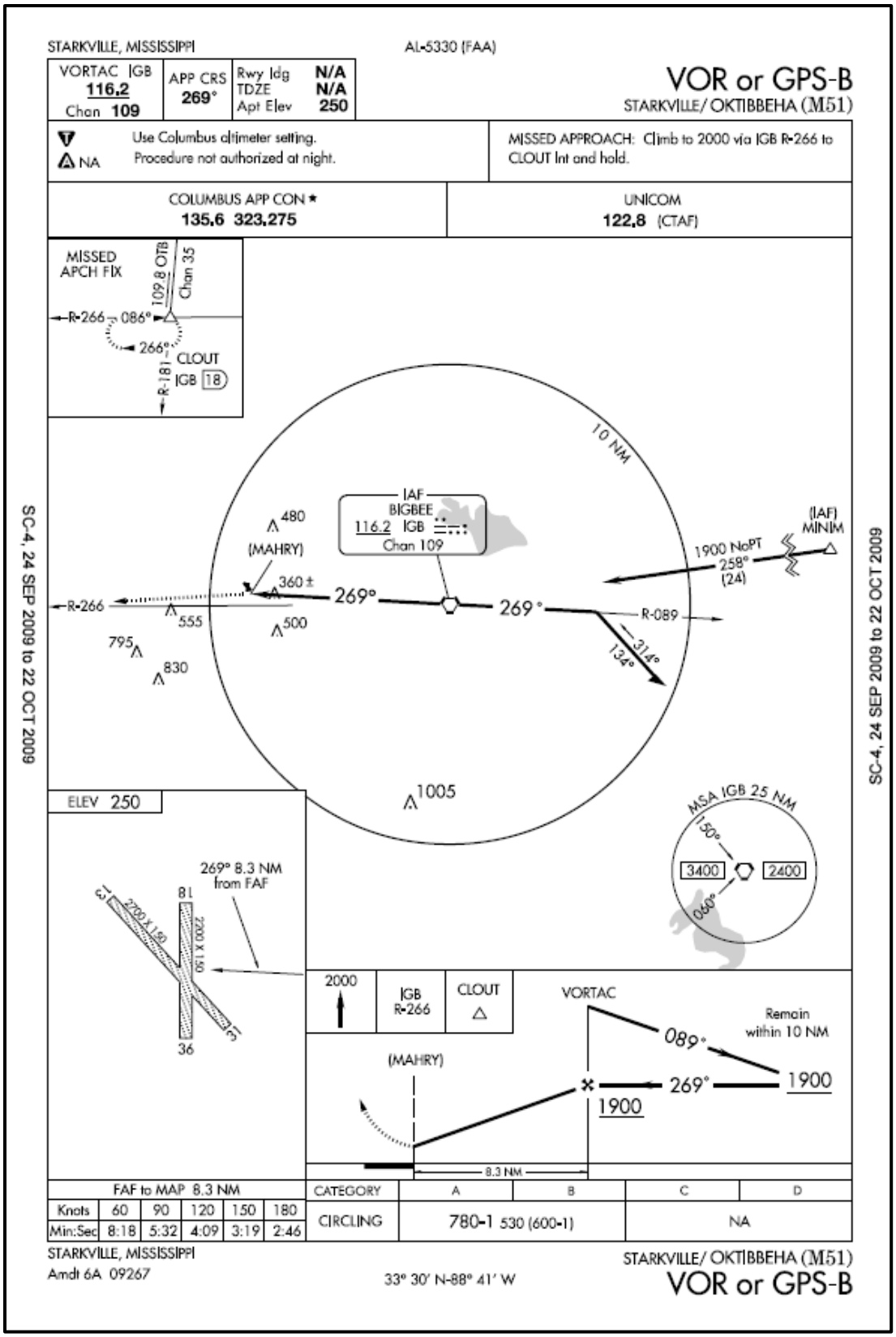


Figure 8-15 VOR or GPS-B (M51)

819. RADAR VECTORS TO FINAL APPROACH COURSE (RVFAC)

General

Navigate to the final approach course following controller instructions.

Description

Radar vectors to final approach course is a procedure used by approach control to increase the arrival rate of aircraft by providing vectors onto the final approach course through the most expeditious routes consistent with traffic situations.

Although this routing does expedite arrival at your destination, it has one characteristic of which you should be aware – the lack of published minimum altitudes until joining a segment of a published approach. Approach control has the statutory responsibility for ensuring terrain clearance while vectoring you for the approach. This is done using Minimum Vectoring Altitude (MVA) charts superimposed on radar displays.

NOTE

Pilots should never fully relinquish the responsibility for terrain clearance to an outside agency. Maintain situational awareness and crosscheck terrain clearance altitude by using available NAVAIDS and charts. Never blindly follow vectors from a controller. Be aware of what lies ahead on your assigned heading. If in doubt, query the controller.

Procedure

Fly 200 KIAS on downwind and 150 KIAS on base. If being vectored on an extended final or extended dog-leg to final, maintain 200 KIAS until within 15 NM of the airport (Figure 8-16).

1. Tune and identify the appropriate NAVAID.

2. Check the PFD is configured properly.

3. Set the final approach course into the CDI.

4. Follow radar vectors given by approach control.

5. If a lower altitude is assigned, perform a terminal descent.

6. Transition to BAC:

   a. When within 5 NM of the FAF and aircraft heading is within 90º of the final approach course.

b. Once established on the FAC and cleared for the approach if no FAF is depicted.

7. When cleared for the approach, maintain the last assigned altitude and heading given by ATC until established on the approach. As the CDI begins to center, ***and you are cleared for the approach***, you are expected to turn onto the final approach course and track inbound.

8. Once established inbound, comply with the remainder of the Low Altitude Instrument Approach Procedures.

Common Errors

1. Poor orientation, loss of SA.

2. Not setting the correct NAV source in the PFD.

3. Failure to transition to BAC at the appropriate time.

4. Failure to intercept the approach course once cleared for the approach. Be alert for CDI movement and lead the turn sufficiently to roll out on course.

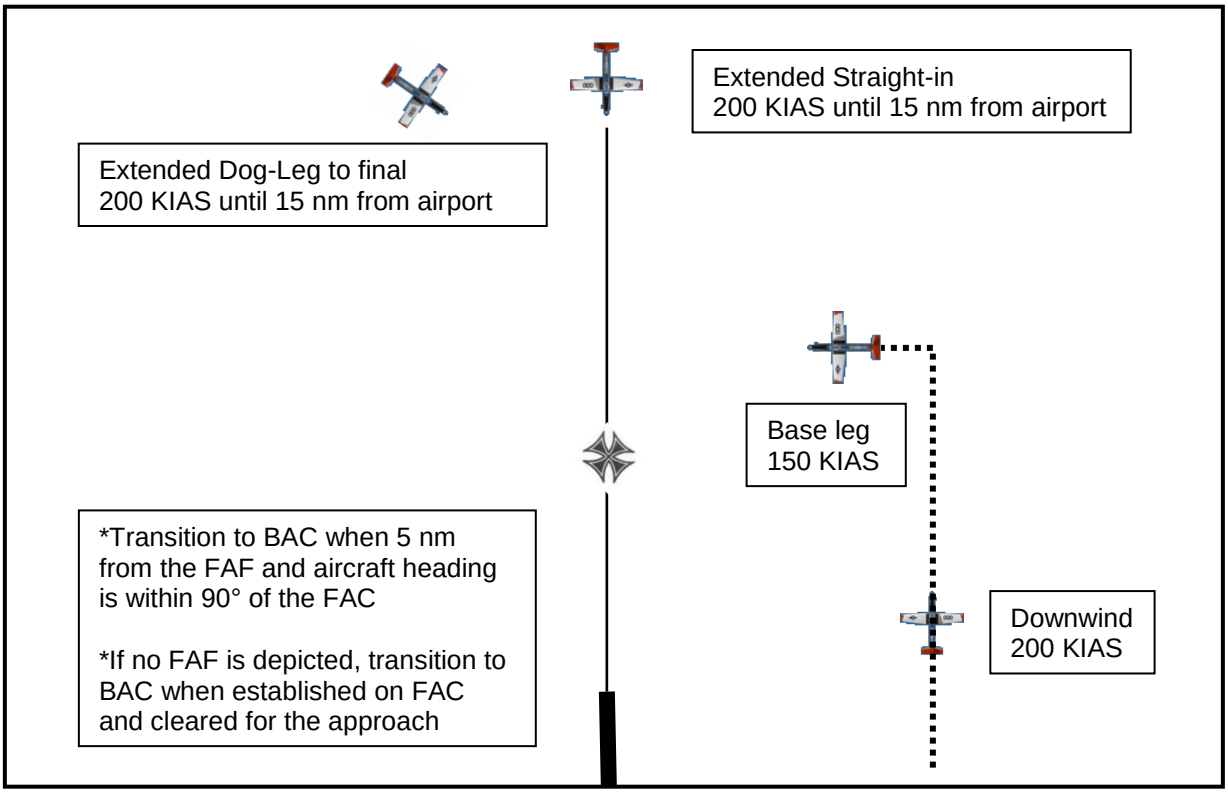


Figure 8-16 RVFAC (FAF Depicted)

820. HIGH ALTITUDE APPROACH

Description

A high altitude instrument approach enables an aircraft to transition from the high altitude structure to the final approach course for landing. These approaches are routinely executed by high performance military aircraft into military aerodromes to maintain efficient fuel consumption, higher TAS, and to avoid low altitude weather until closer to the destination.

The procedures used to execute a High Altitude Instrument approach combine a penetration descent with Instrument Approach Procedures (typically a Teardrop, Arcing, or Straight-In approach). For this reason, High Altitude approaches normally require higher indicated airspeeds and rates of descent until the transition to BAC. Once the aircraft is configured to BAC, procedures for both High and Low Altitude Instrument approaches are the same.

Procedure

Assume cleared for the HI-VOR RWY 19 (KNPA) (Figure 8-17).

1. Inbound to the IAF, complete the Descent Checklist.

2. At the IAF, execute the 6 Ts:

   a. **TIME** - Not required.

   b. **TURN** - Turn in the shortest direction to parallel the penetration course (327°).

NOTES

1. The penetration course is depicted on high altitude IAP charts by a bold–dotted track (Figure 8-17).

2. If the outbound course is more than 90° from the course used inbound to the IAF, turn to an intercept heading not to exceed 45°.

   c. **TIME** - As required.

   d. **TRANSITION** - Initiate the penetration by reducing power as required to meet a target descent rate (2000-4000 FPM). Fly 200-250 KIAS, use speed brake as required.

   e. **TWIST** - Set the appropriate course in the CDI (327°) and establish an intercept heading (if not previously accomplished).

   f. **TALK** - Make the appropriate report if required.

3. Manage energy to comply with all course, altitude, and DME restrictions. Approximately 1000' prior to level-off from penetration, reduce rate of descent to 500-1500 fpm. Level segments of the penetration may be flown at normal cruise.

a. Teardrop Penetration

– At one-half your initial altitude or reaching the published penetration turn, fly the penetration turn in the published direction. Use 30º AOB for turns during the penetration. During the last half of the turn, note the position of the head of the bearing pointer:

(a). If the head of the bearing pointer ***is not*** within 5º of the inbound course, stop the turn with a 45º intercept.

(b). If the head of the bearing pointer ***is*** within 5º of the inbound course, continue the turn and roll out with a double-the-angle intercept.

b. Penetration including an Arcing Maneuver

– When intercepting an ARC, or a radial from an ARC, at speeds that preclude the use of a full SRT, using 1.0% of the groundspeed for the lead computations will allow for a ½ SRT. In either case, do not exceed 30° AOB.

NOTE

Some high altitude approach charts have penetration instructions printed in the profile view of the approach chart. Review and comply with all printed instructions.

4. Once established inbound, comply with the remainder of the Low Altitude Instrument Approach procedures.

NOTE

High altitude approach charts do not contain landing minimums for category B aircraft. T-6Bs should use category C minimums.

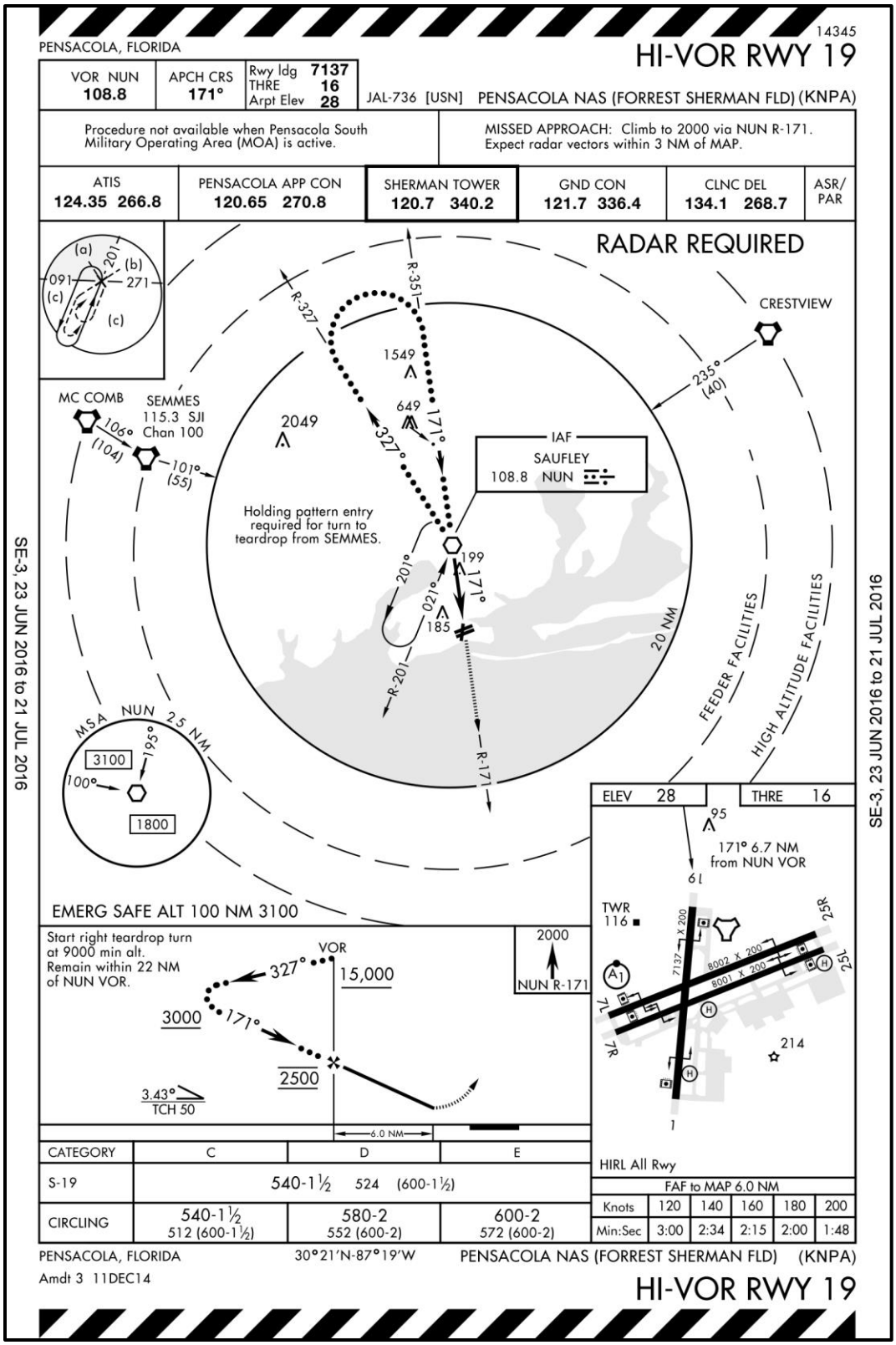


Figure 8-17 High Altitude Approach (KNPA)

CHAPTER NINE
FINAL APPROACH PROCEDURES

900. INTRODUCTION

The previous chapter covered how to safely navigate to the final approach fix. This chapter will cover the segment between the FAF to the MAP. This segment of the approach is the most demanding, as the aircraft is slow, low, and configured.

901. NON-PRECISION APPROACH

General

Fly the final segment of the instrument approach on speed, on course and arrive at the published MDA prior to the MAP to set the aircraft up for landing.

Description

The final segment for Non-Precision approaches may include the following variations.

1. Approaches requiring a small course change at the final approach fix.

2. Approaches without a FAF.

3. Visual Descent Points (VDPs).

4. Approaches with or without DME.

5. MAPs identified by timing, DME, DME backed up with timing, or station passage.

Procedure

For the following example, assume the aircraft is at the FAF for the VOR or GPS RWY 16 (KDAB) (Figure 9-1), configured in BAC.

1. Perform 6 Ts:

    a. **TIME** - Start timing if given (backup to identify the MAP if DME fails).

    b. **TURN** - Turn in the shortest direction to parallel the final approach course (156º).

    c. **TIME** - Not required.

    d. **TRANSITION** - Set approximately 20% torque, trim for 120 KIAS descent to next segment altitude or MDA, as required (700’MDA).

NOTE

Adjust pitch to maintain airspeed; use power as required to maintain a stabilized rate of descent not to exceed 1000 fpm.

e. **TWIST -** If not already done, twist the final approach course (FAC) into the CDI (156º) and set intercept as required.

f. **TALK -** Give the appropriate voice report if required.

2. Approximately 100' prior to MDA, slowly add power to arrest the rate of descent.

3. Level off at the MDA (700') at or before the published or derived VDP in order to have a normal descent angle to land, and maintain 120 KIAS (approximately 42% torque). Proceed to the MAP (7.4 DME).

NOTE

Do not descend below the MDA, even if the field is in sight, until reaching the VDP. In this example, a VDP of 5.2 DME is calculated using procedures outlined in this chapter and Appendix B.

NOTE

Avoid rapid descent requirements on final by crossing the FAF at the published altitude. Note that you can descend from the FAF once on the appropriate heading outbound from the station or the appropriate radial inbound. Do not wait to descend until the needle settles out from the cone of confusion.

4. Once the field is in sight and a safe landing can be made, maneuver to land.

5. At the MAP, if the field is not in sight or a safe landing cannot be made, execute a Missed Approach.

Visual Descent Point

Depending on the location of the MAP, the descent from the MDA often will have to be initiated prior to reaching the MAP in order to execute a normal (approximately 3°) descent to landing. This point is called the Visual Descent Point (VDP). The VDP will often be published on the approach chart; if not depicted, it may be computed.

WARNING

> While the FAA is attempting to place more VDPs on approaches, it should be noted that if there is a penetration of the obstruction clearance surface on final, they will not publish a VDP. Therefore, if there is no VDP published, it may be for a reason. If choosing to calculate a VDP, it may be used, but be vigilant looking for obstacles from the VDP to landing.

The first step to computing a VDP is to divide the HAT by your desired descent gradient. Most pilots desire approximately a 3° (300 ft/NM) glidepath for landing utilizing the following formula:

HAT/Gradient (normally 300) = VDP in NM from end of runway

This distance can then be added/subtracted to/from the DME at the end of the runway to get a DME for your VDP.

Example: HAT = 665 FT, MDA = 700 FT MSL, DME at the end of the runway = 7.4 DME

VDP = HAT/Gradient = 665/300 = 2.2 NM from end of runway

VDP DME = DME at end of runway - VDP distance = 7.4 DME - 2.2 DME = 5.2 DME

Common Errors

1. Excessive corrections over or near the VOR.

2. Failure to back up DME with timing where appropriate.

3. Descending below MDA.

4. Late recognizing the MAP.

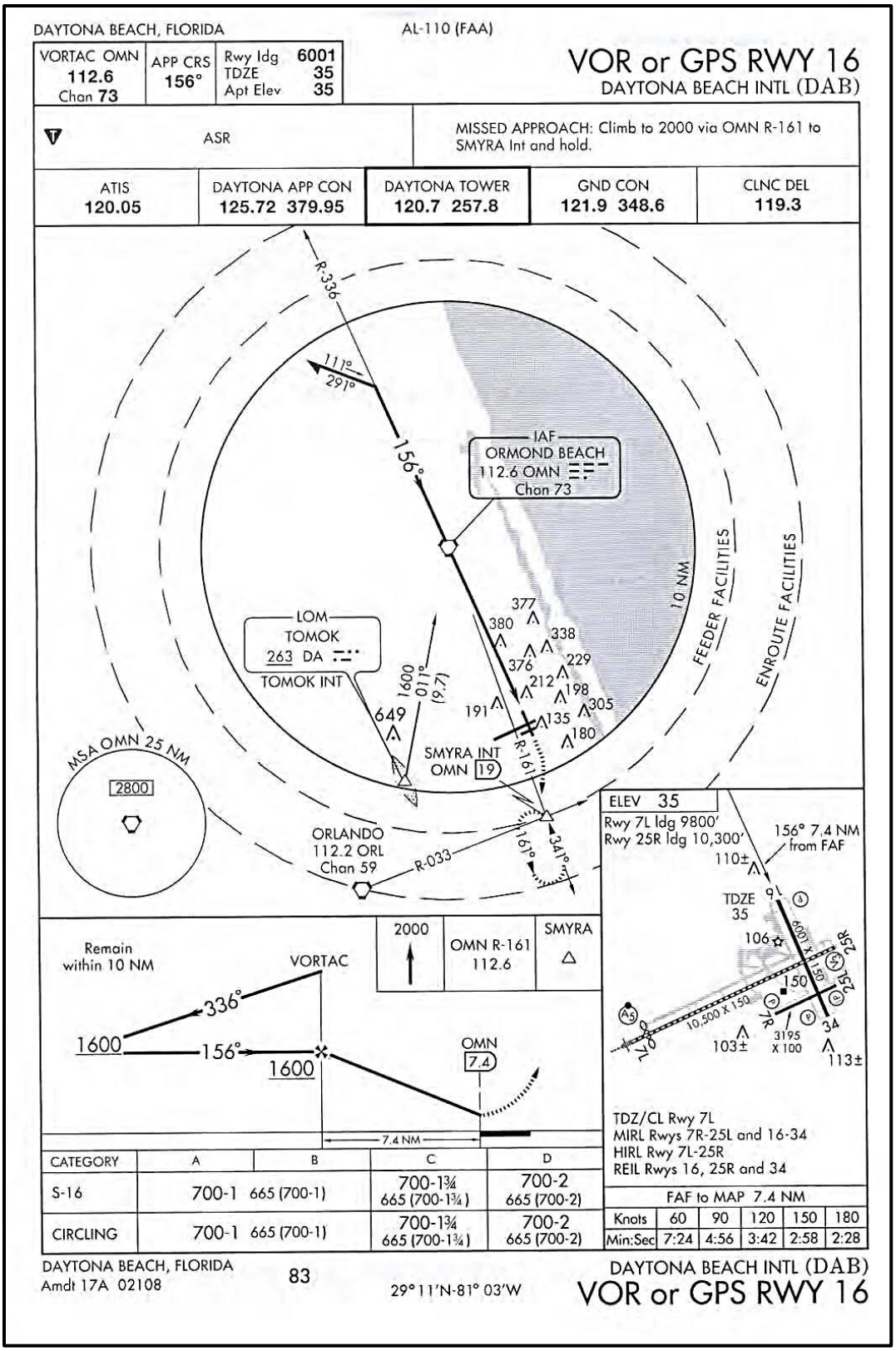


Figure 9-1 VOR or GPS RWY 16 (KDAB)

902. INSTRUMENT LANDING SYSTEM (ILS) APPROACH

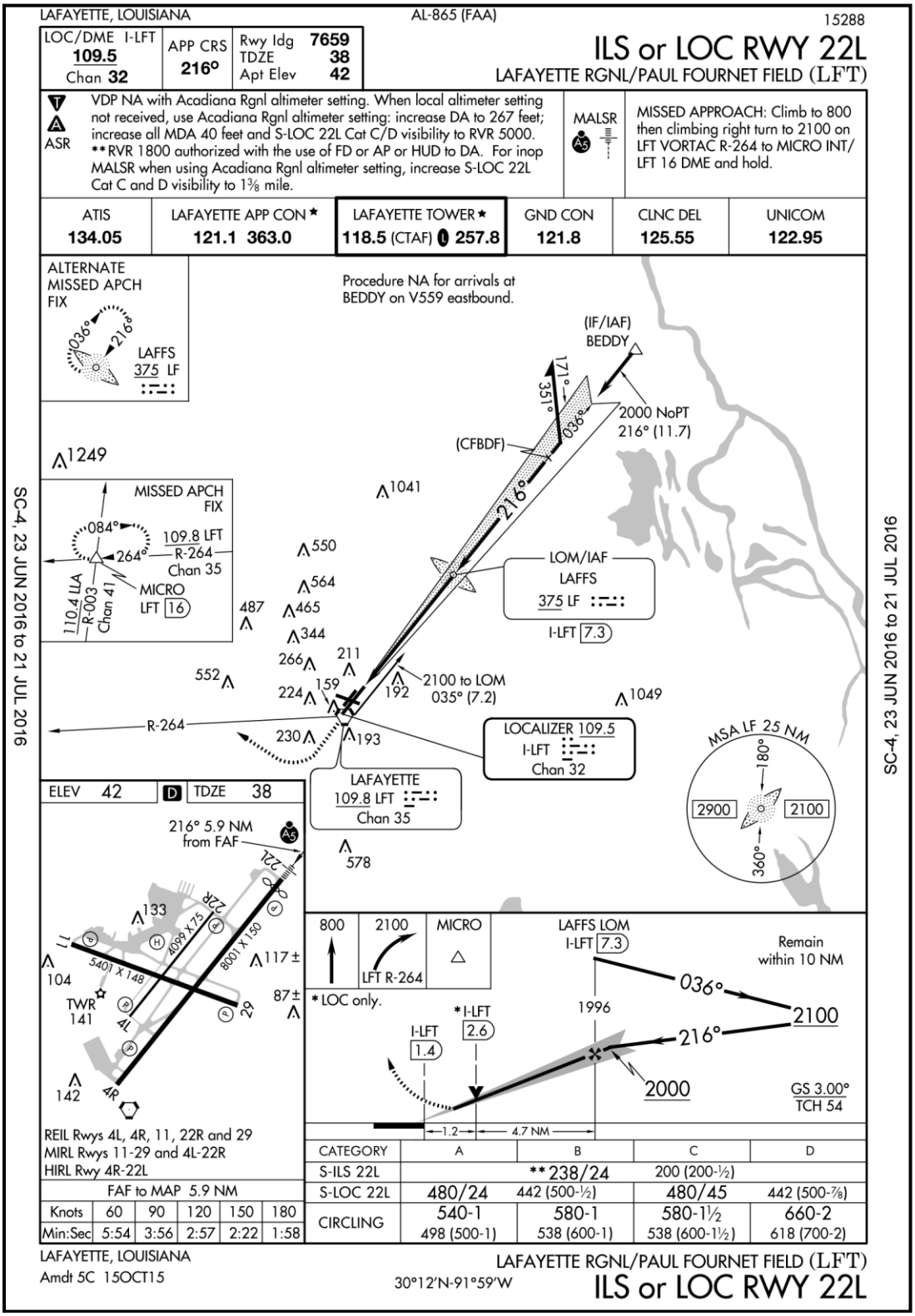


Figure 9-2 ILS or LOC RWY 22L (KLFT)

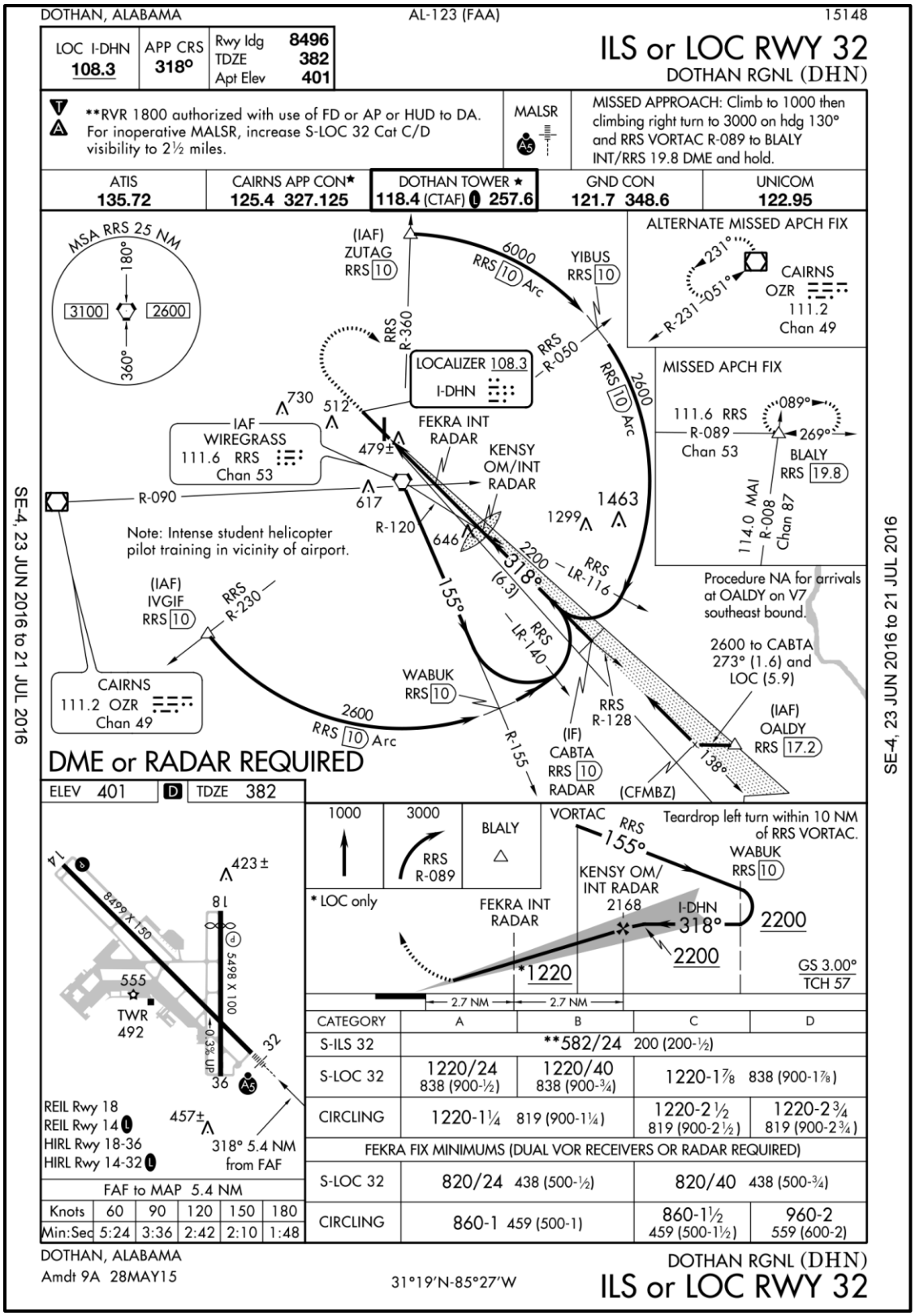


Figure 9-2a ILS or LOC RWY 32 (KDHN)

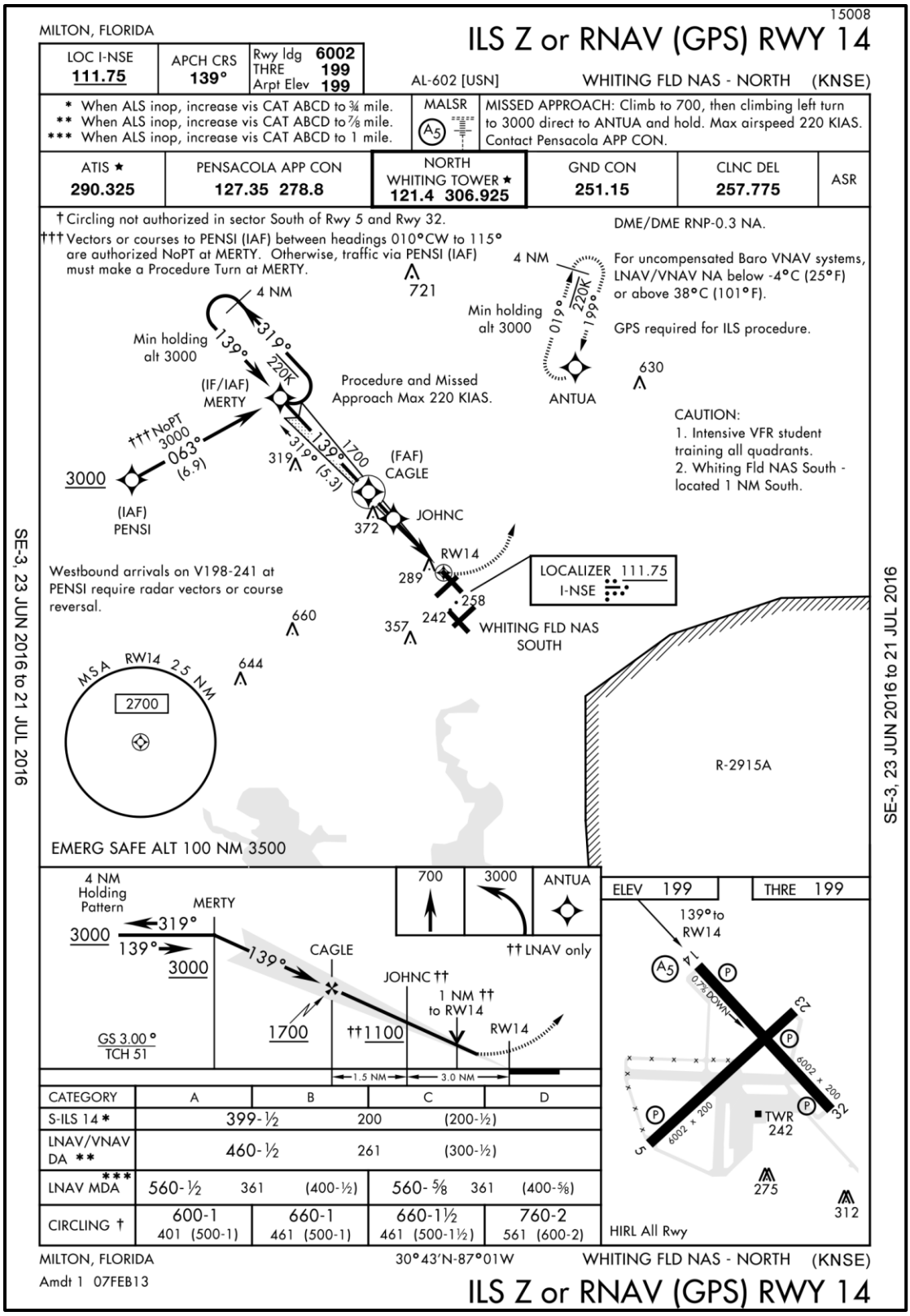


Figure 9-2b ILS or RNAV (GPS) RWY 14 (KNSE)

General

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 (DME). The system is automatically monitored and provides changeover to a standby localizer or glideslope transmitter when the main system malfunctions.

Because both Course and Glidepath information is provided, it constitutes a precision approach and DA/DH minimums may be used.

The system may be divided functionally into three parts:

1. Guidance information: localizer, glideslope.

2. Range information: marker beacon, DME.

3. Visual information: approach lights, touchdown and centerline lights, runway lights.

ILS Minimums

The lowest authorized ILS minimums with all required ground and airborne system components operative are:

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

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

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

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

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

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

7. **Category IIIc.** No DH and no RVR limitation.

NOTE

The T-6B falls under Category I. Due to its tandem seat configuration, OPNAVINST 3710.7 classifies it as "Single-Piloted." As such, it is further restricted to absolute minimums of 200' ceiling and ½ SM visibility. Special authorization and equipment are required for Categories II and III.

Inoperative ILS 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.

Transition Procedures

Because of the highly "localized" broadcast area, the course and glidepath signals cannot be displayed until on or very near to the final approach course. As such they require transitions procedures to establish the aircraft onto final.

These transitions include:

1. Radar Vectors to the Final Approach Course (RVFAC). This is the most common method and may be used or required whenever radar service is available.

2. Feeder fixes that put the aircraft on an intercept heading and altitude to be maintained until established on the localizer course.

3. Straight-In approach

4. Arcing approach

5. Procedure Turn approach

6. Teardrop approach

7. HILO approach

8. GPS approach

Examples:

Figure 9-2 ILS RWY 22L (KLFT):

1. Feeder fix LFT, 035° Course at 2100' until established on the localizer, I-LFT, then to IAF LAFFS for the Procedure Turn approach (PT).

2. Direct to LAFFS IAF using the GPS until established on the localizer then using the Procedure Turn approach (PT).

3. Straight-In approach from BEDDY.

Figure 9-2a ILS or LOC RWY 32 (KDHN)

1. IAF OALDY, Heading, 273° at 2600' until established on the localizer I-DHN.

2. IAF RRS, for the Teardrop approach (TD).

3. IAFs IVGIF or ZUTAG, for the Arcing approach.

Figure 9-2b ILS Z or RNAV (GPS) RWY 14 (KNSE)

1. IAF MERTY, for the "Holding-in-lieu of Procedure Turn" (HILO) approach.

2. IAF PENSI, for the GPS approach.

System characteristics

When a localizer frequency is tuned into the VHF NAV, several differences exist from when a VOR station is tuned.

1. PFD Source option of LOC becomes available (VOR option is removed).

2. When the PFD Source is selected to LOC, the localizer Course/Glidepath scales will appear on the PFD. When a good signal is being received, the associate Course/Glidepath marker (Green Diamonds) will appear.

3. The Morse code identifier will consist of four letters, of which the first letter will always be "I."

4. The CDI will be 4 times more sensitive than the VOR (1.25° per dot, 2.5° full scale).

NOTE

As you near the localizer transmitter the CDI responsiveness will increase significantly. Establishing a tracking solution prior to the FAF is crucial. Inside the FAF full scale deflection can happen very quickly if drift is not corrected in a timely manner. If the CDI is not centered, correct immediately; however, to avoid chasing the course when between the FAF and MAP, keep the heading changes close to the wind corrected heading (WCH). (Increments of 5° or less are usually sufficient.)

5. The localizer signal is transmitted at the far end of the runway. It is adjusted for a course width of (full scale fly-left to a full scale fly-right) of 700 feet at the runway threshold (on the approach end).

6. Normal CDI sensing will be available ***only*** if the ***front*** course is set into the CDI. The front course is the FAC depicted for the ILS/LOC approach procedure. (On approaches titled "LOC BC" the depicted FAC is the ***back*** course and will result in reverse sensing if set into the CDI).

NOTE

On aircraft without reverse sensing capability (such as the T-6B), when a localizer frequency is tuned, selecting the front course on your Course Deviation Indicator (CDI) will prevent reverse sensing (the need to fly away from needle deflection in order to return CDI to center). With the front course set, the CDI will deflect in the proper direction, whether you are on a back course or outbound on a front course.

7. The course and glideslope indicators are reliable only when (1) their warning flags are not displayed (red X in the PFD display), (2) The localizer identifier is received, and (3) the aircraft is within the usable range of the equipment (green diamonds present).

8. The localizer (course) signal is considered reliable within 18 miles of the transmitter within 10° of the course centerline, or 10 miles from the transmitter within 35° of the course centerline, unless the published approach depicts a transition point at a farther distance. Once established within the "usable range," the Green Diamond should appear on the PFD course scale.

9. The glideslope is considered reliable within 10 miles of the transmitter, provided the aircraft is on the localizer course. Once established within the "usable range," the Green Diamond should appear on the PFD glideslope scale.

ILS Final Approach Fix

The ILS FAF may or may not coincide with the non-precision FAF. The non-precision FAF is always depicted with the Maltese cross symbol (✠). The FAF for the ILS occurs when the aircraft is "on" glideslope ***and*** at the published glideslope intercept altitude. This point is depicted on the instrument approach procedure with a "lightning bolt" symbol ( ).

Examples:

Figure 9-2c; The ILS FAF occurs when the aircraft is on glidepath at 2200 feet MSL. This point occurs just prior to the non-precision FAF of KENSY OM. (Note the number written below KENSY OM (2169), this is the MSL altitude that an aircraft on the ILS Glidepath should indicate crossing KENSY OM.)

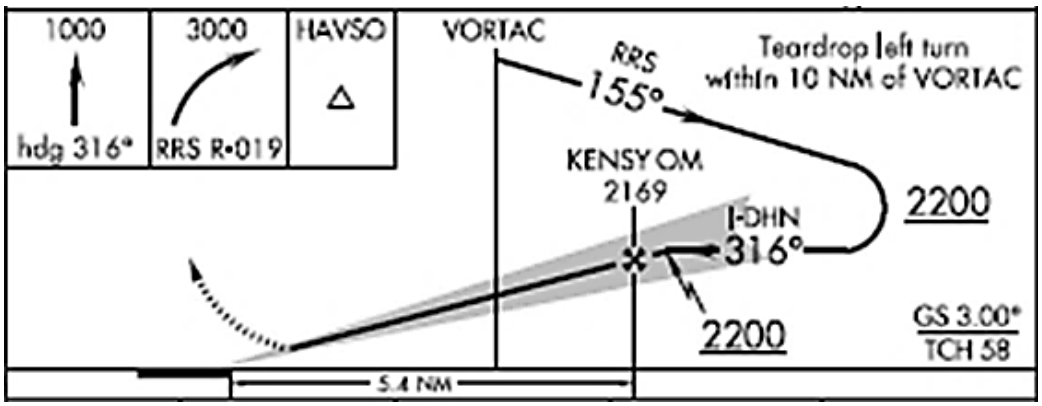


Figure 9-2c ILS FAF Prior to the Non-Precision FAF

Figure 9-2d; The ILS FAF (on glidepath at 1700' MSL) coincides with the non-precision FAF of CAGLE.

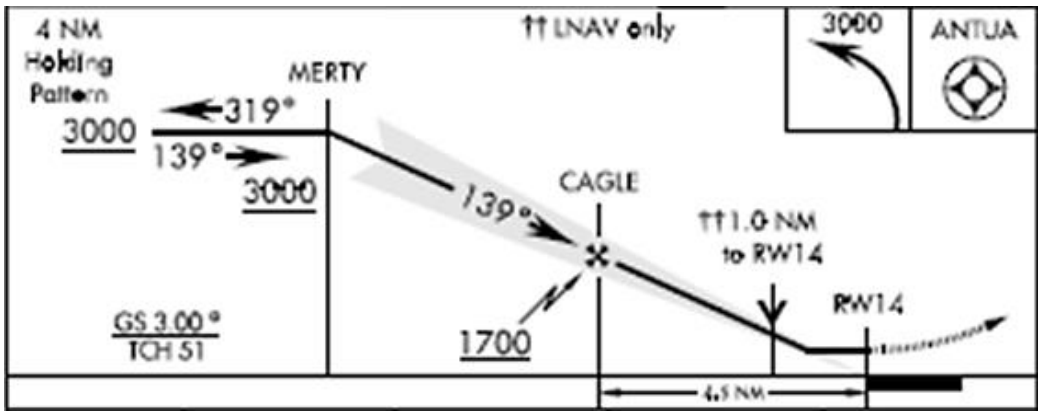


Figure 9-2d ILS FAF Coincides with Non-Precision FAF

Procedure

Comply with the appropriate "Transition Procedure" to establish the aircraft onto or near the Localizer course***. Pilots should tune the VHF NAV receiver to identify and monitor the localizer identification signal as soon as practical during the transition procedure***. **D LIDS** is an effective memory aid for setting up the ILS or LOC approach.

Use Figure 9-2 for the following example where the aircraft is on downwind, being radar vectored to final for the ILS approach to runway 22L at KLFT. One of the advantages of radar vectors to final for the ILS or LOC approach is the VHF NAV is free to be set up well in advance of final.

1. As soon as practical (prior to localizer interception), set NAVAIDS. Perform **D LIDS** check.

   D - DME Hold - Set (N/A in this example. DME is provided from the localizer's paired frequency Chan 32)

   L - Localizer Frequency - Tune, ID and monitor (I-LFT 109.5)

   I - Inbound Course - Set CDI to FAC (front course 216°)

   D - Display - Set PFD Source to LOC

   S - Speed - Appropriate for transition procedure (RVFAC downwind 200 KIAS)

2. Transition to BAC in accordance with the associated transition procedure.

   Methods for determining 5 nm from the ILS FAF

   a. DME (not all ILS approaches provide DME)

   b. ATD from a GPS waypoint (from an approved FMS database)

   c. Controller provided radar identification

   d. Established at the published glideslope intercept altitude and the glideslope indication is "alive" (green diamond first starts to move down from the top of the glideslope scale on the PFD).

Alternate method for BAC transition: Set descent power (24%) within 5 nm of the FAF and allow the aircraft to slow towards 120 KIAS. Transition to BAC once the glideslope diamond indicates 1 ½ to 1 dot prior to glideslope intercept. If this transition is timed well, the aircraft will reach 120 KIAS as the glideslope is intercepted and the descent will require only small power changes from the FAF to the MAP.

NOTE

If the CDI indicates full-scale deflection prior to the FAF, re-intercept the FAC. If unable to return to "On-scale" indication by the FAF, do not descend below the depicted glideslope intercept altitude.

3. At glideslope intercept, set power to 24% and descend to the DA/DH (238' MSL, 200' AGL) on course and glideslope.

NOTES

1. 24% power is an approximate setting based on a 3° glideslope with no-wind. Other glideslope angles and/or headwind/tailwind components will require adjustments in power as necessary to maintain the glideslope.

2. The glideslope angle (GS) and Threshold Crossing Height (TCH) are listed in the Profile view of the approach plate (GS 3.00°, TCH 54' in our example).

3. Power controls rate of descent (glideslope) and nose attitude controls airspeed; however any change to one will affect the other. For example, if slightly below glideslope and 10 KIAS fast, adjusting nose up to correct the airspeed will also reduce the rate for descent and aid in returning to an "on glideslope" condition.

4. At the non-precision FAF (Maltese cross) start backup timing if available (LAFFS I-LFT 7.3 DME, time for 2:57 with 120 KTS groundspeed).

NOTE

Maintain careful course and glideslope control between the FAF and DA/DH. Comply with the following constraints:

<u>Glideslope.</u>

If more than 1 dot below the glideslope:

Restrict altitude to not lower than the published localizer MDA until glideslope is reestablished or the non-precision MAP is reached.

If more than 2 dots above the glideslope:

Continue inbound but revert to the non-precision localizer approach procedures. (***Do not*** exceed stabilized descent parameters for a non-precision approach in attempt to reestablish the glideslope).

Course.

If full scale CDI defection occurs between the FAF and DA/DH:

Simultaneously turn to reestablish and track the localizer course to the non-precision MAP, while climbing to the missed approach altitude, except when a maximum altitude is specified between the final approach fix (FAF) and the MAP. In that case, comply with the maximum altitude restriction. Upon reaching the non-precision MAP, comply with the published missed approach or ATC assigned climb-out instructions.

5. Upon reaching the DA/DH, if the runway environment is in sight and a safe landing can be made, continue descent and transition to landing. If not, execute the missed approach.

NOTE

During low visibility operations (dark night) when the runway environment is in sight prior to the DA/DH, continuing to reference the glideslope indicator or available Visual Glide Slope Indicator (VGSI) systems will help avoid becoming too high or low for a safe landing transition.

Common Errors

1. Failing or late to perform D LIDS check.

2. Flying through the FAC (missing the turn to final).

3. Not starting back-up timing when appropriate.

4. Overcorrecting/inappropriate inputs for course and glideslope.

5. Continuing the approach to DA/DH with CDI at full scale inside the FAF.

6. Utilizing wrong minimums for DA/DH.

7. Leveling off at DA/DH.

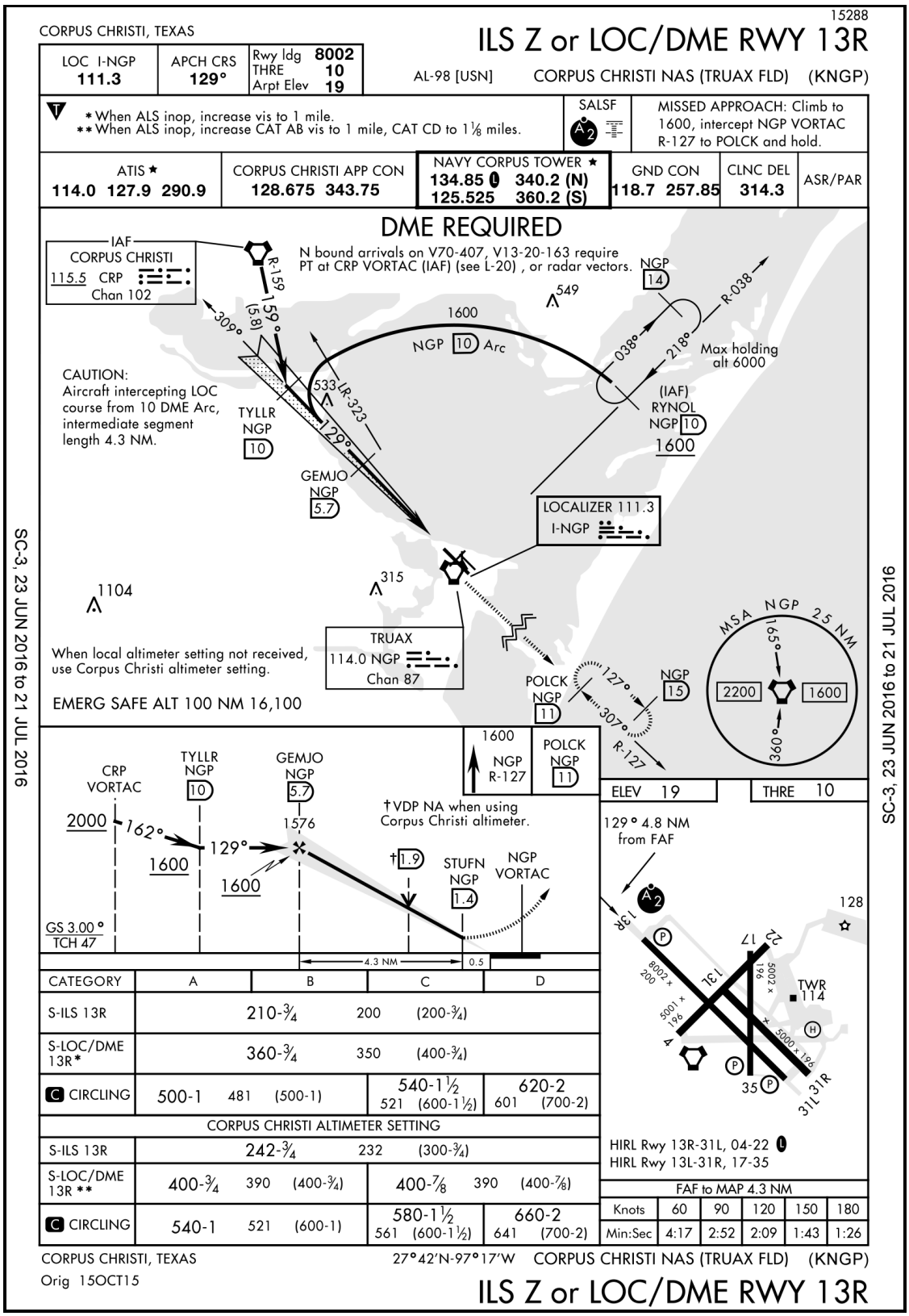


Figure 9-3 ILS Z or LOC/DME RWY 13R (KNGP)

903. LOCALIZER APPROACH

General

A localizer approach is a non-precision approach that utilizes the localizer component of the ILS system to provide accurate course guidance to the runway centerline. The process of establishing the aircraft onto the FAC and localizer characteristics are exactly the same as those discussed for the ILS approach.

Once established on the final approach course, the procedures closely reflect those used for other non-precision approaches.

On approaches titled ILS or LOC, where the glideslope information is not used, or is unavailable, non-precision rules and minimums apply.

Procedure

Comply with the appropriate "Transition Procedure" to establish the aircraft onto or near the Localizer course. ***Pilots should tune the VHF NAV receiver to identify and monitor the localizer identification signal as soon as practical during the transition procedure***. **D LIDS** is an effective memory aid for setting up the ILS or LOC approach.

Use Figure 9-3 for the following example; assume the aircraft is on downwind, being radar vectored to final for the LOC/DME approach to runway 13R at KNGP. One of the advantages of radar vectors to final for the ILS or LOC approach is the VHF NAV is free to be set up well in advance of final.

1. As soon as practical (prior to localizer interception), set NAVAIDS. Perform **D LIDS** check.

   D - DME Hold - Set (114.0 in this example. DME is provided from the TRUAX VORTAC).

   L - Localizer Frequency - Tune, ID and monitor (I-NGP 111.3)

   I - Inbound Course - Set CDI to FAC (129°)

   D - Display - Set PFD Source to LOC

   S - Speed - Appropriate for transition procedure (RVFAC Downwind 200 KIAS)

   Comply with the appropriate transition procedure until established on the localizer final.

2. Transition to BAC in accordance with the appropriate transition procedure.

NOTE

If CDI indicates full-scale deflection prior to the FAF, re-intercept the FAC. If unable to return to "On-scale" indication by the FAF, do not descent below the FAF altitude.

3. At the non-precision FAF (Maltese cross at GEMJO I-NGP 5.7 DME) perform the 6 Ts:

a. **TIME** - Start timing. (Will be needed as a back-up to ID the MAP in the event of DME failure.)

b. **TURN** - As required to continue tracking the localizer course.

c. **TIME** - Not required.

d. **TRANSITION** - Set approximately 20% torque, trim for 120 KIAS descent to next segment altitude or MDA, as required.

NOTE

Adjust pitch to maintain airspeed; use power as required to maintain a stabilized rate of descent not to exceed 1000 fpm.

e. **TWIST** - Ensure Front course is set in the CDI, continue tracking.

NOTE

If full scale CDI defection occurs between the FAF and the MAP, simultaneously turn to reestablish and track the localizer course to the non-precision MAP, while climbing to the missed approach altitude, except when a maximum altitude is specified between the FAF and the MAP. In that case, comply with the maximum altitude restriction. Upon reaching the non-precision MAP, comply with the published missed approach or ATC assigned climb-out instructions.

f. **TALK** - Give appropriate voice report if required.

4. Approximately 100' prior to the LOC MDA (360' MSL) - set approximately 42% torque and transition to level flight at or above MDA. Continue tracking to the MAP (I-NGP 1.4 DME, backed-up with 2:09 timing).

5. If runway environment is in sight and a safe landing can be made, maneuver to land. If not, execute the missed approach.

Common Errors

1. Failing or late to perform **D LIDS** check.

2. Flying through the FAC.

3. Not starting back-up timing when appropriate.

4. Overcorrecting/inappropriate inputs for course.

5. Continuing the approach to MDA with CDI at full scale inside the FAF.

6. Utilizing wrong minimums for MDA.

7. Executing missed approach upon reaching MDA vice waiting for MAP.

904. BACK COURSE LOCALIZER APPROACH (LOC BC)

Description

A variant of the LOC approach is the LOC-BC or "back course" approach. Localizer antennae are positioned at the opposite end of the runway from the front course approach direction and are aligned with the runway centerline. Every localizer transmitter radiates a signal in two directions, one being the "front course" and the other being the "back course." For example, the localizer antenna for an ILS system for RWY 26 (FAC 260°), would be located off the approach end of RWY 8. It radiates a front course for RWY 26. The back course radiates for RWY 8. If an IAP has been charted for this back course, then you can fly it just as you would a LOC approach, with one important exception: ***You must set the front course in the CDI***. If the front course is not used, the CDI will give reverse sensing.

Procedure

Comply with the appropriate "Transition Procedure" to establish the aircraft onto or near the Localizer course. ***Pilots should tune the VHF NAV receiver to identify and monitor the localizer identification signal as soon as practical during the transition procedure***. **D LIDS** is an effective memory aid for setting up the ILS or LOC approach.

Use Figure 9-4 for the following example where the aircraft is executing the LOC BC approach to runway 16 at KCLL from IAF YOBUR. In this case the CLL VOR will be required for the arcing maneuver until just prior to the localizer final.

1. As soon as practical, perform **D LIDS** check. (The lead radial LR-344 would be useful in determining when to start D-LIDS.)

   D - DME Hold - Set (N/A in this example. DME is provided from the I-CLL paired frequency, Chan 42(Y).)

L - Localizer Frequency - Tune, ID and monitor (I-CLL 110.55)

I - Inbound Course - Set CDI to FAC (343°)

NOTE

The FRONT COURSE must be set into the CDI to avoid reverse sensing on final. The depicted BACK COURSE is 163°. Its reciprocal (343°) is the FRONT COURSE and should be set in the CDI to maintain the localizer centerline and insure normal sensing.

D - Display - Set PFD Source to LOC

S - Speed - Appropriate for the transition procedure being used (150 KIAS for the arcing maneuver).

2. Comply with the appropriate transition procedure until established on the localizer final. (Maintain 2300 feet MSL until established on final, then no lower than 2000 feet MSL until the FAF.)

3. Transition to BAC in accordance with the appropriate transition procedure. (5 NM prior to the FAF for the arcing transition).

NOTE

If CDI indicates full-scale deflection prior to the FAF re-intercept the FAC. If unable to return to "On-scale" indication by the FAF do not descent below the FAF altitude.

4. At the non-precision FAF (Maltese cross at BRYIN I-CLL 4.8 DME) perform the 6 Ts:

a. **TIME** - Start timing. (2:09 will be needed as back-up ID of MAP in the event of DME failure.)

b. **TURN** - As required to continue tracking the localizer course.

c. **TIME** - Not required.

d. **TRANSITION** - Set approximately 20% torque, trim for 120 KIAS descent to next segment altitude or MDA as required.

NOTE

Adjust pitch to maintain airspeed; use power as required to maintain a stabilized rate of descent not to exceed 1000 fpm.

e. **TWIST** - Ensure Front course is set in the CDI, continue tracking.

NOTE

If full scale CDI deflection occurs between the FAF and the MAP, simultaneously turn to reestablish and track the localizer course to the MAP while climbing to the missed approach altitude, except when a maximum altitude is specified between the final approach fix (FAF) and the MAP. In that case, comply with the maximum altitude restriction. At the MAP comply with the published missed approach or ATC assigned climb-out instructions.

f. **TALK** - Give appropriate voice report if required.

5. Approximately 100’ prior to the BC LOC MDA (920 MSL) - set approximately 42% torque and transition to level flight at or above MDA. Continue tracking to the MAP (I-LFT 0.5 DME, backed-up with 2:09 timing).

6. If runway environment is in sight and a safe landing can be made, maneuver to land. If not, execute the missed approach.

NOTE

Do not descend below the MDA, even if the field is in sight, until reaching the VDP. (VDP in this example is the I-CLL 1.5 DME.) Disregard glideslope indications during Back Course approaches.

Common Errors

1. Failing or late to perform **D LIDS** check.

2. Setting Back Course into CDI and getting reverse sensing.

3. Flying through the FAC (Missing turn to final).

4. Not starting back-up timing when appropriate.

5. Overcorrecting/inappropriate inputs for course.

6. Continuing the approach to MDA with CDI at full scale inside the FAF.

7. Utilizing wrong minimums for MDA.

8. Executing missed approach upon reaching MDA vice waiting for MAP.

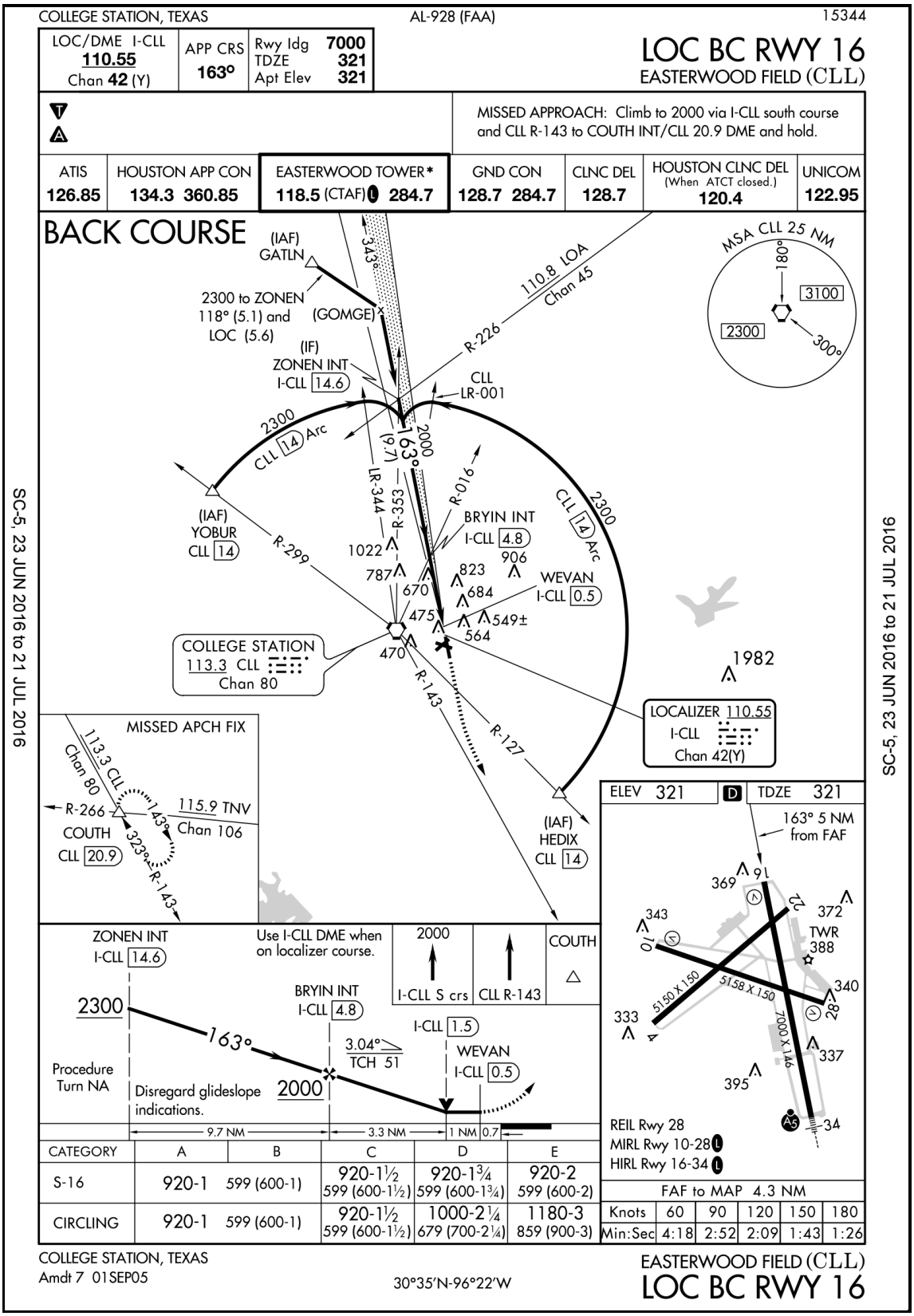


Figure 9-4 LOC BC RWY 16 (KCLL)

905. RADAR APPROACHES

A Radar Approach, also known as the Ground Controlled Approach (GCA), will fall into one of three types:

1. Precision Approach Radar (**PAR**)

   – During a PAR approach, the controller utilizes an airport surveillance radar system to transition the aircraft to final and then hands off to another controller. This "Final Controller" utilizes a precision radar system located at the airport to ***provide precise course, range and glideslope*** feedback during the final approach segment. Because both course and glideslope information is available, it constitutes a ***Precision Approach.***

2. Airport Surveillance Radar (**ASR**)

   – During the ASR approach, the controller utilizes an airport surveillance radar system to Transition the aircraft to the runway environment. This controller can ***only provide course and range information***. Because no glideslope information is available, it constitutes a ***Non-Precision Approach***.

3. Precision Approach Radar Without Glideslope (**PAR W/O GS**)

   – During the PAR W/O GS approach, the controller utilizes an airport surveillance radar system to transition the aircraft to final and then hands off to another controller. This "Final Controller" utilizes a precision radar system located at the airport to ***provide precise course and range information*** but ***has no glideslope data***. Because no glideslope information is available, this constitutes a ***Non-Precision Approach***. However, due to the precise nature of the course and range information available, the associated MDA for this type of approach may be lower than a standard ASR.

Approach Clearance

Clearance for a radar approach may include:

1. Type of approach, runway, and airport to which the approach will be made.

2. Altimeter setting.

3. If available, ceiling and visibility if the ceiling at the airport of intended landing is reported below 1,000 feet or below the highest circling minimum, whichever is greater, or if the visibility is less than 3 miles.

4. Special weather observations may not be issued if they are included in the ATIS broadcast and the pilot states the appropriate ATIS broadcast code.

5. Pertinent information on known airport conditions if they are considered necessary to the safe operation of the aircraft concerned.

6. Lost communication procedures as required.

7. Missed approach/climbout instructions as required.

NOTE

Current approach information contained in the ATIS broadcast may be omitted if the pilot states the appropriate ATIS broadcast code.

Lost communications and missed approach contingencies

The controller will transmit lost communication and missed approach instructions when weather reports indicate that an aircraft will likely encounter IFR weather conditions during the approach. These instructions will be issued as soon as possible after establishing radar identification and radio communications. They may be omitted after the first approach when successive approaches are made and the instructions remain the same.

Lost communications.

In these instructions the controller will advise the pilot that if radio communications are lost for a specified time interval (not more than 1 minute on vector to final approach, 15 seconds on a surveillance or PAR W/O GS final approach, or 5 seconds on a PAR final approach) to:

1. Attempt contact on a secondary or a tower frequency.

2. Proceed in accordance with visual flight rules if possible.

3. Proceed with an approved non-radar approach, or execute the specific lost communications procedure for the radar approach being used.

Missed approach instructions.

The controller will issue a specific missed approach procedure approved for the radar approach being conducted.

Climb-out instructions.

Before an aircraft which plans to execute a low approach or touch-and-go (VMC or IMC) begins the final descent, the controller will issue appropriate departure instructions to be followed upon completion of the approach. Climb-out instructions must include a specific heading and altitude, except when the aircraft will maintain VFR and contact the tower.

Depending on local airfield agreements with the FAA, pilots may be issued IFR coded departure instructions, also known as "canned" departures. Instead of repeating the same lengthy instructions to every aircraft shooting multiple approaches, the controller can simply issue the Arrow-4 climb-out from runway 13R at KNGP. This directs the pilot to fly runway heading, maintain 1,600 ft, and squawk assigned code. These IFR coded departure instructions can be found in local SOPs or in-flight guides.

NOTE

Do not confuse the missed approach/climb-out instructions with lost communication instructions.

Minimums

Radar instrument approach minimums are published in the front section of the FLIP Terminal Instrument Approach Procedures (approach plates). Refer to Figure 9-5 for the following example:

PAR to KNBG RWY 4

1. This approach has a Glideslope (**GS**) of 3°.

2. If the aircraft is on glideslope as it crosses the landing threshold it will be at 51' AGL, the Threshold Crossing Height (**TCH**).

3. If the aircraft is on glideslope at touchdown, it will be 973' past the runway threshold. This is referred to as the Runway Point of Intercept (**RPI**).

4. This approach is applicable for Category A, B, C, D and E aircraft.

5. The published Decision Height (**DH**) is 99' MSL (FAA is in the process of changing DH to DA when the altitude referred to is in MSL).

6. The Height Above Touchdown (**HAT**) at the **DA**/**DH** is 100' AGL.

7. The minimum ceiling and visibility requirements for the approach are 100' and ¼ mile.

RADAR INSTRUMENT APPROACH MINIMUMS

NEW ORLEANS NAS JRB (KNBG), (ALVIN CALLENDER FLD) LA (11181 USN)

RADAR[1] - (E) 125.95 126.55 269.025 290.0 308.4 311.6 336.5 353.65 ▽ ELEV 2

	RWY	GS/TCH/RPI	CAT	DH/ MDA-VIS	HAT/ HATh/ HAA	CEIL-VIS
~~PAR~~	~~4[2]~~	~~3.0°/51/973~~	~~ABCDE~~	~~99-¼~~	~~100~~	~~(100-¼)~~
	22[3]	3.0°/43/861	ABCDE	249-¾	250	(300-¾)
~~PAR W/O GS~~	~~4[4]~~		~~ABC~~	~~380-½~~	~~381~~	~~(400-½)~~
			DE	380-¾	381	(400-¾)
	22[5]		ABCDE	300-1	301	(400-1)
~~ASR~~	~~4[6]~~		~~AB~~	~~420-½~~	~~421~~	~~(500-½)~~
			CD	420-¾	421	(500-¾)
			E	420-1	421	(500-1)
	22[7]		AB	460-¾	461	(500-¾)
			C	460-1	461	(500-1)
			D	460-1¼	461	(500-1¼)
			E	460-1½	461	(500-1½)
	14		AB	440-1	438	(500-1)
			C	440-1¼	438	(500-1¼)
			DE	440-1½	438	(500-1½)
	32[8]		AB	440-1	438	(500-1)
			C	440-1¼	438	(500-1¼)
			DE	440-1½	438	(500-1½)
CIR[9,10,11]	All Rwy		AB	480-1	478	(500-1)
			C	520-1½	518	(600-1½)
			D	560-2	558	(600-2)
			E	640-2¼	638	(700-2¼)

NOTE: Rwy 32: Multiple trees 43' AGL/40' MSL, 1300' from thld.

[1]No-NOTAM preventive maint Mon 1300-1800Z++. [2]When ALS inop, increase vis CAT ABCDE to ½ mile. [3]When ALS inop, increase vis Cat CDE to 1 mile. [4]When ALS inop, increase vis CAT ABC to 1 mile, CAT DE to 1¼ miles. [5]When ALS inop, increase vis CAT ABCDE to 1¼ miles. [6]When ALS inop, increase vis CAT AB to 1 mile, CAT CD to 1¼ miles, CAT E to 1½ miles. [7]When ALS inop, increase vis CAT AB to 1 mile, CAT C to 1¼ miles, CAT D to 1½ miles, CAT E to 1¾ miles. [8]Procedure not authorized at night. [9]CAT E circling not authorized NW of Rwy 4-22. [10]Night circling not authorized to Rwy 32. [11]When circling from PAR W/O GS Rwy 22, increase vis CAT AB to 1¼ miles.

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RADAR INSTRUMENT APPROACH MINIMUMS

Figure 9-5 Radar Instrument Approach Minimums

906. PRECISION APPROACH RADAR (PAR)

General

For the following discussion and procedure, consider the PAR approach to RWY 4 at New Orleans NAS (KNBG) (see Figure 9-5).

PAR Minimums

Due to its tandem configuration, OPNAVINST 3710.7 classifies the T-6B as a Single-Piloted aircraft. As such, it is restricted to absolute minimums of 200' ceiling/height above touchdown and visibility of ½ statute-mile/2,400 feet RVR.

The published HAT of 100' AGL must be increased to 200' AGL. The published DH of 99' MSL must be increased by the same amount that was required to raise the HAT to 200'. In our example this results in the adjusted DH of 199' MSL. The published visibility of ¼ mile would become a minimum of ½ mile.

Thus, the single-piloted minimums for the PAR to RWY 4 at KNBG become;
DH: 199' MSL, HAT: 200' and ceiling/visibility: 200-½.

NOTE

The HAT is 200 AGL (that's what matters). While the airport elevation is +2 feet, the airport sketch for RWY 4 (see Figure 9-6) shows the TOUCH DOWN ZONE ELEVATION (TDZE) as a negative 1-foot, so the DH of 199' MSL will equate to 200' AGL.

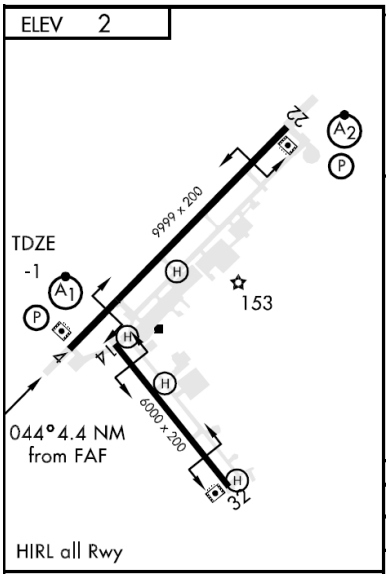

Figure 9-6 Airport Sketch Diagram (KNBG)

Transition to Final

Other than the BAC transition point, transition to final segment of the radar approach uses the same procedures discussed in section 819: Radar Vectors to Final Approach Course.

This portion of the approach is controlled using surveillance radar equipment. It includes all maneuvering up to a point where the aircraft is inbound on the final approach course and approximately 8 nm from touchdown.

The radar controller directs heading and altitude changes required to position the aircraft on final approach. Turns and descents should be initiated immediately after instructions are received. Perform turns using a standard rate turn (not to exceed 30° of bank).

While transitioning to final, at Naval Air Stations, the pilot is advised to perform landing checks. Perform the checks as required. For an approach brief, review approach minimums, lost communications and missed approach/climb out procedures. In addition, use all navigational receivers to remain position oriented and/or ready to comply with lost communications procedures. Throughout this segment, the controller should periodically advise you of the aircraft position relative to the airfield.

Precision Final Approach

The precision final approach starts when the aircraft is within range of the precision radar and contact is established with the final controller. A precision approach radar system includes two antennas, one scanning elevation and the other scanning azimuth. The range is limited to 10 miles, azimuth to 20 degrees, and elevation to 7 degrees. ***The initial call to the final controller should include the current status of the gear.***

The transition to BAC and the landing checklist should be completed prior to glideslope interception. When the controller advises that the aircraft is intercepting glideslope, adjustment of the power is required to establish the predetermined rate of descent based on groundspeed and glideslope angle. Adjust the pitch attitude on the attitude indicator to maintain final approach speed and power for rate of descent corrections.

NOTE

> 10 to 30 seconds prior to glidepath interception the controller will advise “approaching glidepath, you may begin your descent.” For the T-6B, do not begin the descent until the controller reports “on glide path.” At some point the controller will state, “No need to acknowledge further transmissions (do not acknowledge this transmission either.)”

If the aircraft is observed to deviate from the course or glide path, the pilot is given the relative amount of deviation by use of terms “slightly” or “well.” Trend information is also issued with respect to the elevation of the aircraft and may be modified by the terms “rapidly” and “slowly,”

e.g., "well above glidepath, coming down rapidly." Range from touchdown is given at least once each mile.

Maintain a constant airspeed during the approach. When power changes are required, avoid excessive throttle movements. Accuracy of heading is important for runway alignment during the final approach phase. When instructed to make heading changes, make them immediately. Instructions to turn are preceded by the phrase "turn right" or "turn left." To prevent overshooting, the angle of bank should approximate the number of degrees to be turned, not to exceed a 1/2 standard rate turn. After a new heading is directed, the controller assumes it is being maintained. Additional heading corrections will be based on the last ***assigned*** heading.

If an aircraft is observed by the controller to proceed outside of specified safety zone limits for azimuth and/or elevation and continue to operate outside these prescribed limits, the pilot will be directed to execute a missed approach or to fly a specified course unless the pilot has the runway environment (runway, approach lights, etc.) in sight.

Navigational guidance in azimuth and elevation is provided to the pilot until the aircraft reaches the published Decision Altitude (DH/DA).

NOTE

> After reaching DH/DA, the precision final controller will continue to provide course and glideslope information until the aircraft passes over the landing threshold. This information is strictly advisory in nature.

A missed approach shall be initiated immediately if any of the following occurs:

1. DA/DH as noted on the pilot's altimeter and runway environment is not in sight.

2. Controller reports "At Decision Height/Altitude" and runway environment is not in sight.

3. When directed by the controller, tower, wheels watch, or runway duty officer.

4. When a safe landing cannot be made.

Procedure

1. Promptly comply with vectors/altitudes provided by the controller. Maintain situational awareness at all times. Acknowledge all transmissions until instructed otherwise.

2. Fly 200 KIAS on downwind and 150 KIAS on base leg (if being vectored on an extended final or extended dog-leg to final, maintain 200 KIAS until within 15 NM of the airport).

3. Transition to BAC and complete landing checks when established on final or on a dog leg to final and within 15 miles of the airport. (The transition to BAC and the landing checklist should be completed ***prior*** to glideslope interception.)

4. Contact the final controller when directed. The initial call to the final controller should include the current status of the gear.

NOTE

During a Single Frequency Approach (SFA), the approach controller will hand you over to the Final Controller by instructing you to "Stand by for your Final Controller."

5. Once final controller advises you are ***"ON GLIDEPATH;"***

– Set power to 24% torque, establish 120 KIAS, 600 FPM descent and continue to comply with assigned headings.

NOTE

Control airspeed with pitch attitude and glideslope with power. Make adjustments to preplanned rate of descent as required for glidepath corrections.

6. At the DH/DA (as noted on the cockpit altimeter or the controller stating "At Decision Height," whichever occurs first), if the runway environment is not in sight or you are not in a position to make a safe landing, execute the missed approach or climbout instructions.

NOTE

The controller will state "At Decision Altitude" based on the ***published minimums***. Your OPNAVINST 3710.7 Single-Piloted minimums may be higher.

Common Errors

1. Slow to comply with, or missing controller instructions.

2. Transition to BAC not completed prior to glidepath interception.

3. Leveling off at the DH/DA.

4. Confusing missed approach or climbout instructions with the lost communication instructions.

5. Loss of orientation during vectors to final.

907. AIRPORT SURVEILLANCE APPROACH (ASR) AND PAR WITHOUT GLIDESLOPE (PAR W/O GS)

General

Because glideslope information is either not available, or not used, the ASR and PAR W/O GS approaches are both non-precision. Both are accomplished using the same procedures. The minor differences that exist between them are due the different types of radar used to define the final approach course.

The ASR uses only an Airport Surveillance Radar (ASR) facility for the entire approach. The PAR W/O GS uses the ASR to establish the aircraft on final and then hands the aircraft off to a final controller who utilizes only the azimuth portion of the Precision Radar to provide course and range information.

Due to the increased accuracy of course and range information available during the PAR W/O GS, the associated MDA may be lower.

For the following discussion and procedure, consider the ASR and PAR W/O GS approaches to RWY 4 at New Orleans NAS (KNBG) (see Figure 9-5).

Note the following published differences for these two approaches at KNBG.

1. ASR RWY 4: MDA 420’ MSL, ceiling 500’ AGL-visibility ½ mile

2. PAR W/O GS RWY 4: MDA 380’ MSL, ceiling 400’ AGL-visibility ½ mile

Transition to Final

During non-precision radar approaches, the controller will establish the aircraft on final in the same manner as described in the PAR approach.

Final Approach

On a PAR W/O GS the aircraft will be handed off to the Final controller. During an ASR, the aircraft may continue with the Approach controller.

In both cases the controller will continue to provide ***heading*** information as described in the PAR approach.

NOTE

> With no glideslope information to pass, transmissions from the controller will not be as intense. On final, continue to acknowledge all instructions unless directed, “No need to acknowledge further transmissions.”

The pilot will be advised of the location of the Missed Approach Point (MAP) prescribed for the procedure and the aircraft's position each mile on final from the runway, airport or MAP, as appropriate.

The controller will direct the pilot when to commence descent to the Minimum Descent Altitude (MDA) or, if appropriate, to an intermediate step-down fix Minimum Crossing Altitude and subsequently to the prescribed MDA.

The published MDA for straight-in approaches will be issued to the pilot before beginning descent. If the approach will terminate in a circle-to-land maneuver, the pilot must furnish the aircraft approach category to the controller. The controller will then provide the pilot with the appropriate circling MDA (unless task saturated, this information should be obtain by the student from the radar approach section of the approach plates).

If requested by the pilot, recommended altitudes will be issued at each mile, based on the descent gradient established for the procedure, down to the last mile that is at or above the MDA.

Recommended altitudes provide a stabilized descent rate to the MDA. Heavy rain increases ground clutter on some radar systems. Dropping to MDA too early can result in a loss of radar contact. If notified “Radar contact lost,” and the runway environment is not in sight, a missed approach shall be executed.

At the MAP the controller will terminate guidance and instruct the pilot to execute a missed approach unless the pilot has the runway environment in sight.

Radar service is automatically terminated at the completion of a radar approach.

Procedure

1. Promptly comply with vectors/altitudes provided by the controller. Maintain situational awareness at all times. Acknowledge all transmissions until instructed otherwise.

2. Fly 200 KIAS on downwind and 150 KIAS on base leg. (If being vectored on an extended final or extended dog-leg to final, maintain 200 KIAS until within 15 NM of the airport).

3. Transition to BAC and complete landing checks when established on final or on a dog leg to final and within 15 miles of the airport.

4. Contact the final controller if directed (any initial call to a final controller should include the current status of the gear).

5. Descend to the MDA when directed.

    a. When utilizing recommended altitudes: Set power to approximately 24% torque, trim for 120 KIAS descent. Adjust rate of descent as required to meet recommended altitudes. It is your responsibility to reach MDA prior to the MAP.

b. When not utilizing recommended altitudes: Set power to approximately 20% torque, trim for 120 KIAS descent to the MDA. Adjust pitch to maintain airspeed; use power as required to maintain a stabilized rate of descent not to exceed 1000 fpm.

6. Approximately 100' prior to MDA, initiate level-off. Maintain MDA and assigned headings until the MAP.

7. The controller will advise when the aircraft has reached the MAP. If the runway environment is not in sight or you are not in a position to make a safe landing, execute the missed approach or climb-out instructions.

Common Errors

1. Slow to comply with or missing controller instructions.

2. Transition to BAC not completed prior to controller directing descent to MDA.

3. Not leveling off at the MDA.

4. Executing the missed approach upon reaching MDA prior to the MAP.

5. Confusing missed approach or climb-out instructions with the lost communication instructions.

6. Loss of orientation during vectors to final.

908. NO-GYRO APPROACH

General

A No-Gyro approach is available to a pilot under radar control who experiences circumstances wherein the directional gyro or other stabilized compass is inoperative or inaccurate. When this occurs, the pilot should so advise ATC and request a No-Gyro vector or approach.

No-Gyro radar vectors may be provided for the following types of radar approaches:

1. PAR

2. ASR

3. PAR W/O GS

4. Vectors for a visual approach (when the airport is under VMC conditions).

Examples:

"New Orleans Approach, Navy 3E123, Request No-Gyro approach for ASR RWY 4 at Navy New Orleans, for training."

or

"New Orleans Approach, Navy 3E123, I have lost my directional gyro, Request No-Gyro approach for PAR RWY 4 at Navy New Orleans."

The pilot should make all turns at standard rate and should execute the turn/roll out immediately upon receipt of instructions. For example, *"Turn right," "Stop turn."* When a surveillance or precision approach is made, the pilot will be advised after the aircraft has been turned onto final approach to make turns at half standard rate.

NOTE

During a normal radar approach, if a controller observes incorrect directional responses, or suspects the pilot has lost directional awareness, they may begin issuing No-Gyro vectors.

Example:

"Navy 3E123, I show you well left of course, disregard your directional gyro, these will vector for the No-Gyro PAR to RWY 4. Make all turns ½ Standard Rate, turn right."

Procedures

1. Request a No-Gyro PAR, ASR or PAR W/O GS approach.

2. Comply with the normal PAR, ASR/PAR W/O GS procedures.

3. Turn immediately when directed using SRT (not to exceed 30° AOB) until on final, then make all turns at ½ SRT unless otherwise directed.

4. Acknowledge all instructions unless directed *"No need to acknowledge further transmissions."*

Common Errors

1. Slow to comply with or missing controller instructions.

2. Transition to BAC not completed prior to descent on final.

3. Inappropriate transition at DA/MDA.

4. Using improper rate of turn based on controllers instructions/position in pattern.

5. Confusing missed approach or climbout instructions with the lost communication instructions.

6. Loss of orientation during vectors to final.

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CHAPTER TEN
GPS APPROACH PROCEDURES

1000. INTRODUCTION

General

Area navigation (RNAV) is a method of navigation which permits aircraft operation on any desired flight path within the coverage of ground-or space-based navigation aids. The following discussion will cover the T-6B space-based Global Positioning System (GPS). It is essential that the student read the T-6B NATOPS flight manual and be thoroughly familiar with the components and operation of the Flight Management System (FMS) and GPS.

1001. GPS ALLOWABLE OPERATIONS

Pilots are not authorized to fly a published RNAV (GPS) instrument approach procedure (IAP), departure procedure (DP), or arrival procedure (STAR) unless it is retrievable by the procedure name from a current aircraft navigation database and conforms to the charted procedure. The system must be able to retrieve the procedure by name from the aircraft navigation database, not just as a manually entered series of waypoints from the database.

Basically, an FAA approved FMS/GPS system may be used to navigate to, identify, or hold at any waypoint(s) retrieved from a FAA approved (and current) database. It cannot be used to navigate the final segment (lateral navigation) of any approach that does not have (GPS) in the title. See "Uses of suitable (RNAV) GPS Systems" below for specific AIM rules.

Uses of Suitable (RNAV) GPS Systems

Subject to the operating requirements, operators may use a suitable RNAV (GPS) system in the following ways:

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

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

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

4. Fly an arc based upon DME.

NOTES

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

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

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

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

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

6. "VOR" includes VOR, VOR/DME, and VORTAC facilities and "compass locator" includes locator outer marker and locator middle marker.

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

1002. TERMINAL ARRIVAL AREA (TAA)

TERMINAL ARRIVAL AREA

TAAs are the method by which aircraft are transitioned from the RNAV enroute structure to the terminal area with minimal ATC interaction. Terminal arrival areas are depicted in the planview of the approach chart, and each waypoint associated with them is also provided with a unique five character, pronounceable name. The TAA consists of a designated volume of airspace designed to allow aircraft to enter a protected area, offering guaranteed obstacle clearance where the initial approach course is intercepted based on the location of the aircraft relative to the airport.

Where possible, TAAs are developed as a basic "T" shape (see Figure 10-1) that is divided into three separate arrival areas around the head of the "T": left base, right base, and straight-in. Typically, the TAA offers an IAF at each of these three arrival areas that are 3-6 NM from an IF, which often doubles as the IAF for straight-in approaches, a FAF located approximately 5 NM from the runway threshold, and a MAP.

An obstacle clearance of at least 1,000 feet is guaranteed within the boundaries of the TAA.

TAAs are modified or even eliminated if necessary to meet the requirements of a specific airport and surrounding terrain, or airspace considerations negating the use of the "T" approach design concept. Variations may eliminate one or both base areas, and/or limit or modify the angular size of the straight-in area. When both base areas are eliminated, TAAs are not depicted in the planview. (See examples in Figure 10-2).

Normally, a portion of the TAA underlies an airway. If this is not the case, at least one feeder route is provided from an airway fix or NAVAID to the TAA boundary. The feeder route provides a direct course from the enroute fix/NAVAID to the appropriate IF/IAF. Multiple feeder routes may also be established. In some cases, TAAs may not be depicted because of airspace congestion or other operational requirements.

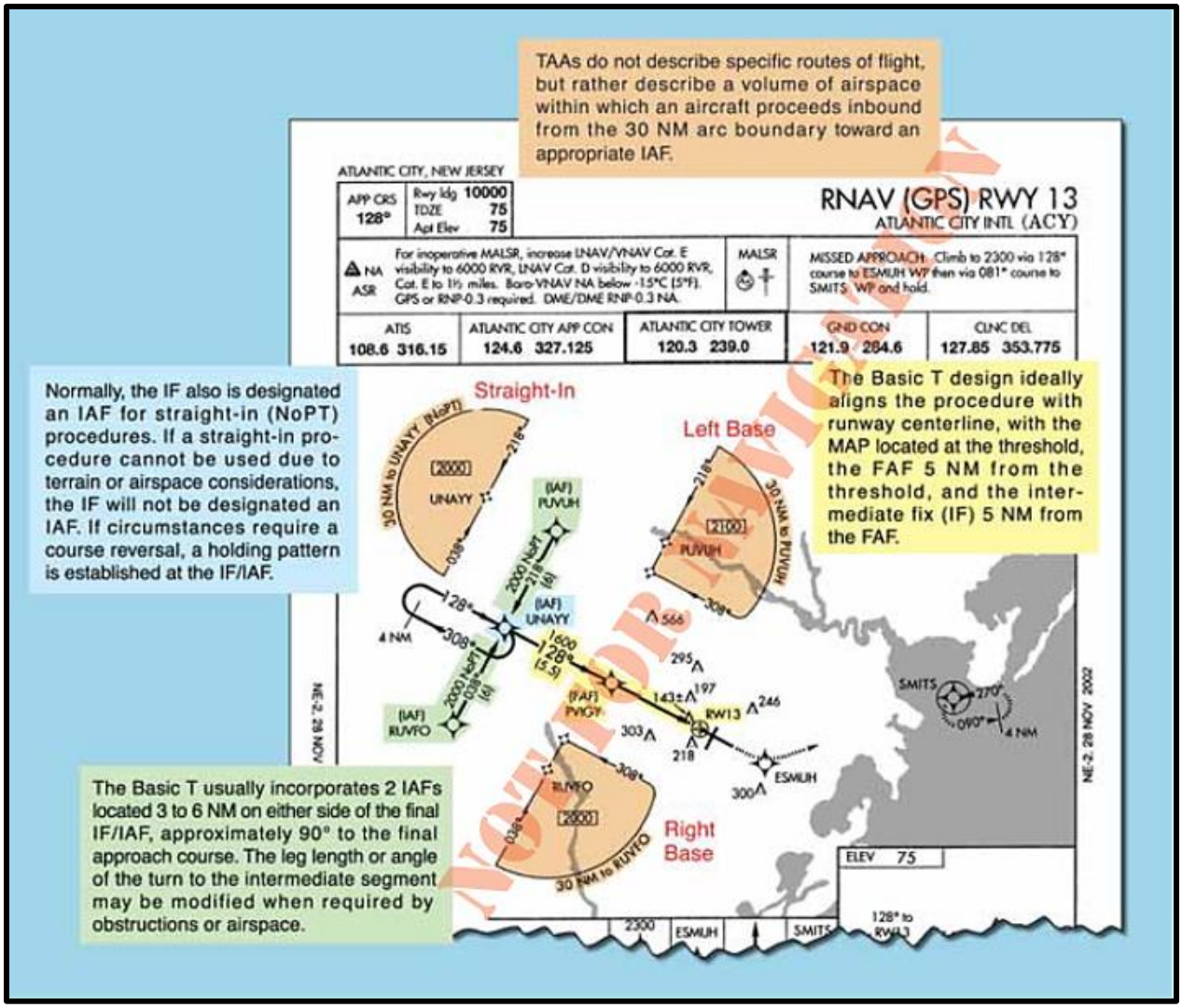

Figure 10-1 Terminal Arrival Area Design (Basic "T")

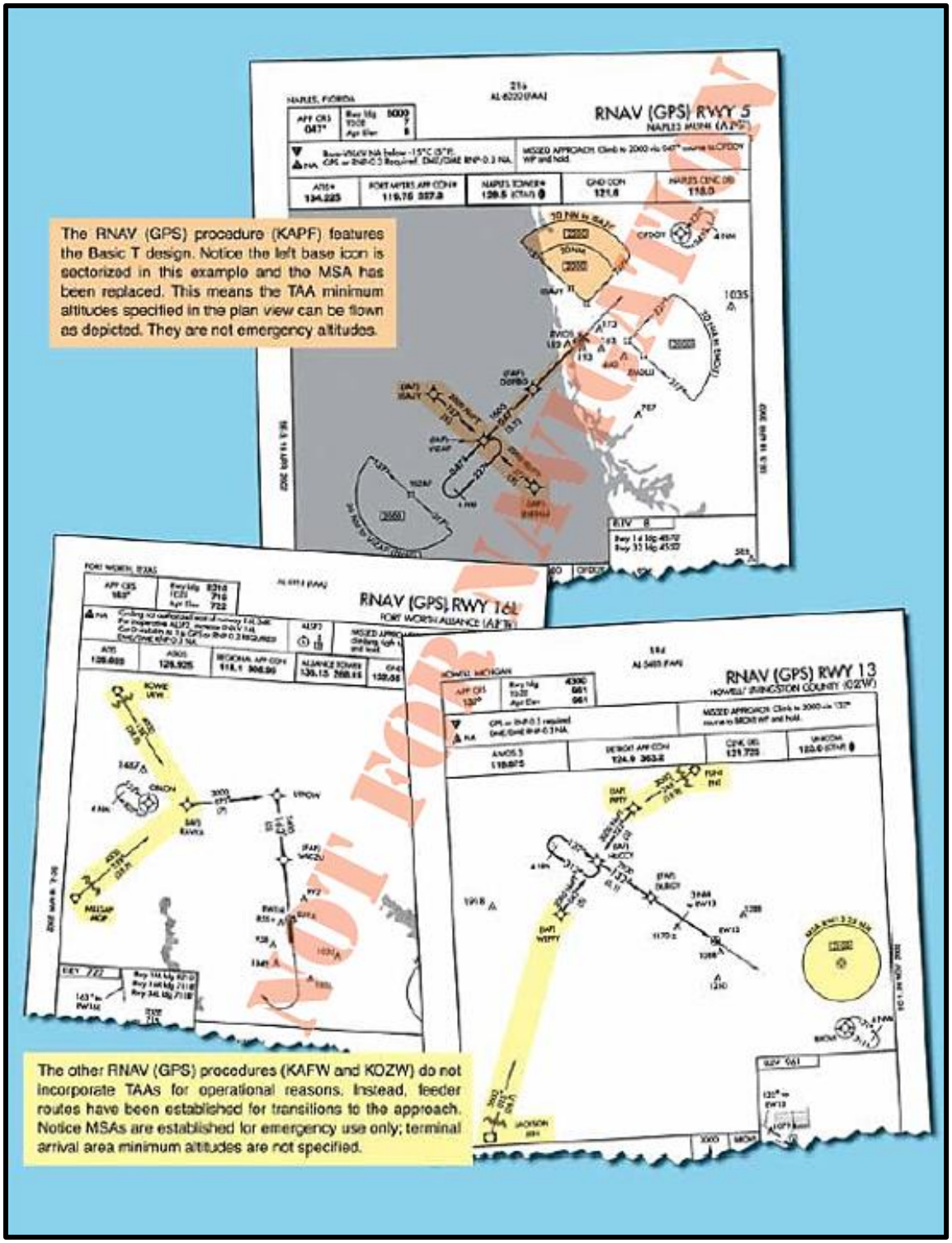

Figure 10-2 Terminal Arrival Area Design (Variations)

1003. GPS STAND-ALONE APPROACHES

Stand-alone approach procedures specifically designed for GPS systems have replaced many of the original overlay approaches. All approaches that contain "GPS" in the title (e.g., "VOR or GPS RWY 24," "GPS RWY 24," or "RNAV (GPS) RWY 24") can be flown using GPS. GPS-equipped aircraft do not need underlying ground-based NAVAIDs or associated aircraft avionics to fly the approach. Monitoring the underlying approach with ground-based NAVAIDs is suggested when able. Existing overlay approaches may be requested using the GPS title; for example, the VOR or GPS RWY 24 may be requested as "GPS RWY 24." Some GPS procedures have a Terminal Arrival Area (TAA) with an underlining RNAV approach.

NOTE

The T-6B is certified to fly RNAV (GPS) approaches to LNAV MDA minimums. ***LNAV/VNAV or VNAV minimums may NOT be used.*** The T-6B on-board system is ***NOT*** capable of providing approach approved VNAV data.

1004. GPS OVERLAY OF NON-PRECISION APPROACHES

GPS overlay approaches are designated non-precision instrument approach procedures that pilots are authorized to fly using GPS avionics. Localizer (LOC), localizer type directional aid (LDA), and simplified directional facility (SDF) procedures are not authorized. Overlay procedures are identified by the "name of the procedure" and "or GPS" (e.g., VOR/DME or GPS RWY 15) in the title. Authorized procedures must be retrievable from a current onboard navigation database.

The navigation database may also enhance position orientation by displaying a map containing information on conventional NAVAID approaches. This approach information should not be confused with a GPS overlay approach (See the receiver operating manual, AFM, or AFM Supplement for details on how to identify these approaches in the navigation database.)

NOTE

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

1005. RNAV (GPS) APPROACHES

A ***BOLD*** standard racetrack holding pattern (***HILO***) may be provided at the IAF. The published procedure will be annotated to indicate when the course reversal is not necessary when flying within a particular TAA area, or from a specific feeder fix; e.g., "NoPT." Otherwise, the pilot is expected to execute the course reversal. The pilot may elect to use the course reversal pattern

when it is not required by the procedure, but must inform air traffic control and receive clearance to do so.

Prior to arriving at the TAA boundary, the pilot can determine which area of the TAA the aircraft will enter by selecting the IF (IAF) if needed to determine the magnetic bearing TO the center IF/IAF. That bearing should then be compared with the published bearings that define the lateral boundaries of the TAA areas. Using the end IAFs may give a false indication of which area the aircraft will enter. This is critical when approaching the TAA near the extended boundary between the left and right-base areas, especially where these areas contain different minimum altitude requirements.

Once "Cleared" for the approach, pilots entering the TAA are expected to proceed directly to the IAF associated with that area of the TAA at the altitude depicted, unless otherwise instructed by air traffic control. ***Being cleared direct to an Initial Approach Fix (IAF) without a clearance for the procedure does not authorize a pilot to descend to a lower TAA altitude***. If a pilot desires a lower altitude without an approach clearance, request the lower TAA altitude. If a pilot is not sure of what they are authorized or expected to do by air traffic, they should ask air traffic or request a specific clearance. Pilots entering the TAA with two-way radio communications failure must maintain the highest altitude prescribed by the FIH lost communications section until arriving at the appropriate IAF.

WARNINGS

1. Published GPS approach procedures may contain final approach step-down fixes that have no corresponding waypoints in the associated GPS approach retrieved from the FMS database. It is the pilot's responsibility to identify these points relative to the appropriate ***charted*** references.

2. The GPS displays Along Track Distance (ATD) to the active waypoint, which is different than DME distances from a conventional NAVAID. Pilots must use extreme caution to use the appropriate charted reference distances to preclude a potentially dangerous early or late descent on final.

3. Use caution removing route discontinuities between the last waypoint in the flight plan clearance limit and a loaded approach procedure. Except as defined in the FIH under lost communications, you may not proceed past the clearance limit unless cleared for an approach or when complying with assigned vectors.

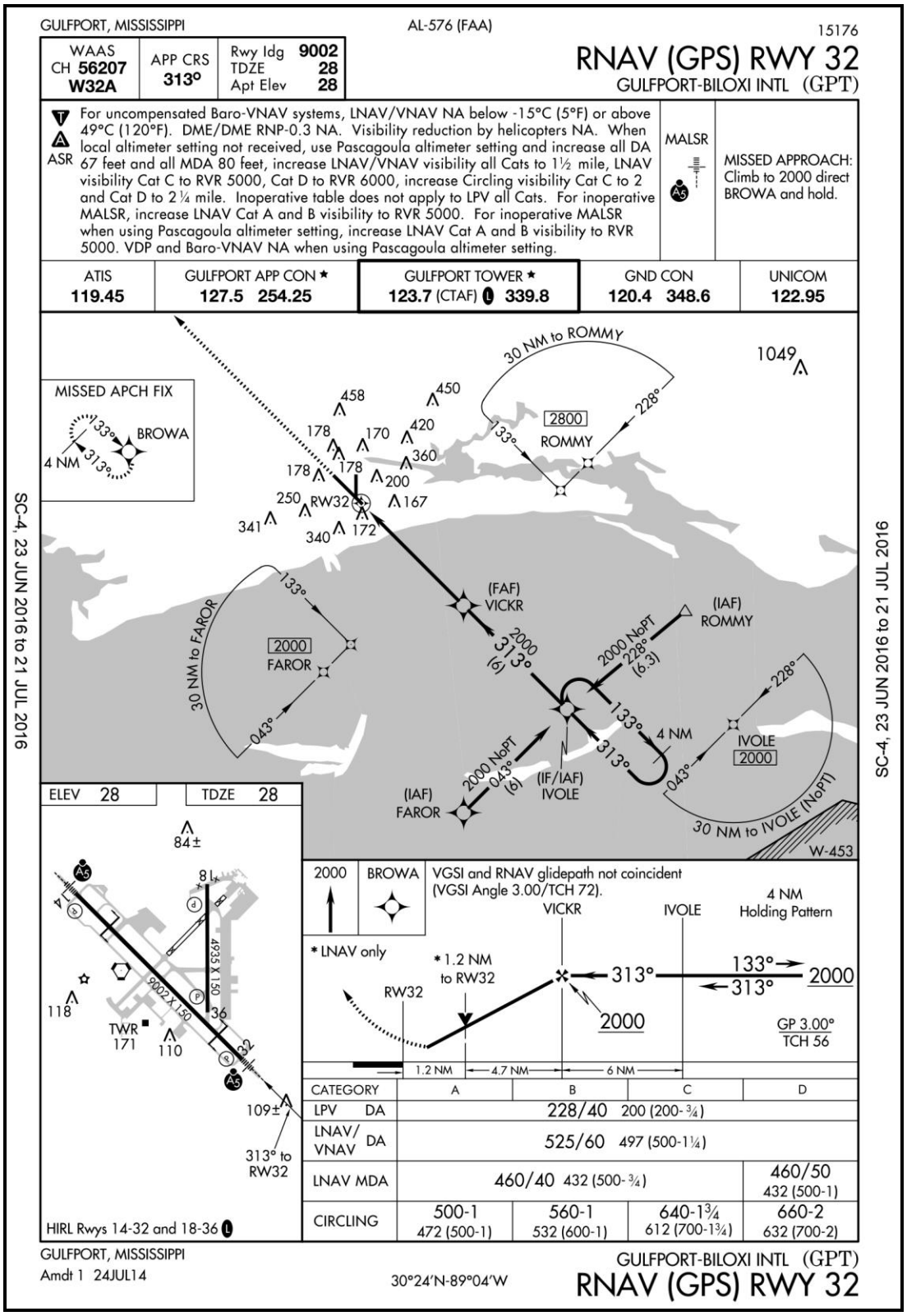

Figure 10-3 RNAV (GPS) RWY 32 (KGPT)

Procedure

For the following example refer to the RNAV (GPS) RWY 32 at Gulfport-Biloxi Intl (see Figure 10-3). ***"Little Dogs Dig Holes Always"*** (***LDDHA***) is helpful mnemonic for FMS setup.

In this example the bearing to IVOLE (the center IF/IAF) is between 043° and 133° and you have been "Cleared for the RNAV RWY 32 approach." From this area you are expected to proceed direct to FAROR and may comply with the depicted TAA altitudes.

Upon receiving approach clearance:

1. **L** – Load GPS approach. (If not previously accomplished).

NOTE

Ensure that the appropriate approach transition is selected (FAROR in this example). Where opted, failing to select an appropriate transition will prevent needed waypoints from being loaded to the LEGS Page (IAF, /H (HILO), PT, Arcs or other approach options).

2. **D** – Direct to IAWP, (in this case FAROR).

NOTE

If being radar vectored to final, first move FAWP VICKR to LSK1 on the LEGS Page 1, extend the intercept course 313 by pressing RSK6, then select execute. Comply with vectoring procedures until "cleared for approach."

3. **D** – Display – PFD source should be set to FMS.

4. **H** – Hold – If the approach requires a turn in holding (HILO), ensure that the waypoint appears in the legs page with the /H suffix.

5. **A** – Approach Mode – Verify "APR" (approach) mode at 2NM from MAWP on PFD.

6. Descend to appropriate altitude per TAA/ATC instructions (cleared for the approach and within 30 NM of FAROR descend to 2000' MSL).

7. Within 5 NM of the IAWP (FAROR), Slow to 150 KIAS.

8. Fly published procedure to establish aircraft inbound to the FAWP (VICKR).

9. Comply with courses and altitudes (use Turn anticipation where appropriate).

NOTE

In our example, maintain 2000′ MSL until FAFWP tracking 043° course from FAROR to the IF IVOLE, then 313° from IVOLE to FAWP VICKR (the published "NoPT" on this segment indicates that the published HILO pattern should ***not*** be executed).

10. Within 5 NM of the FAWP (VICKR) transition to BAC.

NOTE

Expect handoff to Tower or advisory frequency when inbound to the FAFWP. On initial contact, report position along the approach, gear status and your intentions.

11. At 3 NM from the FAWAP (VICKR) observe **"HSI SCALES TO CHANGE"** message.

12. At 2 NM from the FAWP (VICKR) observe transition to **APR** (approach) mode.

NOTE

If the FMS fails to transition to the APR MODE notify the Instructor and comply with Loss of GPS integrity prior to the FAWP procedures.

13. At the FAWP execute the 6T's:

TIME - As required for any backup approach.

TURN - Continue tracking FMS to the MAWP.

TIME - Not required.

TRANSITION - Set approximately 20% torque, trim for 120 KIAS descent to segment altitude or MDA as required (LNAV MDA 460' MSL).

NOTE

Adjust pitch to maintain airspeed; use power as required to maintain a stabilized rate of descent not to exceed 1000 fpm.

TWIST - Track course from FAC to the MAWP (course is set by the FMS).

NOTES

1. On some approaches, a course change may be required passing the FAWP.

2. Named waypoints on the published instrument approach between the FAWP and MAWP that can be defined using Along-Track-Distance (ATD) from the MAWP or other charted methods may not appear on the NAV/TSD display or on the LEGS page.

TALK - As required/directed.

NOTE

If a GPS Integrity warning occurs between the FAWP and the MAWP, execute the Loss of GPS Integrity "Inside the FAF" procedures.

14. Approximately 100' prior to the MDA, slowly add power to arrest the rate of descent.

15. At the MDA (460'), adjust power to maintain altitude and approach speed.

16. Fly at the MDA to the MAWP (RWY32).

17. Upon reaching the MAWP (RWY32), if the runway is not insight or the aircraft is not in a position to make a safe landing, execute the Missed Approach.

NOTE

The VDP for this approach is defined by distance from the MAWP (1.2 NM prior to RWY32)

The FMS will ***NOT*** automatically sequence to any waypoints required for execution of the Missed Approach procedure. Automatic sequencing will cease at the MAWP. Once stabilized in the climb and clean, if a Missed Approach is required the pilot must manually sequence the system to the first Missed Approach WPT by selecting MISS APR and EXEC. Until MISS APR is selected the FMS will continue to provide course guidance along the FAC.

Common Errors

1. Loading wrong approach/transition.

2. Inappropriate use of feeder fix/TAA altitudes.

3. Not slowing to 150 KIAS within 5 NM of the IAWP (for non-radar vectors).

4. Late transition to BAC.

5. Not verifying APR mode within 2 NM of the FAWP.

6. Using wrong Minimums for the approach.

1006. LOSS OF GPS INTEGRITY

Prior to the FAWP:

If a GPS integrity warning occurs prior to the FAWP, or system sensitivity does not change to APR mode within 2 NM of the FAWP:

1. Transition to a backup approach if available.

NOTE

This does not, for example, give the pilot the option to fly an ILS approach if the clearance given was to a stand-alone RNAV (GPS) approach. If however, the clearance given was to an overlay approach, the pilot may transition to the underlying NAVAID and continue on the approach.

If no backup approach is available (or until obtaining clearance for one);

2. Continue on course to the FAWP.

3. At the FAWP continue to the MAWP maintaining the FAWP altitude.

4. At the MAP, execute the published Missed Approach or climbout instructions as appropriate.

NOTE

Inform the controlling agency as soon as practical.

Inside the FAWP:

A GPS integrity warning occurring after the FAWP is a serious situation. Pilots must be prepared to take immediate action.

1. Transition to your backup approach, if available (see note from step one above).

2. Climb to the Missed Approach altitude.

3. Continue tracking to the MAWP.

4. At the MAWP, execute the published Missed Approach or climbout instructions as appropriate.

NOTE

Inform the controlling agency as soon as practical.

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CHAPTER ELEVEN
TRANSITION TO LANDING AND MISSED APPROACH

1100. INTRODUCTION

The transition to the visual segment on an instrument approach begins once the field is in sight, and you are in a safe position to land.

1101. STRAIGHT-IN APPROACHES

On properly executed PAR, ASR, ILS/Localizer and most GPS approaches, the aircraft should be very close to being lined up on centerline when you gain visual reference to the runway environment. The transition, in this case, should be relatively simple. All that is normally required is an airspeed reduction and possible configuration change while continuing the descent from the DA/MDA to intercept a normal visual glidepath.

On some Non-Precision Straight-in approaches, the final approach course may be as much as 30º off runway heading. In this case, it will be necessary to continue on the final approach course until you can make a turn to line up on centerline.

Some Non-precision approaches have MDAs of 800' or higher. If not depicted on the approach, a VDP should be calculated. Even if the runway is in sight, you should remain at the MDA until reaching the VDP before making a normal descent to the runway.

If the runway environment is not in sight until the MAP a descent from MDA to the normal touchdown zone could require an unsafe rate of descent. In this case a longer landing must be acceptable or a safe landing may not be possible. ***Remember, just because the runway environment is in sight at the MAP, does NOT mean a safe landing can be made.***

1102. CIRCLING MANEUVERS

Description

Prior to commencing an approach that will end in a circling maneuver, a plan should be formulated on how the circle will take place. Consider the following:

1. Winds: Will they push the aircraft towards or away from the runway?

2. Runway alignment with respect to the approach being flown.

3. Airport environment: mountains, trees, towers, etc.

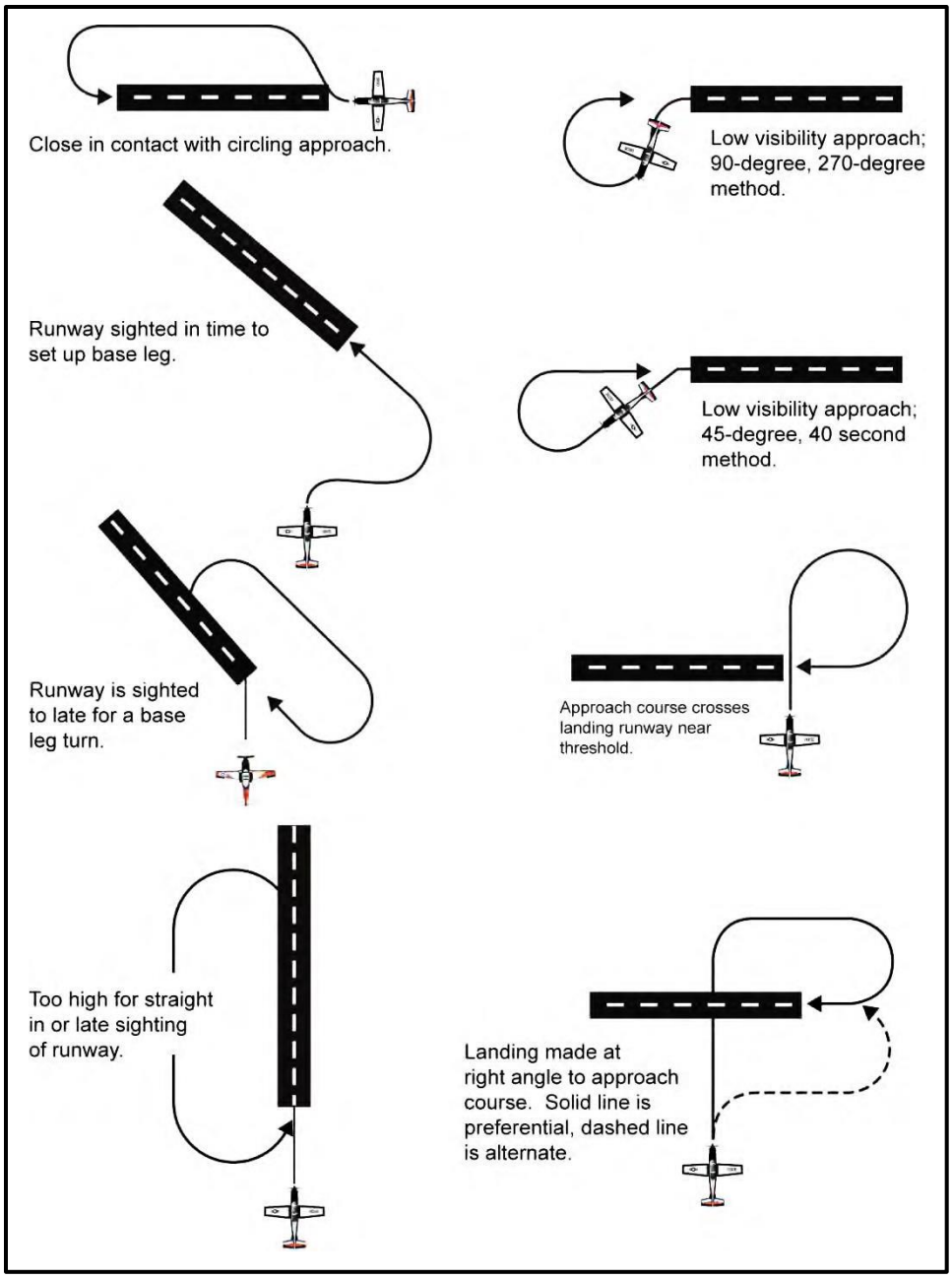

Figure 11-1 Circling Maneuvers

Procedure

Upon breaking out of the weather, locate the intended runway in use. Remain at or above the circling altitude until the aircraft is in a position to land. Every effort should be made to fly normal VFR checkpoints (e.g., 180, 90, final).

NOTE

Normal checkpoints such as WTD may be different since you may be at either a higher or lower altitude than a normal pattern.

NOTE

Because of obstacles near the airport, a portion of the circling area may be restricted by a procedural note (e.g., "Circling NA E of RWY 17–35"). It is the pilot's responsibility to review any circling restrictions for the intended airport. These restrictions can be found in the Approach Plates, AP1, IFR Supplement or current NOTAMs.

Circling Minimums

In some busy terminal areas, ATC may not allow circling and circling minimums will not be published. Published circling minimums provide obstacle clearance when pilots remain within the appropriate area of protection (see Figures 11-2 and 11-3).

NOTE

Where standard instrument approach procedures (SIAPs) authorize circling approaches, they provide a basic minimum of 300 feet of obstacle clearance at the MDA within the circling area considered.

When cleared for a circling maneuver, comply with any restrictions noted on the instrument approach procedure or any verbal instructions received from the controller.

When the direction of the circling maneuver in relation to the airport/runway is required, the controller will state the direction (eight ***cardinal*** compass points) and specify a left or right base/downwind leg as appropriate.

Pilots should remain at or above the circling altitude until the aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal rate of descent using normal maneuvers.

The following basic rules apply:

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

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

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

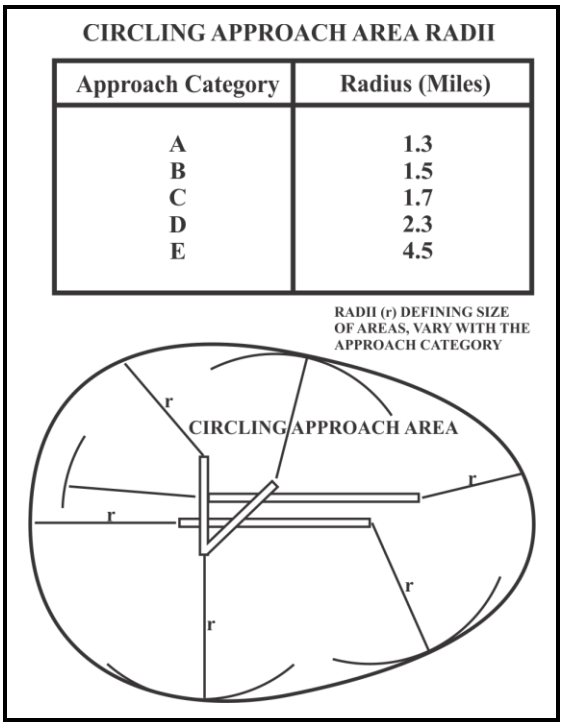

Figure 11-2 Circling Approach Area Radii

Charting Changes

Aeronautical charting providers have implemented new specifications to identify circle-to-land minima based on the new TERPS criteria. U.S. Terminal Procedures instrument approach charts use an "Inverse C" circle icon (see Figure 11-4) to identify circling radius minima based on the new criteria:

Circling MDA in feet MSL	Approach Category and Circling Radius (NM)				
	CAT A	CAT B	CAT C	CAT D	CAT E
1000 or less	1.3	1.7	2.7	3.6	4.5
1001-3000	1.3	1.8	2.8	3.7	4.6
3001-5000	1.3	1.8	2.9	3.8	4.8
5001-7000	1.3	1.9	3.0	4.0	5.0
7001-9000	1.4	2.0	3.2	4.2	5.3
9001 and above	1.4	2.1	3.3	4.4	5.5

Figure 11-3 New Circling Area Radii

11-4 TRANSITION TO LANDING AND MISSED APPROACH

C CIRCLING	1460-1 600 (600-1)	1480-1 620 (700-1

Figure 11-4 U.S. Terminal Procedures Approach Charts – Circling Minima Based on (New) Larger Circling Areas

Missed Approach from a Circling 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 an alternate missed approach procedure is specified by ATC).

To become established on the prescribed missed approach course, the pilot ***should make an initial climbing turn toward the landing runway*** and continue the turn until established on the missed approach course (see Figure 11-5).

Making the initial turn toward the landing runway will help assure that an aircraft will remain laterally within the circling and missed approach obstruction clearance areas (see Figures 11-2 and 11-3).

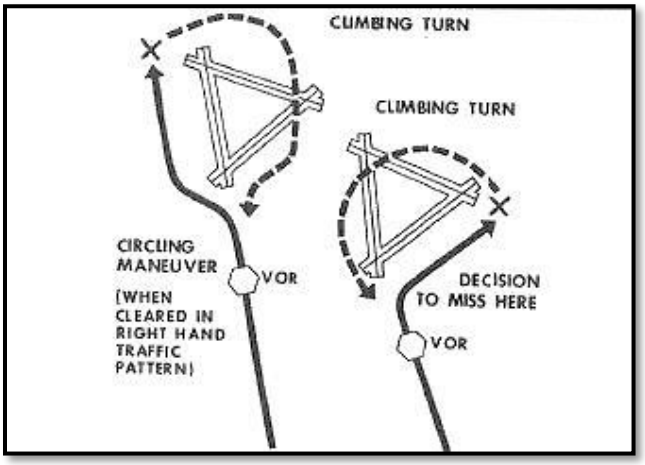

Figure 11-5 Missed Approach from a Circling Maneuver

1103. MISSED APPROACH

Description

A Missed Approach is a procedure used to discontinue an instrument approach if the runway environment is not in sight, or the aircraft is not in a position to make a safe landing. The primary concern if unable to land is to climb to a safe altitude. Therefore, establishing and maintaining a positive rate of climb should be your first priority if a Missed Approach is commenced. Your second priority should be to turn the aircraft (if required) to intercept the Missed Approach course or to the designated heading.

Missed Approach instructions are found in the pilot briefing information and profile view sections of the approach plate. The student should review the Missed Approach prior to the FAF or once established on final if no FAF is depicted.

Pilots may not operate an aircraft at any airport below the authorized MDA or continue an approach below the authorized DA/DH unless:

1. The aircraft is continuously in a position from which a descent to a landing on the intended runway can be made at a normal descent rate using normal maneuvers.

2. The flight visibility is not less than that prescribed for the approach procedure being used.

3. At least one of the following visual references for the intended runway is visible and identifiable to the pilot:

   a. Approach light system

   b. Threshold

   c. Threshold markings

   d. Threshold lights

   e. Runway End Identifier Lights (REIL)

   f. Visual Approach Slope Indicator (VASI)

   g. Touchdown zone or touchdown zone markings

   h. Touchdown zone lights

   i. Runway or runway markings

   j. Runway lights

Obstacle protection for published missed approach procedures are predicated on the missed approach being initiated at the decision altitude/height (DA/DH) or at the missed approach point and not lower than minimum descent altitude (MDA). ***A climb gradient of at least 200 feet per nautical mile is required unless a higher climb gradient is published in the notes section of the approach procedure chart.***

When higher than standard climb gradients are specified, the end point of the non-standard climb will be specified at either an altitude or a fix. Pilots must preplan to ensure that the aircraft can meet the climb gradient (expressed in feet per nautical mile) required by the procedure in the event of a missed approach, and be aware that flying at a higher than anticipated ground speed increases the climb rate requirement (feet per minute).

11-6 TRANSITION TO LANDING AND MISSED APPROACH

Tables for the conversion of climb gradients (feet per nautical mile) to climb rate (feet per minute), based on ground speed, are located inside the back cover on the DOD Terminal Procedures booklets (approach plates).

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

NOTE

When flying practice approaches, ATC frequently assigns climbout instructions that differ from the published Missed Approach procedures. You are expected to fly the assigned climbout instructions vice Missed Approach procedures when executing a Missed Approach.

Missed Approach Prior to the FAF

If executing an instrument approach and full scale deflection of the CDI occurs PRIOR to the FAF, the pilot should make every attempt to return back onto course. If unable to reestablish the aircraft on course, do not descend below the FAF altitude, inform ATC, and follow ATC instructions.

Missed Approach between the FAF and MAP

If executing an instrument approach and full scale deflection of the CDI occurs at any time between the FAF and the MAP, begin an ***immediate*** climb to the depicted Missed Approach altitude (or altitude ATC has assigned in the event of a Missed Approach), fly to the MAP and execute the Missed Approach procedure. Advise ATC at the earliest opportunity. Set an intercept heading to establish the aircraft back on the final approach course.

WARNING

Obstacle clearance is not ensured when the aircraft is off the published portions of an approach. With full scale deflection of the CDI in areas of high terrain or obstacles, a climb to the Minimum Safe Altitude (MSA) may be required.

Procedure

At the MAP, if sufficient visual cues are not available, the aircraft is not in position to maneuver to a safe landing or directed by ATC, execute a Missed Approach.

1. Increase PCL to MAX.

2. Raise the nose to a positive climbing attitude (10-15º nose-up).

3. Check altimeter and VSI for positive rate of climb and report *"Two positive rates, Gear."*

4. Raise the landing gear.

5. Check and report *"Above 110, Flaps."*

6. Raise the Flaps, when up report *"Gear and Flaps up at ___ knots."*

7. Climb accelerating towards 180 KIAS (8-10° nose-up).

8. Start a SRT toward the Missed Approach course or heading. Maintain a positive rate of climb.

NOTE

A normal climb gradient for the T-6B at 180 KIAS clean at sea level is approximately 650 ft/nm (2000 fpm). ***Should a steeper climb gradient be required, refer to the CLIMB GRADIENT FOR OBSTACLE CLEARANCE CHART in the NATOPS PCL***. The charted performance is based on a 140 KIAS clean climb.

9. Establish an intercept to a Missed Approach course if required.

10. Make the "Missed Approach" report to Tower (or local traffic on CTAF at non-towered fields). (State the reason for Missed approach, e.g.; *"Missed approach for training,"* or *"Missed approach field not in sight"* for tower controlled fields.)

11. Level-off at the missed approach altitude at an airspeed appropriate for the follow-on maneuver.

12. Contact ATC, inform them of your Missed Approach and state your intentions.

Options include:

a. ***Request the same approach***. If the missed approach was due to poor BAW or when required for training, you might request to fly the same approach again.

b. ***Request a different approach*.** With lower minimums, if available.

c. ***Request clearance to your alternate***. If weather and/or fuel considerations dictate that you proceed to your alternate, coordinate with ATC to obtain clearance. The **DRAFT** mnemonic is useful in formatting your request.

Destination (alternate airport name)
Route (same rules used for route of flight section on a DD-1801)
Altitude (comply with semi-circular rules)
Fuel (estimated time until flameout in hours + minutes based on cruise fuel flow)
Time (estimated time enroute (ETE) in hours + minutes)

13. Update the weather as appropriate.

Common Errors

1. Poor Instrument Scan/Poor BAW.

2. Slow to establish a climb.

3. Neglecting navigation requirements while talking to ATC prior.

4. Confusion between assigned courses versus headings.

5. Not trimming as the aircraft accelerates.

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APPENDIX A
GLOSSARY

A100. NOT APPLICABLE

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APPENDIX B
60-TO-1 RULE AND OTHER FORMULAS

B100. 60-TO-1 RULE AND OTHER FORMULAS

At 60 NM from a NAVAID the distance between each radial is approximately 1 NM.

Mathematical Basis for 60-to-1 Rule: Circle Circumference = 2 x radius x 3.14 = 6.28 x radius

Therefore, @ 60 NM, $1\ degree = \frac{6.28 \text{ x } 60 \text{ nm}}{360 \text{ degrees}}$ =1.05 nm/degree ≈1 nm

To:	Use:
Convert Groundspeed to **NM / Min**	$\frac{\text{NM}}{\text{Min}} = \frac{\text{Groundspeed in Knots}}{60}$
Convert **Ft/NM to Rate of Climb/Descent In FPM**	NM/Min x Ft/NM = Rate of Climb/Descent in Feet per minute (FPM)
Calculate **Lead Point DME** Turn Radius (**TR**) for 90° turn	For Standard Rate Turn: TR = 0.5% of Groundspeed in Knots For ½ Standard Rate Turn: TR = 1% of Groundspeed in Knots
Calculate **Lead Radial** For 90° turn	60/DME = Radials/NM Radials/NM x TR = Number of radials for lead Number of radials for lead prior to desired Radial = Lead Radial
Estimate **Crosswind** component	Determine difference between runway heading and winds 15° off = 25% of the wind 30° off = 50% of the wind 45° off = 75% of the wind ≥ 60° off = 100% of the wind

Calculate **VDP**	Distance from the runway $\approx \frac{HAT\ (in\ 100s\ \ of\ feet)}{Gradient}$ "GUS wears a HAT"
Calculate **Gradient**	$\frac{100s\ of\ feet}{Distance\ in\ NM}$ = Descent Gradient in Degrees
Calculate Required Rate of Descent **(VSI)**	$\frac{NM}{Min}$ X 100 ft x Gradient = Required VSI

APPENDIX C
COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

C100. INTRODUCTION

Radio communications are a critical link in the ATC system. The link between pilot and controller can flow very smoothly or it can be broken with surprising speed and disastrous results. Discussion herein provides basic procedures for new pilots and also highlights safe operating concepts for all pilots.

The single, most important thought in pilot-controller communications is Clarity (understanding). It is essential that pilots acknowledge each radio communication with ATC by using the appropriate aircraft call sign***. Brevity is important in high traffic areas***. Contacts should be kept as brief as possible. Controllers must know what you want to do before they can properly carry out their control duties; and you, the pilot, must know exactly what the controller wants you to do***. If concise phraseology is not adequate, use whatever words are necessary to get your message across.***

Pilots are to maintain vigilance in monitoring air traffic control radio communications frequencies for potential traffic conflicts with their aircraft especially when operating on an active runway and/or when conducting a final approach to landing.

The Aeronautical Information Manual (AIM) Pilot/Controller Glossary is very helpful in learning what certain words or phrases mean. Good phraseology enhances safety and is the mark of a professional pilot. ***Jargon, chatter, and slang have no place in ATC communications.***

The Pilot/Controller glossary will aid you in understanding appropriate aviation phraseology and achieving the primary objectives of all communications, ***"BREVITY and CLARITY."***

Here are four common and very often misused terms:

AFFIRMATIVE - YES

NEGATIVE - NO

ROGER - I have received all of your last transmission. It should ***not*** be used to answer a question requiring a yes or no answer. (See AFFIRMATIVE and NEGATIVE.)

ROGER is a brevity term that can be used to acknowledge information that requires no read back of the information or pilot action.

WILCO - I have received your message, understand it, and will comply with it.

WILCO is a brevity term that can be used to acknowledge instructions that require an action but read back of the information is not required.

NOTE

1. To reply *"ROGER"* or *"WILCO"* and then read back all the information is redundant.

2. Saying *"ROGER WILCO"* is inappropriate.

Examples:

Controller	Pilot
"TEXAN 123, can you accept a 20 minute delay for the approach?"	*"TEXAN 123, AFFIRMATIVE."*
"TEXAN 123, do you have the airport in sight?"	*"TEXAN 123, NEGATIVE."*
"TEXAN 123, you will be number seven for the approach."	*"TEXAN 123, ROGER."*
"TEXAN 123, standby Final Control on this frequency."	*"TEXAN 123, WILCO."*
"TEXAN 123, descend and maintain 3000."	*"TEXAN 123, leaving 6000 for 3000."*

C101. RADIO ETIQUETTE

Listen before you transmit. Many times you can get the information you want through ATIS or by just monitoring the frequency**.** ***If you have just changed frequencies, pause, listen, and make sure the frequency is clear.*** If you hear someone else talking, the keying of your transmitter will be futile and you will probably jam their receivers causing them to repeat their call.

Think before keying your transmitter. Know what you want to say, if it is lengthy; e.g., a flight plan or IFR position report, jot it down.

The microphone should be very close to your lips (mask on) and after pressing the mike button, a ***slight pause may be necessary to be sure the first word is transmitted.*** Speak in a normal, conversational tone.

When you release the button, wait a few seconds before calling again. The controller or FSS Specialist may be jotting down your number, looking for your flight plan, transmitting on a different frequency or selecting the transmitter for your frequency.

C-2 COMMUNICATIONS PHRASEOLOGY AND TECHNIQUES

Be alert to the sounds ***or the lack of sounds*** in your receiver. Check your volume, recheck your frequency and ***make sure that your microphone is not stuck*** in the transmit position. Frequency blockage can, and has, occurred for extended periods of time due to unintentional transmitter operation. This type of interference is commonly referred to as a "stuck mike" or "hot mike," and controllers may refer to it in this manner when attempting to assign an alternate frequency.

Be sure that you are within the performance range of your radio equipment and the ground equipment. Remote radio sites do not always transmit and receive on all of a facility's available frequencies, particularly with regard to VOR sites where you can hear but not reach a ground station's receiver. Remember that higher altitudes increase the range of VHF "line of sight" communications.

C102. INITIAL CONTACT OR CALLUP

The terms "initial contact" or "initial callup" refer to the first radio call you make to a given facility or the first call to a different controller or FSS specialist within a facility. Use the following format:

1. Name of the facility being called.

2. Your ***full*** aircraft identification as filed in the flight plan.

3. When operating on an airport surface, state your position.

4. The type of message to follow (a courtesy call) or your full request ***if it is short.***

Example:

"Columbia Ground, Shooter Zero Three One, south ramp, I−F−R Memphis."

"Miami Center, Boomer Zero Five Six, request V−F−R traffic advisories."

Many FSSs are equipped with Remote Communications Outlets (RCOs) and can transmit on the same frequency at more than one location. The frequencies available at specific locations are indicated on charts above FSS communications boxes. To enable the specialist to utilize the correct transmitter, state the location and the frequency on which you expect a reply.

Example:

St. Louis FSS can transmit on frequency 122.3 at either Farmington, Missouri, or Decatur, Illinois. If you are in the vicinity of Decatur, your callup should be:

"Saint Louis radio, Red Knight Zero Niner Six, receiving Decatur One, Two, Two, Point Three."

If radio reception is reasonably assured, inclusion of your request, your position or altitude, and the phrase "Information Charlie" (ATIS), in the initial contact helps decrease radio frequency

congestion. Use discretion; do not overload the controller with information unneeded or superfluous. If you do not get a response from the ground station, recheck your radios or use another transmitter, but keep the next contact short.

Example:

"Atlanta Center, Navy Six Echo Zero Four One, request V−F−R traffic advisories, Twenty Northwest Rome, seven thousand five hundred."

FSSs and Supplemental Weather Service Locations (SWSLs) are allocated frequencies for different functions; for example, 122.0 MHz is assigned as the Enroute Flight Advisory Service frequency at selected FSSs. In addition, certain FSSs provide Local Airport Advisory on 123.6 MHz or other frequencies which can be found in the Aerodrome/Facilities Directory (A/FD). If you are in doubt as to what frequency to use, ***122.2 MHz is assigned to the majority of FSSs as a common enroute simplex frequency.***

NOTE

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

Example:

"Dayton radio, Texan One Two Three on one, two, two, point two, over Springfield V−O−R."

Certain VOR voice channels are being utilized for recorded broadcasts; e.g., ATIS, HIWAS, etc. These services and their appropriate frequencies are listed in the A/FD. During VFR flights pilots are urged to utilize them***. When in contact with a control facility, notify the controller if you plan to leave the frequency to monitor these broadcasts.***

Initial Contact When Your Transmitting and Receiving Frequencies are Different

If you are attempting to establish contact with a ground station and you are receiving on a different frequency than being transmitted, indicate the VOR name or the frequency on which you expect a reply. Most FSSs and control facilities can transmit on several VOR stations in the area. Use the appropriate FSS call sign as indicated on charts.

Example:

New York FSS transmits on the Kennedy, the Hampton, and the Calverton VORTACs. If you are in the Calverton area, your callup should be;

"New York radio, Boomer One Six Zero, receiving Calverton V−O−R."

If the chart indicates FSS frequencies above the VORTAC or in the FSS communications boxes, transmit or receive on those frequencies nearest your location.

When unable to establish contact and you wish to call ***any*** ground station, use the phrase:

"Any radio (tower) (station), give Navy Three Echo One Six Zero a call on (frequency) or (V−O−R)."

If an emergency exists or you need assistance, state so.

C103. SUBSEQUENT CONTACTS AND RESPONSES TO CALLUP FROM A GROUND FACILITY

Use the same format as used for the initial contact except you should state your message or request with the callup in one transmission.

The ground station name may be omitted if the message requires an obvious reply and there is no possibility for misunderstandings. ***You should acknowledge all callups or clearances*** unless the controller or FSS specialist advises otherwise.

There are some occasions when controllers must issue time-critical instructions to other aircraft, and they may be in a position to observe your response, either visually or on radar. If the situation demands your response, take appropriate action or immediately advise the facility of any problem. Acknowledge with your aircraft identification, either at the beginning or at the end of your transmission, and one of the words "Wilco," "Roger," "Affirmative," "Negative," or other appropriate remarks; e.g., "Shooter Zero One Six, Roger."

C104. ACKNOWLEDGEMENT OF FREQUENCY CHANGES

When advised by ATC to change frequencies, acknowledge the instruction. If you select the new frequency without an acknowledgement, the controller's workload is increased because there is no way of knowing whether you received the instruction or have had radio communications failure.

At times, a controller/specialist may be working a sector with multiple frequency assignments. In order to eliminate unnecessary verbiage and to free the controller/specialist for higher priority transmissions, the controller/specialist may request the pilot *"(Identification), change to my frequency 123.4."* This phrase should alert the pilot that the controller/specialist is only changing frequencies, not controller/specialist, and that initial callup phraseology may be abbreviated.

Example:

"United Two Twenty, switch to my frequency on one two three point four."

Response:

"United Two Twenty switching one, two, three, point four."

C105. COMPLIANCE WITH FREQUENCY CHANGES

When instructed by ATC to change frequencies, select the new frequency as soon as possible ***unless instructed to make the change at a specific time, fix, or altitude***. A delay in making the change could result in an untimely receipt of important information.

If you are instructed to make the frequency change at a specific time, fix, or altitude, monitor the frequency you are on until reaching the specified time, fix, or altitude.

C106. ACKNOWLEDGEMENT OF INSTRUCTIONS

It is not required nor desired to readback all instructions verbatim. Where clarity is assured, brevity terms should be employed to the greatest extent possible. (See C-1 for definitions of ROGER, WILCO, AFFIRMATIVE and NEGATIVE.)

Instructions requiring a change in altitude will be acknowledged by reading back the altitude with the appropriate associated instruction (leaving xxx, climbing to, or descending to xxx).

For training students will be expected to read back the following items:

1. Altimeter settings

2. Headings

3. Frequencies

If you miss all or part of a transmission, the term ***"Say again"*** should be used and the controller will repeat the last transmission.

If you only need a specific portion of a transmission repeated, use ***"Say again"*** followed by the item you need repeated.

Examples:

"Houston Center, TEXAN one two three, say again." (Controller repeats entire transmission.)

"Houston Center, TEXAN one two three, say again altitude." (Controller repeats only assigned altitude.)

DO NOT ACKNOWLEDGE SOMETHING YOU DID NOT GET OR UNDERSTAND!

DO NOT READBACK A CLEARANCE YOU ARE UNSURE OF WITH AN INQUISITIVE TONE IN YOUR VOICE!

IF YOU'RE UNSURE OR UNCLEAR, SAY SO!

C107. COMPLIANCE WITH CLEARANCES/INSTRUCTIONS

Listen carefully to the tense of any clearance to ensure you complying with controller instruction at the appropriate time. Unless a specific time or place is stipulated in the clearance, it is ***"present tense"*** and the clearance should be executed with no delay. If a specific time or place is specified, then it is ***"future tense,"*** and execution should be delayed until the specified time or place.

C108. AIRCRAFT CALLSIGNS

Precautions in the Use of Callsigns

Improper use of call signs can result in pilots executing a clearance intended for another aircraft. Call signs should never be abbreviated on an initial contact or at any time when other aircraft call signs have similar numbers/sounds or identical letters/numbers.

Example:

Assume that a controller issues an approach clearance to an aircraft at the bottom of a holding stack and an aircraft with a similar call sign (at the top of the stack) acknowledges the clearance with the last two or three numbers of the aircraft's call sign. If the aircraft at the bottom of the stack did not hear the clearance and intervene, flight safety would be affected, and there would be no reason for either the controller or pilot to suspect that anything is wrong. This kind of "human factors" error can strike swiftly and is extremely difficult to rectify.

Pilots, therefore, must be certain that aircraft identification is complete and clearly identified before taking action on an ATC clearance. ATC specialists may initiate abbreviated call signs of other aircraft by using the *prefix and the last three digits/letters* of the aircraft identification ***after communications are established.*** The pilot may use the abbreviated call sign in ***subsequent*** contacts with the ATC specialist.

When aware of similar/identical call signs, ATC specialists will take action to minimize errors by emphasizing certain numbers/letters, by repeating the entire call sign, by repeating the prefix, or by asking pilots to use a different call sign temporarily. Pilots should use the phrase "***Verify clearance for*** (your complete call sign)" if doubt exists concerning proper identity.

Military aircraft use a variety of systems including serial numbers, word call signs, and combinations of letters/numbers. Examples include Army Copter 48931; Air Force 61782; REACH 31792; Pat 157; Air Evac 17652; Navy Three Echo 064; Marine 4 Charlie 36, Boomer, Blackbird, Shooter, etc.

See local operating procedures (FWOP/SOP) for specific rules.

C109. GROUND STATION CALL SIGNS

Pilots, when calling a ground station, should begin with the name of the facility being called followed by the type of the facility being called as indicated below.

Facility	Call Sign
Airport UNICOM	"Shannon UNICOM"
FAA Flight Service Station	"Chicago Radio"
FAA Flight Service Station (Enroute Flight Advisory Service (Weather))	"Seattle Flight Watch"
Airport Traffic Control Tower	"Augusta Tower"
Clearance Delivery Position (IFR)	"Dallas Clearance Delivery"
Ground Control Position in Tower	"Miami Ground"
Radar or Nonradar Approach Control Position	"Oklahoma City Approach"
Radar Departure Control Position	"St. Louis Departure"
FAA Air Route Traffic Control Center	"Washington Center"

Figure C-1 Facility Call Sign

C110. PHONETIC ALPHABET

The International Civil Aviation Organization (ICAO) phonetic alphabet is used by FAA personnel when communications conditions are such that the information cannot be readily received without their use.

ATC facilities may also request pilots to use phonetic letter equivalents when aircraft with similar sounding identifications are receiving communications on the same frequency.

Pilots should use the phonetic alphabet when identifying their aircraft during initial contact with air traffic control facilities. Additionally, use the phonetic equivalents for single letters and to spell out groups of letters or difficult words during adverse communications conditions.

Character	Word	Pronunciation
0	Zero	ZE-RO
1	One	WUN
2	Two	TOO
3	Three	TREE
4	Four	FOW-ER
5	Five	FIFE
6	Six	SIX
7	Seven	SEV-EN
8	Eight	AIT
9	Nine	NIN-ER
A	Alpha	ALFAH
B	Bravo	BRAHVOH
C	Charlie	CHARLEE
D	Delta	DELLTAH
E	Echo	ECKOH
F	Foxtrot	FOKSTROT
G	Golf	GOLF
H	Hotel	HOHTELL
I	India	INDEE AH
J	Juliett	JEWLEE ETT
K	Kilo	KEYLOH
L	Lima	LEEMAH
M	Mike	MIKE
N	November	NOVEMBER
O	Oscar	OSSCAH
P	Papa	PAHPAH
Q	Quebec	KEHBECK
R	Romeo	ROWME OH
S	Sierra	SEEAIRAH
T	Tango	TANGGO
U	Uniform	YOUNEE FORM
V	Victor	VICKTAH
W	Whiskey	WISSKEY
X	X-ray	ECKSRAY
Y	Yankee	YANGKEY
Z	Zulu	ZOOLOO

Figure C-2 ICAO Phonetics

C111. NUMBERS

Figures indicating hundreds and thousands in round number, as for ceiling heights, and upper wind levels up to 9,900 must be spoken in accordance with the following.

Example:

1. 500 . . . . . Five hundred

2. 4,500 . . . . . Four thousand five hundred

Numbers above 9,900 must be spoken by separating the digits preceding the word "thousand."

Example:

1. 10,000 . . . . . One zero thousand

2. 13,500 . . . . . One three thousand five hundred

Airway or Jet route numbers as follows.

Example:

1. V12 . . . . . Victor Twelve

2. J533 . . . . . J Five Thirty−Three

All other numbers must be transmitted by pronouncing each digit.

Example:

10 . . . . . One zero

When a radio frequency contains a decimal point, the decimal point is spoken as "POINT."

Example:

122.1 . . . . . One, two, two, point one

NOTE

ICAO procedures require the decimal point be spoken as "DECIMAL." The FAA will honor such usage by military aircraft and all other aircraft that are required to comply with ICAO procedures.

C112. ALTITUDES AND FLIGHT LEVELS

Up to, but not including 18,000 feet MSL, state the separate digits of the thousands plus the hundreds if appropriate.

Example:

1. 12,000' . . . . . One two thousand

2. 12,500' . . . . . One two thousand five hundred

3. 350'. . . . . Three hundred fifty

At and above 18,000 feet MSL (FL 180), state the words "flight level" followed by the separate digits of the flight level.

Example:

1. 19,000 . . . . . Flight Level One Niner Zero

2. 27,500 . . . . . Flight Level Two Seven Five

NOTE

The transition altitude in the continental U.S. is 18,000 ft MSL, which determines the lowest Flight Level. Consult appropriate FLIP to find the transition altitude outside of the continental U.S.

C113. DIRECTIONS

The three digits of bearing, course, heading, or wind direction should always be magnetic. The word "true" must be added when it applies.

Example:

1. (Magnetic course) 005 . . . . . Zero, zero, five

2. (True course) 050 . . . . . Zero, five, zero true

3. (Magnetic bearing) 360 . . . . . Three, six, zero

4. (Magnetic heading) 100 . . . . . Heading one, zero, zero

5. (Wind direction) 220 . . . . . Wind two, two, zero

C114. SPEEDS

Use the separate digits of the speed followed by the word "KNOTS." Except, controllers may omit the word "KNOTS" when using speed adjustment procedures; e.g., ***"Reduce/Increase Speed to Two Five Zero."***

Example:

(Speed) 250 . . . . . Two, five, zero knots

(Speed) 190 . . . . . One, niner, zero knots

The separate digits of the Mach number preceded by "Mach"

Example:

(Mach number) 1.5 . . . . . Mach one point five

(Mach number) 0.64 . . . . . Mach point six four

(Mach number) 0.7 . . . . . Mach point seven

C115. TIME

FAA uses Coordinated Universal Time (UTC) for all operations. The word "local" or the time zone equivalent must be used to denote when local time is given during radio and telephone communications. The term "Zulu" may be used to denote UTC.

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

Example:

0000 . . . . . Zero, zero, zero, zero

0920 . . . . . Zero, niner, two, zero

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

C116. MANDATORY REPORTS

In both the RADAR and NON-RADAR environments, the following reports should be made to ATC or FSS facilities without a specific ATC request:

1. When vacating any previously assigned altitude or flight level for a newly assigned altitude or flight level.

2. When an altitude change will be made if operating on a clearance specifying "VFR ON TOP."

3. When unable to climb/descend at a rate of at least 500 feet per minute.

4. When approach has been missed. (Request clearance for specific action; e.g., to alternative airport, another approach etc.)

5. Change in the average true airspeed (at cruising altitude) when it varies by 5 percent or 10 knots (***whichever is greater***) from that filed in the flight plan.

6. The time and altitude (or flight level) upon reaching a holding fix or point to which cleared.

7. When leaving any assigned holding fix or point.

NOTE

The reports in subparagraphs 6 and 7 may be omitted by pilots of aircraft involved in instrument training at military terminal area facilities when radar service is being provided and the holding was requested.

8. In controlled airspace, any loss of VOR, TACAN, ADF, low frequency navigation receiver capability, complete or partial loss of ILS receiver capability or impairment of air/ground communications capability. Reports should include aircraft identification, equipment affected, and degradation to the capability to operate under IFR.

NOTE

Other equipment installed in an aircraft may effectively impair safety and/or the ability to operate under IFR. If such equipment (e.g., airborne weather radar, GPS) malfunctions and in the pilot's judgment either safety or IFR capabilities are affected, reports should be made as above.

9. Any information relating to the safety of flight.

10. Any weather conditions which have not been forecast, or hazardous conditions which have been forecast.

C117. ADDITIONAL MANDATORY REPORTS FOR NON-RADAR ENVIRONMENT

1. When leaving final approach fix inbound on final approach (non-precision approach) or when leaving the outer marker, or fix used in lieu of the outer marker, inbound on final approach (precision approach).

2. A corrected estimate anytime it becomes apparent that a time estimate as previously submitted is in error in excess of three minutes.

C118. IFR GROUND COMMUNICATIONS

Call For Clearance

Once you have filed an IFR flight plan, ATC will approve, disapprove, or revise your plan and provide it to the appropriate controlling agency. At most airports this will be Clearance Delivery.

If there is no Clearance Delivery listed for a tower controlled airport, this function will be covered by Ground Control. Place your clearance on request prior to calling for taxi.

Example:

"North Whiting Clearance, TEXAN 123, IFR to Mobile Regional Airport, Clearance on request, ready to copy."

Clearance Delivery (or Ground Control) will issue the approved flight clearance to the pilot if it has been received from ATC.

The IFR clearance will consist of eight basic items:

1. Aircraft ID - who the clearance is for

2. Clearance Limit - how far you are cleared to proceed

3. Type Of Departure - via Radar, Direct, or a DP typically

4. Route Of Flight - waypoints, intersections, airways, NAVAIDS

5. Altitude Assignment

6. Frequency Assignment - to contact ATC after takeoff

7. Beacon Code Assignment - Transponder SQUAWK

8. Any Additional Information Required - holding, expected delays etc.

Example of IFR clearance:

"TEXAN one two three, you are cleared to the Mobile Regional Airport via the BAEYE One to PENSI, Victor one Niner eight to BROOKLEY, Direct SQWID, climb and maintain six thousand, Pensacola Departure on two seven eight point eight or one two seven point three five, SQUAWK zero four two zero."

*During simulator training, expect to read back the IFR clearance verbatim.

Call For Taxi

The call for Taxi includes the usual items, information letter, and where you are located on the airfield. While this is scripted for local operations (FWOP/SOP), it can be less obvious at other fields where you are not familiar with their normal operations and taxiways.

Having the airport diagram open from the Approach plate will aid in providing your location to the Ground Controller and in understanding any taxi instructions issued to you.

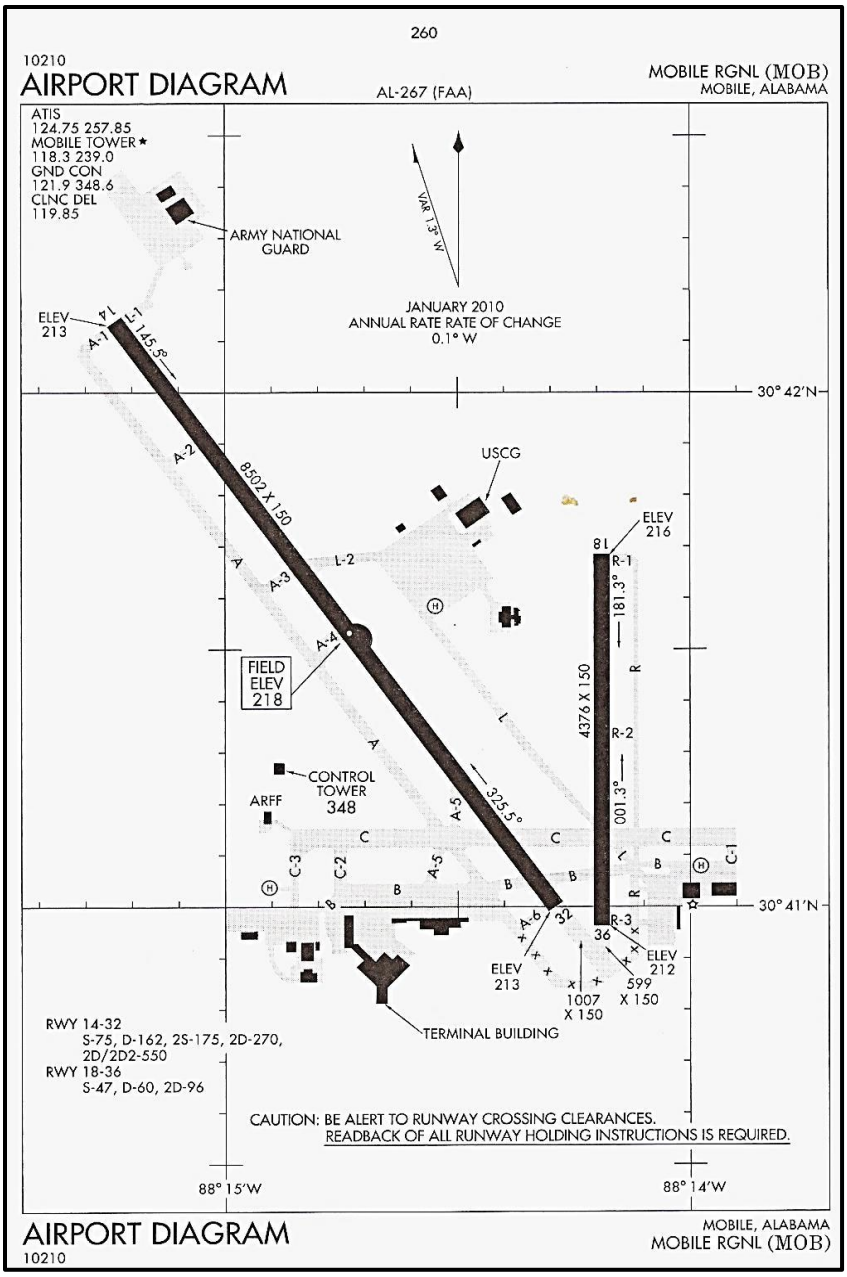

Figure C-3 Airport Diagram (KMOB)

Example: (see Figure C-3)

"Mobile Ground, TEXAN one two three, taxi from the Coast Guard ramp with information ALPHA."

BE ALERT TO RUNWAY CROSSING CLEARANCES. READBACK OF ALL RUNWAY HOLDING INSTRUCTIONS IS REQUIRED.

C119. CALL FOR TAKEOFF

When ready for takeoff, say "*Tower name, callsign, Ready for IFR Departure*." Your takeoff clearance from Tower provides instructions to transition into the air route system. Typically it will include a direction of turn (if required) and an initial heading assignment. ***With the exception of wind information, these instructions should be read back in the same order they were received.***

This clearance may include authorization to switch to departure frequency prior to takeoff.

Example:

"TEXAN one two three, after takeoff turn left heading zero three zero, change to departure, winds are calm, cleared for takeoff runway zero five."

C120. IFR INITIAL CONTACT

Non-Radar Environment

The pilot should inform the controller of the aircraft's present position, altitude, and time estimate for the next reporting point.

Examples:

"Pensacola Departure, TEXAN one two three, off North Whiting, Passing one thousand five hundred for eight thousand, estimate PENSI two zero."

"Jacksonville Center, TEXAN one two three, two seven miles West of Crestview, level eight thousand, estimate PENSI two zero."

Radar Environment

The pilot should inform the controller of the aircraft's assigned altitude preceded by the words "level," "climbing to," or "descending to," as appropriate; and the aircraft's present vacating altitude, if applicable.

Examples:

"Pensacola Departure, TEXAN one two three, Passing one thousand five hundred for eight thousand."

"Jacksonville Center, TEXAN one two three, level eight thousand."

NOTE

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

C121. POSITION REPORTING

Position Reporting Points - Federal Aviation Regulations require pilots to maintain a listening watch on the appropriate frequency and to furnish position reports passing certain reporting points. Reporting points are indicated by symbol on enroute charts. The designated compulsory reporting point symbol is the solid triangle and the "on request" reporting point symbol is an open triangle. Reports passing an "on request" reporting point are only necessary when requested by ATC.

Non-Radar Environment

Flight along airways/routes - A position report is required by all flights regardless of altitude, including those operating in accordance with an ATC clearance specifying "VFR on TOP," over each designated compulsory reporting point along route being flown.

Flight along a Direct Route - Regardless of the altitude or flight level being flown, including flights operating in accordance with an ATC clearance specifying "VFR on TOP," pilots shall report over each point used in the flight plan to define direct legs for the route of flight.

Report Format - At each required reporting point the pilot should give the controller a complete position report. This report contains a large amount of information. To ensure the controller is ready to receive the report a ***"Courtesy Call"*** is recommended. This call would consist of your CALLSIGN and the name of the present reporting point.

Example:

"Jacksonville Center, TEXAN one two three, PENSI."

Once the controller is ready to receive your report they will usually state *"Go ahead."*

A full position report contains the following information:

1. Identification

2. Position

3. Time

4. Altitude or flight level (Include actual altitude or flight level when operating on a clearance specifying "VFR ON TOP.")

5. Type of flight plan (Not required in IFR position reports made directly to ARTC Centers or approach control)

6. Name and ETA of next reporting point

7. The name only of the next succeeding reporting point along the route of flight

8. Pertinent remarks

A commonly used mnemonic for a full position report made to ARTC Centers or an approach control is: **PTAPTP**

Position, **T**ime, **A**ltitude
(The name of the current reporting point, the time you arrived there, and your current altitude)

Position, **T**ime
(The name of your next reporting point and the estimated time of arrival)

Position
(The name of the next succeeding reporting point)

Example: (Assume arrival at PENSI with BRATT and LOXLY as next required reporting points)

"Jacksonville Center, TEXAN one two three, PENSI, Two Zero, Six thousand, BRATT, Two Five, LOXLY."

When there are no follow on positions to report, end the transmission with "Destination" or "Clearance Limit."

Radar Environment

ATC will inform the pilot *"Radar Contact:"*

1. When aircraft is initially identified in the ATC system.

2. When radar identification is re-established after radar service has been terminated or radar contact lost.

Subsequent to being advised that the controller has established radar contact, this fact will not be repeated to the pilot when handed off to another controller.

At times, the aircraft identity will be confirmed by the receiving controller; however, this should not be construed to mean that radar contact has been lost.

The identity of transponder equipped aircraft will be confirmed by asking the pilot to "Ident," "Squawk Standby," or to change codes.

Aircraft without operational transponders will be advised of their position to confirm identity. In this case, the pilot is expected to advise the controller if he disagrees with the position given. If the pilot cannot confirm the accuracy of the position given because he is not tuned to the NAVAID referenced by the controller, the pilot should ask for another radar position relative to the NAVAID to which he is tuned.

When informed by ATC that their aircraft are in "Radar contact," pilots should discontinue position reports over designated reporting points.

They should resume normal position reporting when ATC advises *"Radar contact lost"* or *"Radar service terminated."*

C122. IFR HOLDING COMMUNICATIONS

Holding Clearance

ATC should issue a holding clearance at least five minutes before the aircraft reaches a clearance limit. A full clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information, either stated or implied:

1. Direction of the holding from the fix, in terms of the eight cardinal compass points (N, NE, E, SE, S, SW, W, NW).

2. The name of the holding fix (This may be omitted if included at the beginning of the transmission as the clearance limit.)

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

4. Leg length in miles, if DME, or GPS Along Track Distance (ATD) is to be used (leg length will be specified in minutes on pilot request or if the controller considers it necessary). If leg length is not stated it is implied that timing is to be used.

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

6. Time to Expect Further Clearance (EFC) and any pertinent additional delay information (times are given in GMT).

NOTES

1. If the holding pattern is charted and the controller doesn't issue complete holding instructions, the pilot is expected to hold as depicted on the appropriate chart. When the pattern is charted, the controller may omit all holding instructions ***except the charted holding direction and the statement "as published"*** (e.g., hold east as published). Controllers must always issue complete holding instructions when pilots request them.

2. If no holding pattern is charted and holding instructions have not been issued, the pilot should ask ATC for holding instructions prior to reaching any enroute clearance limit.

Example:

"TEXAN one two three, you are cleared to hold east of BRATT on Victor one niner eight, left turns, four mile legs, expect further clearance time one two four five."

Reporting Entry into Holding

In accordance with the FIH, pilots should report the time and altitude/flight level upon reaching a holding fix or point to which cleared. ***This report may be omitted by pilots of aircraft involved in instrument training at military terminal-area facilities when radar service is being provided, and the holding was requested.***

You are considered established in holding when you cross the holding fix for the first time. A mnemonic for this call is: **PTA** (**P**osition-**T**ime-**A**ltitude)

Example:

"Jacksonville Center, TEXAN one two three, BRATT, two five, eight thousand."

Confirming an EFC time

Confirm your Expected Further Clearance time (EFC) with ATC at least five minutes prior to the EFC time.

Receipt of an EFC time is ***NOT*** a clearance to proceed on course or commence an approach at that time ***UNLESS*** you have lost communications with ATC.

Example:

"Jacksonville Center, TEXAN one two three, confirm EFC time five, five."

Departing Holding

In accordance with the FAR/AIM, pilots should report leaving a clearance limit. This report does not require the altitude or time in the report***. This report may be omitted by pilots of aircraft involved in instrument training at military terminal-area facilities when radar service is being provided, and the holding was requested.***

Examples:

Enroute holding:

"Jacksonville Center, TEXAN one two three, departing holding, proceeding on course."

Holding in the terminal area and cleared for an approach:

"Mobile Approach, Texan one two three, departing holding, cleared for the VOR ALPHA."

C123. IFR TERMINAL COMMUNICATIONS

Initial Contact

If available, ATIS, ASOS, AWOS, or airport advisories should be obtained prior to initial contact with the terminal area controller (usually "Approach Control").

If the airport information is not available, checking in with "Negative ATIS" will alert the controller to pass any available airport information to you on their initial call.

ATC will provide current landing information, as appropriate, to arriving aircraft. Landing information contained in the ATIS broadcast may be omitted if the pilot states the appropriate ATIS code. Runway, wind, and altimeter may be omitted if a pilot uses the phrase "have numbers."

NOTE

Pilot use of "have numbers" does not indicate receipt of the ATIS broadcast.

If you have the airport information, and are ready to make an approach request, it may be included in the initial contact. If you will be asking for more than one approach use the word "request" at the end of you initial call.

Non-Radar Environment

In a Non-Radar environment, in order to ensure separation, the controller will need to know where you will be next, what time you will arrive there, and your altitude. A good mnemonic is **ETA**.

Estimating (position name)
Time (you expect to arrive there)
Altitude

Example with no airport information:

"Mobile Approach, TEXAN one two three, estimating Brookley time four five, eight thousand, negative information."

"TEXAN one two three, Mobile Approach, Mobile regional weather, one thousand overcast, visibility two miles in light rain, winds one three zero at five knots, altimeter three zero one two, landing runway one four."

"TEXAN one two three, roger, altimeter three zero one two, request."
(If the request is known, and is short and simple, it may be included in this reply.)

"TEXAN one two three, Mobile Approach, go ahead your request."

Example with ATIS and ready for an approach:

"Mobile Approach, TEXAN one two three, estimating Brookley time four five, eight thousand, with information BRAVO, Request."
(If the request is known, and is short and simple, it may be included in this reply.)

"TEXAN one two three, Mobile Approach, go ahead your request."

Radar Environment

In a RADAR environment, report your ***altitude*** and ***ATIS information letter*** (or negative information) on Initial contact with Approach.

Example with no airport information:

"Mobile Approach, TEXAN one two three, level eight thousand, negative information."

"TEXAN one two three, Mobile Approach, Mobile regional weather, one thousand overcast, visibility two miles in light rain, winds one three zero at five knots, altimeter three zero one two, landing runway one four."

"TEXAN one two three, roger, altimeter three zero one two, request."

(If the request is known, and is short and simple, it may be included in this reply.)

Example with ATIS and ready for an approach:

"Mobile Approach, TEXAN one two three, level eight thousand, with information BRAVO, Request." (If the request is known, and is short and simple, it may be included in this reply.)

C124. REQUESTING AN APPROACH

The name of the approach, ***as published***, is used to identify the approach.

Approach name items contained within parenthesis; e.g., RNAV (GPS) RWY 04, are not included in approach clearance phraseology.

Where more than one procedure is published on a single chart ***and*** a specific procedure is to be flown, the approach clearance will specify execution of the specific approach to be flown.

Example:

If published on a chart as HI−VOR/DME or TACAN RWY 6L, and ATC requires use of one or the other the clearance would be stated as either:

1. *"HI VOR/DME Runway Six Left Approach."*

2. *"HI TACAN Runway Six Left Approach."*

If published as ILS Z or RNAV (GPS) RWY 32, and ATC authorizes either approach the clearance will be stated as:

"ILS Z or RNAV Runway Three Two Approach."

The terminal controller needs to know your intentions as soon as possible. When requesting approaches, it is helpful to state how an approach will terminate.

1. Full Stop

2. XXX Approach, followed by…

Letting the controller know ***all*** your intentions for their area will greatly aid traffic management. Where multiple approaches are requested, controllers will often provide "climb-out" instructions that expedite your subsequent request.

Example when only one approach to landing is desired:

"TEXAN one two three, request the VOR-A to Mobile Regional, full stop."

Example where multiple approaches are desired:

"TEXAN one two three, request the VOR-A to Mobile Regional, followed by the RNAV runway one four, then radar vectors to final for the ILS or LOC RWY runway one four, then clearance to NAS Pensacola."

C125. COMMUNICATIONS DURING THE APPROACH

During Non-Radar operations, the pilot ***must*** report when leaving the final approach fix inbound on final approach (Non-precision approach) or when leaving the outer marker, or fix used in lieu of the outer marker, inbound on final approach (precision approach).

In order to maintain separation between aircraft during Non-Radar operations, or to aid in controller task management ***in both Radar and Non-Radar operations***, the controller may additionally instruct the pilot to report when arriving at different positions along the approach.

Some examples are:

"TEXAN one two three, report VOR outbound."

"TEXAN one two three, report Procedure turn inbound."

"TEXAN one two three, report when established on final."

"TEXAN one two three, report VOR inbound."

A simple acknowledgement would be:

"TEXAN one two three, WILCO."

To avoid possible confusion, if a report is needed upon arrival at such points, report them using the same terminology given by the controller. (Listen up, they will tell you ***what to say***, and ***when to say it***. There is no need to get creative.)

C126. HANDOFF TO TOWER OR ADVISORY FREQUENCY

The point at which an aircraft is instructed to contact the tower is determined by prior coordination between the tower and approach control and will vary, depending on the runway in use, weather, etc., The transfer of communications ordinarily occurs at least 5 miles from the runway.

"TEXAN one two three, contact Mobile Tower two three niner point zero."

"TEXAN one two three, switching Tower two three niner point zero."

At an airport not served by a tower or FSS, the controller will approve a change to the advisory service frequency when they no longer require direct communications.

Example:

"TEXAN one two three, change to advisory frequency approved."

"TEXAN one two three, Roger."

C127. INITIAL CONTACT ON TOWER OR ADVISORY FREQUENCY

At tower controlled airports:

Clearance for the approach ***does not*** constitute clearance to land!

Contact tower when directed. Include your position along the approach, gear status, and intentions.

"Mobile Tower, TEXAN one two three, final approach course, gear down, full stop."

C128. LANDING GEAR CHECKS

USA/USAF/USN

The controller should remind aircraft to check wheels down on each ***approach unless the pilot has previously reported wheels down for that approach.***

NOTE

> ***The intent is solely to remind the pilot to lower the wheels, not to place responsibility on the controller***. If you fail to report your gear status on initial contact, it is one more thing the controller will have to say.

Example:

"Check wheels down."

"Wheels should be down."

C129. LANDING CLEARANCE

Tower, when issuing a clearance to land, will first state the runway number followed by the landing clearance. If the landing runway is changed, controllers will preface the landing clearance with *"Change to runway."*

Example:

"TEXAN one two three, Runway one four, cleared to land."

or

"TEXAN one two three, change to Runway three two, cleared to land."

For USA/USN/USAF aircraft, the controller should issue the runway identifier along with surface wind when clearing an aircraft to land, touch and go, stop and go, low approach, or the option.

Example:

"TEXAN one two three, Runway one four, wind one three zero at one zero, cleared to land."

The "Cleared for the Option" procedure will permit pilot the option to make a touch-and-go, low approach, missed approach, stop-and-go, or full stop landing. This procedure will only be used at those locations with an operational control tower and will be subject to ATC approval.

At non-tower controlled airports

When making an IFR approach to an airport not served by a tower or FSS, after ATC advises *"Change to advisory frequency approved"* ***you should broadcast your intentions, including the type of approach being executed, your position, and when over the final approach fix inbound*** (Non-precision approach) or when over the outer marker, or fix used in lieu of the outer marker, inbound (precision approach). Continue to monitor the appropriate frequency (UNICOM, etc.) for reports from other pilots.

Example:

"Monroeville Traffic, TEXAN one two three, final approach fix inbound, RNAV runway two one, full stop, Monroeville Traffic."

C130. MISSED APPROACH

In the event of a missed approach or when executing assigned climbout instructions, once safely established in the climbout (gear and flaps up) and cockpit workload permits (the required navigation actions are in hand), notify the tower or local traffic.

At tower controlled airports

Advise ATC. Include the reason for the missed approach unless the missed approach is initiated by ATC.

Examples:

"Corpus Tower, TEXAN one two three, missed approach for training."

"Corpus Tower, TEXAN one two three, missed approach, runway not in sight."

"Corpus Tower, TEXAN one two three, executing climbout."

At this time the controller will hand you off to the appropriate departure, approach or center controller.

At non-tower controlled airports

Let the local traffic know your intentions.

Example:

"Monroeville Traffic, TEXAN one two three, missed approach, departing to the northwest, Monroeville Traffic."

At this time you would contact the appropriate departure, approach, or center controller. On initial contact you should include your request for a specific action (e.g., another approach, hold for improved conditions, proceed to an alternate airport, etc.).

If it is a short request, make it on the initial contact. If it will be lengthy and involve a lot of data, use a courtesy call.

Examples:

"Mobile Tower, TEXAN one two three, missed approach, request direct SQWID for the VOR-A approach."

"Mobile Tower, TEXAN one two three, missed approach, request to hold at SAINT for two zero minutes."

"Mobile Tower, TEXAN one two three, missed approach, request clearance to my alternate."

(In this case, waiting for the controller to say *"Go ahead"* will insure they are ready for the large amount of information you will be passing.)

C131. REQUESTING CLEARANCE TO ALTERNATE

A helpful format for requesting clearance to an alternate from ATC is the **"DRAFT"** report.

Destination Airport
Route of flight

Altitude
Fuel onboard (Total fuel onboard in HR+MIN)
Time enroute
(HR+MIN)

*"TEXAN 123, request clearance to **Pensacola International**, via **SAINT, Victor one niner eight, PENSI**, at **3000**', Fuel **1+10**, Time **0+16.**"*

C132. LOST COMMUNICATIONS WITH TOWER (VFR)

VFR lost communications in the tower environment for local and OLF operations are covered by local instruction (FWOP/SOP).

The FAA lost communications procedures for IFR flight allow an aircraft that is able to maintain VMC to land a soon as practical. When arriving at an airport in VMC conditions that is not covered in the local operation procedures, the following guidelines are provided in the AIM.

Arriving Aircraft:

Receiver inoperative

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

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

Transmitter inoperative

Remain outside or above the Class D surface area until the direction and flow of traffic has been determined; then, join the airport traffic pattern. Monitor the primary local control frequency as depicted on Sectional Charts for landing or traffic information, and look for a light signal which may be addressed to your aircraft. During hours of daylight, acknowledge tower transmissions or light signals by rocking your wings. At night, acknowledge by blinking the landing or navigation lights.

Transmitter and receiver inoperative

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

Departing Aircraft:

If you experience radio failure prior to leaving the parking area, make every effort to have the equipment repaired.

In the unlikely event that the flight must be conducted, the following guidance is provided:

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