

NAVAL AIR TRAINING COMMAND



NAS CORPUS CHRISTI, TEXAS

CNATRA P-871 (09-16)

FLIGHT TRAINING INSTRUCTION



SNFO INSTRUMENT NAVIGATION T-6A

2016



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

CNATRA P-871
N712
13 SEP 16

CNATRA P-871 (Rev. 09-16)

Subj: FLIGHT TRAINING INSTRUCTION, SNFO INSTRUMENT NAVIGATION,
T-6A

1. CNATRA P-871 (Rev. 09-16) PAT, "FLIGHT TRAINING INSTRUCTION, SNFO INSTRUMENT NAVIGATION, T-6A" is issued for information, standardization of instruction, and guidance to all flight instructors and Student Naval Flight Officers within the Naval Air Training Command.
2. This publication shall be used as an explanatory aid to the T-6A Primary/Intermediate NFO Flight Curriculum. It will 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 CNATRA P-871 (Rev. 07-07) PAT is hereby cancelled and superseded.


M. B. TATSCH
By direction

Distribution:
CNATRA Website

INSTRUMENT FLIGHT TRAINING INSTRUCTION

FOR

SNFO INSTRUMENT NAVIGATION

T-6A



LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:

Original...31 Mar 03 (this will be the date issued)

Revision 1...0...13 Mar 06

Revision 2...0...15 July 07

Change Transmittal...1...08 May 09

Revision 3...0...13 Sep 16

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 224 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No.
COVER	0		
LETTER	0		
iii – xvi	0		
1-1 – 1-3	0		
1-4 (blank)	0		
2-1 – 2-4	0		
3-1 – 3-6	0		
4-1 – 4-71	0		
4-72 (blank)	0		
5-1 – 5-19	0		
5-20 (blank)	0		
6-1 – 6-54	0		
7-1 – 7-4	0		
8-1 – 8-11	0		
8-12 (blank)	0		
9-1 – 9-14	0		
10-1 – 10-3	0		
10-4 (blank)	0		
A-1 – A-7	0		
A-8 (blank)	0		
B-1 – B-6	0		

INTERIM CHANGE SUMMARY

The following changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE

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

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

SECURITY AWARENESS NOTICE

This course does not contain any classified material.

SAFETY/HAZARD AWARENESS NOTICE

There are no special safety precautions to be observed during this lesson.

TABLE OF CONTENTS

LIST OF EFFECTIVE PAGES	iv
INTERIM CHANGE SUMMARY	v
SECURITY AWARENESS NOTICE	vi
SAFETY/HAZARD AWARENESS NOTICE	vii
TABLE OF CONTENTS	viii
TABLE OF FIGURES	xii
TERMINAL OBJECTIVES	xiv
PRIMARY ENABLING OBJECTIVES	xv
CHAPTER ONE – INTRODUCTION TO INSTRUMENT NAVIGATION	1-1
100. INTRODUCTION.....	1-1
101. COCKPIT ORGANIZATION.....	1-2
102. CONCLUSION.....	1-3
CHAPTER TWO - INTRODUCTION TO FLIGHT INSTRUMENTS	2-1
200. INTRODUCTION.....	2-1
201. AIR NAVIGATION AIDS.....	2-3
202. AIRCRAFT NAVIGATION SYSTEMS.....	2-3
203. RADIO AND EQUIPMENT CHECKOUT.....	2-4
CHAPTER THREE - GROUND PROCEDURES	3-1
300. INTRODUCTION.....	3-1
301. PREFLIGHT THROUGH ENGINE START.....	3-1
302. TAXI.....	3-1
303. INSTRUMENT CHECKLIST.....	3-3
304. PREPARING FOR TAKEOFF.....	3-3
305. TAKEOFF ROLL.....	3-5
306. LANDING.....	3-5
307. AFTER LANDING.....	3-5
308. COMMON ERRORS.....	3-6
CHAPTER FOUR - ENROUTE PROCEDURES	4-1
400. INTRODUCTION.....	4-1
401. INSTRUMENT NAVIGATION DEFINITIONS AND BASIC CONCEPTS.....	4-1
402. DIRECT TO A VOR STATION AND DIRECT TO A GPS WAYPOINT.....	4-5
403. STATION PASSAGE.....	4-13
404. BEARING POINTER AND CDI CHARACTERISTICS.....	4-14
405. COURSE INTERCEPTS.....	4-16
406. POINT-TO-POINT.....	4-35
407. ARCING AND LEAD POINTS.....	4-44
408. RADIAL/ARC INTERCEPTS.....	4-46
409. ARC/RADIAL INTERCEPTS.....	4-50
410. GROUND SPEED CALCULATIONS.....	4-52
411. WIND ANALYSIS.....	4-52
412. INSTRUMENT TAKEOFF PROCEDURES.....	4-55

413.	OPERATIONS CHECK	4-57
414.	ALTITUDE WARNINGS	4-58
415.	AIRCRAFT DEVIATION	4-58
416.	ALTIMETER CHANGEOVER PROCEDURES	4-59
417.	CLIMBS AND DESCENTS	4-59
418.	AIRSPEEDS	4-60
419.	FREQUENCY CHANGES	4-61
420.	INSTRUMENT DEPARTURES	4-61
421.	TURN-POINT PROCEDURE CALLS	4-67
422.	TIMING	4-68
423.	LEADING TURNS ENROUTE	4-69
424.	COMMON ERRORS FOR ENROUTE PROCEDURES	4-70
CHAPTER FIVE - HOLDING.....		5-1
500.	INTRODUCTION	5-1
501.	HOLDING CLEARANCE	5-1
502.	TERMINOLOGY	5-2
503.	AIRSPEEDS	5-3
504.	ORBITS	5-3
505.	TIMING	5-4
506.	GENERAL HOLDING FLOW	5-4
507.	HOLDING PROCEDURES	5-5
508.	HOLDING DURING ADVERSE WIND CONDITIONS	5-18
509.	CLEARANCE FOR AN APPROACH WHILE IN HOLDING	5-18
CHAPTER SIX - TERMINAL PROCEDURES		6-1
600.	INTRODUCTION	6-1
601.	ATIS.....	6-1
602.	FIELD BRIEF.....	6-2
603.	DESCENT CHECKLIST.....	6-3
604.	DRAFT REPORT	6-3
605.	INSTRUMENT APPROACH PLATES.....	6-4
606.	PILOT BRIEFING INFORMATION.....	6-6
607.	PLAN VIEW.....	6-6
608.	PROFILE VIEW	6-8
609.	LANDING MINIMA SECTION.....	6-9
610.	AIRPORT SKETCH.....	6-10
611.	APPROACH BRIEFS.....	6-11
612.	STANDARD TERMINAL ARRIVALS	6-15
613.	LOW ALTITUDE APPROACHES.....	6-16
614.	PROCEDURE TURN APPROACHES.....	6-16
615.	ARCING APPROACHES	6-21
616.	RADAR VECTORS TO FINAL APPROACH COURSE.....	6-24
617.	INSTRUMENT LANDING SYSTEM (ILS).....	6-26
618.	LOCALIZER APPROACHES	6-30
619.	GPS APPROACHES	6-33
620.	RADAR APPROACHES	6-35

621.	PRECISION APPROACH RADAR (PAR) APPROACHES	6-35
622.	AIRPORT SURVEILLANCE RADAR (ASR) APPROACHES	6-39
623.	NO-GYRO APPROACHES	6-40
624.	CIRCLING APPROACHES.....	6-40
625.	HIGH ALTITUDE APPROACHES.....	6-44
626.	VISUAL GLIDESLOPE INTERPRETATION.....	6-47
627.	MISSED APPROACH REVIEW	6-50
628.	MISSED APPROACH EXECUTION.....	6-51
629.	ICS PROCEDURES	6-53
CHAPTER SEVEN - OUT-AND-IN/CROSS-COUNTRY PROCEDURES		7-1
700.	INTRODUCTION	7-1
701.	PLANNING PROCEDURES	7-1
702.	CONCLUSION.....	7-4
CHAPTER EIGHT - FLIGHT LOGS.....		8-1
800.	INTRODUCTION	8-1
801.	DEPARTURE SECTION	8-1
802.	CLEARANCE SECTION.....	8-2
803.	DESTINATION SECTION	8-3
804.	ENROUTE NAVIGATION SECTION.....	8-3
805.	ALTERNATE SECTION	8-5
806.	FUEL PLAN SECTION	8-6
807.	EMERGENCY “BINGO” TO ALTERNATE SECTION.....	8-7
808.	CHECKLIST/DESTINATION/ALTERNATE SECTION	8-8
809.	T-6A PLANNING DATA	8-10
810.	CONCLUSION.....	8-11
CHAPTER NINE - IN-FLIGHT WEATHER ANALYSIS		9-1
901.	INTRODUCTION	9-1
902.	PREFLIGHT ANALYSIS	9-1
903.	WEATHER BRIEFINGS	9-4
904.	IN-FLIGHT WEATHER INFORMATION	9-5
905.	WEATHER AVOIDANCE SERVICES	9-9
906.	WEATHER CRITERIA FOR FILING.....	9-10
907.	CONCLUSION.....	9-14
CHAPTER TEN - EMERGENCY PROCEDURES		10-1
1000.	INTRODUCTION	10-1
1001.	EMERGENCY FIELD SELECTION.....	10-1
1002.	LOST COMMUNICATIONS	10-1
1003.	ICING	10-2
1004.	AIRCRAFT EMERGENCIES UNDER IFR.....	10-2
APPENDIX A - GLOSSARY.....		A-1
APPENDIX B - ACRONYMS		B-1

TABLE OF FIGURES

Figure 2-1	Control Instruments	2-1
Figure 2-2	Navigation Instruments	2-1
Figure 2-3	Performance Instruments	2-2
Figure 2-4	Standby Instruments	2-2
Figure 4-1	Outbound Course Intercept	4-2
Figure 4-2	Inbound Course Intercept	4-3
Figure 4-3	V241 Airway	4-4
Figure 4-4	TIM the Station	4-5
Figure 4-5	Bearing Pointer under EHSI	4-6
Figure 4-6	Centered CDI with “TO” Indication	4-7
Figure 4-7	Crab into the Wind to Maintain Course	4-8
Figure 4-8	EHSI in GPS NAV Mode	4-9
Figure 4-9	GPS-Control Head Showing Direct To HADKI Waypoint	4-10
Figure 4-10	GPS Pointer Under EHSI Heading Index	4-11
Figure 4-11	CDI with DTK that Coincides with Heading	4-12
Figure 4-12	Crab Into the Wind to Maintain DTK	4-13
Figure 4-13	Bearing Pointer	4-14
Figure 4-14	CDI on the EHSI	4-15
Figure 4-15	Course Intercept	4-17
Figure 4-16	Inbound Intercept	4-18
Figure 4-17	Outbound Intercept	4-19
Figure 4-18	Intercept Heading 285°	4-20
Figure 4-19	Intercept Angle 45°	4-21
Figure 4-20	EHSI showing CRS 230	4-22
Figure 4-21	Heading 180° to Intercept CRS 230	4-23
Figure 4-22	Inbound Intercept Heading	4-24
Figure 4-23	Outbound Intercept Heading	4-25
Figure 4-24	Outbound Desired Course (TDC + 45)	4-26
Figure 4-25	Outbound 45° Intercept (TDC+45)	4-27
Figure 4-26	Completing Outbound 45° Intercept (TDC+45)	4-28
Figure 4-27	Outbound DTA Initial Heading	4-29
Figure 4-28	Outbound DTA Intercept Heading	4-30
Figure 4-29	Inbound 30° Intercept (CB+30) Determine Initial Heading	4-31
Figure 4-30	Inbound DTA Initial Heading	4-32
Figure 4-31	Inbound DTA Intercept Heading	4-33
Figure 4-32	Outbound Course Intercept Over the Station Initial Heading	4-34
Figure 4-33	Outbound Course Intercept Over the Station Intercept Heading	4-35
Figure 4-34	Present Position vs Desired Position	4-36
Figure 4-35	Point-to-Point Initial Heading	4-37
Figure 4-36	Point-to-Point Smaller DME vs Larger DME	4-38
Figure 4-37	Pencil Method Present Position vs Desired Position	4-39
Figure 4-38	Pencil Method No-Wind Heading	4-40
Figure 4-39	Pencil Method Updated Heading	4-41
Figure 4-40	Arcing	4-44

Figure 4-41	Arc Lead Point	4-46
Figure 4-42	Arcing Initial Heading.....	4-47
Figure 4-43	Bearing Pointer 5° Below the 90° Reference Point	4-48
Figure 4-44	Bearing Pointer 10° Above the 90° Reference Point.....	4-49
Figure 4-45	Lead Radial	4-50
Figure 4-46	Arc to Radial Lead Radial	4-51
Figure 4-47	Trouble “T”	4-63
Figure 4-48	GEYSER FOUR DEPARTURE (OBSTACLE)	4-64
Figure 4-49	SALISBURY-FIVE DEPARTURE.....	4-65
Figure 5-1	Standard Holding Pattern.....	5-2
Figure 5-2	Standard Pattern Entry.....	5-6
Figure 5-3	Standard Holding.....	5-7
Figure 5-4	HI-ILS or LOC RWY 30 at KVPS.....	5-8
Figure 5-5	Non-Standard Pattern	5-9
Figure 5-6	Non-Standard Holding	5-9
Figure 5-7	HI-ILS or LOC/DME RWY 14 at KGPT.....	5-10
Figure 5-8	TAIL-RADIAL-TURN.....	5-13
Figure 5-9	TAIL-RADIAL-TURN II.....	5-14
Figure 5-10	No Wind Orbit.....	5-16
Figure 5-11	Correction Orbit	5-17
Figure 6-1	Approach Plate Sections.....	6-5
Figure 6-2	Pilot Briefing Information.....	6-6
Figure 6-3	Plan View with Concentric Rings and Required Equipment	6-7
Figure 6-4	Profile View	6-8
Figure 6-5	Missed Approach Procedure, Boxed Icons.....	6-8
Figure 6-6	Landing Minima.....	6-9
Figure 6-7	IFR RNAV Landing Minima	6-10
Figure 6-8	Airport Sketch.....	6-11
Figure 6-9	VOR A at KMOB (Mobile Regional Airport).....	6-13
Figure 6-10	VOR RWY 16 at KDAB (Daytona Beach International).....	6-18
Figure 6-11	VOR/DME Z RWY 13R at KNGP (Corpus Christi NAS).....	6-22
Figure 6-12	RVFAC (FAF Depicted).....	6-26
Figure 6-13	ILS RWY 14 at KGPT (Gulfport-Biloxi International).....	6-29
Figure 6-14	“T” Approach RNAV RWY 26 at KPNS (Pensacola Regional).....	6-32
Figure 6-15	Radar Instrument Approach Minimums.....	6-37
Figure 6-16	Circling Approach Area	6-42
Figure 6-17	Missed Approach from a Circling Maneuver	6-43
Figure 6-18	HI-VOR RWY 19 at KNPA (Pensacola NAS).....	6-46
Figure 6-19	Common VASI Indications	6-47
Figure 6-20	Common PAPI Indications	6-48
Figure 6-21	IFLOLS Assembly	6-49
Figure 6-22	IFLOLS Visual Indications.....	6-50

Figure 8-1:	Flight Log Sections.....	8-1
Figure 8-2:	Departure Section	8-2
Figure 8-3:	Clearance Section.....	8-2
Figure 8-4:	Destination Section.....	8-3
Figure 8-5:	Enroute Navigation Section	8-4
Figure 8-6:	Alternate Section	8-5
Figure 8-7:	Fuel Plan Section.....	8-6
Figure 8-8:	Emergency “Bingo” to Alternate Section	8-8
Figure 8-9:	Checklist/Destination/Alternate Section	8-9
Figure 8-10:	Climb Data	8-10
Figure 8-11:	Cruise Data	8-10
Figure 8-12:	Bingo Data	8-11
Figure 9-1:	Weather Depiction Chart.....	9-2
Figure 9-2:	Radar Instrument Approach Minimums for NAS Pensacola.....	9-11
Figure 9-3:	IFR Filing Criteria	9-12

TERMINAL OBJECTIVES

1. Apply without error the policies and guidance of Squadron, Wing, and Naval Aviation Safety Programs to identify, avoid, and report hazards.
2. Maintain spatial orientation while directing the control of an aircraft through the use of an instrument scan in Visual Meteorological Conditions (VMC) or Instrument Meteorological Conditions (IMC) with instructor assistance, during day and night shore-based operations.
3. Direct the navigation of an aircraft using aircraft instruments and ground-based or Global Positioning System (GPS) Navigational Aids (NAVAIDs).
4. Make recommendations to execute a VHF Omnidirectional Range (VOR) approach, Localizer (LOC) approach, Instrument Landing System (ILS) approach, Ground Control Approach (GCA), or GPS approach, in accordance with published procedures.
5. Communicate with appropriate controlling facilities via two-way radio using standard Naval Aviation and Federal Aviation Administration (FAA) terminology.
6. Comply with specified flight policies, guidance, and procedures provided by OPNAVINST 3710.7(Series), NATOPS, Federal Aviation Regulations (FARs), and command directives.
7. Use Flight Information Publications (FLIP), Notices to Airmen (NOTAM), and other applicable flight information to plan and fly in the National Airspace System (NAS).
8. Apply Crew Resource Management (CRM) concepts and procedures during aircraft operations.
9. Relay safety of flight information to instructor: VMC, IMC, day and/or night, without error.
10. Demonstrate adequate preparation for flight and mission accomplishment.

PRIMARY ENABLING OBJECTIVES

Enabling and Terminal objectives are defined by the Course Training Standards (CTS) for the applicable Maneuver Item Files found in the Primary and Intermediate SNFO T-6A Master Curriculum Guide (MCG).

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER ONE

INTRODUCTION TO INSTRUMENT NAVIGATION

100. INTRODUCTION

In this stage of flight training, you will be introduced to the elements of Instrument Navigation (INAV). You will build upon the skills learned thus far to safely navigate from one point to another in actual or simulated IMC.

You will learn to depart from one airfield, navigate using radio instrument and GPS navigation procedures, direct the aircraft throughout an approach, and land at your destination. You will accomplish this by maintaining a constant awareness of your geographical position through the operation and interpretation of the aircraft's navigation systems and instruments.

You will also learn flight planning and the standard procedures for communicating with Air Traffic Control (ATC) agencies while operating under Instrument Flight Rules (IFR).

To learn about instrument navigation, you must be thoroughly familiar with the references of this Flight Training Instruction (FTI). Additionally, you must also consult other sources of information including, but not limited to:

1. T-6A Aircraft NATOPS Flight Manual and Pocket Checklist.
2. TW-6 In-Flight Guide.
3. OPNAVINST 3710.7 Series.
4. CTW-6 and VT-10 Standard Operating Procedures (SOP).
5. NATOPS Instrument Flight Manual (NIFM).
6. Department of Defense (DoD) Flight Information Publications (FLIP):
 - a. General Planning (GP).
 - b. Area Planning (AP/1, AP/1A, AP/1B).
 - c. Flight Information Handbook (FIH).
 - d. IFR Enroute Supplement.
 - e. IFR Enroute Charts.
 - f. Instrument Approach and Departure Procedures.
 - g. Standard Terminal Arrival Routes (STARs).

- h. NOTAMs.
- i. FAR Part 91 - Aeronautical Information Manual (AIM).
- j. FAA Air Traffic Control Order 7110.65.

Instrument navigation is a demanding stage of training requiring dedicated study. A thorough working knowledge of procedures is essential to your success on instructional flights, but you must go beyond simply memorizing procedures and strive for a clear understanding of each maneuver before you get into the plane. Remember, the knowledge gained in this stage is the foundation of the instrument navigation concepts you will be expected to master as you progress through training and into your operational squadrons.

As important as instrument procedures and concepts are, you must be aware of your basic priorities in flight. Remember the golden rule: “*AVIATE, NAVIGATE, COMMUNICATE, CHECKLISTS.*” These functions must be addressed in that order of priority. In other words, monitoring desired flight parameters (attitude, altitude, airspeed, etc.) and aircraft systems’ performance should be your first priority. Do not become preoccupied with navigation at the expense of safety of flight. It is pointless to have a precise plot of your position if you inadvertently allow the pilot to stall the aircraft while you are “heads down” over your chart.

Likewise, properly navigating your aircraft takes priority over communicating with the outside world. During many flights, there are situations where just navigating takes almost all of your concentration. In these situations, an attempt to engage in radio chatter could overload your already task-saturated Situational Awareness (SA). While necessary radio transmissions should not be omitted or delayed excessively, a slight delay in reporting to ATC is preferable to ending up in an unsafe situation because you overloaded yourself with communication tasks. Your last priority should be briefs and checklists between the pilot and yourself.

101. COCKPIT ORGANIZATION

The cockpit of the T-6A, much like the cockpits of most tactical aircraft, is less than spacious. You have to be well-organized in flight, making sure that all required materials are properly stowed and still easily accessible.

You are required to carry ALL applicable, current (up-to-date) Enroute and Terminal FLIP – including Temporary Change Notices (TCNs), FIH, and IFR Supplement. However, given the space constraints of the cockpit, you will not be able to keep all of these publications out at one time. Consider keeping your Pocket Checklist (PCL), enroute chart, and approach plates out, while stowing your TW-6 In-Flight Guide (IFG) and all other FLIP in the cockpit map case and/or a navigator’s bag. These additional publications need to be stowed as you are flying in an ejection seat aircraft and you do not want any interference in case you need to eject during an emergency. You will need to avoid dropping any of the items that you carry in the aircraft. Publications, pens, and other items have been known to interfere with the aircraft controls and, if not found, constitute Foreign Object Damage (FOD) in the aircraft. Leave the aircraft with everything that you brought with you. If you drop something in flight, inform your instructor.

1-2 INTRODUCTION TO INSTRUMENT NAVIGATION

Have a scratch pad on your kneeboard for all calculations, and to keep your notes clearly organized in flight. Before your first sortie, have your kneeboard configured in a way that makes it easy to find what you need. When you chair fly, practice using your pubs and kneeboard until you find the cockpit organizational method that works best for you.

102. CONCLUSION

For each flight, you must rehearse all your procedures, from brief to debrief. Simulators, 2B47 Trainers, and the RIOT Trainer are all excellent training tools and you are strongly encouraged to use them. Practice as often as necessary until you are 100% proficient with the required procedures. Mentally visualize your route of flight (“chair fly”) before every sortie. These habits will help you tremendously as you progress through the syllabus.

As you progress through the syllabus, your instructor will become less directive and you will be required to perform more duties, including directing the flight event. You are ultimately training to be a mission commander. Direct the pilot to do everything. Take charge of each situation and recommend a solution to any conflicts. If your instructor does not agree with your recommendation, he/she will let you know and this will be a de-brief topic. The more proactive you are as a crewmember, the better your mission commander skills will become. Someday your life – and the lives of your crew – may depend on this training. In addition to building Naval Flight Officers, we are building leaders: *You* are that leader.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER TWO INTRODUCTION TO FLIGHT INSTRUMENTS

200. INTRODUCTION

Aircraft flight instruments are divided into three categories, according to their specific function. Control instruments display immediate power and attitude indications (primary engine data display, Electronic Attitude Direction Indicator [EADI]) (Figure 2-1), navigation instruments convey the aircraft's location in space (Electronic Horizontal Situation Indicator [EHSI], GPS) (Figure 2-2), and performance instruments (Vertical Speed Indicator [VSI], altimeter, airspeed indicator) that show how the aircraft is performing as a result of attitude and power changes (Figure 2-3).



Figure 2-1 Control Instruments



Figure 2-2 Navigation Instruments



Figure 2-3 Performance Instruments

In addition to the instruments listed above, the T-6A is equipped with several standby instruments should the primary instruments become unusable. The T-6A is equipped with a standby airspeed indicator, standby attitude indicator, standby altimeter, standby turn and slip indicator, and standby magnetic compass (Figure 2-4). There are several limitations associated with the standby instruments and it is imperative to have a thorough working knowledge of NATOPS and its associated system limitations.



Figure 2-4 Standby Instruments

In order to navigate properly on instruments and gain a thorough understanding of the procedures discussed later in this manual, you need a thorough knowledge of navigation instruments, how they function, and what they depict. Additionally, you must be able to visualize your position relative to a NAVAID.

201. AIR NAVIGATION AIDS

The VOR is a navigation system which operates in the VHF frequency range (108.00 to 117.95 MHz). VOR course information is not affected by lightning or other types of severe weather; however, its reception is limited to line-of-sight. Normal reception range is typically 40–45 Nautical Miles (NM) at 1000 feet Above Ground Level (AGL) and increases with altitude. VORs provide azimuth information only, with accuracy being generally $\pm 1^\circ$. Most VORs are equipped for VHF voice transmission on the assigned VOR frequency. The only positive method of identifying a VOR is by its Morse code identification or the recorded automatic voice identification. **T**une, **I**dentify, **M**onitor (TIM) are the steps required to change from NAVAID to NAVAID. Never rely solely on identification from voice transmissions by the Flight Service Station (FSS) or approach control facility, because many FSSs remotely operate several VORs.

Tactical Air Navigation (TACAN) is also used for airways flight and instrument approaches. TACAN is a navigational aid which provides both azimuth and slant range distance, measured by Distance Measuring Equipment (DME), to the aircrew, enabling precise fixing of the aircraft's geographical position at all times. TACAN stations operate in the UHF range (962 to 1213 MHz), are selected by dialing one of 252 "X" or "Y" channels, and are identified by an aural Morse code repeated every 35 seconds. As with VORs, reception range is limited to line-of-sight and is not affected by weather. Although the T-6A is not equipped with a TACAN, it is important to understand the basics since the majority of your follow-on aircraft will be TACAN equipped.

Most airways in the United States are defined by a combination of VORs, TACANs, and/or VHF Omni-directional Range Tactical Air Navigation (VORTAC) stations. The latter provides both VOR and TACAN azimuth plus TACAN DME at one site. The VOR portion of the facility is identified by a coded tone modulated at 1020 MHz or a combination of tone and voice. The TACAN is identified by a coded tone modulated at 1350 MHz, transmitted once for every three or four times that the VOR identifier is transmitted. DME furnishes reliable, line-of-sight, SLANT RANGE information at distances up to 199 NM with an accuracy of 2 NM or 3% of the distance, whichever is greater.

202. AIRCRAFT NAVIGATION SYSTEMS

Refer to the aircraft NATOPS Manual Section I for a complete discussion of navigation systems and their proper use. You should have a working knowledge of the following systems:

1. Standby Flight Instruments
2. Digital Clock

3. Angle of Attack (AOA) System
4. Intercommunications System (ICS)
5. Transponder
6. Radio Management Unit (RMU)
7. Ultrahigh Frequency (UHF) Backup Control Unit
8. Electronic Flight Instrument System (EFIS)
9. Attitude Heading and Reference System (AHRS)
10. Traffic Advisory System (TAS)
11. Very High Frequency (VHF) Navigation System
12. Distance Measuring Equipment (DME)
13. Global Positioning System (GPS)
14. Interior Lighting
15. Exterior Lighting

203. RADIO AND EQUIPMENT CHECKOUT

VOR azimuth can be tested over select stations or by using certified checkpoints, either in the air or on an airport surface. The VOR transmits a test signal, identified by either a continuous series of dots or a continuous 1020-hertz tone. With the proper VOR Test (VOT) Facility frequency tuned, the VOR bearing pointer points to 180. Selecting a course of 180° should center the Course Deviation Indicator (CDI) with a “TO” indication. VOT frequencies are listed in the IFR Enroute Supplement (in the “NAVAIDS” section for selected airports) and in Enroute Low Altitude and Area charts (in the “AG Voice Communication” section).

Certified airborne checkpoints have been established on airways and in the vicinity of VOR stations to check the accuracy of VOR azimuth in flight. VOR airborne checkpoints are published in Chapter 3 of the FLIP AP/1 under “VOR Receiver Checkpoints.” For instance, “CRESTVIEW, FL (Bob Sikes) – 106°, 8.6 NM; over rotating beacon; 1200 feet.” When flying directly over the rotating beacon at Bob Sikes airport with the Crestview VORTAC tuned in, the VOR bearing pointer and EHSI should indicate a course of 106° with 8.6 in the DME.

NOTE

With error in excess of $\pm 4^\circ$ during a ground check or $\pm 6^\circ$ during an airborne check, IFR flight should not be attempted.

CHAPTER THREE GROUND PROCEDURES

300. INTRODUCTION

You will be navigating from the rear cockpit. Therefore, the way you will run checklists during the Instrument Navigation stage is different from the way you ran them in the Contact stage. For example, you still give the challenges, but now the instructor gives the replies for the front-cockpit only items. For both items, you give the challenge, check the position of your switch, but wait for the instructor to reply before you give the proper checklist response. When executing the Instrument Checklist the student will respond before the instructor. Practice these checklists when you chair fly.

301. PREFLIGHT THROUGH ENGINE START

1. Perform the Before Exterior Inspection Checklist.
2. Perform those portions of the Exterior Inspection Checklist assigned by your instructor.
3. Perform the Cockpit Checklist.
4. Perform the Engine Start Checklist.

302. TAXI

1. Perform the Before Taxi Checklist.

Copy the Automated Terminal Information Service (ATIS) and place your clearance on request with Clearance Delivery (or Ground Control, as appropriate) in accordance with the Before Taxi Checklist and squadron SOP.

Student: *“Clearance Delivery, KATT Six XX, Clearance on Request.”*

An example of a departure clearance using assigned radar vectors after takeoff follows:

Clearance Delivery: *“KATT Six XX is cleared to Navy Pensacola as filed. 1 DME past the TACAN, turn right heading one five zero, climb and maintain three thousand, expect niner thousand ten minutes after departure. Departure Control frequency two seven zero point eight, squawk four zero zero two.”*

NOTES

1. During Primary and Intermediate flight training, you are required to read back the entire ATC departure clearance. If your clearance is not available prior to taxi, it is ***your*** responsibility to reestablish contact with Clearance Delivery (or Ground Control, as

appropriate) some time before takeoff to copy the departure clearance.

2. Normally, an ATC departure clearance is relayed by Clearance Delivery. (If the airport does not have a Clearance Delivery, aircrews must contact Ground Control to place their IFR clearance on request.) Clearance Delivery does not exercise any surveillance or control over the movement of aircraft. Clearance Delivery instructions **do not** supersede subsequent ATC issued altitude restrictions on departure. Only ATC can override departure procedures (DP).

2. Contact Base (as applicable) and report taxiing outbound in accordance with squadron SOP.

3. Request taxi clearance from Ground Control and perform the Taxi Checklist.

Student: “*Sherman Ground, KATT Six XX, taxi with Information Alpha*”

When the taxi route is confirmed, give your instructor the Taxi Brief in accordance with squadron SOP. Keep the airport diagram readily available and provide your instructor with progressive taxi instructions while proceeding to the runway hold short line.

Set your altimeter according to the information included in your taxi clearance if it differs from the ATIS information.

NOTES

1. You are not required to read back ATC taxi instructions (except runway assignment, runway crossing clearance, altimeter settings, and hold short instructions). However, clarify any portion of any clearance that is not completely understood. In addition, understand that ATC controllers may request a readback of any clearance, in which case you must comply.

2. At tower controlled airports, you must get a clearance before entering a taxiway or runway, known as the movement area. Ramps and parking areas are often considered non-movement areas, and a clearance to move the aircraft is not required. If there is any doubt as to whether the ramp is controlled or uncontrolled, **Get taxi clearance before moving the aircraft.** At an unfamiliar field, you may request a “progressive” taxi from Ground Control if unsure how to get to the active runway. At a non-towered airport, announce aircraft movements over Unicom or CTAF.

303. INSTRUMENT CHECKLIST

The Instrument Checklist is a TRAWING SIX local checklist that will be issued with your NATOPS checklists. Initiate the Instrument Checklist after the Taxi Checklist is complete.

Make sure the radios, NAVAIDs, and EHSI are set for flight. When configuring the NAVAIDs and EHSI, consider all the requirements for departure, an approach back to the departure airfield in the event of an emergency return, and navigation to the first fix along your cleared flight path.

In aviation it is important to know the current time. A “time hack” is one of the ways aircrew synchronize their timing devices, either to validate specific events based on time or to perform certain actions or arrive at certain places at specified times. For your training, the time hack can refer to one of two scenarios:

1. Tracking the current Local or Zulu time, used for events such as a holding Expected Further Clearance (EFC), and normally synchronized in the Instrument Checklist.
2. Tracking elapsed minutes and seconds, used for student responsibilities such as the two-minute prior call, and normally initiated before taking the runway for departure (see Step 4 of Section 304 of this FTI).

Setting the current Local or Zulu time can be done during the preflight brief with the aircraft clock, wristwatches, or “egg timers.” Your instructor may or may not have you set Local or Zulu time on the aircraft clock, so you should be familiar with the Greenwich Mean Time (GMT) and Local Time (LT) functions of the cockpit digital clock. Do not rely on your instructor to teach you how to use these.

Zulu time is the standard time used in aviation but you may also use Local time, as long as you are clear about which (Zulu or Local) time you are using. Any time you give a time hack, give some kind of warning to the rest of your crew (usually, a countdown works best). For example:

Student: *“On my hack, time will be one three three five Zulu. Three – two – one -HACK. Time is one three three five Zulu.”*

304. PREPARING FOR TAKEOFF

1. Perform the Overspeed Governor Checklist. You will read the challenges, while your instructor operates the controls and gives the appropriate responses.
2. Perform the Before Takeoff Checklist. For this checklist, you will read the challenges *and* the responses for all items except for the last two. Both crewmembers shall respond for “Seat Safety Pin” and “ISS (Inter Seat Sequencer) Mode Selector.”

3. Give your instructor the Departure Brief. A helpful mnemonic is “**THAR**”
 - a. **Turn:** First turn/DME.
 - b. **Heading:** Initial heading.
 - c. **Altitude:** Initial altitude.
 - d. **Restrictions:** As applicable (refer to DP, Standard Instrument Departure (SID), or ATC instructions).

For example:

Student: “*Departure Brief. 1 DME past the TACAN, right one five zero. Climb three thousand. No restrictions.*”

NOTES

1. If you are ready for takeoff and did not receive departure instructions with your clearance, Tower Control should provide you with instructions.
2. Unless otherwise specified, obstacle clearance for all departures is based on the aircraft crossing the departure end of the runway at or above a certain altitude (35 feet above the departure end of runway elevation at civilian and Army airfields, 0 feet at Air Force and Navy airfields), climbing to 400 feet above the departure end of runway elevation before making the initial turn, and maintaining a minimum climb gradient of 200 feet per nautical mile (FPNM), unless required to level off by a crossing restriction, until the minimum IFR altitude is reached. A greater climb gradient may be specified in the DP to clear obstacles or to achieve an ATC crossing restriction. DPs will be listed by airport in the IFR Takeoff Minimums and Departure Procedures, Section C, of the Terminal Procedures Publications (TPPs), also known as approach books. An Obstacle Departure Procedure (ODP) that has been developed solely for obstacle avoidance will be indicated with the symbol  (“Trouble T”) on appropriate approach plates and DP charts for that airport.
4. Hack the elapsed timer and contact Tower Control for takeoff.

For the minutes and seconds required for turnpoint procedures, we normally use the elapsed timer (ET) function of the aircraft clock, giving a warning countdown to hack and counting out the first few seconds after hack to check proper clock operation. For example:

Student: *“On my hack, we will start the elapsed timer. Three – two – one -HACK-one – two - three.”*

5. After cleared for “Takeoff” or “Lineup and Wait” by Tower, perform the Lineup Checklist.

NOTE

At all airfields, including Naval Air Station (NAS) Pensacola, the frequency change to Departure Control is normally given by Tower Control with takeoff clearance for single-piloted aircraft (per FAA ATC Manual 7110.65). Switch frequencies when directed by ATC unless a greater emergency exists. If you were not given the frequency change as part of your takeoff clearance, Tower Control will direct you to switch to Departure Control once you are airborne.

305. TAKEOFF ROLL

Required student ICS calls during a takeoff roll **SHALL** include:

1. *“Off the peg.”*
2. *“Sixty knots, ___% torque.”*
3. *“Eighty-five knots (or gust corrected rotate speed), rotate.”*

306. LANDING

Like takeoff roll, landing roll also has a student ICS call - the “rollout call.” After the aircraft touches down, reference the airspeed with the runway distance remaining at each 1000 foot marker (board) and report this to your pilot. Make these calls until the airspeed indicates 40 KIAS. For example:

Student: *“Five board, eighty knots, four board sixty knots, three board, forty knots.”*

307. AFTER LANDING

1. If parallel runways are in use and your aircraft lands on the outboard runway, contact Tower Control and get permission to cross the inboard runway.
2. Exiting the runway, have the airport diagram or sketch available so you can direct your instructor’s taxi to parking.
3. Once clear of the active runway(s), contact Ground Control for taxi clearance, complete the After Landing Checklist, and taxi to parking.

4. When the aircraft is in a parking spot and the Lineman is clear, perform the Engine Shutdown Checklist.
5. Perform the Before Leaving Aircraft Checklist.
6. Perform those portions of the Postflight Inspection Checklist assigned by your instructor.

308. COMMON ERRORS

1. Not completing the Taxi Checklist.
2. Not giving the Taxi Brief.
4. Setting up NAVAIDs improperly:
 - a. Not setting the departure course in the CDI (Course Deviation Indicator).
 - b. Selecting an incorrect navigation source.
 - c. Not identifying the tuned station. You must identify each station tuned by pulling out the NAV Mixer Knob on the Audio Control Panel, listening to the Morse code identifier or the recorded automatic voice identification, and confirming the identifier with the published code.
 - d. Incorrectly using the DME Hold function of the RMU.
5. Not giving the Departure Brief.
6. Not performing a time hack for the elapsed timer.
7. Not performing, or not completing, the Lineup Checklist.
8. Not discussing the “Trouble T” when applicable.
9. Not checking actual gear and flap indications before reporting, “Gear and flaps up.”
10. Not making a gust correction to the rotate speed when applicable.
11. Not calculating the Minimum Power (torque) at 60 KIAS (Knots Indicated Airspeed), before takeoff.

CHAPTER FOUR ENROUTE PROCEDURES

400. INTRODUCTION

Staying ahead of the aircraft is critical during all phases of flight training. Thorough preflight planning (including chart and approach study) and strong procedural knowledge are critical to a safe and successful flight. This section covers enroute procedures required to successfully navigate and transition to the terminal phase of flight.

In general, your instructor will act as your “voice-activated autopilot.” It is your responsibility to direct your instructor as necessary to successfully execute your mission. You are required to give timely direction for navigation, including (but not limited to) climbs, descents, turns, acceleration/deceleration, and aircraft configuration changes. When directing a change, include both the desired change and a *specific target*. For example:

INCORRECT: Student: “*Turn right five degrees.*”

CORRECT: Student: “*Right zero niner five.*” For corrections less than 10° call “*Heading zero niner five.*”

401. INSTRUMENT NAVIGATION DEFINITIONS AND BASIC CONCEPTS

Radio instruments are used to determine your position relative to a ground transmitter. By knowing your position relative to a ground station, you can navigate safely without visual reference to the ground; however, simply knowing your position is not enough. To navigate, you need to understand how to interpret your instrument displays in order to intercept and maintain courses and arcs. In addition, you need to know how to proceed direct to a fix. You will use all of these skills during instrument flights for departures, enroute procedures, and approaches. The following general terms, concerning radio instruments, will help you understand the basic differences between a heading, a radial, and a course, as well as the differences between course intercepts and radial tracking.

1. Heading—where your aircraft is pointed; specified in degrees magnetic (from 001 to 360) and is shown on the EHSI.
2. Radial—an imaginary line extending outward from a NAVAID. Radials are bearings referenced in degrees (from 001 to 360). You can determine the radial you are on by looking at the tail of the applicable bearing pointer.
3. Course—in radio instruments, it is the desired track either to or from a navigation aid; referenced in degrees. A course may take you towards or away from a station.

Course vs. Radial

Since both courses and radials are measured in degrees, and since they exist on the same lines of bearing referenced to NAVAIDs, you may get them confused. An outbound course intercept is the same as a radial intercept. For example, intercepting the 360 radial outbound is the same as intercepting the 360° course outbound. Figure 4-1 shows an aircraft on the 360 radial flying a course of 360° outbound.

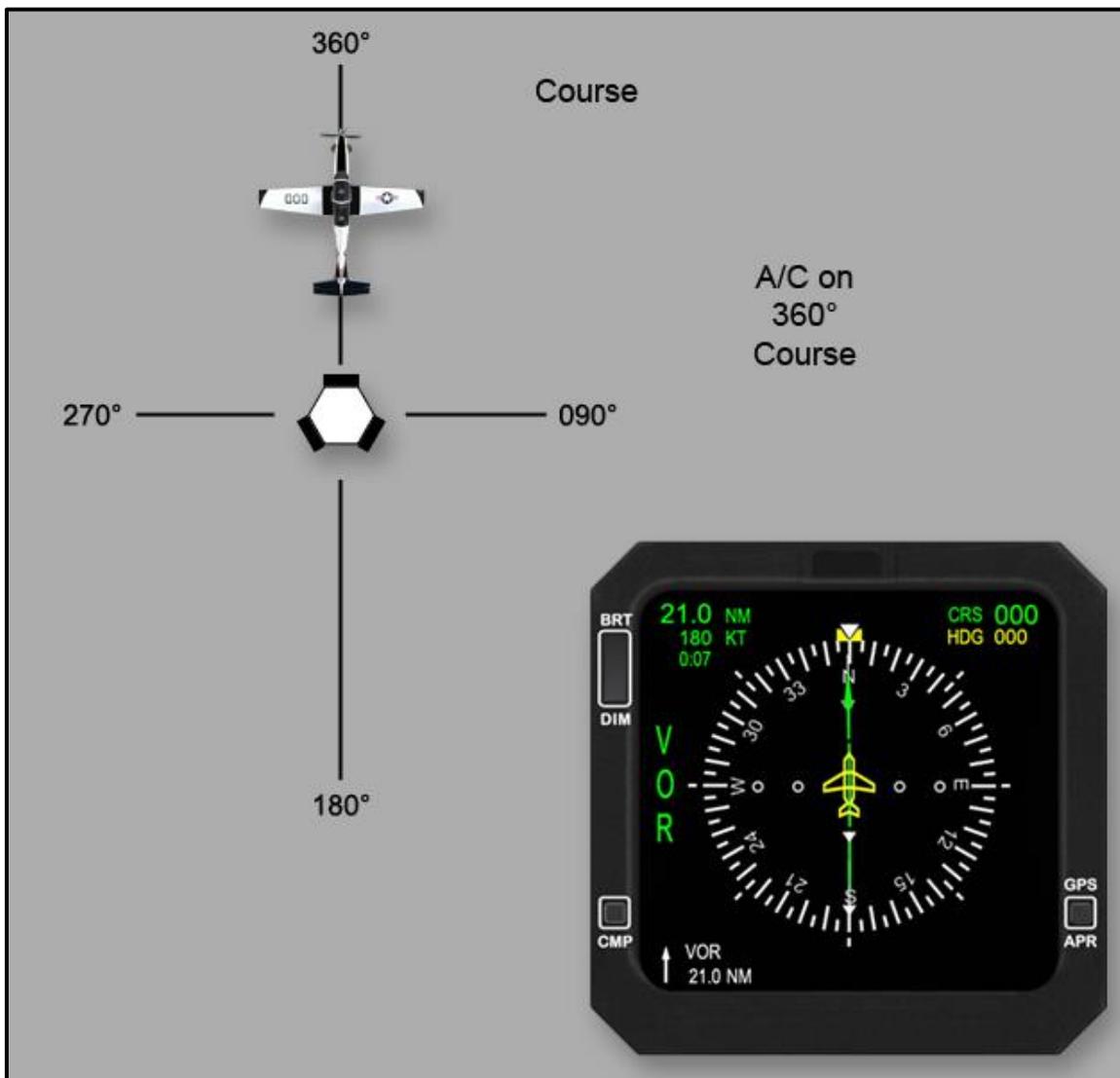


Figure 4-1 Outbound Course Intercept

For inbound course intercepts, you will need to take the reciprocal of the radial to determine the course. Intercepting the 180 radial inbound is the same as intercepting the 360° course inbound. Figure 4-2 shows an aircraft on the 180 radial flying on a course of 360° inbound.

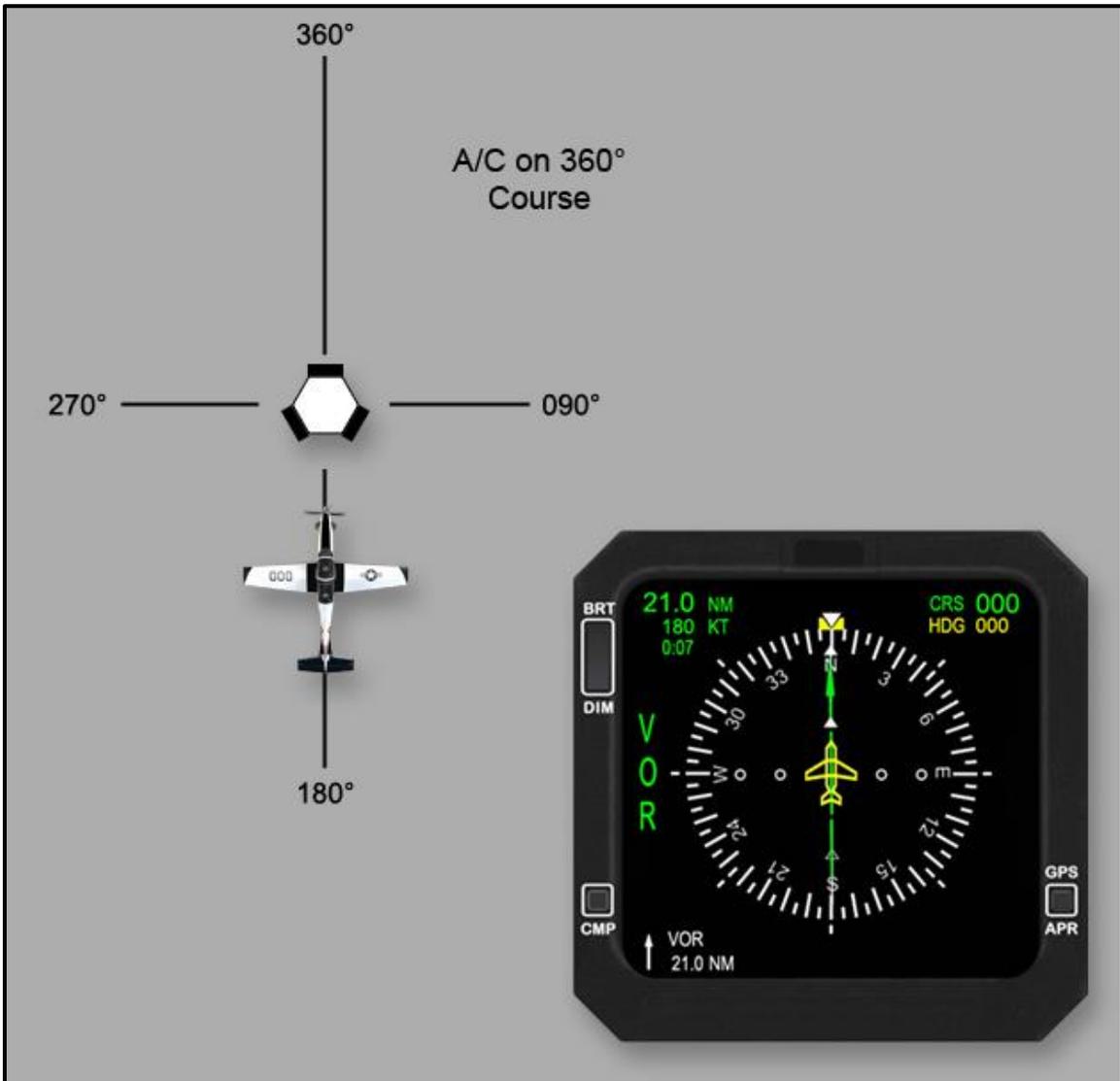


Figure 4-2 Inbound Course Intercept

Variation

Each NAVAID has its own magnetic variation which can be found in the IFR Supplement. This published magnetic variation may or may not be equal to the actual local magnetic variation and may be due to installation error or changes in magnetic variation over time. For example the Semmes (SJI) VORTAC variation is published as 5° East, the Crestview (CEW) VORTAC is published as 3° East, while the local magnetic variation is between 1.5° and 2° West (as of late 2015). If you plot the direct course from SJI to CEW you will measure a True Course of 086° and a Magnetic Course of 088°; however, to fly the direct route as defined by the V241 airway, you must fly outbound from SJI on the 081 radial, and inbound to CEW on the 263 radial (Figure 4-3). It is important to realize that as you fly outbound on a magnetic heading of 088° to maintain the 081 radial, that you do *not* actually have 7° of right crab and a right crosswind.

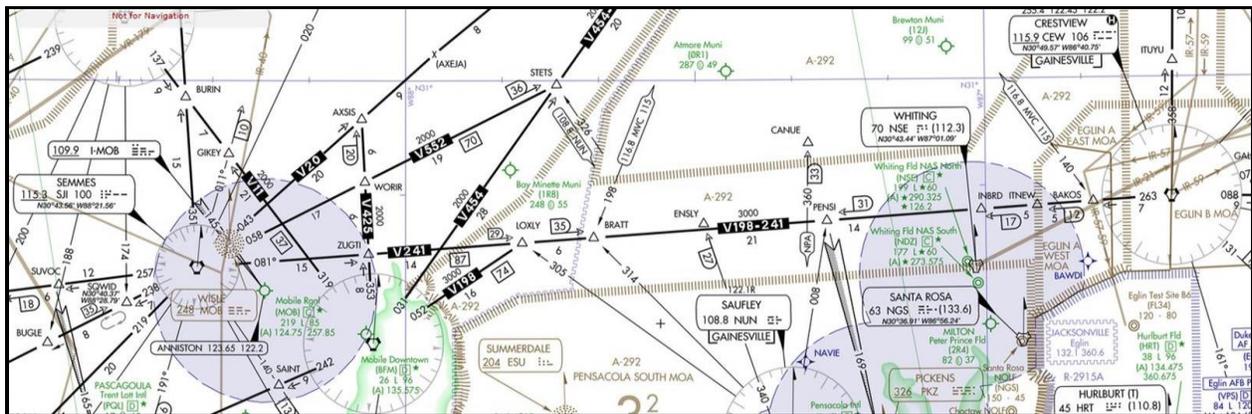


Figure 4-3 V241 Airway

T-I-M

There are many radio instrument maneuvers. For all radio instrument maneuvers, the first thing you must do is tune, identify, and monitor the station. The **T**une, **I**dentify, **M**onitor (TIM) mnemonic may help you remember this procedure. Use the RMU to tune the VOR by pressing the Field Select Key, and then turn the Tuning and Data Entry Controls to the desired frequency. Identify the NAVAID by its Morse code identifier or a voice-callsign with the three-letter Morse code identifier. Monitor the signal by keeping the identifier barely audible in your headset. Once properly tuned, the head of the needle will be pointing towards the station.

402. DIRECT TO A VOR STATION AND DIRECT TO A GPS WAYPOINT

The simplest way to fly from station to station is to turn the aircraft to place the bearing pointer at the heading index at the top of the EHSI. As course drift occurs, you would turn repeatedly to keep the bearing pointer aligned with the heading index. This action is called homing, and though it is simple, it is not very efficient. Rather than homing, you should proceed direct to the station. When you proceed direct, you fly a wind-corrected heading. You adjust your heading to compensate for the wind and maintain a specific inbound course direct to the station.

To proceed direct to a station, execute the following procedures:

1. TIM the station (Figure 4-4).

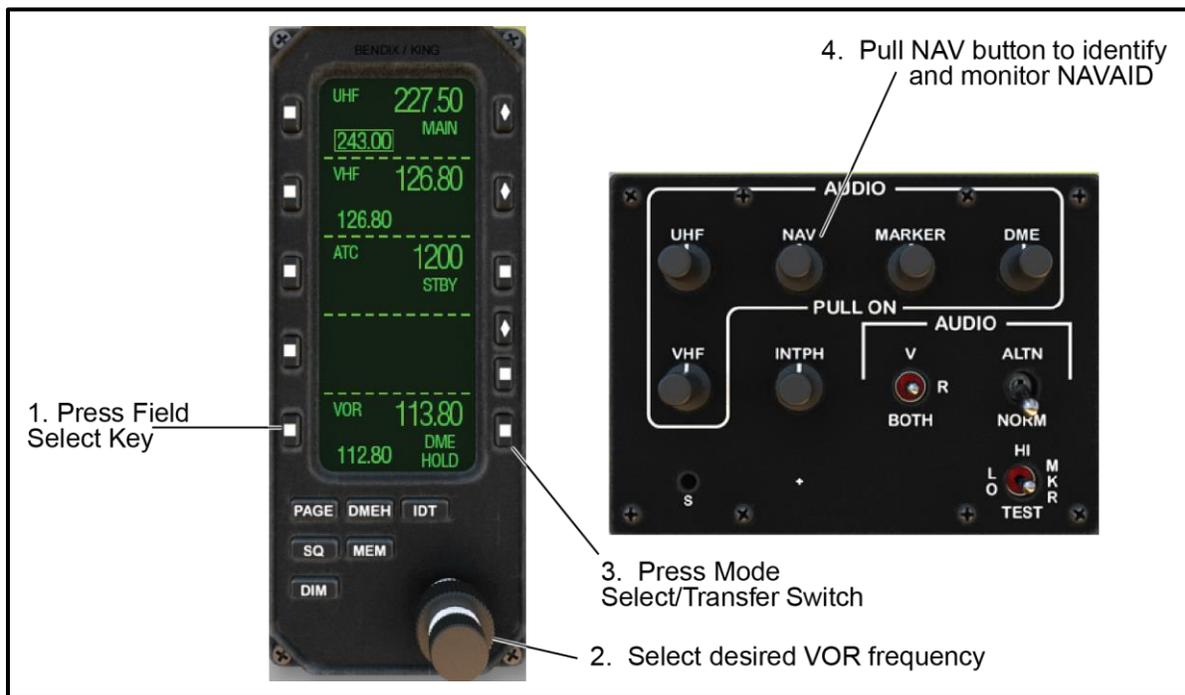


Figure 4-4 TIM the Station

2. Turn in the shorter direction to place the head of the bearing pointer under the EHSI heading index (also called a lubber line) (Figure 4-5).

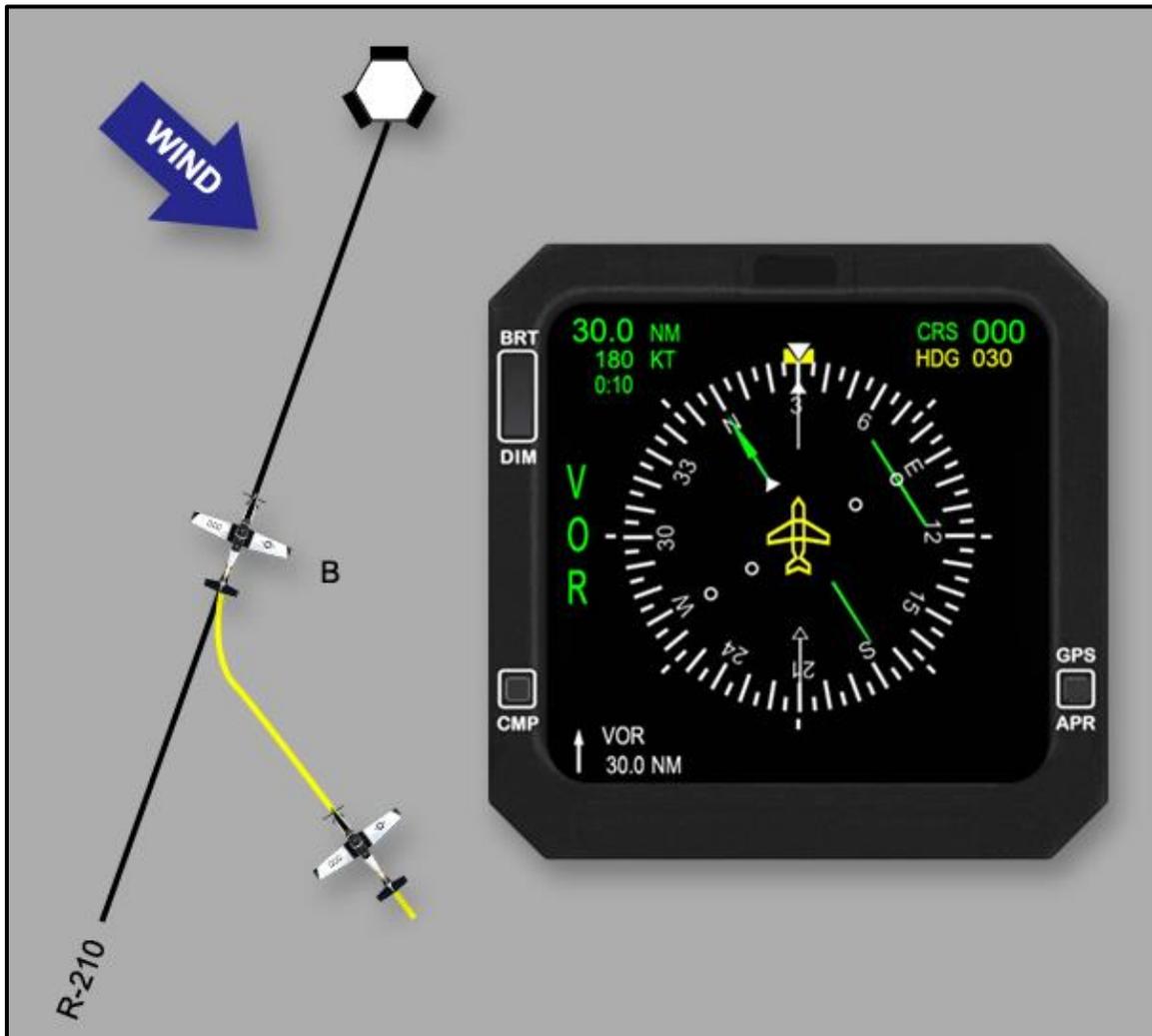


Figure 4-5 Bearing Pointer under EHSI

- Center the CDI with a “TO” indication (TO/FROM pointer or white triangle pointing toward the head of the course pointer), by pulling the CRS (course) knob on the EFIS control panel (Figure 4-6).

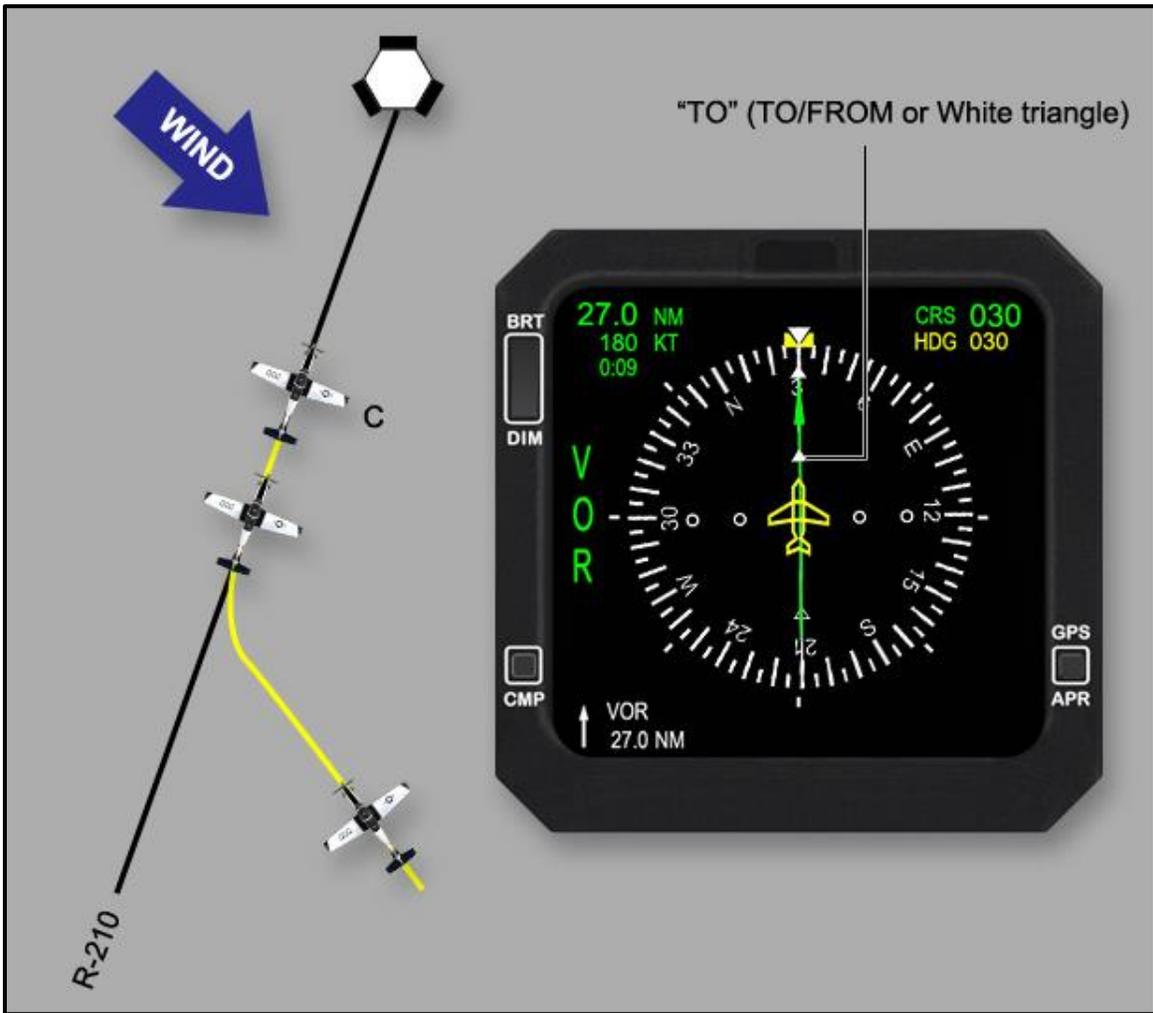


Figure 4-6 Centered CDI with “TO” Indication

- Should drift occur (the CDI moves left or right of center), turn the aircraft to maintain the selected inbound course by crabbing into the wind (Figure 4-7).

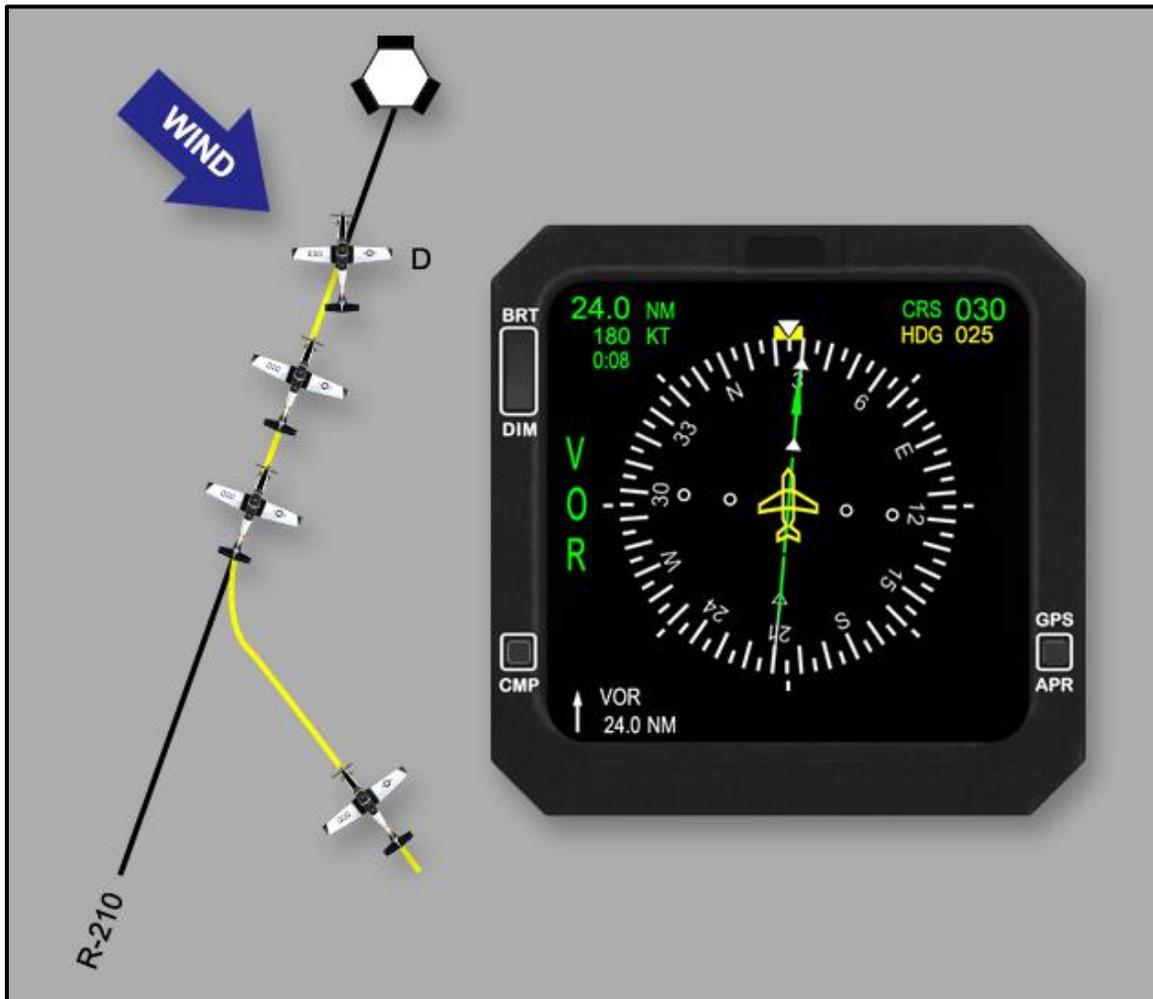


Figure 4-7 Crab into the Wind to Maintain Course

You can also proceed direct to a GPS waypoint. Once proceeding direct to a waypoint, you must still adjust your heading for wind drift to maintain the desired course direct to the GPS waypoint.

To proceed direct using the GPS, execute the following procedures:

1. Select GPS as the NAV source on the EHSI by using the NAV source selector button on the EFIS control panel. Ensure the magenta double needle bearing pointer is displaying GPS data by depressing the double needle source button on the EFIS control panel (Figure 4-8).



Figure 4-8 EHSI in GPS NAV Mode

2. On the GPS control head, select the desired waypoint from the FPL 0 (Flight Plan) page or by pulling out the right inner knob in the SUPER NAV 5 mode and press the Direct To followed by ENT button on the GPS Receiver/Control/Display Unit (Figure 4-9).

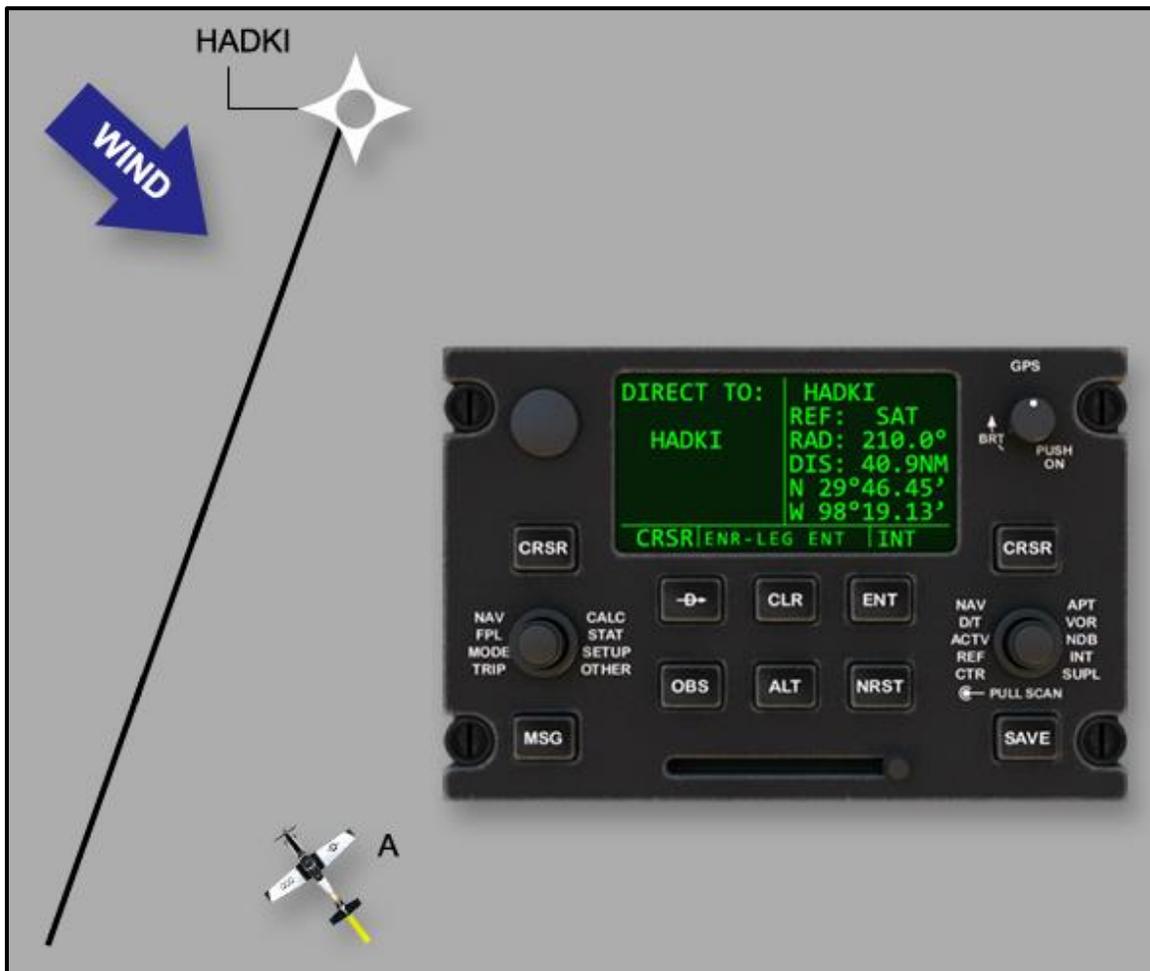


Figure 4-9 GPS-Control Head Showing Direct To HADKI Waypoint

3. Turn in the shorter direction and place the head of the GPS pointer under the heading index (Figure 4-10).

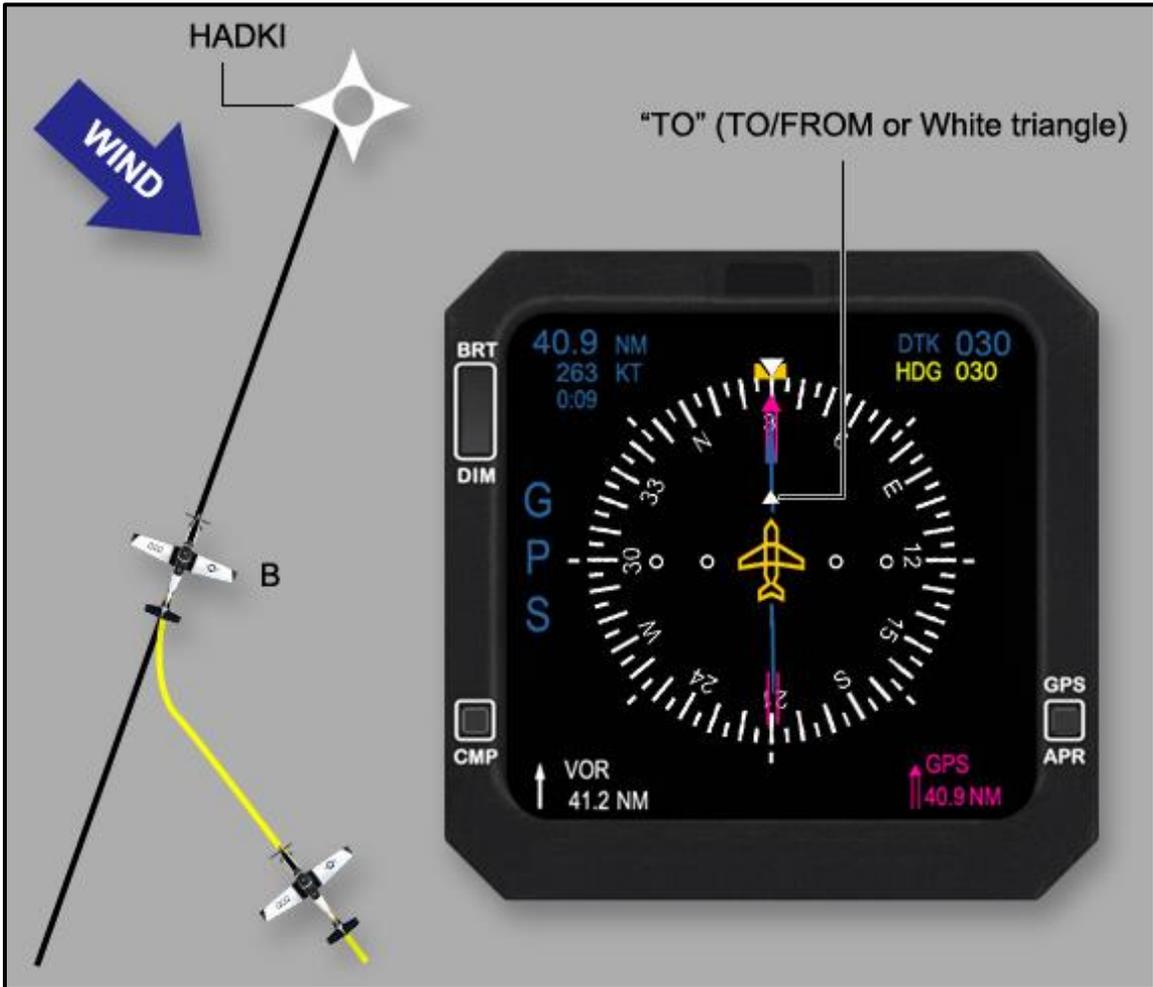


Figure 4-10 GPS Pointer Under EHSI Heading Index

- When established on the initial heading to the waypoint, press Direct To followed by Enter once again to center the CDI with the Desired Track (DTK) that coincides with the heading (Figure 4-11).

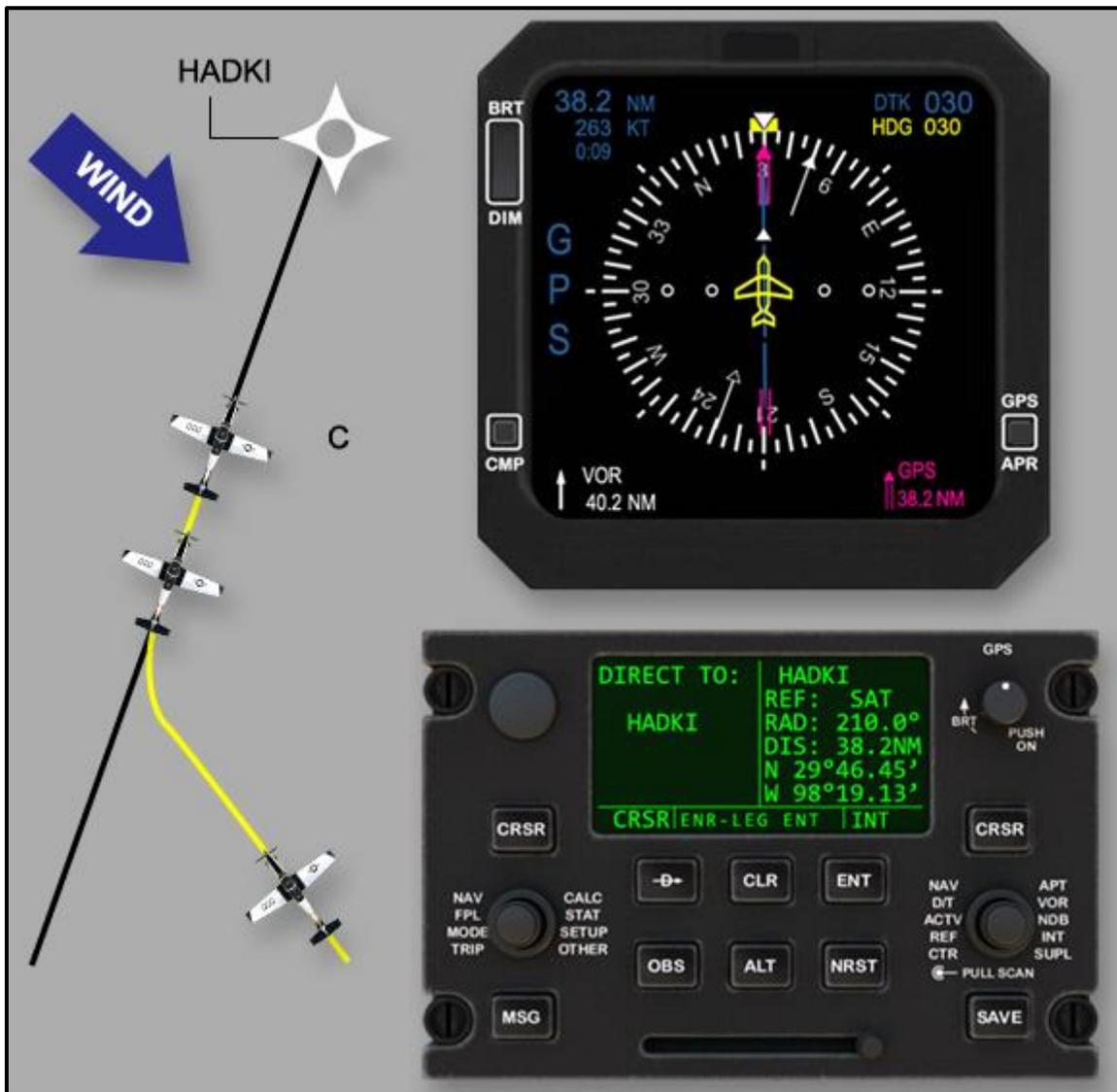


Figure 4-11 CDI with DTK that Coincides with Heading

5. Should track drift occur, turn to maintain the DTK to the waypoint by crabbing into the wind (Figure 4-12).

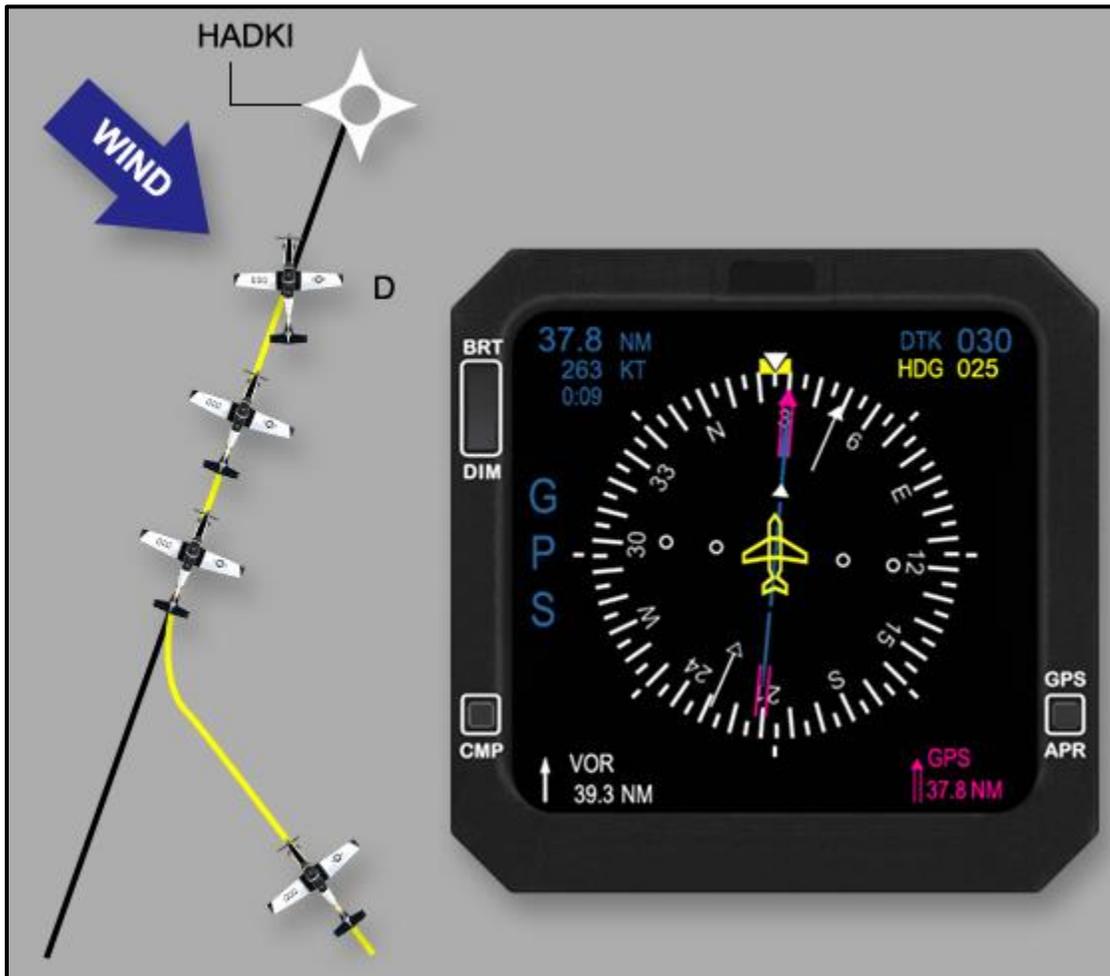


Figure 4-12 Crab Into the Wind to Maintain DTK

403. STATION PASSAGE

Station passage is defined as the moment the aircraft passes directly over or abeam the navigation facility. VOR station passage occurs when the TO-FROM indicator makes the first positive change to “FROM.”

NOTE

The head of the VOR bearing pointer may fall through a radial 90° from the dialed course. If the TO/FROM flag is unavailable, this 90° offset may be used as a secondary indication of station passage. If both the TO/FROM flag and the bearing pointer are unavailable, minimum DME may be used to determine station passage.

404. BEARING POINTER AND CDI CHARACTERISTICS

You have just learned the basics of proceeding direct to a station and maintaining a course. You will use these basics in all phases of flight. Unfortunately, you will rarely start on the course you wish to maintain. To establish the aircraft on a desired course you must first perform a course intercept, and be familiar with how the bearing pointer acts in flight.

Bearing Pointer

If you are flying in any direction other than directly toward or directly away from a station, the bearing pointer will move on the EHSI compass card. In a no-wind situation, the following three statements are always true:

1. The head of the bearing pointer will fall.
2. The tail of the bearing pointer will rise.
3. Your position in the aircraft is always on the tail of the bearing pointer.

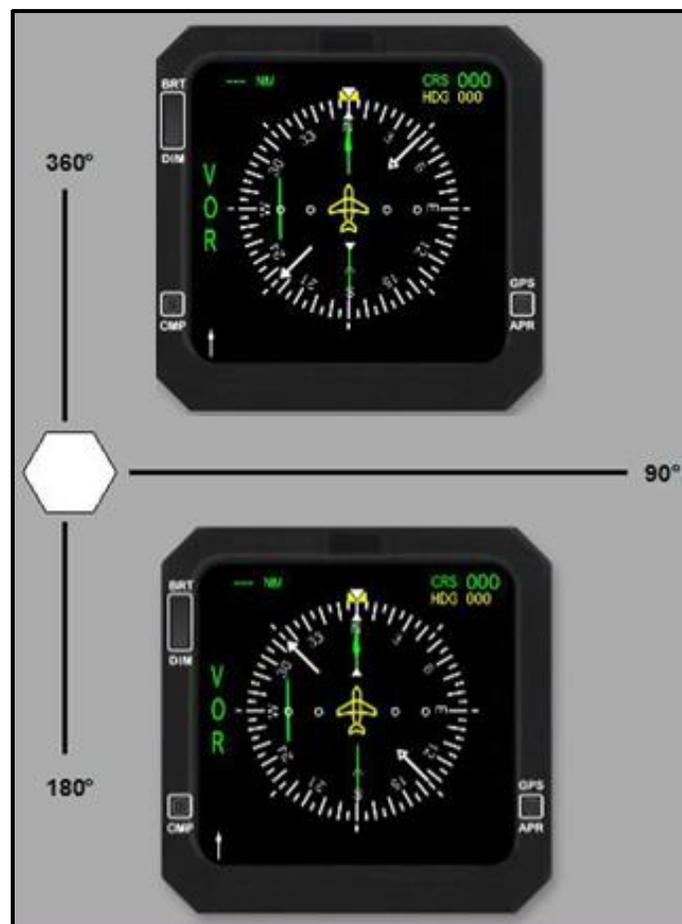


Figure 4-13 Bearing Pointer

TO/FROM Indicator

The TO/FROM indicator is a white triangle near the center of the EHSI. A “TO” indication occurs when the white triangle points toward the head of the course pointer. This indicates that the selected course is taking you toward the station or waypoint. The opposite is true for the “FROM” indication. The TO/FROM indicator is dependent only on the selected course and not on the aircraft heading.

CDI

Along with the bearing pointer, the CDI shows the aircraft position relative to the selected course. If the CDI deflects to the left of center, your aircraft has drifted to the right of the selected course. To correct, you should turn the aircraft to the left, or towards the deflected CDI bar. Each dot on the face of the EHSI indicates 5° of CDI displacement when VOR is selected. As shown on the EHSI in Figure 4-14, if the CDI is displaced two dots to the left of center, your aircraft would be 10° right of the selected course.

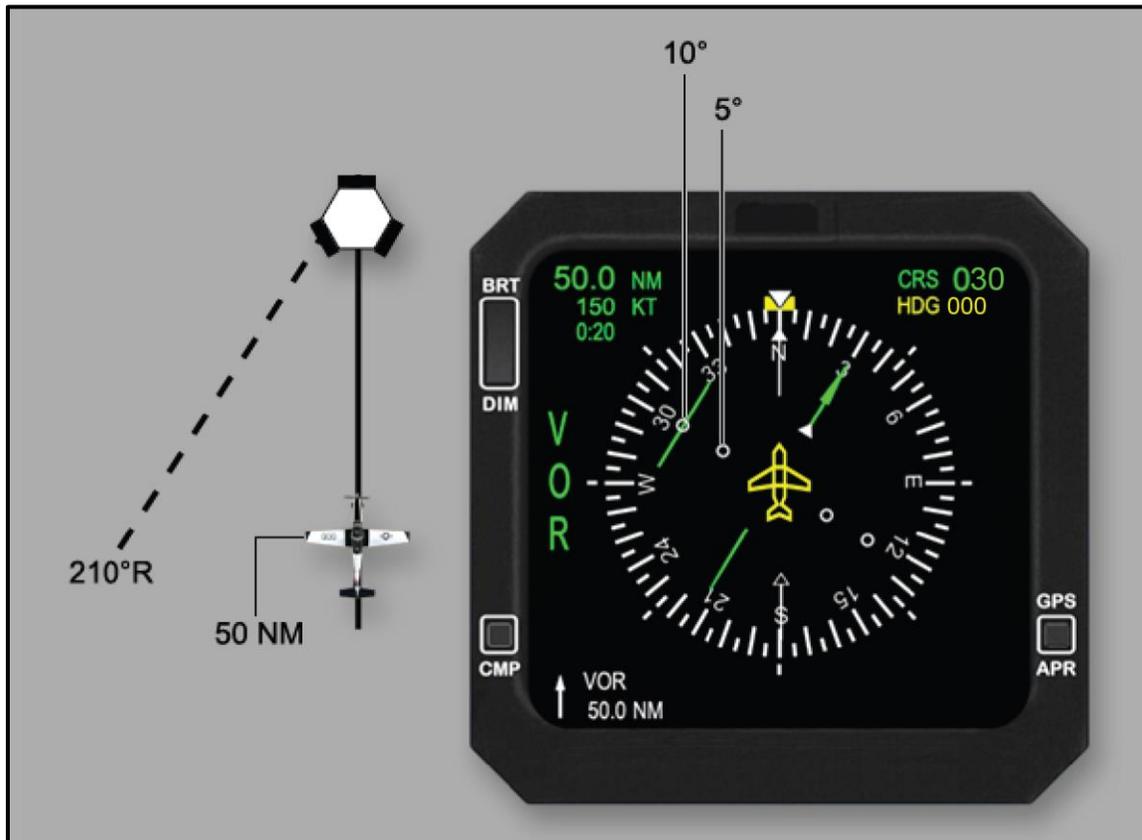


Figure 4-14 CDI on the EHSI

CDI and Bearing Pointer

Since both the bearing pointer and the CDI provide course information, it should be noted that the displays are consistent only when the aircraft is within 10° of the selected course. When the bearing pointer is more than 10° off of the selected course, the CDI will be deflected to a full left or right position, and will remain there until the aircraft's position is corrected to within 10° of the selected course.

CDI and GPS Navigation

GPS navigation information can be displayed on the EHSI with the Map Mode (as in Contact Stage) or with the CDI. Because GPS flight plans are programmed and do not rely on signals from ground NAVAIDs, you will normally proceed direct to each waypoint. The CDI functions differently when using GPS. Rather than displaying degrees off course it displays nautical miles off course. In GPS terminology, the term “course” is replaced with Desired Track (DTK), and the distance off course is called Cross Track Error (XTK). When using the GPS Enroute-Leg Mode, full-scale deflection to the left or right indicates 5 NM off the DTK. Correcting for wind drift and flying GPS legs is very similar to proceeding direct to a station.

405. COURSE INTERCEPTS

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

Course Intercepts Definitions

Course intercept - The act of using your instrument displays to select and fly to a desired course (Figure 4-15).



Figure 4-15 Course Intercept

Inbound intercept – Intercepting a course that will take you to the selected station. The TO/FROM indicator will display a TO indication (Figure 4-16).

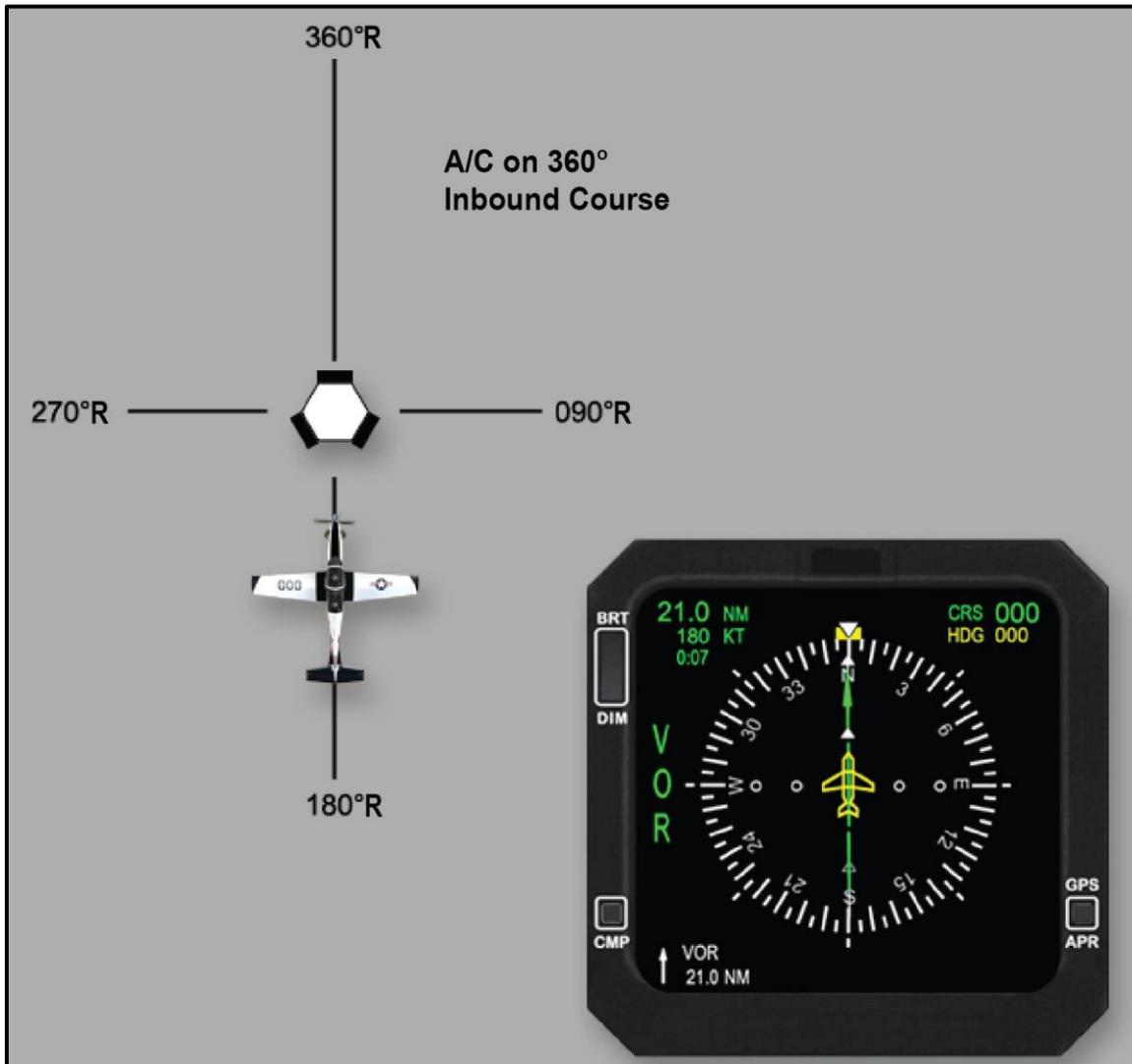


Figure 4-16 Inbound Intercept

Outbound intercept - Intercepting a course that will take you away from the selected station.
 The TO-FROM indicator will display a FROM indication (Figure 4-17).

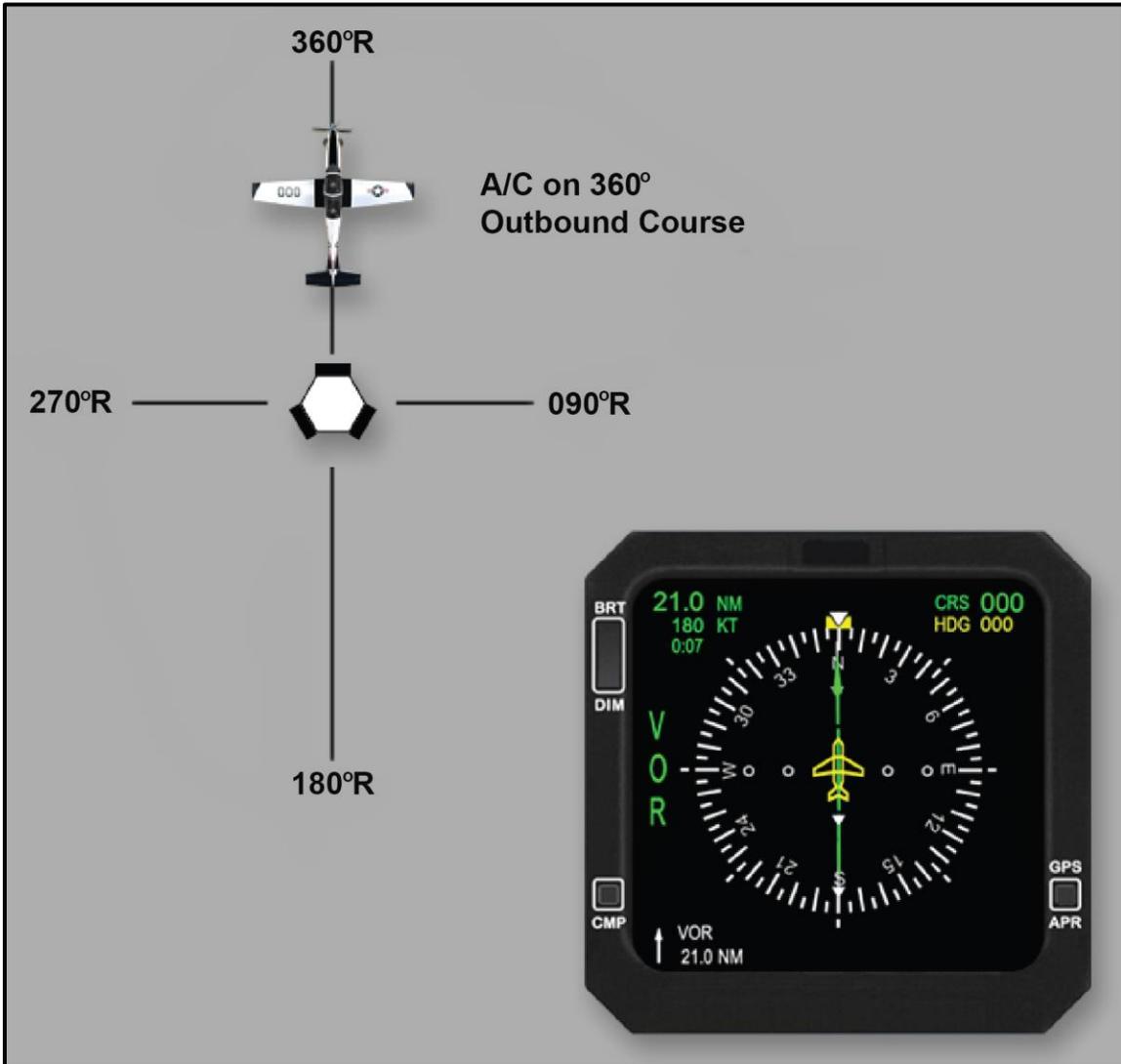


Figure 4-17 Outbound Intercept

Intercept heading - The heading you choose to fly to accomplish a course intercept (Figure 4-18).

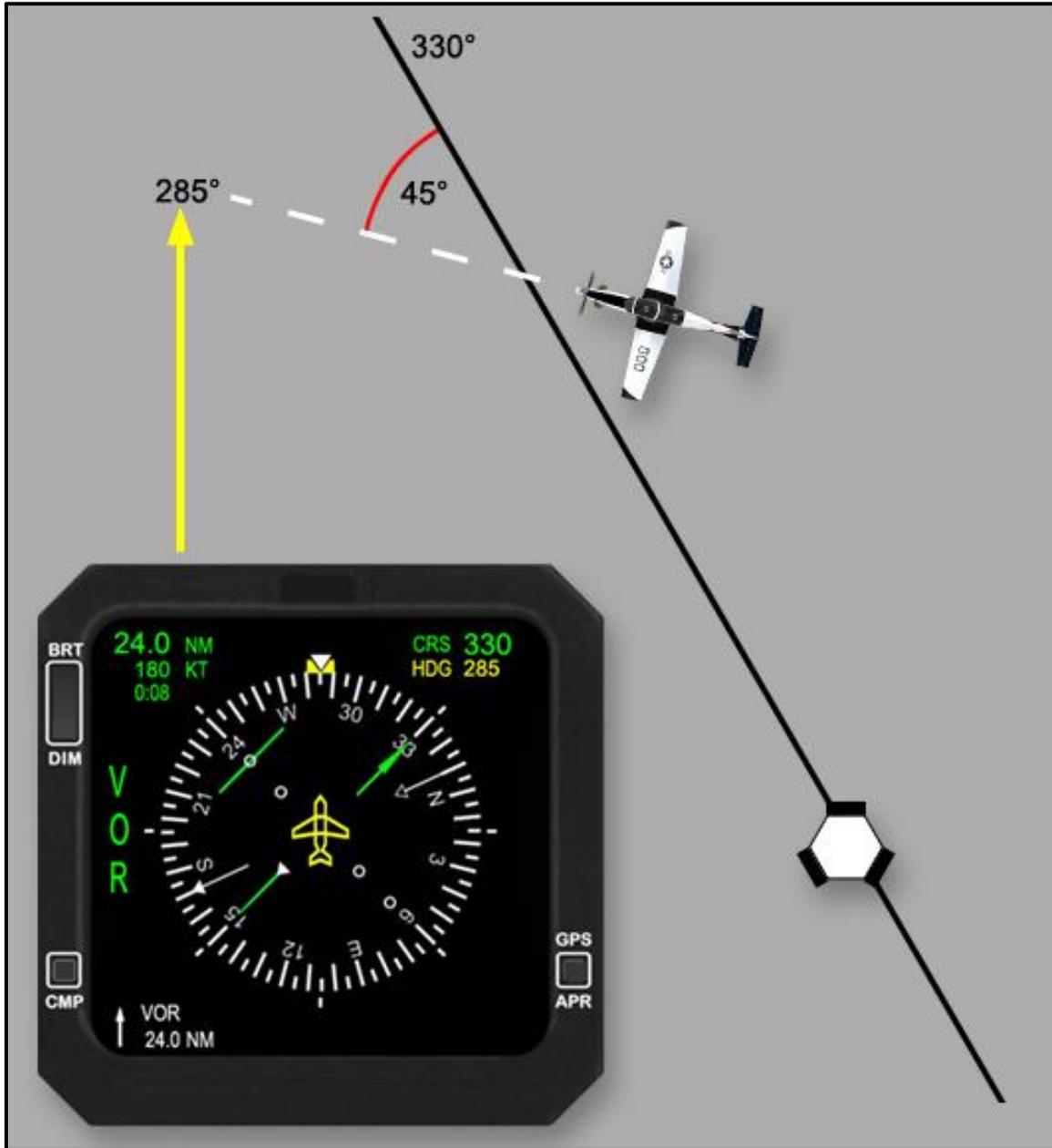


Figure 4-18 Intercept Heading 285°

Intercept angle - The angle between your intercept heading and your desired course (Figure 4-19).

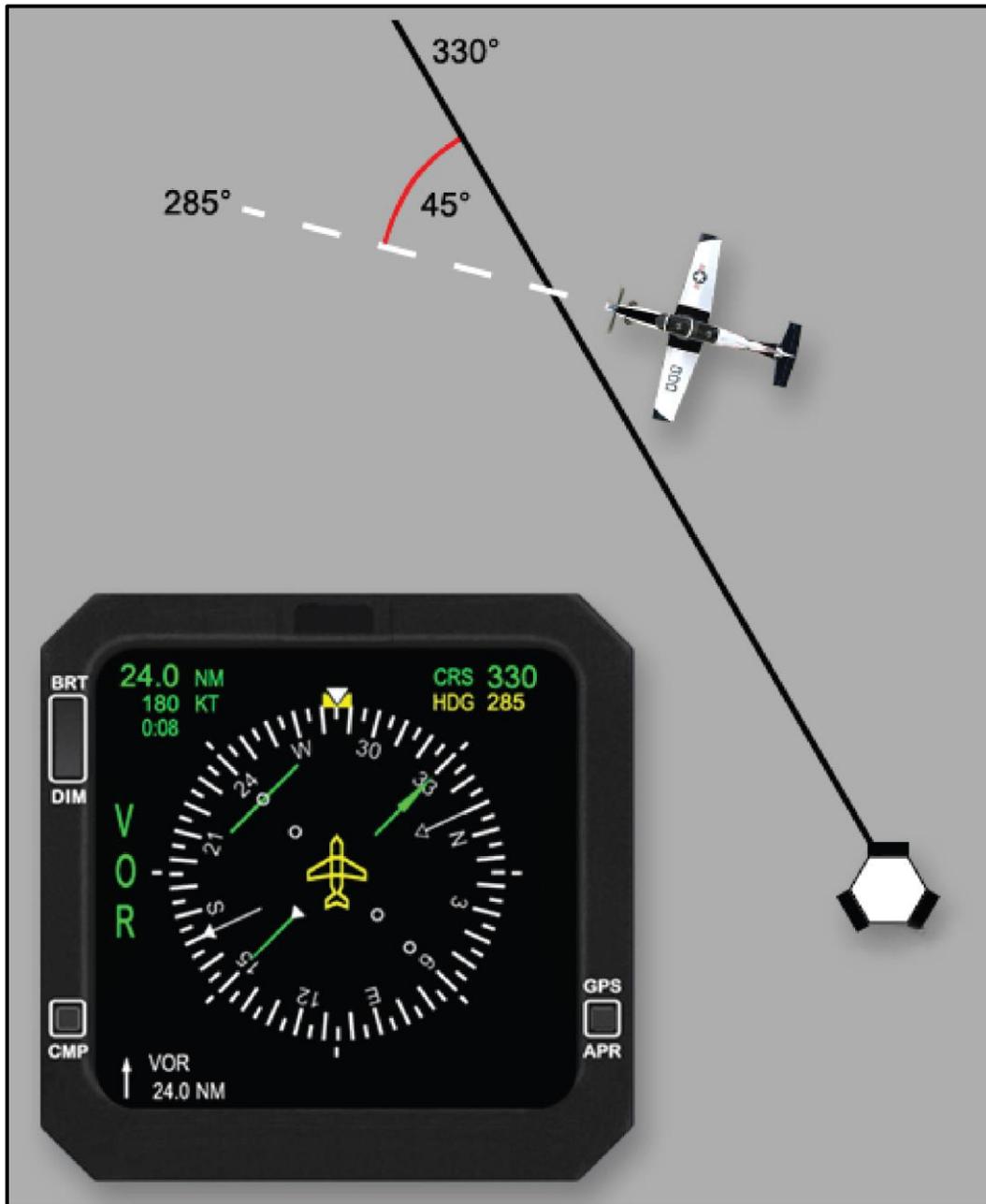


Figure 4-19 Intercept Angle 45°

Basic Procedures for all Course Intercepts

The following basic procedures apply to all outbound and inbound course intercepts:

1. TIM the station.
2. Set the desired course in the EHSI and check for proper TO/FROM indication (Figure 4-20).

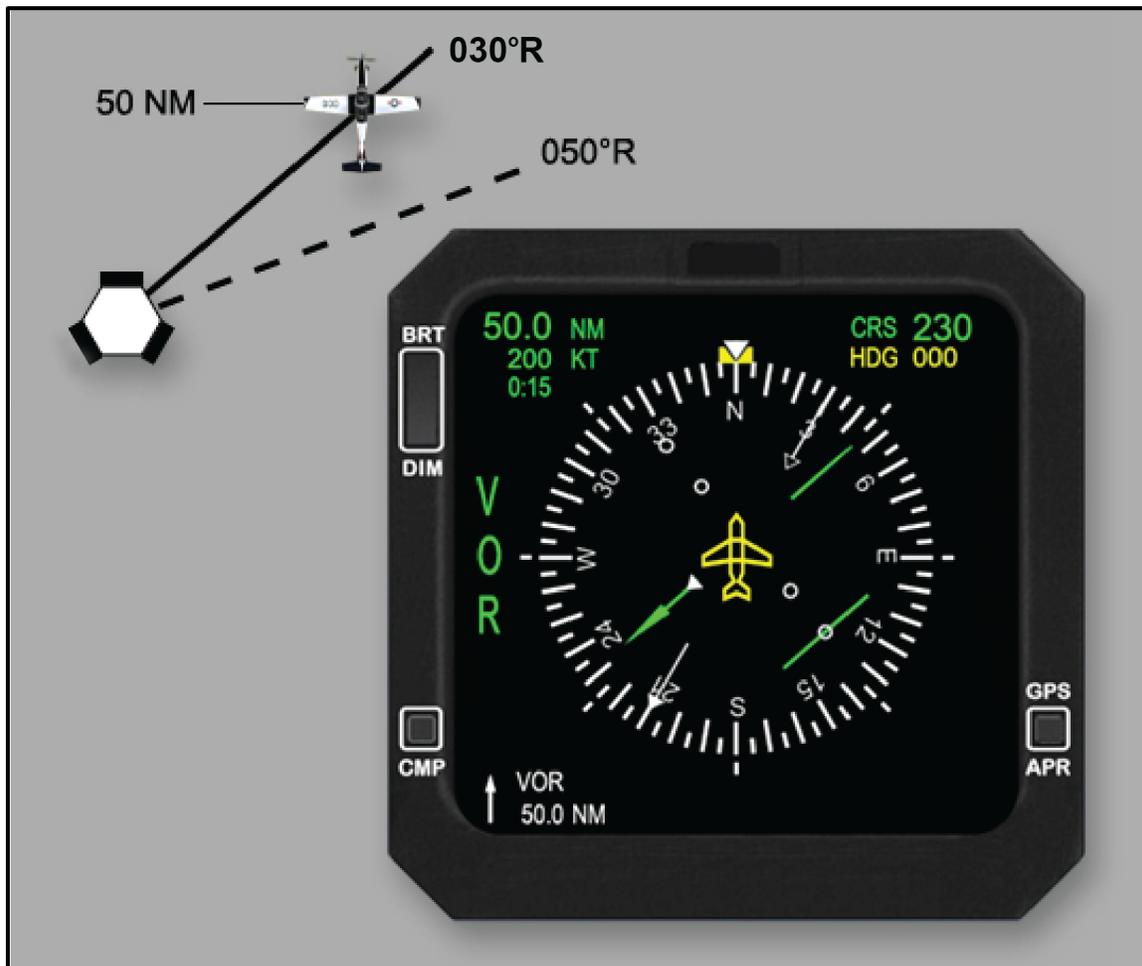


Figure 4-20 EHSI showing CRS 230

- Turn in the shorter direction toward the CDI and place the head of the course arrow in the top half of the case (Figure 4-21).

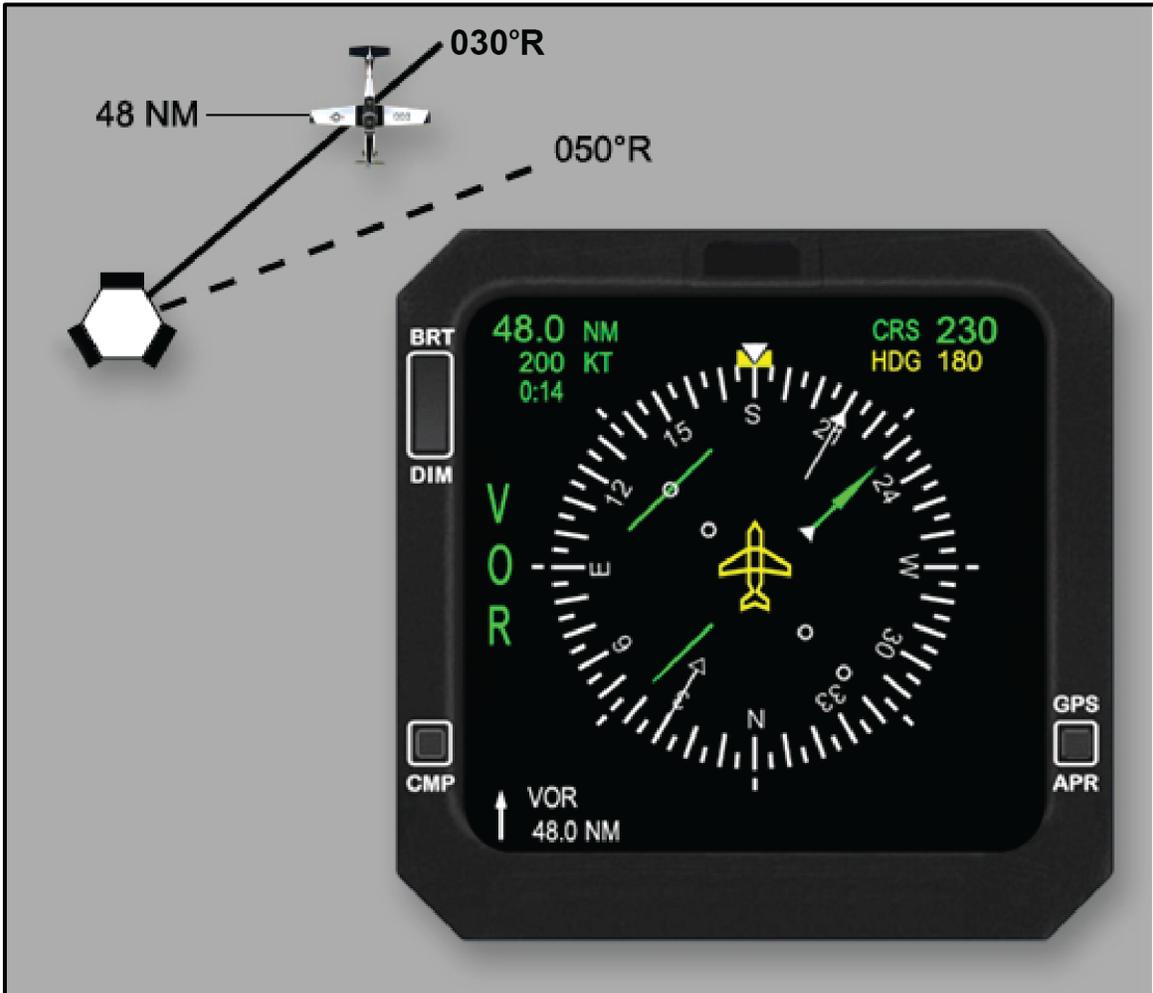


Figure 4-21 Heading 180° to Intercept CRS 230

- For inbound intercepts, roll out of the turn when the bearing pointer is between the upper lubber line and the head of the course arrow to establish an intercept heading (Figure 4-22).

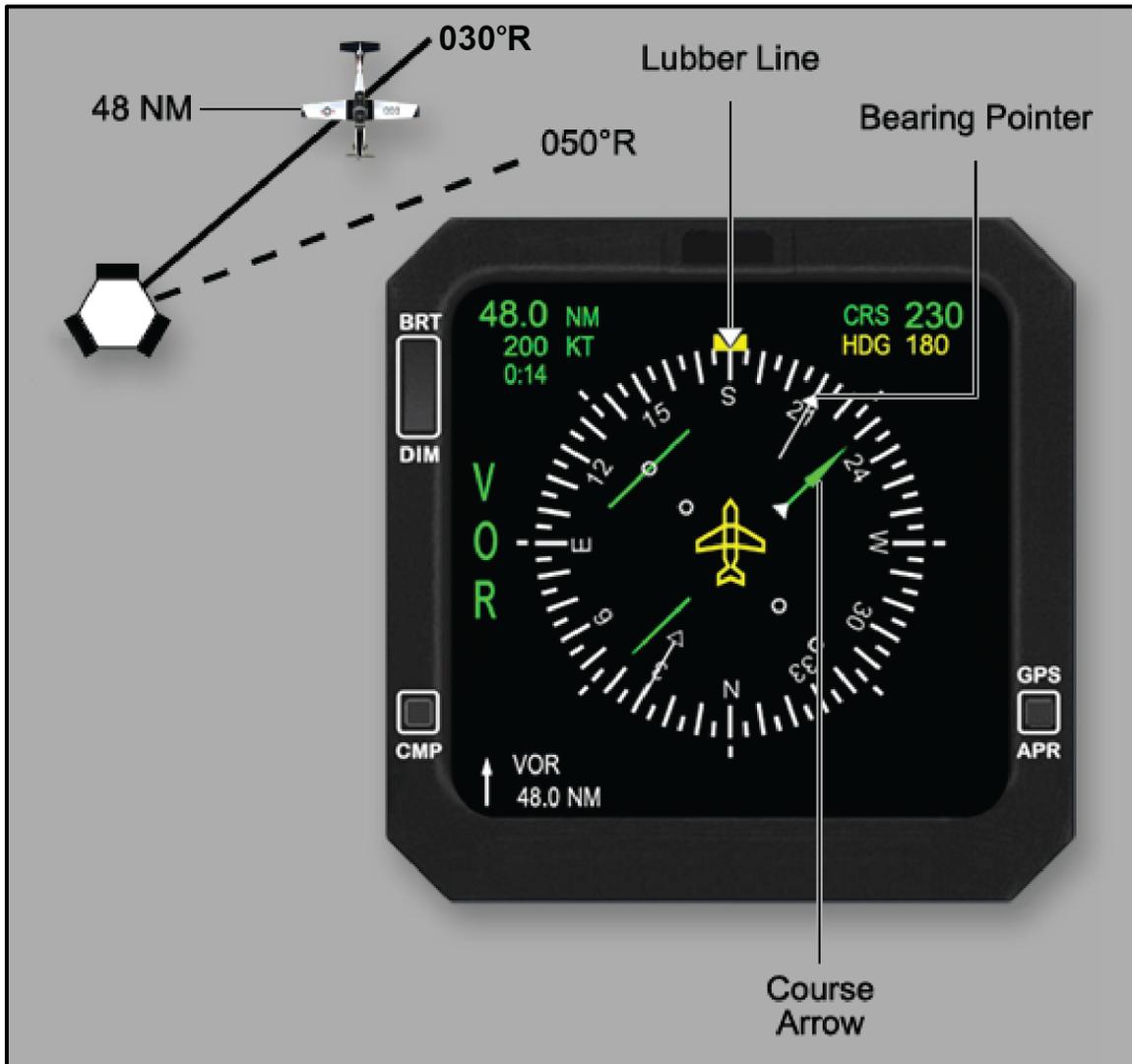


Figure 4-22 Inbound Intercept Heading

5. For outbound intercepts, roll out on an intercept heading, check to ensure the head of the course arrow is under the 45 degree index on the EHSI and the TO/FROM flag is showing a FROM indication (Figure 4-23).

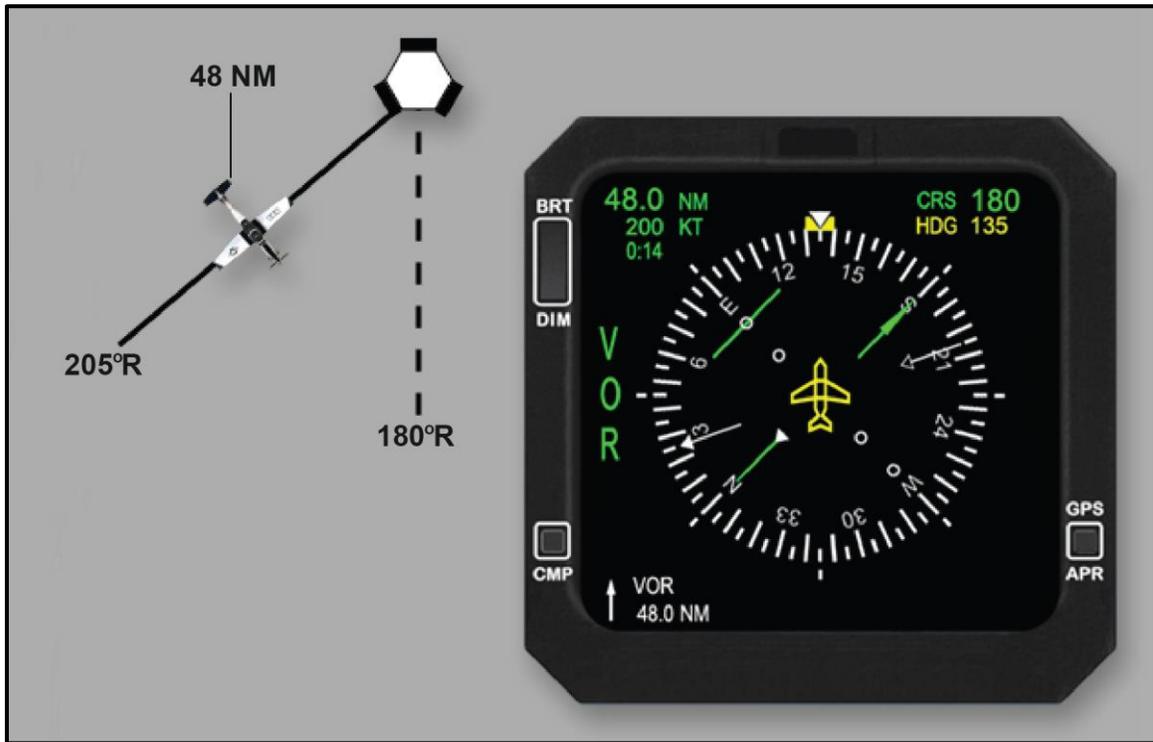


Figure 4-23 Outbound Intercept Heading

After performing the three basic course intercept procedures, you should use one of the following techniques to further refine your intercept heading.

Course Intercept Techniques

There are five proven techniques that work well to assist you in determining good outbound and inbound intercept headings. They provide a good rate of intercept to the desired course:

1. Outbound 45° Intercept (TDC+45)
2. Outbound Double the Angle (DTA)
3. Inbound 30° Intercept (CB+30)
4. Inbound Double the Angle (DTA)
5. Outbound Course Intercept Over the Station

Outbound 45° Intercept (TDC+45)

This method uses a 45° intercept angle to intercept your desired course outbound. An easy way to remember and apply this technique is to use the memory aid, “TDC+45,” which refers to: Tail of the bearing pointer to the Desired Course (TDC) + 45°.

1. TIM the station.
2. Set the desired outbound course in the EHSI (Figure 4-24).

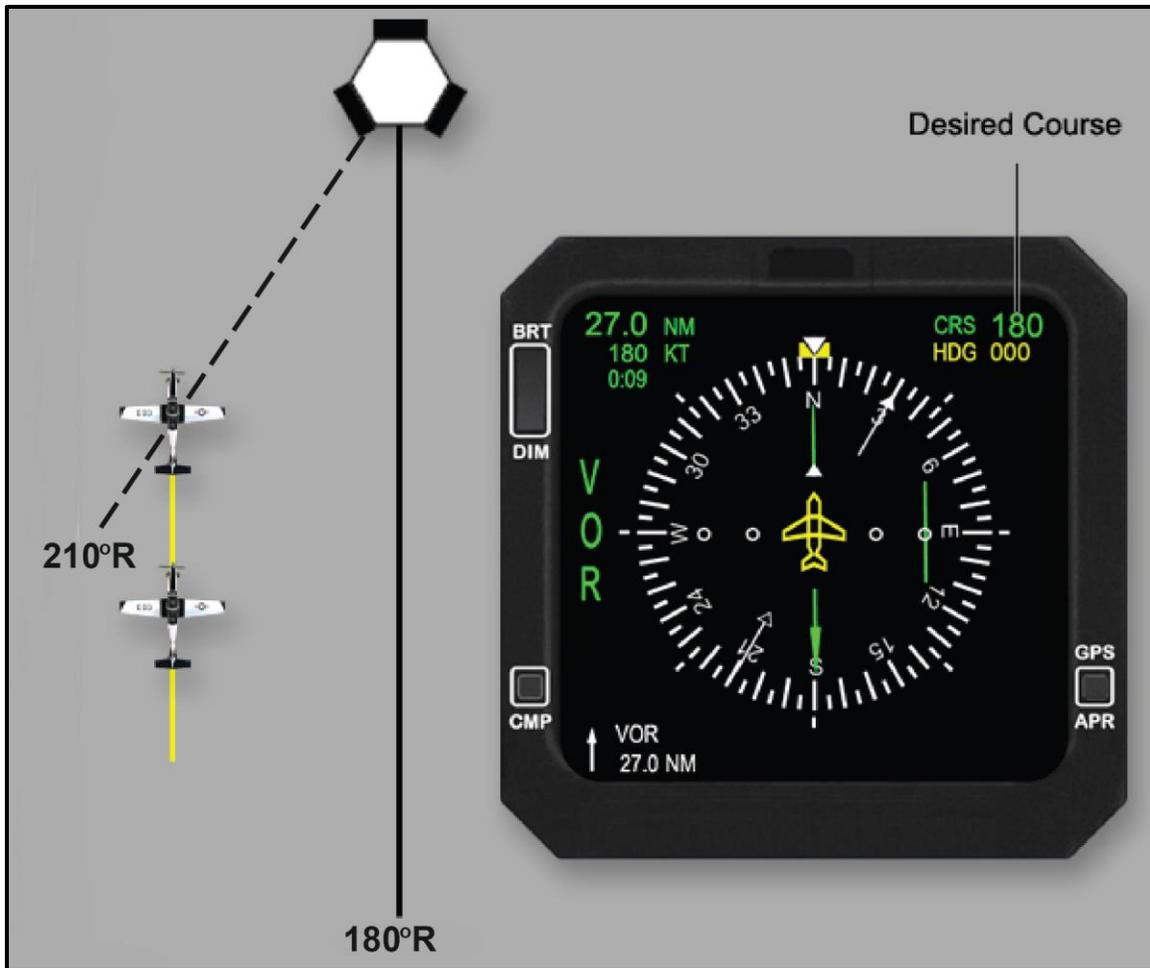


Figure 4-24 Outbound Desired Course (TDC + 45)

- From the Tail of the bearing pointer, locate the head of the course needle (Desired Course), then count 45 more degrees in the same direction, toward the CDI bar. Turn to that heading (Figure 4-25).

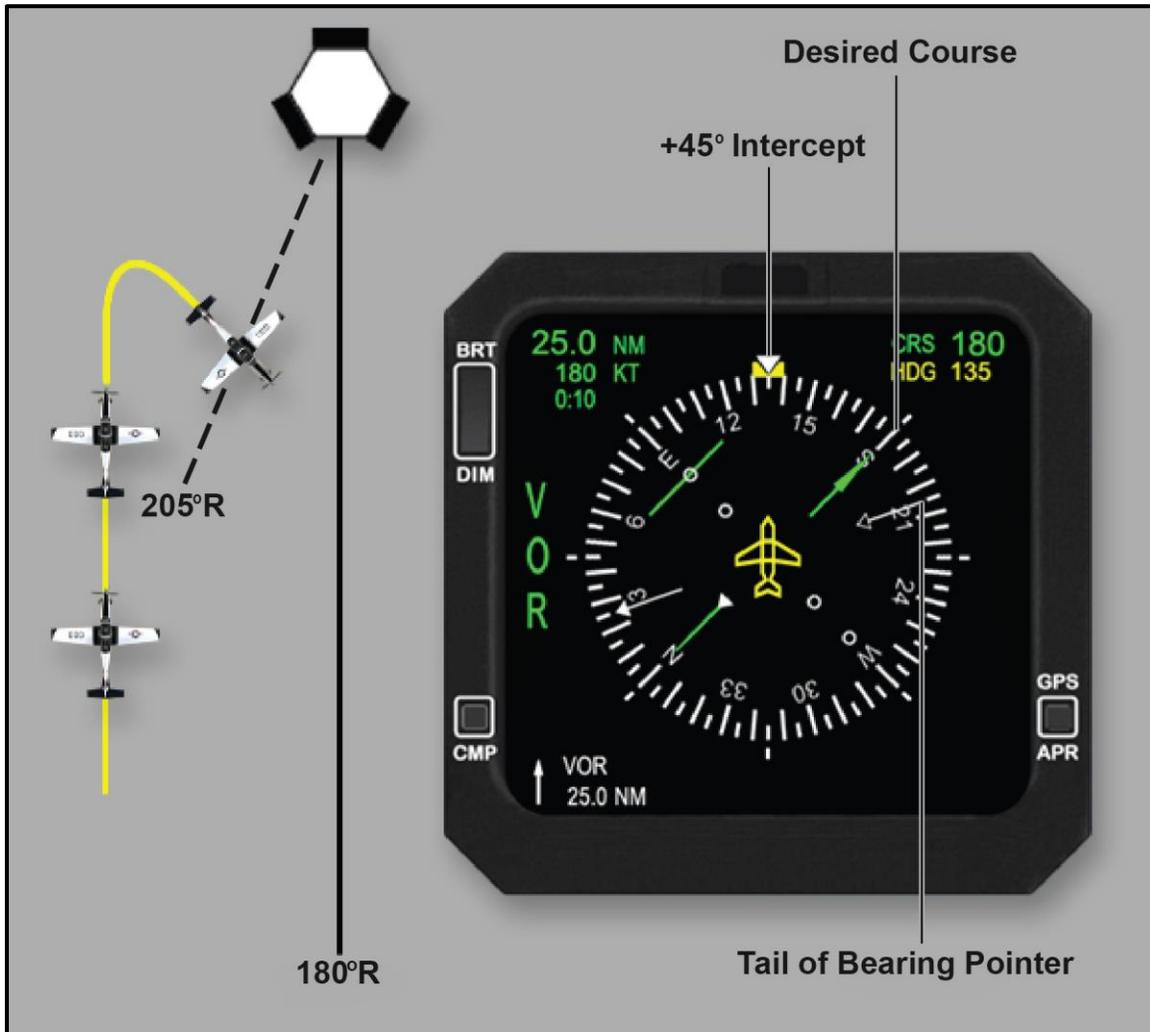


Figure 4-25 Outbound 45° Intercept (TDC+45)

- As you roll out on the intercept heading, check to ensure the head of the course needle is under a 45° index on the EHSI, and the TO-FROM flag is showing a FROM indication. You now will have a 45° intercept heading outbound.

5. To complete the intercept, monitor the rate of CDI movement toward the center. Start your turn onto the desired course based on the rate of movement of the CDI. As a technique, using a lead point of 2° or 3° is normally sufficient (Figure 4-26).

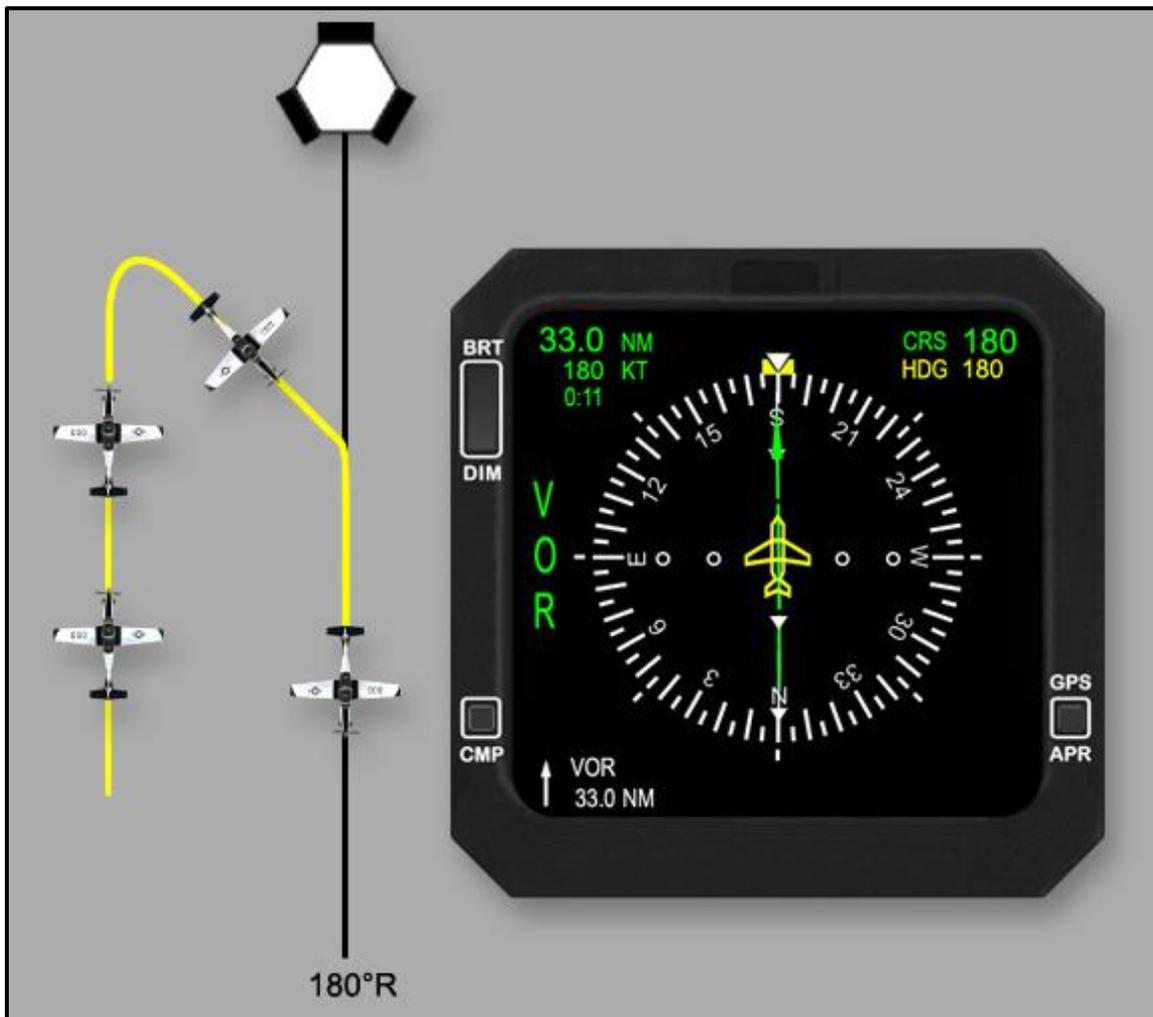


Figure 4-26 Completing Outbound 45° Intercept (TDC+45)

Outbound Double The Angle (DTA)

To use this method, you must determine the number of degrees you are off the desired course, and then use an intercept angle that is equal to twice that amount. The DTA method works well in most situations since it provides small corrections if you are close to course and larger ones if you are well off course. Always ensure that your intercept angle does not exceed 90° , or your outbound intercept will become an inbound intercept. Therefore, DTA should not be used when you are more than 45° off course because the calculated intercept angle will exceed 90° .

1. Perform the three basic course intercept procedures.
2. Determine the difference in degrees between the tail of the bearing pointer and the desired course. Turn twice that number of degrees away from the course needle, toward the CDI (Figure 4-27).

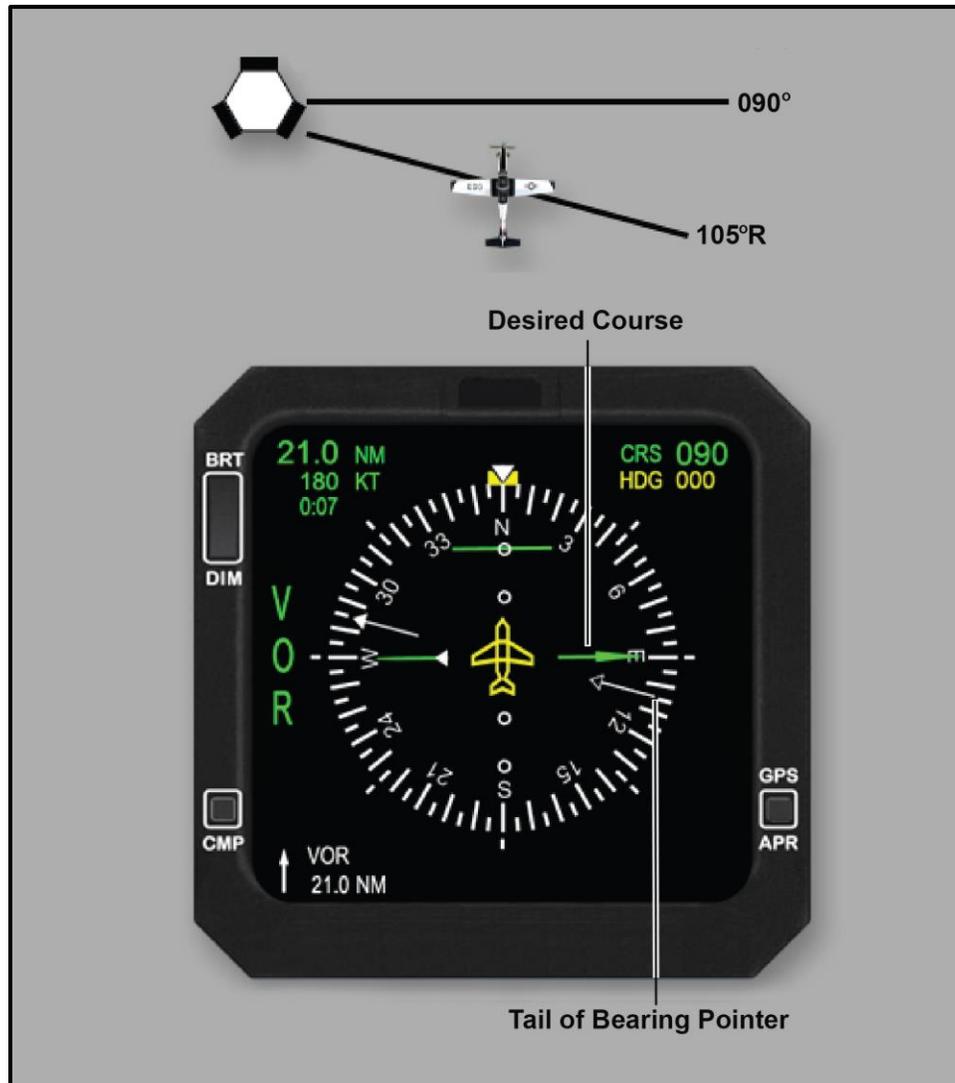


Figure 4-27 Outbound DTA Initial Heading

3. As you roll out, the new intercept heading should provide the “double angle” between your intercept heading and the desired course (Figure 4-28).



Figure 4-28 Outbound DTA Intercept Heading

4. Complete the intercept by turning to your desired course as the CDI centers.

Inbound 30° Intercept (CB+30)

This method uses a 30° intercept angle to intercept your desired course inbound, and is referred to as “Charlie Brown plus 30.” This name is a memory aid for “Course to the Bearing pointer plus 30°.” Once again, your intercept angle must not exceed 90° from the desired course or you will be flying away from the station.

1. Perform the three basic course intercept procedures. Remember to set the course needle to the reciprocal of the desired radial for inbound intercepts.
2. Using “Charlie Brown plus 30,” look to the head of the course needle, then locate the head of the bearing pointer, and count 30 more degrees in the same direction, toward the CDI bar (Figure 4-29). Turn to this heading.



Figure 4-29 Inbound 30° Intercept (CB+30) Determine Initial Heading

3. As you roll out on the intercept heading, check to ensure the head of the bearing pointer is displaced 30° from the heading index of the EHSI, and the TO-FROM flag is showing a TO indication.

4. Complete the intercept by turning to your desired course as the CDI centers. For inbound intercepts, the size of the lead point will vary with your distance from the station. Use the following rules of thumb as a guide: outside 15 NM and using an intercept angle of 30° or less, apply about 2° of lead prior to turn. Inside 15 NM and using an intercept angle of 30° or less, apply about 4° of lead prior to turn.

Inbound Double The Angle (DTA)

The double the angle technique also works for inbound intercepts. Determine the number of degrees you are off the desired course, and then use an intercept angle that is equal to twice that amount. Always ensure that your intercept angle does not exceed 90° , or your inbound intercept will become an outbound intercept. Therefore, DTA should not be used when you are more than 45° off course or the calculated intercept angle will exceed 90° .

1. Perform the three basic course intercept procedures. Remember to set the course needle to the reciprocal of the desired radial for inbound intercepts.
2. Determine the difference in degrees between the head of the bearing pointer and the desired course (Figure 4-30). Turn twice that number of degrees away from the course needle, toward the CDI.



Figure 4-30 Inbound DTA Initial Heading

- As you roll out, the new intercept heading should provide the “double angle” between your intercept heading and the desired course (Figure 4-31).



Figure 4-31 Inbound DTA Intercept Heading

- Complete the intercept by turning to your desired course as the CDI centers.

NOTE

The DTA inbound course intercept may not “look right” to many students, because the heading change is equal to, not double, the difference between the head of the bearing pointer and the course needle. The procedure is correct if the “intercept angle,” is equal to the DTA.

Outbound Course Intercept Over the Station

If you elect to use the TDC+45 or DTA intercept techniques right after station passage and heading outbound, you will probably overshoot your desired course/radial. This calls for a special technique:

1. At station passage, turn to an outbound heading that will parallel the desired course outbound, and set the course needle to the desired course/radial (Figure 4-32).

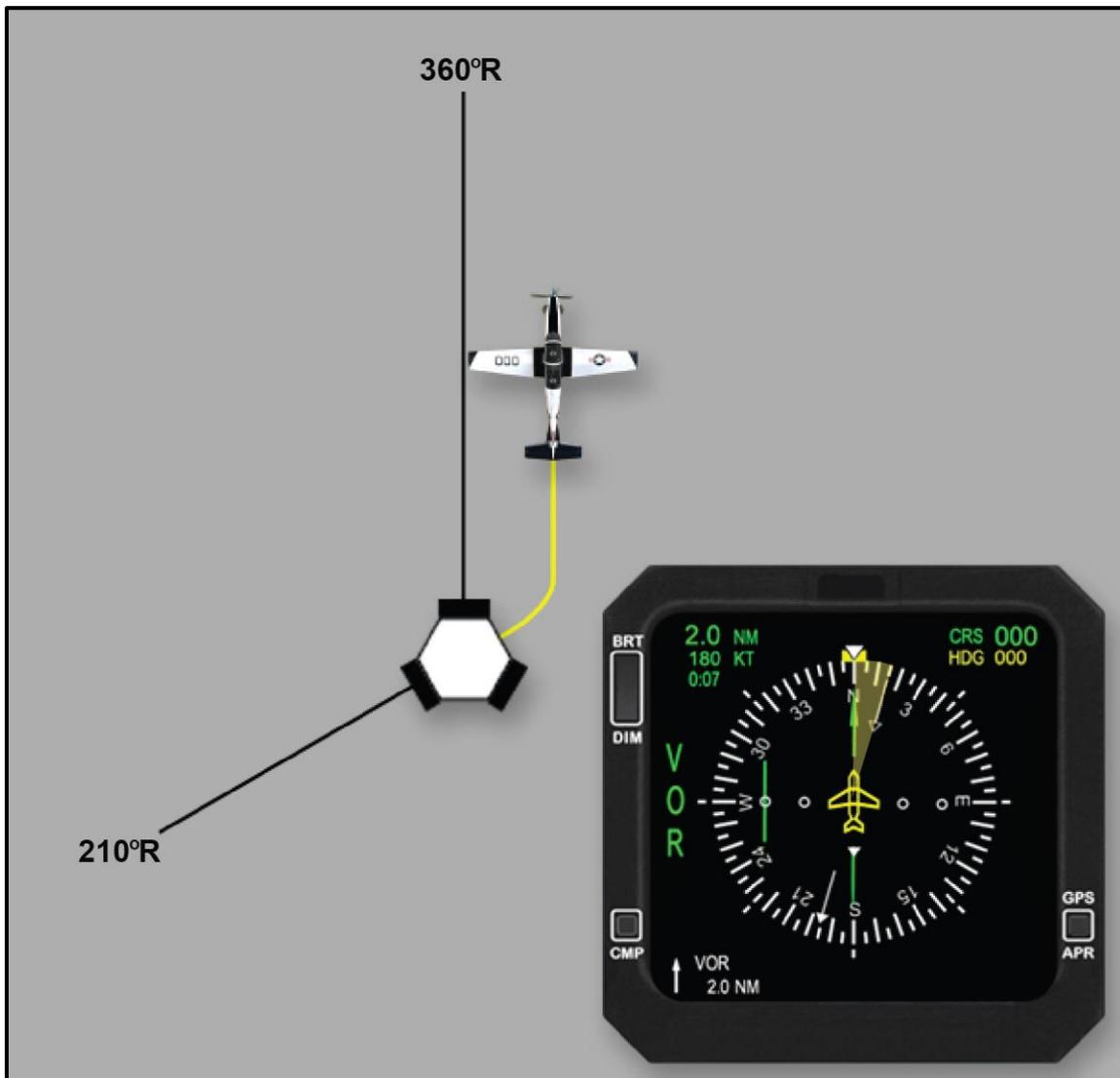


Figure 4-32 Outbound Course Intercept Over the Station Initial Heading

2. Determine the number of degrees between your present radial (tail of the bearing pointer) and the desired outbound course/radial (Figure 4-32).

3. Turn that number of degrees past the course needle in the direction of the CDI.

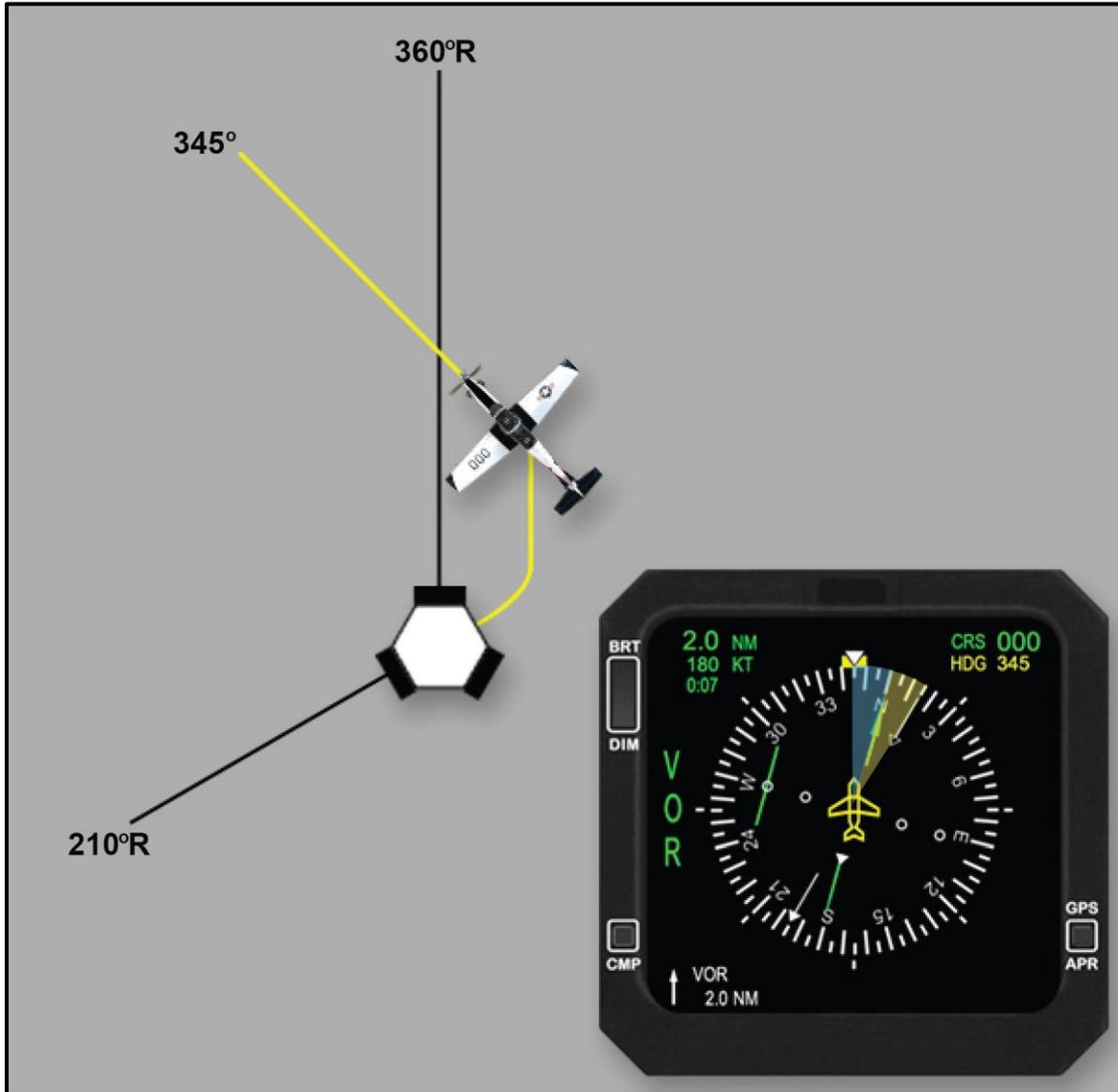


Figure 4-33 Outbound Course Intercept Over the Station Intercept Heading

4. Complete the intercept by turning to your desired course as the CDI centers.

406. POINT-TO-POINT

When cleared direct to a fix, the pilot may choose to either be radar vectored or employ Point-to-Point (PTP) navigation. When cleared direct from one point to another, you must determine the correct heading to fly. One method of determining this is to plot both points on a suitable chart and connect them with a straight line. The heading to fly is the heading along this line. An alternate method which may be used if both points can be defined off the same NAVAID, eliminates cumbersome charts and line drawing and will require you to visualize the aircraft's

present position and the desired fix on the compass card of the EHSI. This method may be used to navigate directly to any fix within reception range of the 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. Your position is always somewhere along the tail of the bearing pointer.
3. The point you are going to is along the radial that defines the point.
4. Visualize the point with the greater DME (actual or desired) on its respective radial at the outer edge of the compass card (20 DME in this example).
5. Visualize the other point at a proportional distance inside the compass card (10 DME) (Figure 4-34).



Figure 4-34 Present Position vs Desired Position

The following example (Figure 4-38) demonstrates the procedures for flying from one fix to another fix. The aircraft is on the 180° radial at 20 NM and you want to navigate to the 90° radial at 10 NM.

Procedures

1. TIM the NAVAID.
2. Set the desired radial in the course needle (Figure 4-35).
3. Turn to a heading approximately halfway between the head of the bearing pointer and the head of the course needle as shown in Figure 4-35.



Figure 4-35 Point-to-Point Initial Heading

Adjustments may be made to the rollout heading as follows. If flying to a larger DME, favor the head of course needle. If flying to a smaller DME as shown in Figure 4-36, favor the head of the bearing pointer. In our example, this would result in a left turn to approximately 020.



Figure 4-36 Point-to-Point Smaller DME vs Larger DME

4. Update the heading enroute and make appropriate corrections using the pencil method described below.

The Pencil Method

1. Establish the fix with the greater distance (20 NM) at the edge of the compass card on its respective radial (180°).
2. Establish the remaining fix (in this case 090° radial/10 NM) along its radial at a proportionate distance from the center of the card (in this case halfway) (Figure 4-37).



Figure 4-37 Pencil Method Present Position vs Desired Position

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 compass card and read the no-wind heading to the desired fix (approximately 020° in this case) (Figure 4-38).



Figure 4-38 Pencil Method No-Wind Heading

4. Turn to this updated heading (Figure 4-39).



Figure 4-39 Pencil Method Updated Heading

5. When wings level, visualize “the line” between the two fixes again. If it is vertical, it represents the desired track and you should be on a good “no-wind” heading to the fix. Apply any wind corrections that are required to remain on the proper track.
6. If the line is not vertical, turn the aircraft in the proper direction 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.

Corrections

As the aircraft approaches the desired point, it will be necessary to determine whether the radial or DME will be reached first. To come as close as possible to the new point, it will be necessary to judge the rate at which the DME is moving and compare it to the rate at which the aircraft is crossing radials. If it is determined that one of these rates is moving faster than the other, it may be that the aircraft will reach the DME or radial first, rather than simultaneously. Keep the following in mind when trying to hit a point:

DME/Radial Rate of Change

1. When the needle is closer to the heading index than the 90° benchmark, i.e., above the 45° benchmark, the DME will change faster than the radials. The opposite is true when the needle is nearer the 90° benchmark, i.e., when the needle is below the 45° benchmark.
2. Remember, when the head of the needle is above the 90° benchmark, the DME will get smaller. When the head of the needle is below the 90° benchmark, the DME will get larger. The only exception to this rule is in the case of strong winds.
3. To get the DME to “speed up,” turn to place the needle closer to the heading index. This will slow the rate at which the aircraft is crossing radials. When going inbound, you will be working the head of the needle.

NOTES

1. When going outbound, reference the tail of the needle.
2. With needle at the 45° benchmark, rate of DME and radial change should be equal. With needle anywhere else, DME and radial change rates are inversely proportional (if DME rate increases, radial change rate decreases).
4. You may 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 making prescribed heading changes before it is too late. Once on the new heading, let things settle down (i.e., cross a few radials; let a few tenths of DME pass) then update again (as required) by trying to determine if the aircraft will hit the radial or DME first. Remember, the goal is getting as close as possible to the point. Continually update your heading until crossing the point; however you are limited to no more than 20 degrees of heading change within 2 minutes prior to the point. If the solution does not work out exactly, you will arrive either at the desired DME or radial prior to the fix. If a large correction would be required inside of 2 minutes to hit the fix exactly, you may need to just estimate at what point you will be closest or abeam the fix, and when it makes sense to begin the turn to the next point to remain on course.

Common Errors

1. Failing to expedite the first three steps. Remember, there is plenty of time to refine the solution once proceeding in the general direction.
2. Reversing the direction of the imaginary no-wind heading line by extending the imaginary line from the desired fix to the present position.
3. Failing to make frequent updates. As the aircraft gets closer to the station, more frequent updates will be required to ensure an accurate solution.
4. Placing the wrong fix at the outer edge of the EHSI card.
5. Proceeding to the reciprocal of the radial/DME instead of the radial/DME.
6. Attempting to arc to the fix when not within 30 radials of the desired fix.
7. Failing to make timely and accurate wind drift corrections enroute to the fix.
8. Failing to monitor basic airwork while working on a navigation solution.

407. ARCING AND LEAD POINTS

Arcing is defined as flying a constant distance from a VORTAC or VOR/DME station by reference to DME (Figure 4-40). It is an integral part of certain instrument Departure Procedures as well as instrument approaches. In most situations you will be required to intercept an arc from a radial using a lead point. At the completion of the arcing maneuver, you will be required to intercept an inbound/outbound radial. The lead point will now be a lead radial.

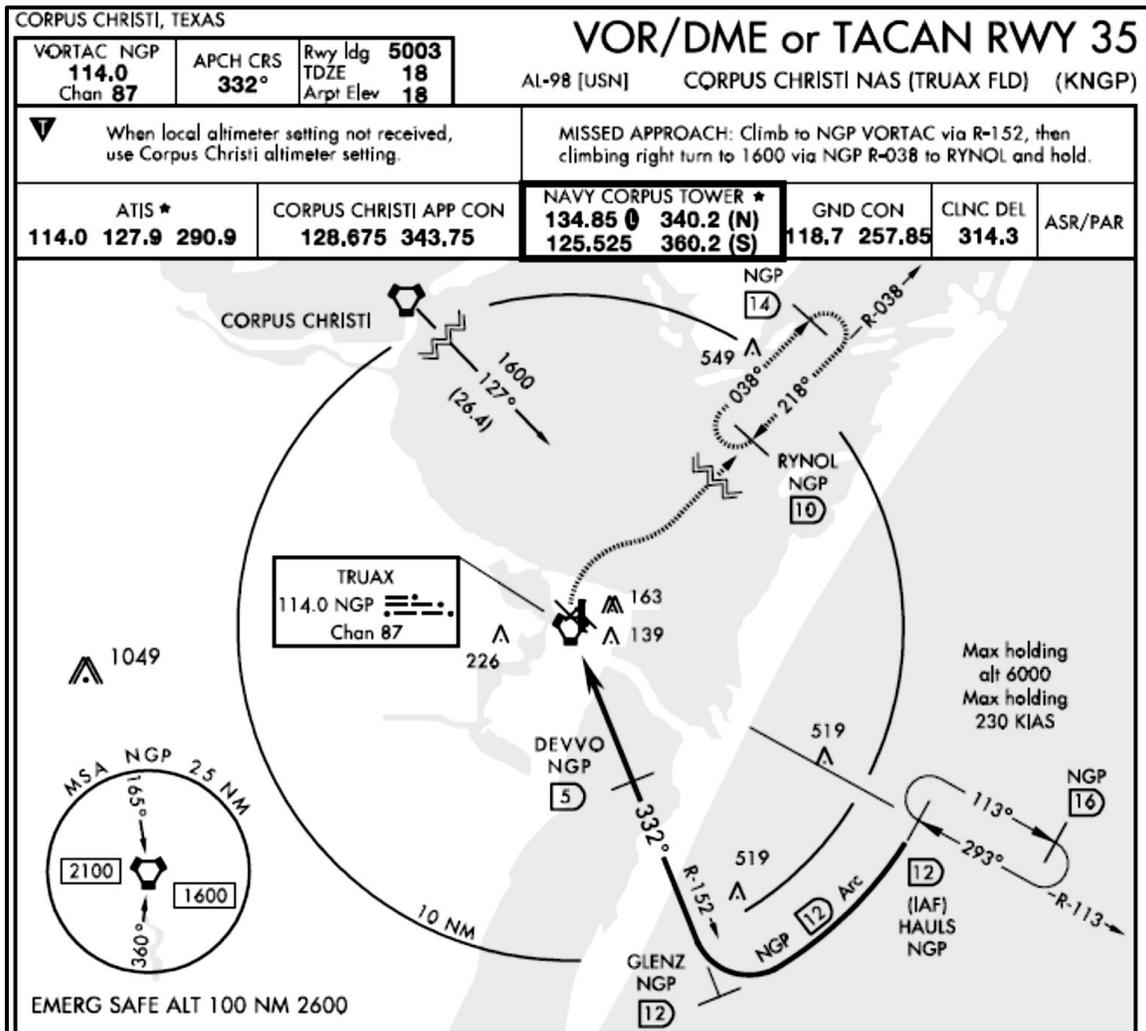


Figure 4-40 Arcing

Lead Points

To determine the lead point for a turn, you need to be able to estimate the aircraft's turn radius in nautical miles for a 90° turn. Remember, the turn radius for an aircraft varies directly with the aircraft airspeed: i.e., the greater the airspeed, the greater the turn radius. However, the turn radius varies inversely with the Angle of bank (AOB) used to make the turn: i.e., the greater the AOB, the smaller the turn radius. To reduce the number of variables in your turn radius

calculations, a standard rate turn (3 degrees per second) with a maximum of 30° AOB will be used on your instrument flights in SNFO T-6 training. The 30° AOB limitation is also important to help prevent spatial disorientation while flying in IMC.

The Turn Radius Lead Point calculation used in the T-6 assumes a Standard Rate Turn (SRT) will be used to make the turn. Therefore, you may be required to determine the AOB that equates to a SRT for the True Airspeed (TAS) the aircraft is flying. You may use this method:
$$\text{SRT} = (\text{TAS}/10) + 7$$

Example: For 150 KTAS (knots true airspeed), the AOB for a $\text{SRT} = (150/10) + 7 = 22^\circ$ AOB
For 240 KTAS, the AOB for a $\text{SRT} = (240/10) + 7 = 31^\circ$ AOB
(In this case, you would limit the AOB to a maximum of 30°.)

Use the following technique to determine a lead point for a 90° turn:

Turn Radius Lead Point (NM) = $\frac{1}{2}$ of 1% of speed for a SRT

For “speed” – Groundspeed (GS) is best. The performance formulas are calculated from TAS, but since winds will affect your track over the ground it is best to use GS. If GS is not available use TAS and as a last resort, use IAS (Indicated Airspeed).

Examples: $\frac{1}{2}$ of 1% x 240 KTAS = 1.2 NM
 $\frac{1}{2}$ of 1% x 150 KGS = 0.75 NM

During cruise flight you will usually fly a constant TAS that you have planned for and calculated, but during other phases of flight you may need to estimate. Remember that TAS can be quickly estimated from IAS by adding 2% of IAS for every 1000 feet of altitude.

Example: 200KIAS at 10,000 feet = $200 + (200 \times 2\% \times 10)$ KTAS = approximately 240KTAS

You may also learn other techniques for turn radius calculations in the future. For faster aircraft you may use $\frac{1}{2}$ SRT and 1% of speed, or for a 30° AOB you can use NM/Min minus 2. Keep in mind that all of these methods provide approximate lead points. It is up to you to determine what works best for you.

408. RADIAL/ARC INTERCEPTS

On some approaches, missed approaches, and departure procedures, you will be required to fly from a radial onto an arc. In this situation, you have to decide when to start your turn off of the radial onto the arc.

Procedures to Intercept an Arc from a Radial

1. TIM the station.
2. Determine the direction of the turn to intercept the arc (Figure 4-41). (e.g., make a right turn to 090°.)

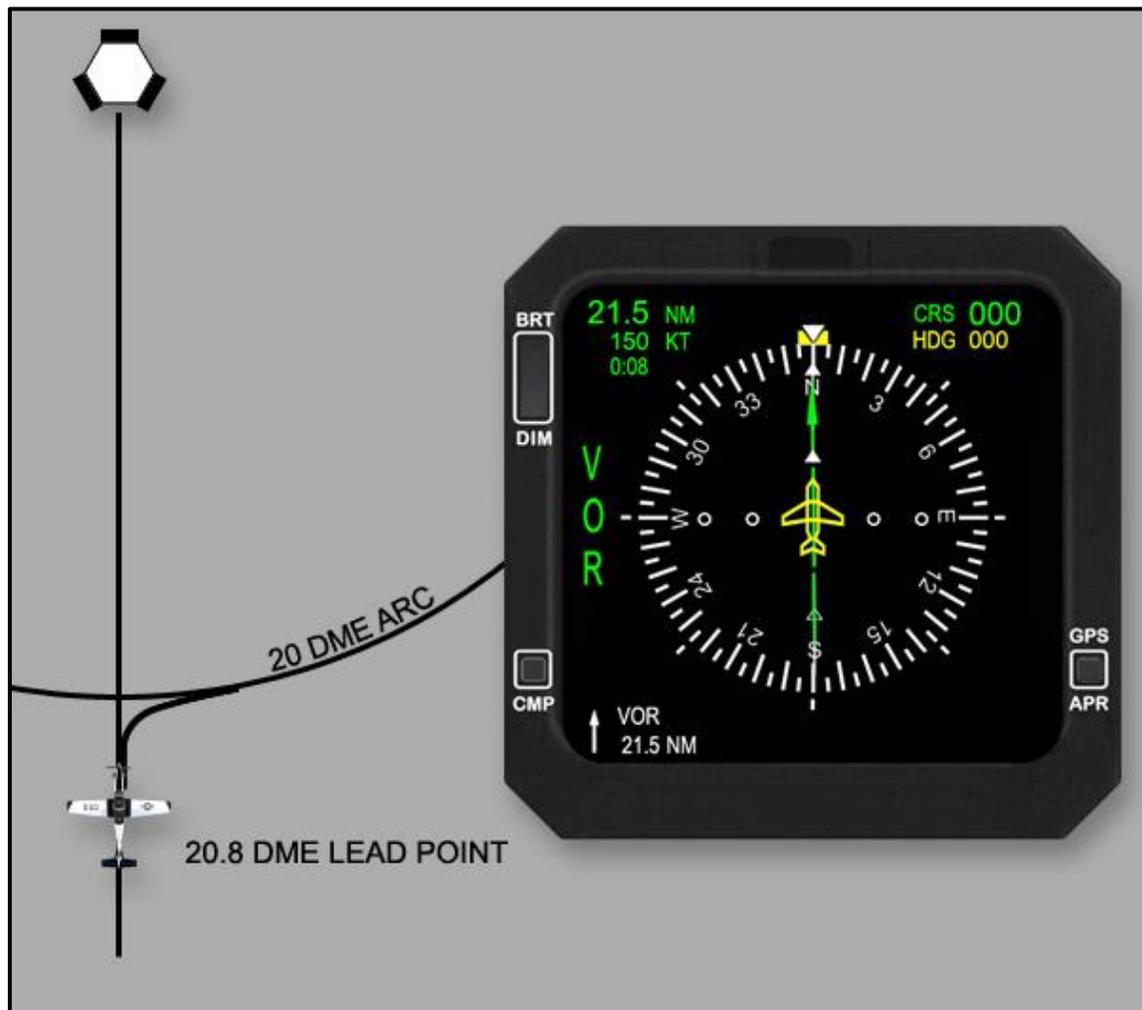


Figure 4-41 Arc Lead Point

3. Determine your lead point. (Use $\frac{1}{2}$ of 1% of GS (for this example 160 KGS) = 0.8 NM. The aircraft is flying inbound to the VOR, so you would add this lead point to the arc DME. The arc is at 20 DME, so: $20 + 0.80 =$ Lead point of 20.8 DME.

4. At the lead point, turn to place the head of the bearing pointer on the 90° index (reference point), and check your DME.

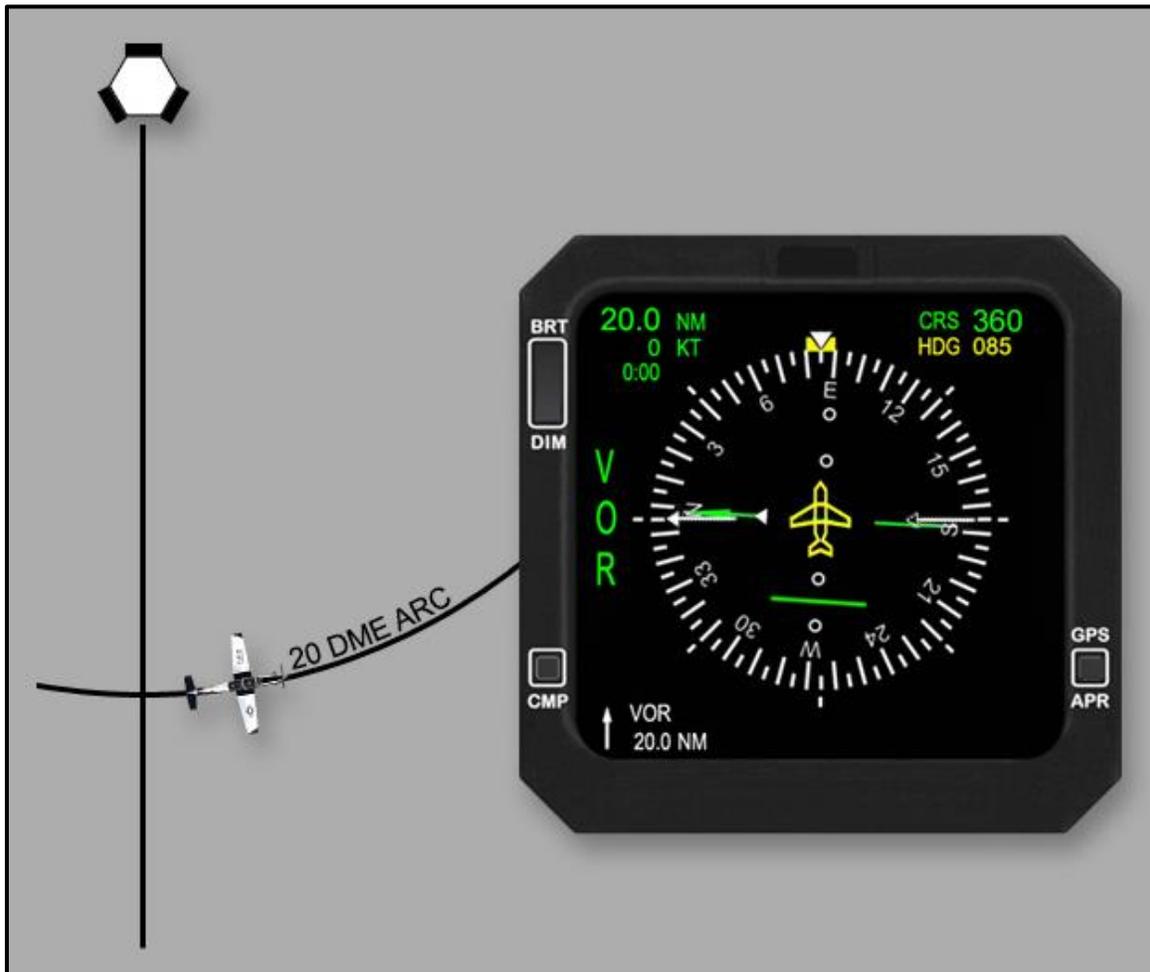


Figure 4-42 Arcing Initial Heading

Steps to Maintain an Arc

To stay on the arc, the most commonly used method is to fly a series of short legs. This is known as the chord method. To use this technique, maintain heading until the bearing pointer is 5 – 10° below the 90° reference point (you will be flying slightly outbound from the NAVAID) (Figure 4-43).



Figure 4-43 Bearing Pointer 5° Below the 90° Reference Point

Then turn to place the head of the bearing pointer 5 – 10° above the reference point (you will be flying slightly inbound towards the NAVAID) (Figure 4-44). Continue this process until reaching the lead point for the turn to the desired radial.



Figure 4-44 Bearing Pointer 10° Above the 90° Reference Point

The above technique to maintain an arc is very basic. However, you must remember that the objective when flying an arc is to fly at a constant distance from a NAVAID. Therefore, you cannot base your decision about when to turn the aircraft solely on the position of the bearing pointer relative to the 90° reference point. You must cross-check the DME change versus the bearing pointer change. You must then establish DME limits (e.g., ± 0.3 DME) that are both acceptable to you and within your training standards. Next make arcing corrections to remain within those targeted DME limits. While arcing, changes in DME will be a bigger factor in determining when to apply the next arcing correction than changes in the bearing pointer. Use the following procedures to make arcing corrections:

1. If you are inside the desired arc (DME too low), displace the bearing pointer 5° below the reference point (wing tip) for each 1/2 mile deviation to the inside of the arc.
2. If you are outside the desired arc (DME too high), displace the bearing pointer 10° above the reference point for each 1/2 mile deviation outside of the arc.

If there are high winds, you may require larger corrections to maintain the arc. Turn into the wind to maintain your track on the arc. The amount of the wind correction depends on the velocity of the winds aloft. Also remember that as you continue arcing, the effect that the winds have on your aircraft will always be changing.

409. ARC/RADIAL INTERCEPTS

On some approaches, missed approaches, or 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 have to decide when to start your turn off the arc to intercept the desired radial on the desired course.

In the following example (Figure 4-45), the aircraft is established on the 20 DME arc flying at 150 KIAS at 5,000 feet and will be turning onto an inbound course of 090° .

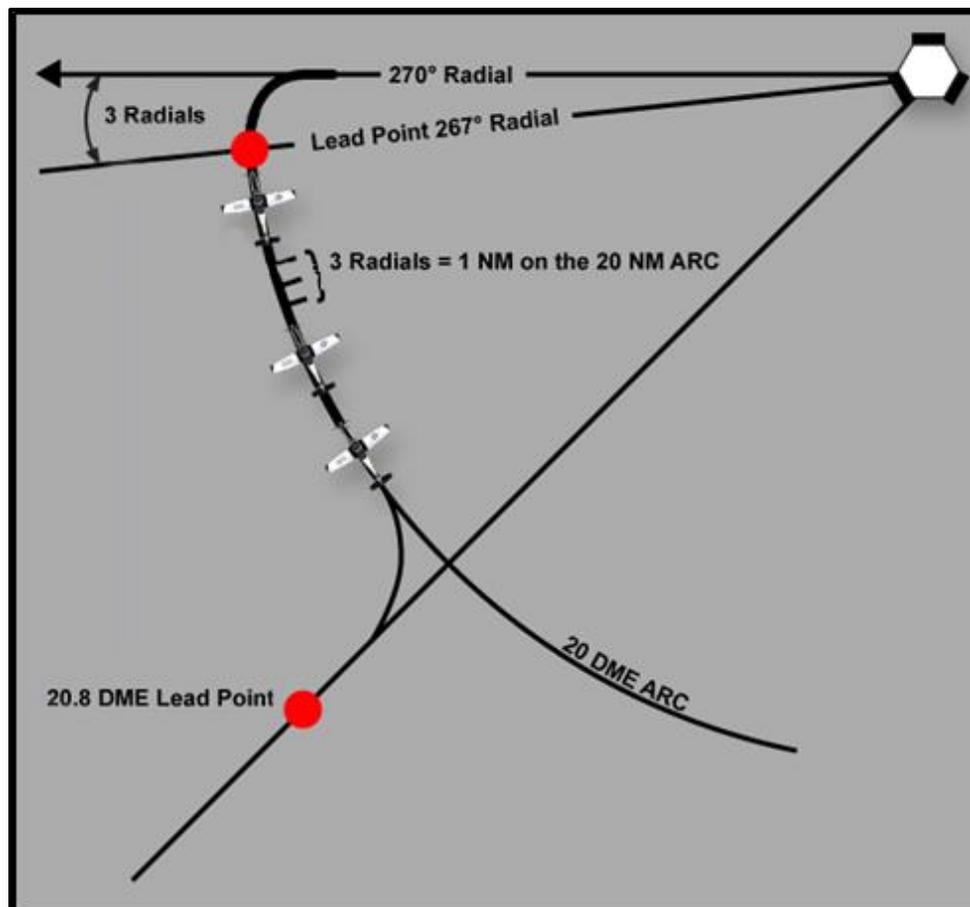


Figure 4-45 Lead Radial

Determining Lead Radial

1. Determine the number of radials per mile. Recall from the 60-to-1 rule, which states that 60 divided by DME equals the number of radials in one mile. Every radial is 1 nautical mile wide when you are 60 nautical miles from the NAVAID.

In this example: $60/20 = 3$ radials per mile on the 20 DME arc.

2. Determine the turn radius of the aircraft (for 90° of turn). This is $\frac{1}{2}$ of 1% of the TAS.

First estimate the TAS by adding 2% of IAS for every 1000 feet to the IAS: $150 + (3 \times 5) = 165$ KTAS.

Calculate turn radius: $\frac{1}{2}$ of 1% of 165 = 0.825 NM (round to 0.8).

3. Multiply the turn radius by the number of radials per mile. $0.8 \text{ NM} \times (3 \text{ radials/NM}) = 2.4$ radials (round up to 3).

4. In this case, start the turn 3 radials prior to the intended course. If you have set the CDI to the inbound course this will be when the CDI bar is just past halfway to the first dot (5°) of deflection as indicated in Figure 4-46 below.



Figure 4-46 Arc to Radial Lead Radial

It should be noted that this is a no-wind calculation. In the aircraft, you will need to take winds into account.

410. GROUNDSPPEED CALCULATIONS

Knowing your groundspeed will allow you to accurately determine Estimated Time of Arrivals (ETAs), facilitate fuel planning, and determine wind information. All methods of determining groundspeed are similar; they either measure the amount of time required to cover a known distance or measure the distance traveled in a known amount of time. In order to perform a groundspeed check, you must be:

1. Tracking a radial (inbound or outbound)
2. At cruising altitude, in unaccelerated flight
3. At the correct calculated IAS for desired TAS
4. At a DME larger than your altitude (in thousands of feet) above the selected NAVAID. For example, if you are flying at an altitude of 12,000 feet with the NAVAID at sea level, you cannot accurately perform a groundspeed check unless you are outside 12 DME.

Note the elapsed timer and note DME. After one minute of elapsed time, note DME again and determine the difference between the two DMEs to get distance flown. Distance flown (divided by 1 minute) is your groundspeed in NM per minute. Give this value to your instructor. To get groundspeed in knots, multiply your groundspeed in miles per minute by 60. Again, give this value to your instructor.

Rough Cut: At 210 KTAS, you are traveling at approximately 3.5 miles per minute (210 NM per hour / 60 = 3.5 NM per minute), no wind. This no-wind value allows you to make reasonably accurate ETAs until the refined procedures described below can be accomplished.

Refinement: Timing for one minute, you travel 3.7 DME. Your groundspeed is therefore 3.7 miles per minute. $3.7 \times 60 = 222$, so your groundspeed is 222 knots.

More accurate groundspeed checks can be accomplished by timing for periods greater than one minute and adjusting the math accordingly. In addition, most Air Route Traffic Control Centers (ARTCC) will be able to provide a groundspeed readout if you are in radar contact. This information may be used to check your own calculations, but for training purposes *shall not* be used as the primary method of groundspeed computation.

411. WIND ANALYSIS

Wind analysis involves determining both magnitude and direction of the winds. There are always two components to the total wind (head/tailwind and crosswind), and there are two methods (the Wind "T" and the CR computer Wind Side) to find the total wind vector. The use of the CR computer was covered in Air Navigation course at Aviation Preflight Indoctrination (API). The basic procedures for the Wind "T" method are:

1. Compute the head/tailwind component by comparing groundspeed to TAS.

If your groundspeed is less than your TAS, you have a headwind. If your groundspeed is greater than your TAS, you have a tailwind. The difference between your groundspeed and your TAS is the head/tailwind component in knots.

For example, if you have calculated a 222 knot groundspeed and are flying 240 KTAS, you have a headwind component of 18 knots.

2. Compute the crosswind component by first determining your guide number, which is your TAS in miles per minute (TAS/60). Secondly, compare the course/radial you are tracking to your actual heading; the difference between the two is your crab angle. Compute the crosswind component using the following formula:

Crab angle x guide number = crosswind component (in knots).

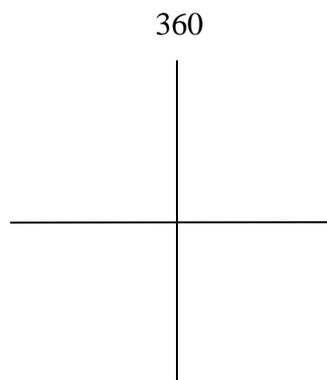
For example, if you are flying at 240 KTAS, your guide number is 4.0. If you are tracking a course of 360° and fly a drift-corrected heading of 003° to maintain that course, then your crab angle is 3° to the right. You therefore have a $(4.0 \times 3^\circ) = 12$ knot crosswind from the right.

3. Estimate the total wind magnitude by adding the larger component to half of the smaller component (i.e., “all the big plus half the small”).

For example, if you have computed an 18 knot headwind and a 12 knot right crosswind, your total wind magnitude is $(18 \text{ knots} + (\frac{1}{2} (12 \text{ knots}))) = 24$ knots.

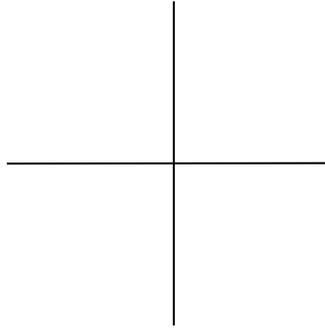
4. Estimate the direction of the total wind vector with the Wind “T.”
 - a. Draw a basic cross diagram, with the desired course at the top of the cross. The top half of the vertical axis represents headwind and the bottom half of the vertical axis represents tailwind. Likewise, the right half of the horizontal axis represents a right crosswind and the left half of the horizontal axis represents a left crosswind.

For example, with a desired course of 360° :



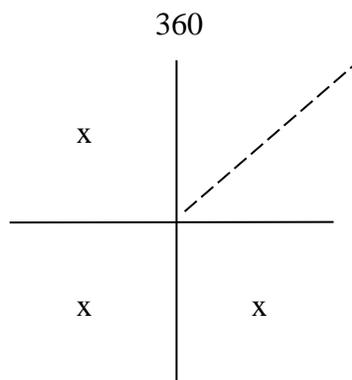
- b. Determine the quadrant affected by your head/tailwind and crosswind components, and draw a small “x” in the other three quadrants.

In our example, with an 18 knot headwind and a 12 knot right crosswind, the upper right quadrant is the affected quadrant.



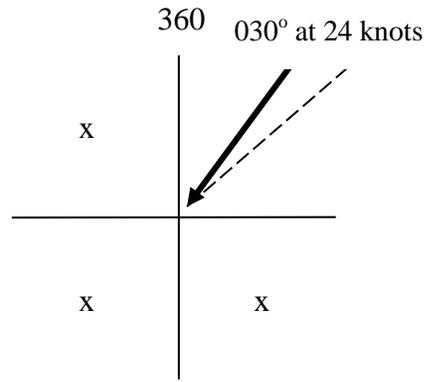
- c. Draw a 45° dashed line through the affected quadrant. This line indicates where the wind vector would be if the head/tailwind component equals the crosswind component. If your headwind/tailwind component is greater than your crosswind component, your total wind vector will be between the 45° dashed line and the vertical axis. If your crosswind component is greater than your head/tailwind component, your total wind vector will be between the 45° dashed line and the horizontal axis.

In our example, with an 18 knot headwind and a 12 knot right crosswind, your headwind component is greater than your crosswind component. Your total wind vector is between the 45° dashed line and the vertical axis of the Wind T.



- d. Use proportional plotting to place your wind vector in the proper quadrant, relative to your 45° dashed line and the appropriate axis.

For example, a crosswind component of 12 knots is two-thirds a headwind component of 18 knots, so the estimated total wind vector looks something like this:



412. INSTRUMENT TAKEOFF PROCEDURES

The instrument takeoff (ITO) is a composite visual and instrument takeoff using outside visual references and the flight instruments. The amount of attention given to each flight instrument varies with the individual, the aircraft, the existing weather, and other environmental conditions. ITO procedures and techniques are invaluable when visibility is reduced or restricted, such as during takeoff into precipitation, low-lying clouds, or fog. Visibility may also be restricted by any of the following:

1. Darkness/night
2. Toward and over water
3. Over desert areas
4. Over snowy areas

Prior to performing an ITO, you should accomplish the following:

1. Ensure the aircraft is ready for flight.
2. Ensure in-flight publications are correct and current.
3. Set up UHF/VHF comm, transponder, and VHF NAV.
4. Check to ensure flight and navigation instruments are within tolerances.
5. Obtain and understand the ATC clearance and departure procedures.

6. Complete the Before Takeoff Checklist.
7. Provide a Departure Brief and Time Hack to your pilot.
8. Check that the heading indicator is within 5° of the runway heading.

Spatial disorientation is a serious hazard associated with an ITO. The transition from using outside references to flying instruments during an ITO, especially at night or in reduced visibility, can be difficult if you are not prepared. To prevent spatial disorientation, it is important that you are mentally prepared and committed to attitude-instrument flying at liftoff.

The ITO begins with the aircraft positioned on the runway centerline with the pilot noting aircraft heading. If sufficient outside references are available, perform your takeoff using primarily visual references. When sufficient outside references are not available, e.g., the horizon is obscured, cross-check the runway centerline and aircraft heading to maintain alignment as you roll down the runway.

At rotation speed, the pilot will use the EADI to rotate to a wings-level attitude of approximately 8-10° nose high. As you become airborne, visual references will likely deteriorate further and you must increase your rate of cross-check of the aircraft instruments.

After takeoff, continue to cross-check the EADI to ensure a wings level, climbing attitude. As ground track references are lost, incorporate the EHSI into your scan to stay on the proper heading/course. As a technique, it is a good idea to set the heading bug to either the runway heading or the heading for the first turn, to assist in your cross-check. Check airspeed for proper acceleration as you become airborne and accelerate to climbout speed.

1. After takeoff, ***confirm two positive rates of climb***, then report on ICS:

Student: *“Two positive rates of climb, gear up...one ten, flaps up.”*

Your instructor will raise the gear and flaps. When gear and flaps indicate up, report on ICS:

Student: *“Gear and flaps up at (actual indicated airspeed).”*

2. Once safely airborne, comply with ATC instructions and perform the initial Operations Check.

NOTE

Maintain constant situational awareness of your position. Question any assigned heading or altitude you believe to be incorrect or unsafe.

3. Report to your instructor when passing 1000 feet prior to assigned altitude. When making altitude calls just use the whole number in your call for the sake of comm brevity. For example:

INCORRECT: Student: *“Passing five thousand for six thousand.”*

CORRECT: Student: *“Passing five for six.”*

Also report to your instructor when the aircraft is approaching the assigned altitude and direct them to level off.

Student: *“Approaching altitude, level off at six.”*

4. The departure phase is considered complete when established in the air route structure or when ATC gives the verbiage:

ATC: *“KATT Six XX, resume own navigation”* or *“KATT Six XX, cleared on course.”*

At this point, provide navigational inputs to your instructor for the enroute phase of your mission.

NOTE

Ask your instructor to provide you the GPS CDI (i.e., GPS NAV mode, without groundspeed readout) on the first leg of an instrument route when that first leg does not afford an opportunity to get a groundspeed check. Before you can use the GPS CDI for groundspeed calculations, you must first be leveled off, with the correct TAS and heading established to the next fix (usually a Point-to-Point). You will be allotted approximately two minutes of GPS CDI usage before your instructor deselects the GPS CDI.

413. OPERATIONS CHECK

The initial Operations Check *shall* be performed immediately after checking in with Departure Control, safety of flight permitting. Subsequent Operations Checks *shall* be initiated at least every 20 minutes (and are recommended after each Wings Level call). Brief the nearest suitable divert airfield with all Operations Checks. Your preflight planning should include the identification of airfields to use as emergency divers along your proposed route.

1. If you are VMC, your emergency divert will be the nearest suitable paved airfield.
2. If you are IMC, your emergency divert will be the nearest “blue or green field” on the low chart that also has a published DoD Instrument Approach Procedure compatible with your aircraft equipment, i.e., no TACAN or ADF (Automatic Direction Finder) only approaches. Not all green fields have a DoD published approach. Suitable IFR divert airfields should be identified during preflight planning.

414. ALTITUDE WARNINGS

Altitude warnings are given to facilitate altitude awareness and *shall* be given:

1. During all climbs:
 - a. Passing 10,000 feet MSL (Pressurization).
 - b. Passing FL 180 (Altimeter reset to 2992).
 - c. Passing 1000 feet prior to any level-off altitude.
 - d. At all level-off altitudes.

2. During all descents outside the FAF (Final Approach Fix):
 - a. Passing FL 180 (Reset Altimeter).
 - b. Passing 15,000 feet MSL.
 - c. Passing 10,000 feet MSL.
 - d. Passing 6000 feet AGL (Minimum Uncontrolled Ejection Altitude).
 - e. Below 6000 feet AGL, warning calls *shall* be made passing each 1000 feet MSL.
 - f. 1000 feet prior to any level-off altitude.
 - g. At all level off altitudes.

Example: “*Passing six for two,*” “*Passing five for two*” etc.

3. During all descents inside the FAF:
 - a. Passing 200 feet prior to any Minimum Descent Altitude/Decision Altitude (MDA/DA).
 - b. At all level-off altitudes, MDA, and DA.

415. AIRCRAFT DEVIATION

Any time you see your aircraft more than 100 feet off assigned altitude, 10 KIAS off assigned airspeed, and/or 5° off assigned heading, you *shall* advise your instructor pilot (IP) of the deviation and direct a correction. Any deviations within the standards listed above are generally acceptable and normally should not be addressed outside the FAF. Use specific terminology when you give any correction. For example:

4-58 ENROUTE PROCEDURES

INCORRECT: Student: *“You’re a little low.”*

CORRECT: Student: *“We’re one hundred fifty feet low. Climb niner thousand.”*

416. ALTIMETER CHANGEOVER PROCEDURES

1. Climbing:
 - a. Dial 29.92 in both altimeters upon reaching or passing 18,000 feet MSL (Mean Sea Level).
 - b. Perform the FL180 Check (a TRAWING SIX local checklist, found in your NATOPS Checklists).
2. Descending:
 - a. Dial local altimeter setting in both altimeters no later than reaching or passing through a flight level equivalent to 18,000 feet MSL (see the table depicted in the FIH, Section B, Altimeter Changeover Procedures).
 - b. Perform the Descent Checklist.

417. CLIMBS AND DESCENTS

This section describes the various types of climbs and descents used for transition from the terminal area to the enroute structure and vice versa.

NOTE

ATC requires a climb/descent rate consistent with the operating characteristics of the aircraft to a point 1000 feet prior to the assigned altitude, followed by a climb/descent rate of 500 – 1,500 feet per minute (fpm) to the assigned altitude (i.e., 500 – 1,500 fpm for the last 1000 feet). If you cannot meet these climb/descent rates for any reason, you must notify ATC. A voice report to ATC upon reaching assigned altitude is not required unless specifically requested by ATC.

Occasionally, ATC will assign you a higher or lower altitude to comply with IFR separation requirements. Also, aircrew may request a different altitude to take advantage of more favorable winds or other in-flight conditions.

The general climb/descent procedure follows:

1. Receive climb/descent clearance. For example, say you are at 12,000 feet MSL and ATC wants you at 16,000 feet MSL:

ATC: *“KATT Six XX, Atlanta Center, climb and maintain one six thousand.”*

2. Acknowledge the transmission and report leaving altitude to ATC. For example:

Student: *“Atlanta Center, KATT Six XX, leaving one two thousand for one six thousand.”*

3. Over the ICS, report 1000 feet prior to the assigned level-off altitude. For example:

Student: *“Passing fifteen for sixteen.”*

Note the indicated outside air temperature and begin computing a new IAS to maintain your desired TAS.

4. Over the ICS (and to ATC, if required), report reaching assigned altitude. Direct your instructor to set the new IAS, as computed in Step 3.

Student: *“Approaching altitude, level off at sixteen thousand, set one eighty-five indicated.”*

418. AIRSPEEDS

The following airspeed profiles apply to both INAV flights and simulator events:

1. Climbing: Direct IP to accelerate to desired climb airspeed of 140-180 KIAS. Charted climb performance is based on 140 KIAS. If obstacle clearance and/or noise abatement are not factors, 160-180 KIAS will result in improved forward visibility during the climb.
2. Level Enroute: Primary Instrument sorties (low-altitude structure) will be planned and flown at 240 KTAS. Any flight in the high altitude structure (aircraft or simulator) will be planned and flown at 270 KTAS. All NPA stereo routes are filed at 240 KTAS. You are familiar with the procedures for computing a target IAS at level-off, you are also provided a TAS-to-IAS conversion chart for in-flight use. TAS is important mainly for flight planning, but in the air, you must report any TAS change of 10 knots or 5%, whichever is greater.
3. Descending: There are four T-6 descent profiles: Enroute, Maximum Range, Penetration, and Rapid (reference T-6A NATOPS, Appendix A).

NOTE

“Pilot’s Discretion” descents are sometimes authorized by ATC to allow a pilot to descend at their discretion. With a pilot’s discretion descent clearance, you may descend at any point of your choosing and level off at any point between your current altitude and your cleared altitude. You may not, however, climb once descent has been initiated.

4. On Approach:
 - a. Radar Vectors (prior to Basic Approach Configuration (BAC)): 150-200 KIAS on downwind, 120-150 KIAS on base, unless otherwise directed by ATC.
 - b. Initial approach (from Initial Approach Fix (IAF) to BAC): 120-150 KIAS.
 - c. Final approach: 110-120 KIAS (gear down, flaps at takeoff).
5. Holding: 150 KIAS (or as necessary).

ATC may request that you fly a specific speed during an approach due to following traffic. If able, try to comply with those requests, but do not allow that request to cause you to lose your situational awareness. If you cannot comply, tell ATC that you are unable. They will continue your approach or vector you around for another approach.

419. FREQUENCY CHANGES

Every time you are handed off to a new controller, the new frequency *shall* be written down. You should first read back the new frequency, write it down, then tune it in. As a technique, write down both the UHF and VHF frequencies. Write each frequency in an orderly fashion so the frequency in use is the last in the line. This method will keep assigned frequencies in sequence and allow you to identify the previous channel/frequency if communication problems occur.

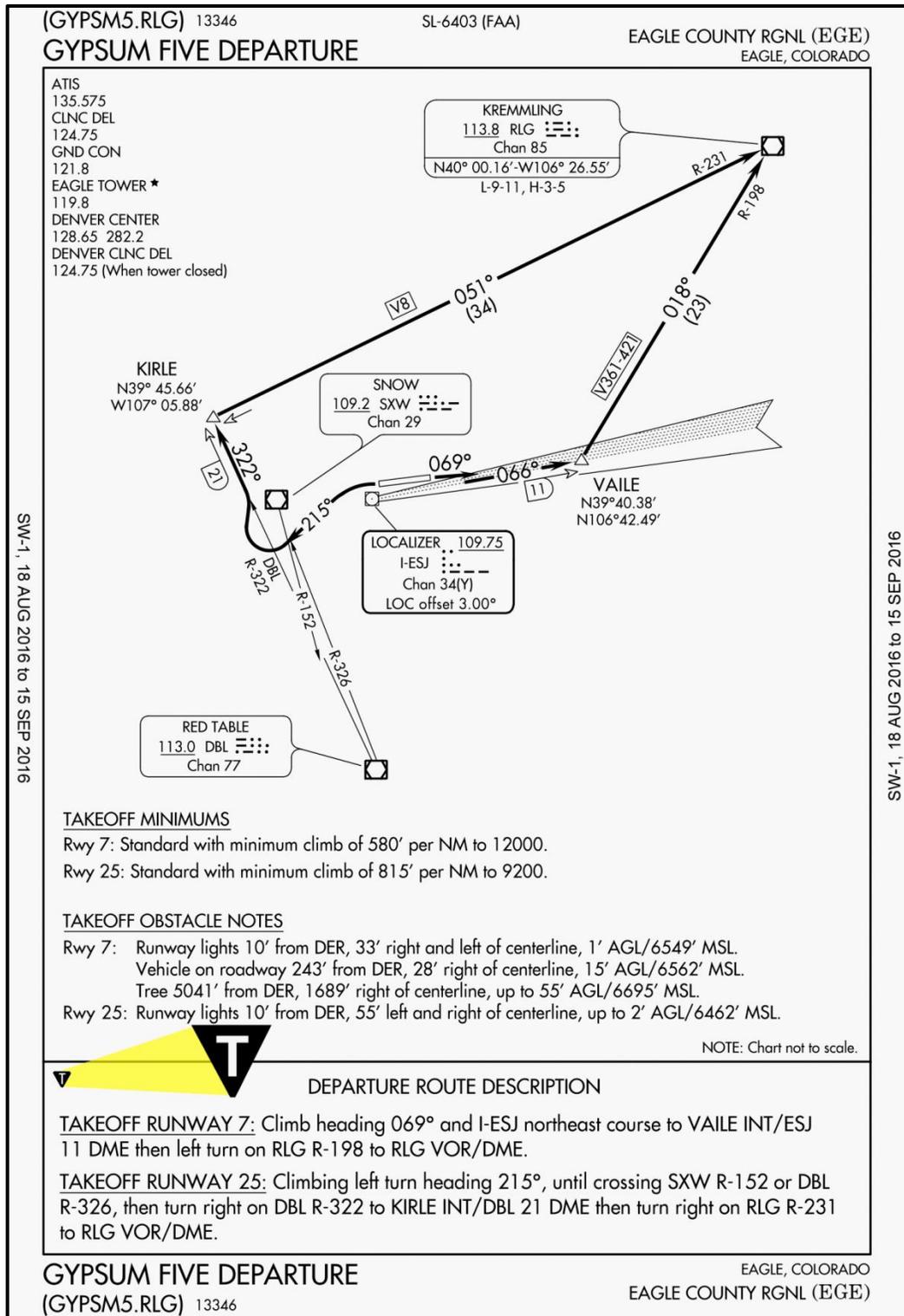
VHF is the primary radio used at civilian airfields, so it is a good idea for you to use, or at a minimum monitor, VHF while communicating with Approach Control or Tower. If you switch from using UHF to VHF radios or vice versa, inform your instructor.

420. INSTRUMENT DEPARTURES

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

NOTE

The Trouble T (Figure 4-47): An ODP that has been developed solely for obstacle avoidance will be indicated with the symbol “T” on Instrument Approach Procedure (IAP) charts (approach plates) and DP charts [ODP or SID plates]. The user of these should refer to the front section of their approach plate for specific information pertaining to the obstacle, and climbout required. Refer to AIM 5-2-8 for more information. OPNAVINST 3710.7 defines takeoff minima for Naval Aircraft.



SW-1, 18 AUG 2016 to 15 SEP 2016

SW-1, 18 AUG 2016 to 15 SEP 2016

Figure 4-47 Trouble “T”

1. Instrument Departure Procedures (DP).

DPs are preplanned 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 (Figure 4-48).

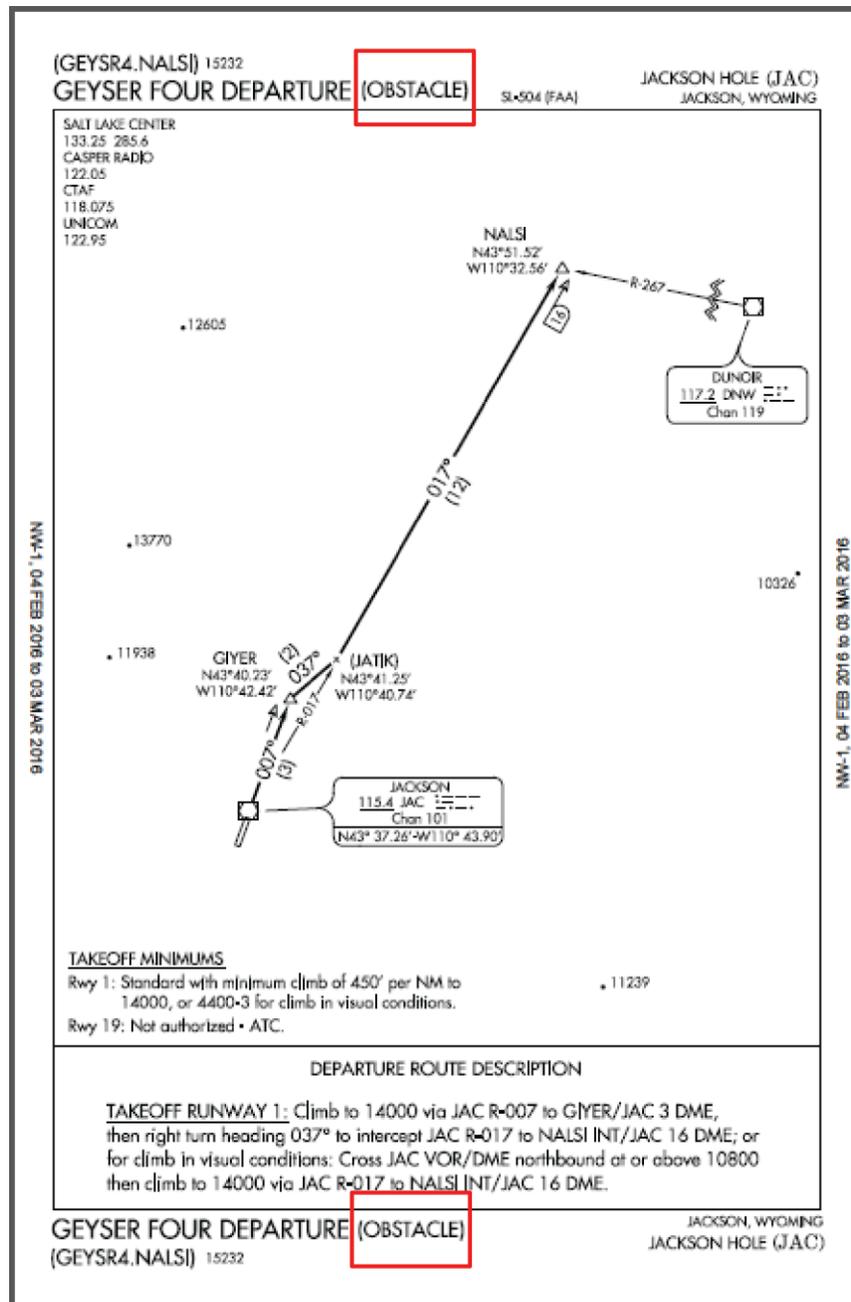


Figure 4-48 GEYSER FOUR DEPARTURE (OBSTACLE)

- b. Standard Instrument Departures (SIDs) are air traffic control procedures printed in graphic form for aircrew use. SIDs provide obstruction clearance and a transition from the terminal area to the appropriate enroute structure. Found in DoD FLIP approach plates (Figure 4-49).

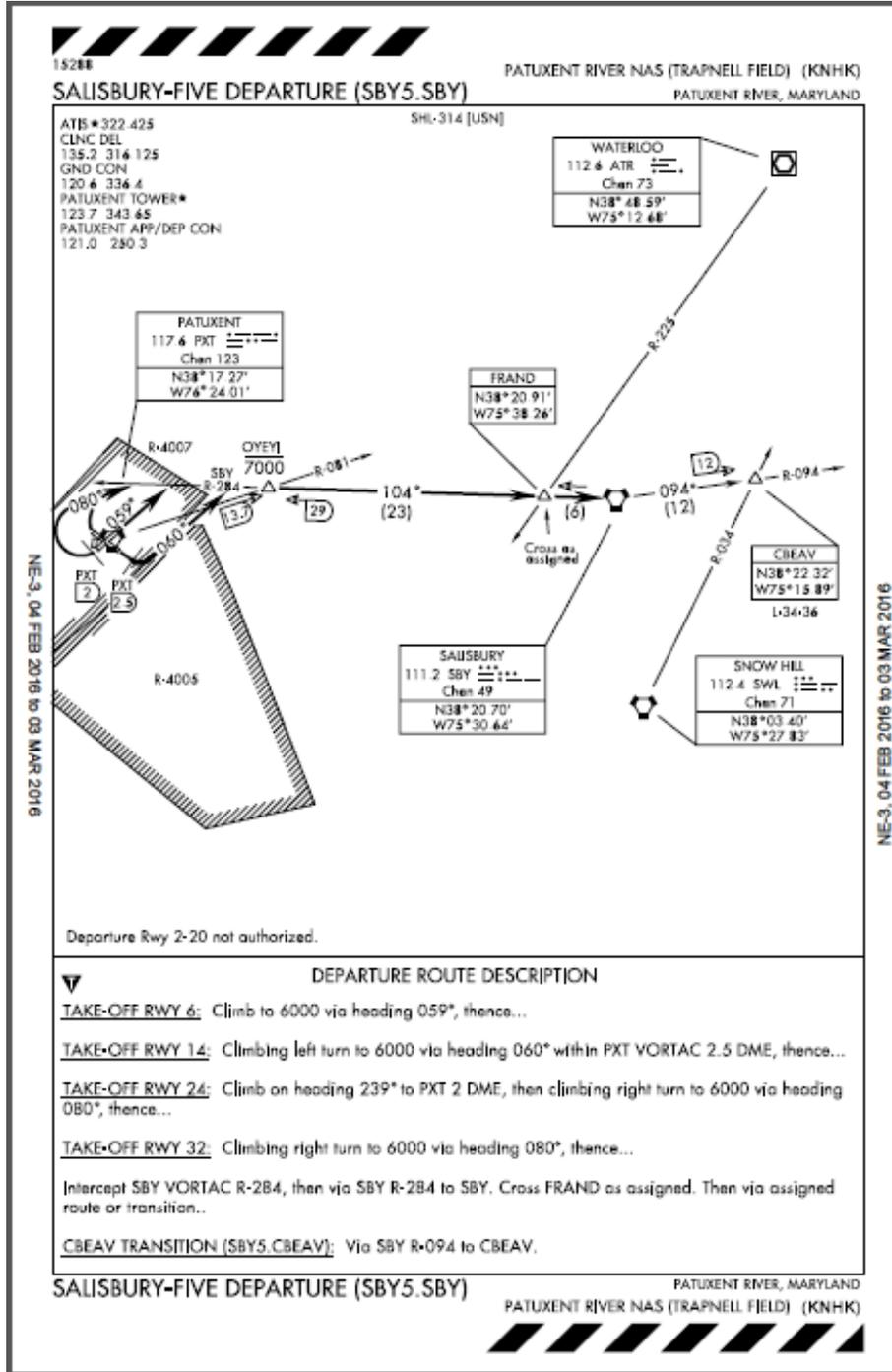


Figure 4-49 SALISBURY-FIVE DEPARTURE

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 may use radar vector instructions or allow the aircraft to proceed direct to a point along the flight plan route. The pilot can expect a radar departure if it is requested 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 instrument departures is when you are cleared as filed on your flight plan.

- a. The diverse departure (and all instrument departures) requires a minimum climb gradient of 200 FPNM and a climb to at least 400' AGL before making any turns (unless specified otherwise for the departure). When at or above 400' AGL, the aircraft may be turned in either direction to the heading required to proceed "as filed."
 - Convert FPNM to a Vertical Speed Indicator (VSI) value as follows:
 - (a). A climbout speed of 180 KIAS = 3 NM per minute.
 - (b). $3 \text{ NM/min} * 200'/\text{NM} = 600'/\text{min}$ or a 600 VSI reading at 180 KIAS.
- b. Upon contact with clearance delivery, you are cleared "as filed, to 15,000 feet."
- c. In this case, takeoff and climbout at 180 KIAS to 15,000' at a minimum of 600'/min VSI. At a minimum of 400' AGL, turn in either direction to the required heading to proceed "as filed" as you continue the climb to 15,000'.

4. Visual Climb Over the Airport (VCOA)

In a VCOA, the pilot is responsible for climbing VFR above the airport to a predetermined altitude, then proceeding outbound on an IFR flight plan. These clearances usually apply to smaller airports, which do not possess a DP or approach control radar to provide vectors upon departure.

Example:

Approach: *"KATT Six XX, climb in visual conditions so as to cross the Beatty airport Southbound at or above six thousand, then climb via the Beatty Three Three Zero to the Beatty VOR, then as filed, climb and maintain one five thousand."*

421. TURN-POINT PROCEDURE CALLS

There are three required ICS calls at each turn-point along your route of flight. The intent of these reports is to develop your instrument scan, teach you to stay ahead of the aircraft, and develop good crew coordination habits.

1. **TWO MINUTE PRIOR CALL:** A Two Minute Prior call is made when the aircraft is two minutes prior to the last updated ETA to the next turn-point. There are several options for computing the two minute prior point, given in order of descending accuracy:

- a. If your groundspeed is known, use it to update the Estimated Time of Arrival (ETA) to the next point, and subtract two minutes to compute your projected elapsed time two minutes out from the next turn-point.
- b. If you are radial tracking with DME and groundspeed is known, multiply groundspeed (in miles per minute) by two, then add/subtract that distance to the next point's DME to compute your projected two minute prior DME.
- c. Add the previous point's ATA to your preflighted ETE to the next point, then subtract two minutes to compute your projected elapsed time two minutes out from the next turn-point.
- d. If your course cuts across a VOR/DME or VORTAC radial at roughly right angles on a Point-to-Point, you can convert distance to radials and use a crossing radial to confirm your two minute prior point.

You should always use the most accurate method available to you.

The intent of the Two Minute Prior call is to give a brief description of your method of navigation to the following turn-point, and it follows the format:

Student: *"Two minutes prior to (next turn-point)."*

"Outbound heading ____, for course of ____."

"ETA to (the subsequent turn-point) min+sec."

"We will proceed via (V22, direct PTP, etc.)."

NOTE

You are not allowed to update the ETA for the next turn-point inside the two minute prior point.

2. **MARK-ON-TOP (MOT) CALL:** The MOT call is given over the turn-point or at the designated lead point. Clear the turn and give the MOT call, using the following format:

Student: *“Clear left/right.”*

“Left/Right, ____.”

“Time min+sec.”

“Place (turn-point).”

“Fuel on board (fuel in pounds).”

“NAVAID switching ____/remains the same.”

“CDI Course changes ____/remains the same.”

Use a course intercept technique to proceed to the next point.

NOTE

Your instructor understands that you may begin leading the turn prior to actually arriving over the fix at the ETA. The time difference should be nominal and will not affect subsequent legs, as ETAs are reestablished after each leg.

3. **WINGS LEVEL CALL:** Check your navigation and make any required course corrections prior to initiating the Wings Level call, using the format:

Student: *“+ (pounds) from preflight.”*

“EFR at IAF ____.”

Operations Checks are recommended after each Wings Level call. Update groundspeed and ETA to next point.

422. TIMING

Both front and rear cockpit elapsed timers *shall* be synchronized during Ground Operations, after the Departure Brief. Be as accurate as possible with the MOT (to the nearest second) and ETAs. State time in minutes plus seconds. For example, 15 minutes and 30 seconds (15+30) elapsed time should be stated as *“One five plus three zero.”*

NOTES

1. The elapsed timer function of the aircraft digital clock displays minutes and seconds until reaching 59 minutes and 59 seconds. After that, it displays hours and minutes. If the enroute portion of your flight exceeds 59 minutes, you will need to re-hack the clock. This should be done on any leg where a groundspeed computation can be completed in order to establish an ETA to your next point. This step *shall* be accomplished prior to the end of the hour.
2. The elapsed timer should also be re-hacked departing the terminal area after practice approaches. This step allows students and instructors to get back on the “same page” for further enroute timing.

423. LEADING TURNS ENROUTE

With the exception of three cases noted below, lead all turns greater than 30°. As previously discussed in paragraph 407, you can use any of the following techniques for lead point computation on a 90° turn:

- Lead Distance (in NM) = ½ of 1 percent of groundspeed (in NM per hour) for a SRT.

If groundspeed is unknown, use TAS. If TAS is unknown, use IAS. This method is accurate when using a SRT, the bank angle for which can be calculated using $(TAS/10) + 7$.

For example, at 240 KTAS and 200 knots groundspeed, your lead distance is 1 NM and your bank angle is 31°.

For turns less than (greater than) 90°, cut (add to) the lead distance by the same fraction. For example, with a 30° turn, 30° is one third of 90°, so the lead distance for a 30° turn is one third of the lead distance for a 90° turn. Likewise, for a 120° turn, 120° is four-thirds of 90°, so the lead distance for a 120° turn is four-thirds the lead distance for a 90° turn.

If you are turning over a NAVAID, add the computed lead distance to the minimum DME (altitude over the NAVAID elevation, divided by 6000) to get your leadpoint DME. If leading a turn over a fix some distance away from a NAVAID, add (or subtract, as appropriate) the lead distance to the fix DME to get the lead point DME.

All of the methods listed above provide an approximate lead-point. It is crucial that, regardless of technique used to calculate lead distance, you make an appropriate correction to establish yourself on desired course/track.

YOU DO NOT LEAD YOUR TURN WHEN:

1. You intend to intercept a course/track outbound from the IAF on a procedure turn or procedure track approach (i.e., 45/180, 80/260, teardrop with course guidance, arcing, or straight-in approach) and your heading is *greater than 90°* from the outbound course/track. In this case, you must overfly the IAF and then turn immediately in the shorter direction to intercept the outbound course/track (see the Terminal Procedures Section in this FTI).
2. You elect to use the AIM racetrack/holding technique (such as the parallel, direct, or teardrop without course guidance) for your course-reversal maneuver on a procedure turn approach. In this case, you will be flying a **HEADING** and not a defined course/track outbound from the IAF. You will overfly the IAF and turn to the predetermined outbound heading (see the Terminal Procedures Section in this supplement).
3. You are flying a PTP. In order to allow your instructor to evaluate your PTP proficiency, plan to overfly the desired fix on all PTPs.

WARNING

If you are flying a PTP to intercept an airway or route, you must be aware that turns initiated at or after fix passage may exceed the boundaries of the airway or route you are turning to intercept. In the absence of leading a turn, aircraft operating in excess of 290 KTAS might exceed the normal airway or route boundaries, depending on the amount of course change required, wind direction and velocity, and fix type (DME, overhead navigation aid, or intersection).

424. COMMON ERRORS FOR ENROUTE PROCEDURES

1. Omitting required altitude or deviation warnings.
2. Calling “6000 feet AGL” at 6000 feet MSL.
3. Omitting checklists.
4. Not directing a new IAS for each level-off altitude.
5. Not notifying your instructor when switching between VHF and UHF radios.
6. Not updating ETAs.
7. Not updating Point-to-Point headings.
8. Dialing the reciprocal of the desired course into CDI or not dialing any course into CDI.

9. Not allowing instrument indications to “settle” prior to establishing radial-intercept heading.
10. Not intercepting or grossly overshooting radial prior to initiation of radial-tracking procedures.
11. Not applying drift-corrected headings or not using CDI to update drift-corrected headings.
12. Making large course corrections near a NAVAID. Remember slant range! When you are close to the station, limit heading changes to within 10° of your desired course unless absolutely necessary.
13. Not recognizing station, fix, or waypoint passage.
14. Not computing or not applying correct lead points for turns.
15. Proceeding direct when cleared to follow an airway or vice versa.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER FIVE HOLDING

500. INTRODUCTION

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, DME fix, or 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 the maximum holding airspeed, as listed in the FLIP GP and the AIM.

501. HOLDING CLEARANCE

If the holding pattern is charted and ATC does not issue complete holding instructions, you are expected to hold as published on the appropriate chart. When the pattern is charted, ATC may omit all holding instructions except the holding direction, altitude, and the statement “as published” (e.g., hold east as published, 5000 feet). ATC will always issue complete holding instructions whenever you request them.

Student: *“Pensacola Approach, KATT Six XX, request holding SAUFLEY as published.”*

An ATC clearance requiring an aircraft to hold at a fix where the pattern is not charted will include the following information:

1. Direction to hold from the fix, in terms of one of the eight following compass points (N, NE, E, SE, S, SW, W, or NW).
2. Holding fix (may be omitted if included at the beginning of the transmission as the clearance limit).
3. Radial, course, bearing, airway, or route on which the aircraft is to hold.
4. Leg length in miles, if DME is to be used (leg lengths will be specified in minutes on aircrew request or if the controller considers it necessary).
5. Direction of turns (if left turns are to be made, the aircrew requests it, or the controller considers it necessary).
6. Time to Expect Further Clearance (EFC) and any pertinent additional delay information. If no holding pattern is charted and holding instructions have not been issued, you are expected to ask ATC for holding instructions prior to reaching any enroute clearance limit.

Approach: *“KATT Six XX, Pensacola Approach, hold WEST at SAUFLEY as published, six thousand feet, expect further clearance two two three zero Zulu.”*

Report to ATC the time and the altitude/flight level when you reach the holding fix, and report leaving the holding fix. You are considered established in holding when you cross the holding fix for the first time. An example of this report is:

Student: *“Pensacola Approach, KATT Six XX, established in holding at SAUFLEY, (current Zulu time in minutes past the hour - **not** the elapsed time!) six thousand feet.”*

NOTE

In accordance with FAR/AIM, you should report the time and altitude/flight level reaching a holding fix (or point cleared) to ATC or FSS facilities, even without a specific ATC request. This report may be omitted by pilots of aircraft involved in instrument training at military terminal area facilities when radar service is being provided.

502. TERMINOLOGY

1. Standard Pattern: Right turns
2. Nonstandard Pattern: Left turns

If turns not specified, assume standard pattern/right turns.

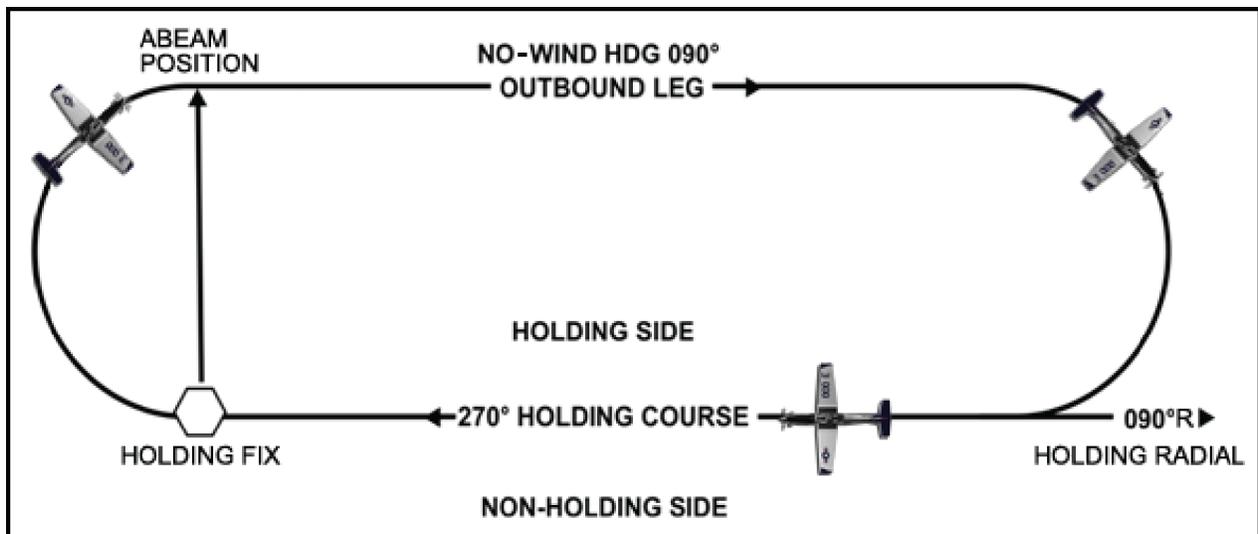


Figure 5-1 Standard Holding Pattern

5-2 HOLDING

503. AIRSPEEDS

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

<u>Altitude (MSL)</u>	<u>Maximum Airspeed (KIAS)</u>
Minimum Holding Altitude (MHA) – 6000 feet	200
6001 – 14,000 feet	230
14,001 feet and above	265

Exceptions to the holding airspeed limits are:

1. Holding patterns from 6001 feet to 14,000 feet MSL 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 United States Air Force (USAF) airfields may be flown at airspeeds up to 310 KIAS, unless otherwise depicted.
3. Holding patterns at United States Navy (USN) fields may be flown at airspeeds up to 230 KIAS, unless otherwise depicted.

NOTE

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

504. ORBITS

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

1. Entry Orbit.
2. No-Wind Orbit.
3. Correction Orbit(s).

The Entry Orbit expeditiously establishes the aircraft inbound on the holding course. The No-Wind Orbit determines the initial corrections required to compensate for existing winds. The Correction Orbits update and refine the wind corrections. Normally, ATC will expect you to correct for winds immediately upon entering holding; however, this three-step procedure is used in training to simplify the learning process. You *shall* accomplish each orbit in holding sequentially.

505. TIMING

Timing is adjusted on the outbound leg of each Correction Orbit to maintain the following leg lengths inbound:

<u>Altitude (MSL)</u>	<u>Inbound leg length</u>
At or below 14,000 feet	1 minute
Above 14,000 feet	1 1/2 minute

506. GENERAL HOLDING FLOW

1. Receive, copy, and read back holding clearance.
2. Determine the holding course and its reciprocal. Determine the direction of holding from the fix in terms of the eight compass points (i.e., N, NE, E, etc.).
3. Determine the type of the entry.
4. Give the Holding Brief.
5. Slow to holding airspeed (150 KIAS).
6. Execute the Entry Orbit.
7. Execute the No-Wind Orbit.
8. Execute the Correction Orbit(s).
9. Confirm the EFC time.
10. Receive and acknowledge clearance out of holding.

NOTE

Due to the sensitivity of the VOR needle and CDI overhead a station, VOR holding should be conducted on a radial/DME fix to the maximum extent possible. During over the station holding, the outbound turn will cross many radials making a true wind corrected heading difficult to find within the 1 minute holding pattern. Consideration should be given to holding away from the station to facilitate better training and understanding of the holding principles.

507. HOLDING PROCEDURES

Although holding may be required enroute, you will most likely be introduced to holding in the terminal area. Steps 1 through 3 below must be performed prior to arrival at the holding fix:

1. Contact Approach Control with your altitude, current ATIS information and your approach request(s).
2. If Approach Control is unable to clear you for an immediate instrument approach, you may be put into holding until they can make room for you and issue your approach clearance. For most of your INAV sorties, you will request holding practice as part of your approach requests given in Step 1 above. In any event, when ATC issues you a holding clearance, copy the instructions and read back the clearance. For example:

Student: *“Atlanta Center, KATT Six XX, level six thousand, request VOR RWY Three Monroeville, negative ATIS.”*

ATC: *“KATT Six XX, Atlanta Center, unable to approve your request due to fouled runway. Hold east of Monroeville on the zero niner zero radial. Current Monroe County weather is nine hundred feet broken, two miles visibility with light rain, altimeter three zero zero six, runway two one in use. Time is now one five five seven, expect further clearance at time one six two zero.”*

Student: *“KATT Six XX, hold east Monroeville on the zero niner zero radial, roger weather and runway, altimeter three zero zero six. Expect further clearance one six two zero.”*

NOTES

1. Request an EFC time if it is not automatically provided by ATC. This time will be used in the event of communication failure to depart the holding pattern and either proceed enroute or commence the approach (if holding at your destination).
2. Legally, you may hold to wait for the weather to improve when it is below minimums for the approach, provided you do not go below Mission Completion Fuel (MCF), which would preclude you from reaching a suitable alternate with required reserve fuel; however, because of the limited fuel capacity of the T-6A, you will not normally hold for an approach you cannot legally execute due to weather.
3. Tell your instructor to reduce airspeed to 150 KIAS (or maximum endurance airspeed when required) when three minutes or less (based on 150 KIAS, not your enroute airspeed) away from the holding fix. Cross the holding fix at or below 150 KIAS.

4. Your instructor should make all turns during entry and holding at 3° per second SRT, not to exceed 30° AOB.

A formula to calculate a SRT AOB is $(TAS/10) + 7$. For example, if you are holding at 150 KIAS and your approximate TAS is 160 KTAS, use $(160/10) + 7 = 16 + 7 = 23^\circ$ AOB.

5. Determine the holding course and the reciprocal of the holding course. The holding course is the inbound course to the holding fix (Figure 5-1). The reciprocal of the holding course (the outbound heading) is used to determine the entry procedure. When the holding fix is a station, the reciprocal will be the same as the radial.

6. Determine the entry procedure by observing the aircraft's heading ($\pm 5^\circ$) when it reaches the holding fix and comparing it to the reciprocal of the holding course.

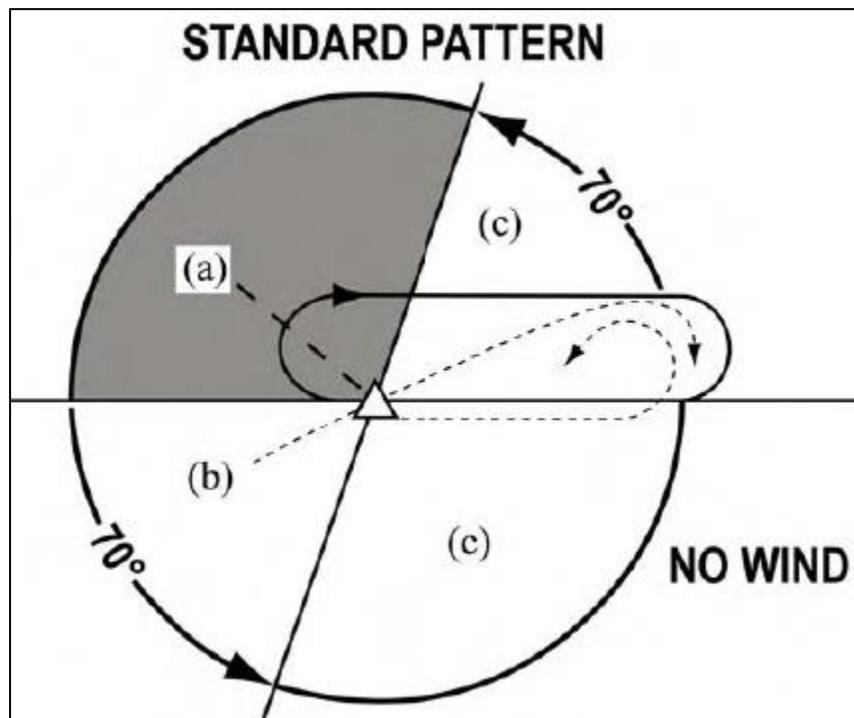


Figure 5-2 Standard Pattern Entry

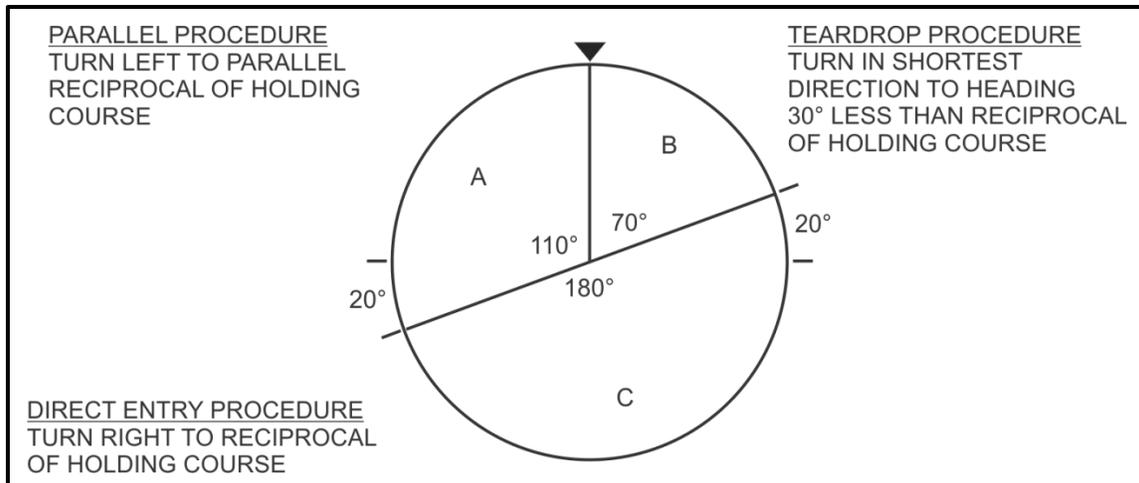


Figure 5-3 Standard Holding

- a. Standard Pattern Entry Procedures (Figure 5-2)
 - i. Sector A (**PARALLEL**): If the reciprocal of the holding course is between the heading index and 110° to the left of the heading index, turn left to parallel the holding course outbound on the nonholding side for one minute, turn in the direction of the holding pattern through more than 180 degrees, and return to the holding fix or intercept the holding course inbound.
 - ii. Sector B (**TEARDROP**): If the reciprocal of the holding course is between the heading index and 70° to the right of the heading index, execute a teardrop entry. This is accomplished by turning in the shortest direction (left or right) to a heading 30° less than the reciprocal of the holding course within the pattern (on the holding side) for a period of one minute, then turn in the direction of the holding pattern to intercept the inbound holding course.
 - iii. Sector C (**DIRECT ENTRY**): If the reciprocal of the holding course does not meet the criteria listed in (i) or (ii) above, turn right to the reciprocal of the holding course.

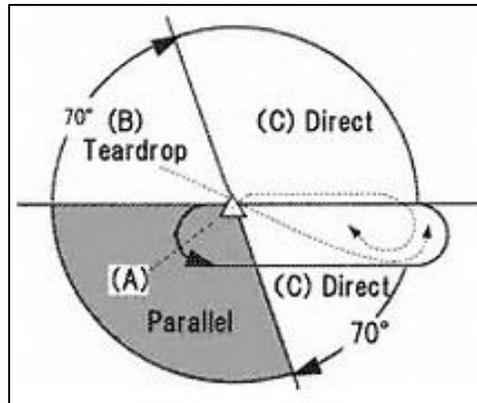


Figure 5-5 Non-Standard Pattern

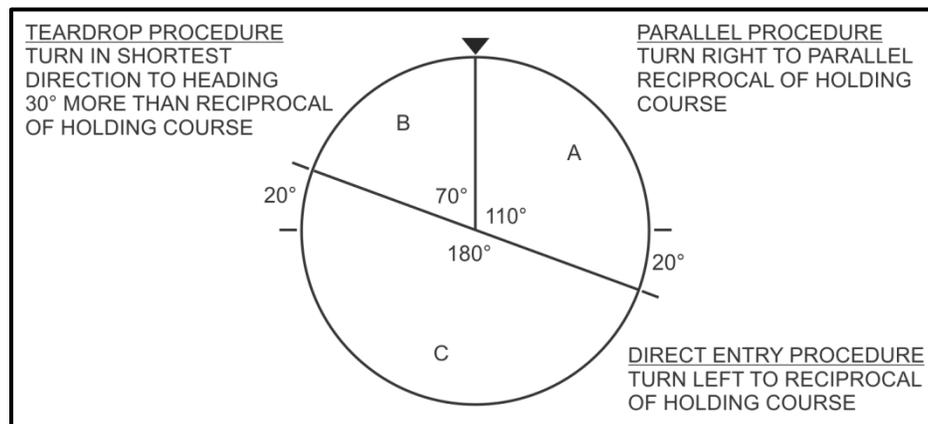


Figure 5-6 Non-Standard Holding

- b. Non-Standard Pattern Entry (Figure 5-5)
- i. Sector A (**PARALLEL**): 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 holding course outbound on the nonholding side for one minute, turn in the direction of the holding pattern through more than 180 degrees, and return to the holding fix or intercept the holding course inbound.
 - ii. Sector B (**TEARDROP**): 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 (left or right) to a heading 30° more than the reciprocal of the holding course within the pattern (on the holding side) for a period of one minute, then turn in the direction of the holding pattern to intercept the inbound holding course.
 - iii. Sector C (**DIRECT ENTRY**): If the reciprocal of the holding course does not meet the criteria listed in (i) or (ii) above, turn left to the reciprocal of the holding course.

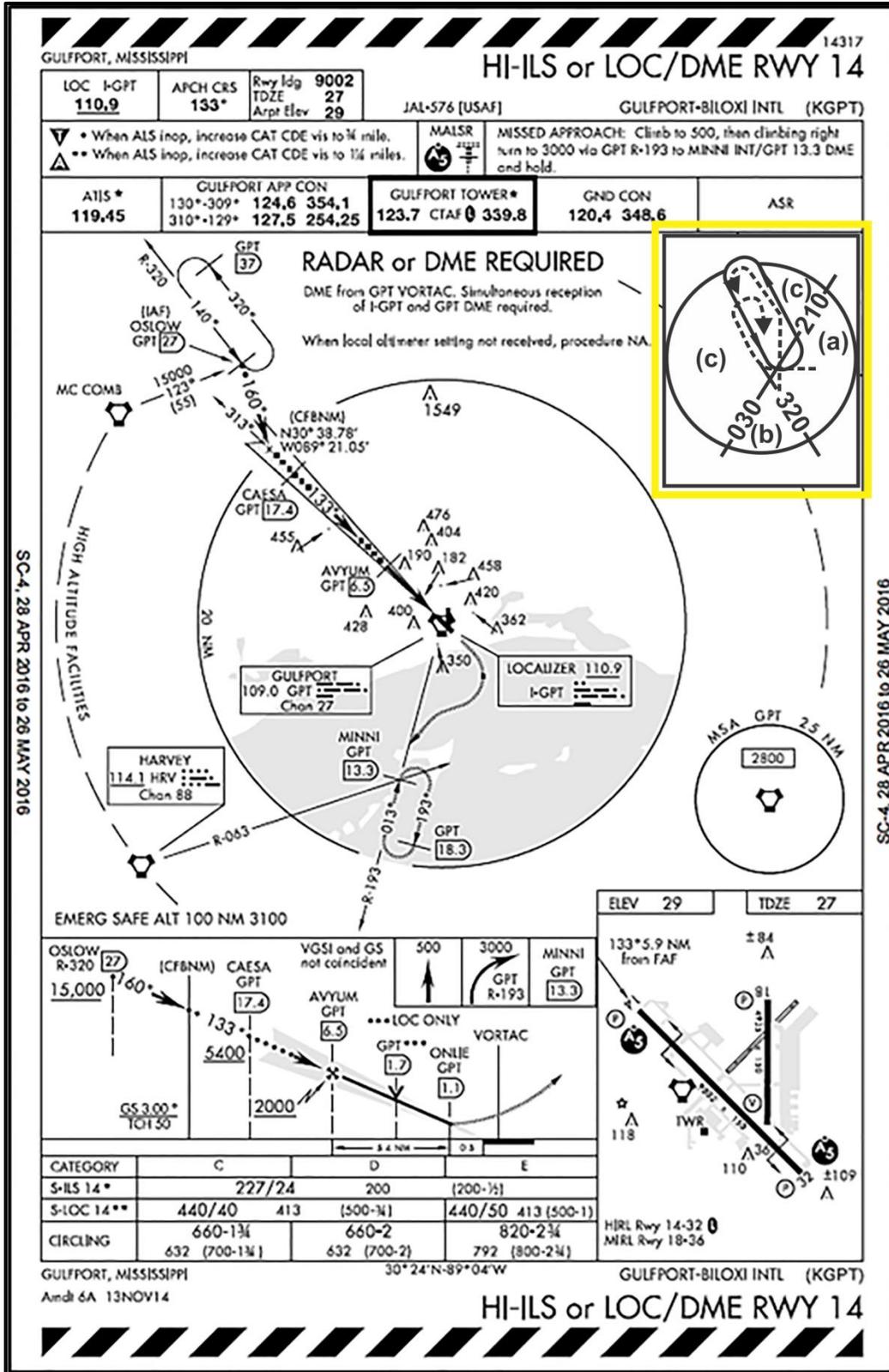


Figure 5-7 HI-ILS or LOC/DME RWY 14 at KGPT

7. Give the Holding Brief when the following conditions are met:
 - a. The Descent Checklist is complete (for terminal area holding only).
 - b. You are proceeding direct to the holding fix with a clearance to hold.
 - c. You have determined the direction of holding, entry procedure, and leg lengths.

The Holding Brief is a crew coordination measure describing the holding pattern, a helpful mnemonic is **FETL**:

Fix: Name and/or radial/DME of holding fix.

Entry: Type of entry and initial heading.

Turns: Direction of turns.

Length: Leg lengths (time or distance).

For example, a typical holding brief prior to executing the Mobile Regional VOR-A is:

Student: "Holding Brief. We will be holding at SEMMES, on the two eight five radial. Entry is a left turn to parallel, heading two eight five, right hand turns, one minute legs."

8. Execute the Entry Orbit. The first time the aircraft crosses the holding fix, perform the 6T's. The 6T's are a memory aid for the procedures to perform whenever crossing a holding fix, IAF, or FAF.
 - a. **TIME:** Write down the time you crossed the holding fix, in Zulu (not elapsed time).
 - b. **TURN:** Turn to establish yourself on the entry heading you determined above.
 - c. **TIME:** Begin initial outbound timing when over/abeam the holding fix, whichever occurs last. In some cases, such as a teardrop entry, over/abeam will occur simultaneously. If unable to determine when abeam, begin timing when the aircraft is wings level outbound.

Subsequent outbound timing is started when outbound and abeam the holding fix on successive orbits. Again, if the abeam position cannot be determined, start timing when wings level outbound.

When holding overhead at a station, the best indicator of the "abeam" position is the TO-FROM indicator. With the **CORRECT HOLDING COURSE** set into the CDI, you will have a TO indication when proceeding inbound to the station. At station passage, the indication will change to a FROM indication. A secondary indication of station passage is the bearing pointer falling through a radial 90° from the holding course.

When holding over a radial/DME fix, the best indicator of the “abeam” position is the DME. While the geometry of slant range means that a given DME outbound is not *exactly* abeam the same DME inbound, it’s the best indicator reasonably available. In this case, begin outbound timing when outbound and at the same DME as the holding fix.

- d. **TRANSITION:** If not already at 150 KIAS, tell your instructor to transition to holding airspeed. Procedurally, you should have already directed the transition to holding speed three minutes out from the holding fix, so this “T” normally serves as a reminder to check your airspeed. Also, direct your instructor to transition to assigned holding altitude.
- e. **TWIST:** Tune the proper NAVAID for holding, select the proper NAV MODE for the EHSI, and set the holding course in the CDI. This “T” may be done any time after the entry turn, but must be completed prior to the inbound turn. If GPS holding, ensure OBS is selected.
- f. **TALK:** Give ATC a voice report stating position, time, and altitude (**P-T-A**) established in holding, if required. For example:

Student: *“Atlanta Center, KATT Six XX, established in holding at Monroeville, one six zero three, six thousand.”*

At the expiration of outbound timing (or upon reaching assigned/published DME), turn to intercept the holding course inbound. Remember, you must remain within the holding airspace. Therefore, ensure you turn in the proper direction. To figure out which direction you should turn, first determine your present position and compare it to the holding radial. Do this by visualizing yourself on the tail of the bearing pointer. Turn toward the holding radial. For example, in Figure 5-4, aircraft A is on the 070 radial with the holding radial of (090) to the right, indicating a right turn. Meanwhile, aircraft C is on the 110 radial with the holding radial (090) to the left, indicating a left turn. Remember: **TAIL-RADIAL-TURN.**

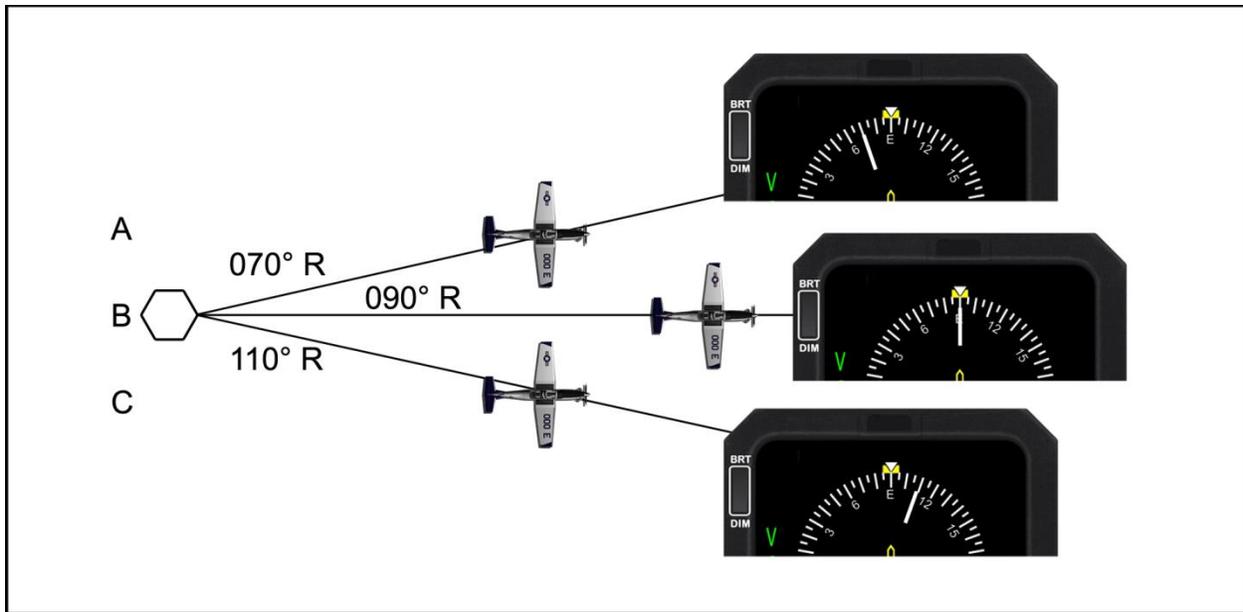


Figure 5-8 TAIL-RADIAL-TURN

In the case where the aircraft (tail of the bearing pointer) is on the holding radial (as with aircraft B), turn towards the holding side of the pattern to remain within holding airspace (a left turn for a standard holding pattern or a right turn for a nonstandard pattern).

During the last half of the turn, check the position of the head of the bearing pointer relative to the holding course. This will enable you to determine whether you will roll out on the holding course, undershoot it, or overshoot it. If the aircraft is on the holding course at the completion of the turn, simply track inbound. If not on course, stop the turn with a double-the-angle intercept for VOR holding at a NAVAID. When holding at a radial/DME from a NAVAID and turning to intercept the inbound course, an intercept greater than “double-the-angle” will be required. This is to compensate for the greater spacing between radials when holding away from the station. In this type of holding, a 30-45° angle of intercept will establish the aircraft on the inbound course.

Your goal is to establish the aircraft on the holding course prior to crossing the holding fix. Judge the rate of the CDI movement to roll out on the holding course with the CDI and bearing pointer centered.

In Figure 5-9, aircraft A will be on the holding course at the completion of the turn. Although the head of the bearing pointer is not directly on 270° at the point illustrated, it will fall the remaining few degrees during the completion of the turn. Aircraft B in Figure 5-5 shows an undershoot situation. The head of the bearing pointer is on 255°, 15° away from the holding course of 270°. Aircraft B should stop the turn at heading 240° (15° away from 255°) and set up a double-the-angle intercept technique. Always check to be sure the head of the bearing pointer is in a position to fall to the desired course. Aircraft C in Figure 5-5 depicts an overshooting situation. Aircraft C should continue the turn until a double-the-angle intercept heading of 310° is established.

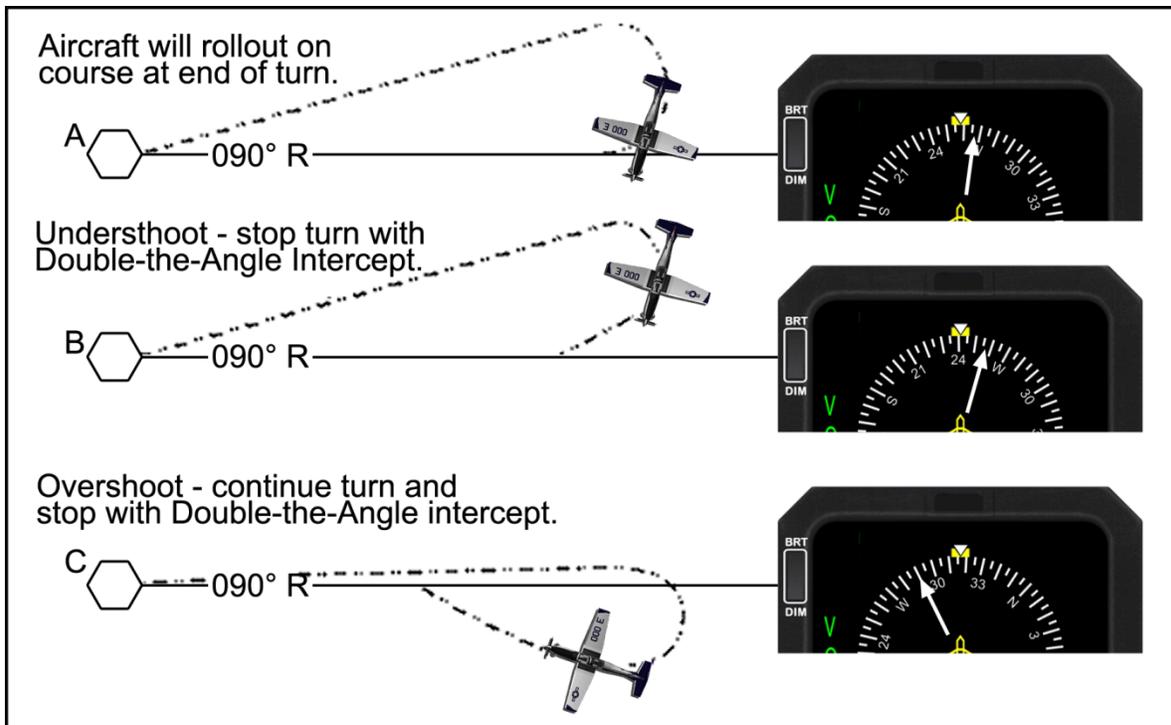


Figure 5-9 TAIL-RADIAL-TURN II

NOTE

The purpose of the DTA intercept technique is to provide for a manageable intercept of the holding course. With strong crosswinds, a DTA intercept technique may not be sufficient. In this event, use a greater than DTA intercept.

9. Execute the No-Wind Orbit, which starts the second time you cross the holding fix. In order to see how the wind is affecting your aircraft, fly the No-Wind Orbit as if there were no wind at all. If there were indeed no wind, you would:
 - a. Roll out of your inbound turn on the holding course.
 - b. Take exactly one minute to reach the holding fix (for timed holding at or below 14,000 feet).

If the above conditions are not met, you have winds which you need to compensate for during the subsequent Correction Orbit(s). How far, and in what direction, you deviate from these two conditions determine your time and heading correction factors. Applying these factors to the No-Wind Orbit gives you a Correction Orbit. You will continue to refine your correction factors until the two conditions above are met.

Perform the 6 Ts:

- a. **TIME:** Note the current Zulu time and compare it to your EFC time.
- b. **TURN:** Turn to the reciprocal of the holding course (right for standard holding, left for non-standard holding).
- c. **TIME:** Begin outbound leg timing (one minute at or below 14,000 feet MSL, 1 1/2 minutes above 14,000 feet MSL) when outbound and abeam the holding fix. If unable to determine abeam, begin timing when your aircraft is wings level outbound.
- d. **TRANSITION:** Check airspeed and altitude; adjust as required.
- e. **TWIST:** Not required.
- f. **TALK:** Not required.

At the expiration of outbound-leg timing (or DME if appropriate), tell your instructor to turn toward the holding radial and intercept the holding course inbound. Remember, **TAIL-RADIAL-TURN**. At the completion of your turn inbound, you will either be established inbound on the holding course or have a course intercept set.

For timed holding, as you roll wings level inbound, re-hack the clock for inbound timing (do not wait until established on the inbound course to hack the clock). At station passage, note the elapsed time to the nearest second. The difference between the No-Wind Orbit inbound timing and one minute (1 1/2 minutes if above 14,000 feet MSL):

- a. Indicates the existence of a head/tailwind
- b. Is the correction factor you will use for the Correction Orbit's outbound timing.

If you had to set an intercept heading to get established on the holding course when you turned inbound, there is a crosswind. To make your Correction Orbit headings easier, think of the wind as being from a cardinal direction, not left or right. **TAIL-RADIAL-WIND** is a helpful memory aid.

Figure 5-10 illustrates a typical No-Wind orbit. In this example, the inbound turn resulted in an overshoot and an intercept heading must be used to establish the aircraft on the holding course. The **TAIL-RADIAL-WIND** rule indicated a wind from the North. The inbound timing of 50 seconds indicated a 10-second timing correction is needed on the outbound leg of the Correction Orbit.

Once you are established on the holding course, note the crab angle you need to maintain that course. This angle will determine the correction factor for the Correction Orbit's outbound heading.

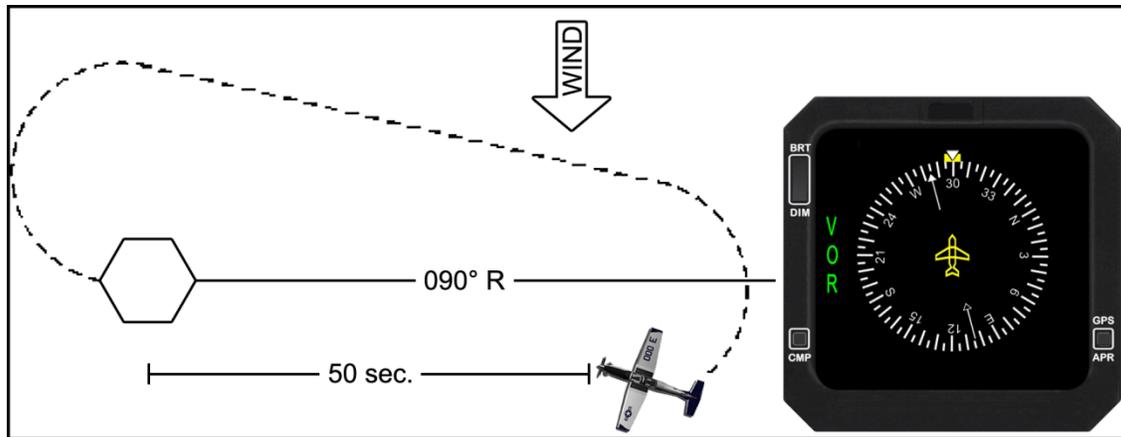


Figure 5-10 No Wind Orbit

10. The third and subsequent holding orbits are all called Correction Orbits. The first Correction Orbit is flown using the correction factors determined on your No-Wind Orbit; subsequent Correction Orbits are flown using the correction factors determined on the preceding Correction Orbit.

Perform the 6 Ts:

- a. **TIME:** Note the current Zulu time and compare it to your EFC time. Confirm your EFC time with Approach Control at least five minutes prior to the EFC. Receipt of EFC is not a clearance to commence approach unless you have lost communications with ATC.
- b. **TURN:** Turn to the reciprocal of the holding course, plus or minus your triple-drift correction factor.

Using Figure 5-11, let us assume the aircraft is established on a holding course of 270°. A 5° right (to the north) drift correction (i.e., heading 275°) is required to maintain course. Applying a triple-drift correction (5° X 3), a 15° left (still to the north) correction to the outbound heading is required, making our outbound heading 075°.

- c. **TIME:** Begin outbound leg timing when outbound and abeam the holding fix. If unable to determine abeam, begin timing when established wings level outbound.

Apply the triple-drift correction immediately after rolling out on the outbound leg of the Correction Orbit, but do not begin your triple-drift timing until passing abeam the holding fix (see note below). Maintain your triple-drift correction for one minute once you commence timing on the outbound leg (or until the expiration of outbound timing, whichever occurs first). After one minute of triple-drift correction, fly a single-drift heading to compensate for wind.

NOTE

It is possible to roll out on the outbound leg with a triple-drift heading established prior to passing abeam the holding fix. In this case, a total triple-drift correction may indeed be established for longer than one minute. Nonetheless, the difference in timing should be minimal and have little effect on your holding corrections. Do not begin triple-drift or outbound timing until passing abeam the holding fix unless you are unable to determine the abeam position.

The inbound leg in Figure 5-10 took 50 seconds, indicating a tailwind component with a 10 second correction factor. To make the inbound leg a full 60 seconds, longer outbound timing is needed. Add that 10 second factor to your No-Wind Orbit's outbound timing, which (for this example) gives us 70 seconds for Correction Orbit outbound timing. Begin outbound timing for 70 seconds when abeam the holding fix outbound. If you are unable to determine abeam, start timing when established wings level outbound.

Conversely, if the inbound leg of the No-Wind Orbit was longer than 60 seconds, use that timing correction factor to shorten the next outbound leg.

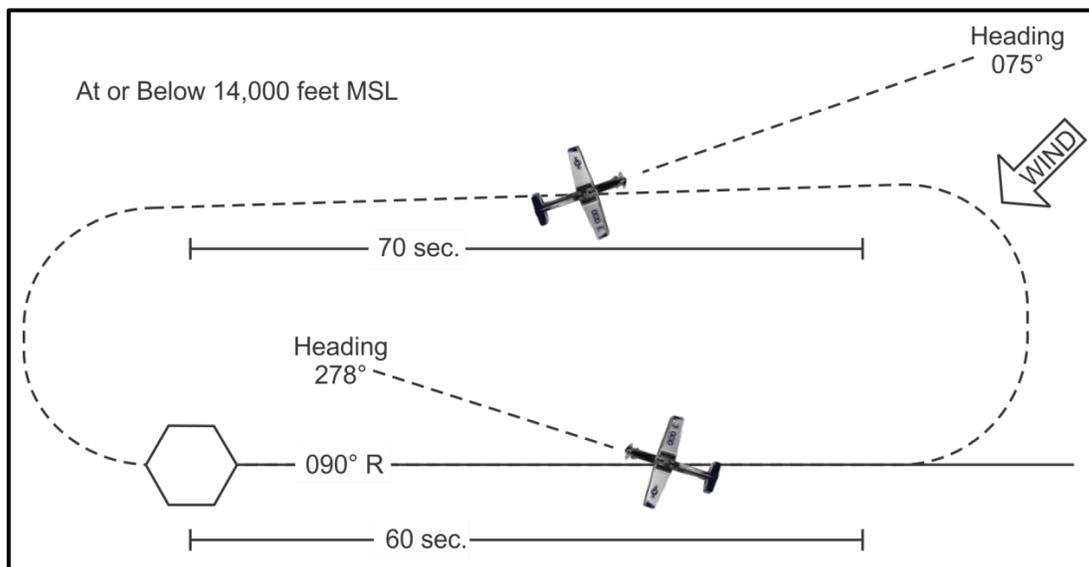


Figure 5-11 Correction Orbit

NOTE

Wind is thought of as being from a compass heading in holding. An examination of Figure 5-11 shows the wind must be from the northeast, since the inbound crab angle was to the right (toward the north) and the outbound timing was longer than the inbound timing.

If the No-Wind Orbit time and drift corrections do not put you on the proper course inbound for one minute on the first correction orbit, you must re-correct on the next orbit. The drift and time corrections are determined the same way as the original No-Wind Orbit, but these corrections must be applied to the corrections from the previous Correction Orbit, not the first (No-Wind Orbit), or you will negate your previous time corrections. It may take several orbits to get the heading and timing exactly right.

- d. **TRANSITION:** Check airspeed and altitude; adjust as required.
- e. **TWIST:** Not required.
- f. **TALK:** Not required.

508. HOLDING DURING ADVERSE WIND CONDITIONS

It is not unusual for winds 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, of course, depend on wind speed and direction. If you feel you need to use modified procedures, be sure to discuss this with your instructor first.

The key to successfully implementing triple drift is intercepting the holding course inbound as soon as possible. Use an aggressive course intercept when necessary to get on course before crossing the holding fix.

You should be able to predict the occurrence of 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 to apply abnormally large drift corrections. A high head/tailwind component would be indicated by a groundspeeds that differs drastically from TAS. 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.

509. 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 your approach clearance once established in holding. Listed below are possible types of clearances you may receive:

Approach: "KATT 6XX, Pensacola Approach, at the completion of this turn in holding you are cleared for the VOR 8 approach."

In this case, you would complete this turn in holding and commence the approach upon arrival at the IAF. You must also maintain your assigned holding altitude until inside the IAF. Listen carefully for any further altitude restrictions from ATC.

Approach: “*KATT 6XX, Pensacola Approach, you are cleared for the VOR 8 approach.*”

In this case, you are *not* required to complete the turn in holding and you may:

1. Turn immediately towards the IAF (remaining within the established limits of the holding pattern), maintain holding airspeed, and commence the approach upon arrival at the IAF.
2. Descend to the published MHA. For those holding patterns where there is no published MHA, upon receiving an approach clearance, you must maintain the last assigned altitude until leaving the holding pattern and established on the inbound course. Thereafter, the published minimum altitude of the route segment being flown will apply.

NOTE

If an aircraft is established in a published holding pattern at an assigned altitude above the published MHA and subsequently cleared for the approach, the pilot may descend to the published MHA. The holding pattern is considered a segment of the approach only when it is published on the instrument procedure chart and is used in lieu of a procedure turn.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER SIX TERMINAL PROCEDURES

600. INTRODUCTION

The last and sometimes most challenging phase of any sortie takes place in the terminal area. A strong working knowledge of all procedures is just as critical as it was in the enroute phase; for most INAV sorties, you can expect the task tempo to increase with a switch to Approach Control. The keys to successful terminal area-operations are to stay ahead of the aircraft, maintain constant positional and situational awareness, and *know your procedures*.

601. ATIS

About 100 NM away from your destination or drop-in airfield, get the current ATIS/Automated Surface Observation System (ASOS)/Automated Weather Observation System (AWOS) and check it against your approach weather minimums. Normally, you should try to check ATIS, etc., on one radio while you monitor the ATC frequency on the other radio (i.e., use VHF for ATIS and UHF for Center or vice versa). Ask your instructor to monitor the ATC frequency while you copy ATIS. Then tell your instructor when you are done with ATIS and are listening to the ATC frequency again. Your instructor will inform you of any changes from ATC. For example:

Student: *“Listening to ATIS on VHF. Please monitor UHF.”*

Instructor: *“Roger, I have UHF.”*

Student: *“Back up on UHF.”*

Instructor: *“Roger, we are (switched to a different frequency, instructed to descend, etc.).”*

If ATIS is available only on the radio you are using to talk to ATC, you have a few options for getting ATIS:

1. Ask ATC for their frequency for the other radio (preferred method). Establish contact with ATC on that radio, then get ATIS while your instructor monitors the new ATC frequency. For example, if you are talking to ATC on UHF and the only available ATIS frequency is also UHF:

UHF: *“Houston Center, KATT 6XX, request VHF frequency.”*

ATC: *“Roger KATT 6XX, switch to my frequency on ____.”*

UHF: *“Houston Center, KATT 6XX, switching ____.”*

VHF: *“Houston Center, KATT 6XX, checking in on VHF.”*

2. Ask ATC for time off frequency. With this request, advise ATC you will monitor guard and report back on frequency. For example:

KATT 694: *“Houston Center, KATT 6XX, request two minutes off frequency. Will monitor Guard and report back up.”*

ATC: *“KATT 6XX, two minutes off frequency approved, monitor Guard, report backup.”*

KATT 694: *“Houston Center, KATT 6XX, WILCO.”*

KATT 694: *“Houston Center, KATT 6XX, back on frequency.”*

3. Another option for obtaining weather information about your destination/alternate airfield (runway information or instrument approach in use will not be provided) is to use the Pilot-to-Metro (PMSV) service, callsign: “METRO,” PMSV services are discussed in Section C of the FIH.

4. Your last resort is to report “negative information” or “negative ATIS” when you check-in with Approach Control. This should be avoided because other aircraft will have to stand by while Approach Control reads the current information to you. Be ready to copy if you use this method. Approach Control will reply immediately with the information.

Be advised, ASOS and AWOS information is normally difficult to obtain at 100 miles away. Sometimes, you may have to be less than 50 miles away before their broadcast is audible. If you encounter issues, you can use squelch to enhance your ability to hear the recording.

602. FIELD BRIEF

The Field Brief is a crew-coordination measure that describes the destination airfield. It is initiated after ATIS information is known. As a technique, remember the mnemonic aid **WERLONA**:

1. **Weather:** ATIS / ASOS / AWOS information.
2. **Elevation:** Field elevation (see airport sketch on approach plate).
3. **Runway:** Description of intended runway(s) (length, width, and available arresting gear). Briefly address names of other runways. This is a good time to bring up known NOTAMs for displaced thresholds, closed runways/taxiways, etc.
4. **Lighting:** Description of runway and approach lighting for intended runway (if night or IMC).
5. **Obstructions:** Location and height of highest obstruction at the airfield (see airport sketch) and the highest obstacle (see plan view on approach plate).

6-2 TERMINAL PROCEDURES

6. NAVAID: Name and location of NAVAID, relative to the airfield.
7. Altitude: Highest Minimum Safe Altitude (MSA).

603. DESCENT CHECKLIST

Once you have initiated descent into the terminal area or established contact with your destination Approach Control, perform the Descent Checklist.

604. DRAFT REPORT

The DRAFT Report for a destination may be requested by your instructor for training purposes at any time, but *shall* be offered:

1. Immediately following the Descent Checklist when a divert (for weather, fuel, etc.) to an alternate airfield may be required, or
2. When an actual divert situation occurs (i.e., an emergency at the primary destination closes the airfield unexpectedly). The intent of this report is to get the crew on the “same page” for a potential change in plans, before approach tasks take priority. It is not required for drop-in approach fields. After completing the Descent Checklist, ask your instructor if he requires a DRAFT Report and have the information ready to brief. Remember the mnemonic aid-**DRAFT**.
 - a. **Destination** Intended divert airfield.
 - b. **Route** Path from point of divert initiation to divert destination.
 - c. **Altitude** Altitude proposed to divert destination (see discussion on altitude selection below).
 - d. **Fuel** Fuel on board at point of divert initiation, expressed in hours and minutes of fuel remaining (see discussion on fuel-remaining computation below).
 - e. **Time** Time to fly from point of divert initiation to divert destination.

Altitude flown to the divert destination is situation dependent. Divert profiles planned at various altitudes to alternate airfields are listed on the flight log and are good references for the DRAFT Report; however, your primary focus should be on **FUEL CONSERVATION**, with situational awareness and good CRM being critical.

Fuel computation is also dependent on the situation. If ATIS for your primary destination reports current weather above minimums prior to your approach, unless given other direction by your instructor, plan your DRAFT to go from the Missed Approach Point (MAP)/DA of the primary destination to the farthest IAF at the divert destination. This DRAFT Report indicates that you will attempt an approach at the primary destination before making the decision to divert.

You can expect to burn 50 pounds of fuel while executing the approach, so subtract 50 pounds from your current fuel load to get fuel at the point of divert initiation.

If ATIS for your primary destination reports weather below minimums, you cannot attempt an approach, plan your DRAFT from your current location to the farthest IAF at the divert destination. This DRAFT Report indicates that you intend to begin divert procedures immediately, and your current fuel load is now fuel at the point of divert initiation.

To convert fuel at divert initiation from pounds to hours and minutes, divide the current/estimated fuel on board by the fuel flow projected for the selected DRAFT altitude.

NOTE

“DRAFT” is a training term. Do not use the word “DRAFT” when communicating with ATC. However, consider giving a DRAFT Report (again, without using the word “DRAFT”) to ATC, before commencing an approach, if the weather is near minimums and there is a strong likelihood a divert to your alternate may be necessary. At a minimum, the DRAFT should be reviewed with your instructor immediately after the Descent Checklist.

605. INSTRUMENT APPROACH PLATES

The DoD FLIP Instrument Approach Plates cover sections of a state, a whole state, or several states. The Cover will list the Volume number (e.g., VOL-19, for Florida), the time and dates the volume becomes effective, when it expires, and the time and date the Terminal Change Notice (TCN) becomes effective. New Instrument Approach Plates are printed every eight weeks. Inside the cover, you find general information. This is followed by any applicable Special notices and a list of abbreviations. This is followed by a Table of Contents. A Legend breaks down every symbol that may be depicted on an approach plate. This is a great reference for understanding any approach segment. IFR Takeoff Minimums and Departure Procedures are listed for affected airfields. Obstacle Departure information is listed for affected airfields and will be used to determine if any obstacles will limit or prohibit you from operating at the airfield given the operational parameters of your aircraft. (The IFR Takeoff Minimums listed in this section only apply to Civilian users. Appropriate service directives govern takeoff minimums for military users.) Radar Instrument Approach Minimums are listed by airfield. The Instrument Approach Procedure charts (often referred to as “approach plates”) are listed alphabetically by airfield name or city.

Each instrument approach plate consists of five sections:

1. Pilot Briefing Information
2. Plan view
3. Profile view

6-4 TERMINAL PROCEDURES

- 4. Landing minima section
- 5. Aerodrome sketch

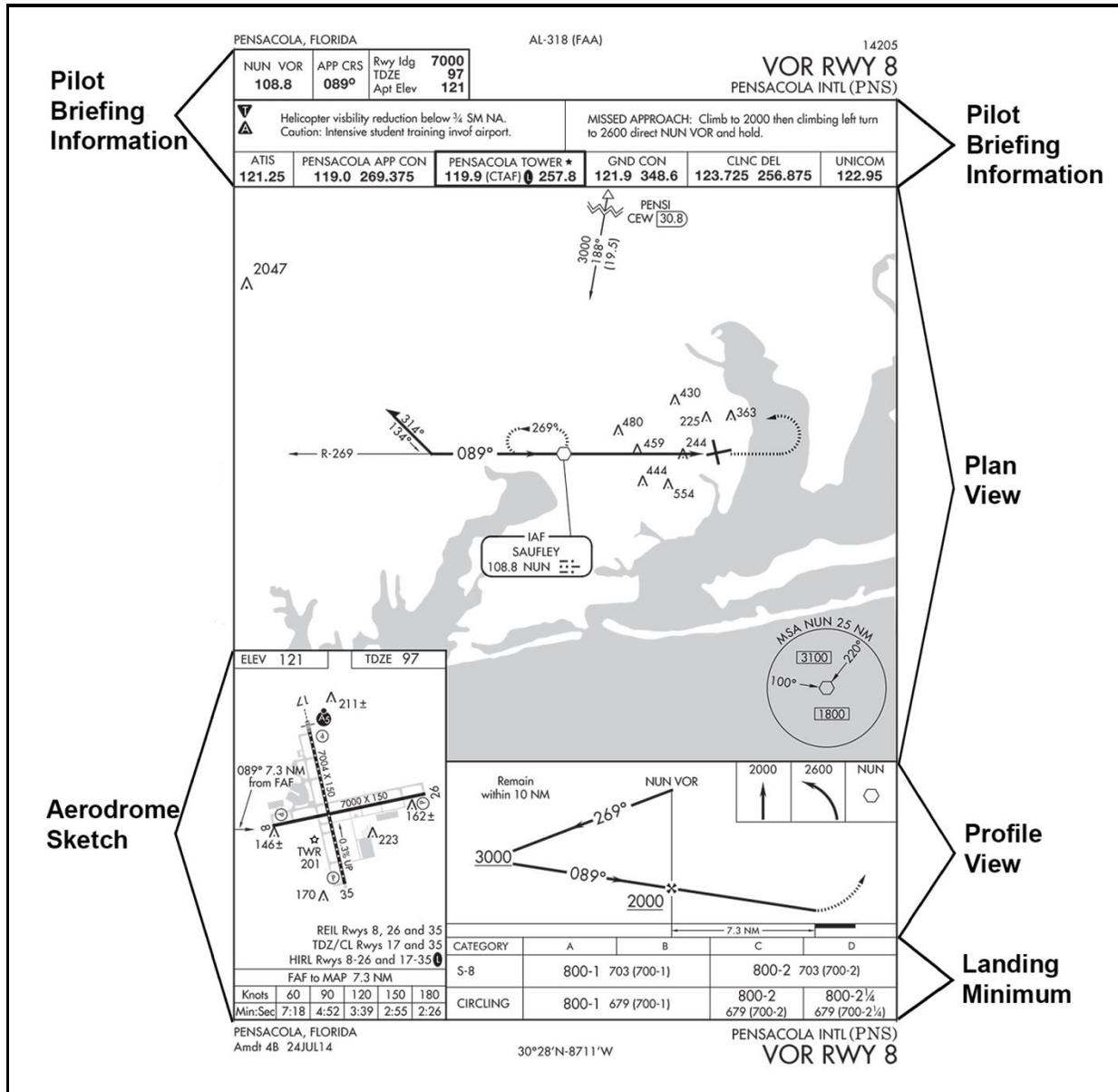


Figure 6-1 Approach Plate Sections

606. 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 and channels, course, and elevations (except height above touchdown [HAT] and height above airport [HAA]) are charted in bold type. The top row contains the primary procedure navigation information, final approach course, landing distance available, and 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.

JACKSON, WYOMING		AL-504(FAA)		RNAV (GPS) X RWY 1 JACKSON HOLE (JAC)	
WASS CH 58299 W01A	APP CRS 006°	Rwy ldg 6300 TDZE 6431 Apt Elev 6451			
 Circling NA east of Rwy 1-19. Inoperative table does not apply.  If local altimeter setting not received, procedure NA. Baro-VNAV NA below -27°C (-16°F. DME/DME RNP-0.3 NA.			MALS 	MISSED APPROACH: Climb to 14000 direct QUIRT and via 088° track to DNW VOR/DME and hold, continue climb-inhold to 14000.	
ATIS 120.625	SALT LAKE CENTER 133.25 285.6	JACKSON TOWER* 118.075 (CTAF) 	GND CON 124.55	UNICOM 122.95	

Figure 6-2 Pilot Briefing Information

607. PLAN VIEW

The plan view provides a graphical overhead view of the instrument approach, and may depict the routes that guide the pilot from the enroute segments to the IAF. NAVAIDs necessary to fly the approach are listed in an information box with the facility name, letter identifier, Morse code sequence, frequency, and channel.

All data depicted on the chart is to scale, except when a route segment is not to scale, the  symbol interrupts the segment, or when concentric rings are used to depict enroute or feeder facilities. 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. The plan view will also depict Minimum Safe Altitude (MSA) and/or Terminal Arrival Area (TAA) information.

NOTE

The plan view may also specify equipment required to fly the approach, i.e., *ADF or RADAR required*. This may be for IAF or FAF identification, but not used for final approach course guidance, so it is not listed in the briefing strip.

6-6 TERMINAL PROCEDURES

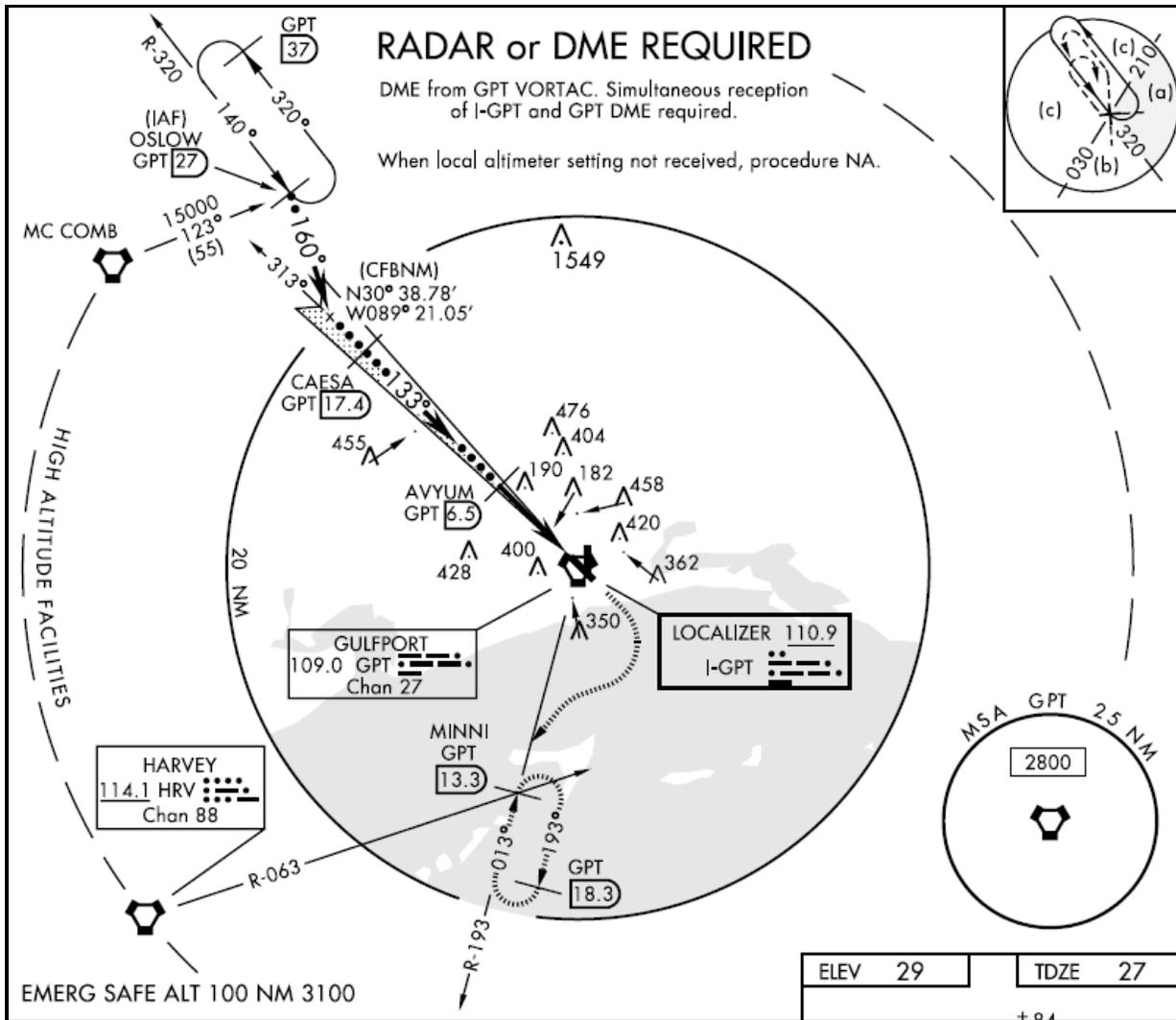


Figure 6-3 Plan View with Concentric Rings and Required Equipment

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.

608. PROFILE VIEW

The Profile View shows a side view of approach procedures (Figure 6-4). The profile view contains:

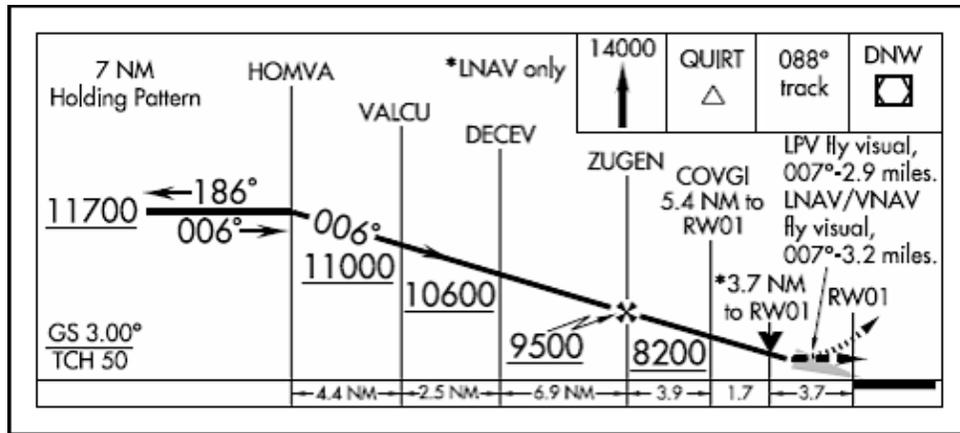


Figure 6-4 Profile View

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 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 are also charted as boxed icons in the chart profile view (Figure 6-5). These icons provide simple to interpret instructions, such as direction of initial turn, next heading and/or course, next altitude, etc.



Figure 6-5 Missed Approach Procedure, Boxed Icons

6-8 TERMINAL PROCEDURES

609. LANDING MINIMA SECTION

Standard Landing Minima: Located below the profile view, the minima section lists the lowest altitude and visibility requirements for the approach being flown. It contains the following (Figure 6-6):

1. Aircraft Approach Category.
2. Decision Altitude (DA); an MSL altitude on a precision approach at which a decision must be made to either continue the approach or to execute a missed approach.
3. 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.
4. 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.
5. Height Above Touchdown (HAT); height of MDA (or DA) above highest elevation in touchdown zone/first 3000 feet of runway.
6. Ceiling and visibility; used for filing purposes and commencing an approach.
7. Height Above Airport (HAA); height of MDA above published airport elevation (used for circling minima).

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 (200-1/2)				
S-LOC 13	480/24	437 (500-1/2)	480/40 437 (500-3/4)	480/50	437 (500-1)
CIRCLING	500-1 457 (500-1)	520-1 477 (500-1)	580-1 1/2 537 (600-1 1/2)	740-2 1/4 697 (700-2 1/4)	860-3 817 (900-3)

Figure 6-6 Landing Minima

RNAV Landing Minima: Area Navigation (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 6-7.

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

NOTE

The T-6A is certified to fly RNAV GPS approaches to Lateral Navigation (LNAV) MDA minimums.

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 6-7 IFR RNAV Landing Minima

Aircraft Approach Category – a grouping of aircraft based on an approach speed equal to 1.3 times the stall speed in the landing configuration at maximum gross weight. Each category provides 300' of obstacle clearance at MDA within the circling radius.

NOTES

1. The T-6A is an Approach Category B aircraft based on approach speed of 91 to < 121 KIAS.
2. If required to fly faster approach speeds, you can always go up a category, but never down.

610. AIRPORT SKETCH

The airport sketch is provided at the bottom of each approach plate. It shows the runways, taxiways, airport lighting, control tower, vertical obstructions, and the field elevation. All elevations are in feet above MSL.

6-10 TERMINAL PROCEDURES

Note the timing “FAF to MAP” information at the bottom of the airport sketch. This table is used to determine the timing from the FAF to the MAP, at various groundspeeds. For example, with an approach speed of 120 KIAS and 10 knots of headwind, the groundspeed becomes 110 knots.

The timing in this case must be interpolated: 110 knots = 2 min 23 seconds. Timing should always be used, when available, as a backup on DME approaches in case the DME should fail.

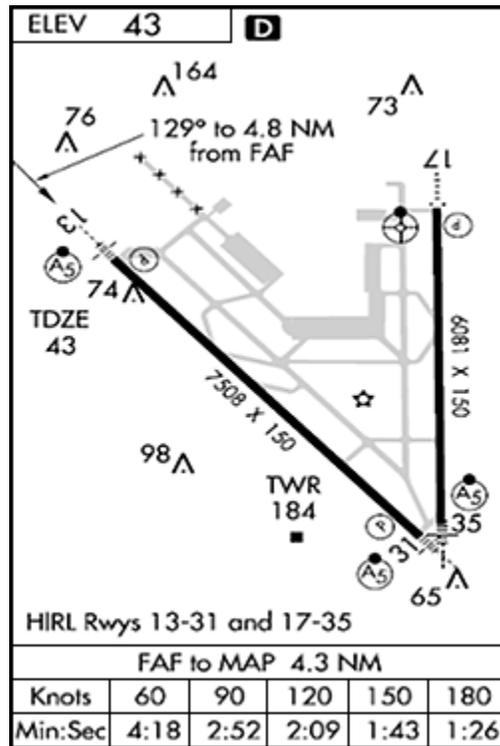


Figure 6-8 Airport Sketch

611. APPROACH BRIEFS

The Approach Brief is a crew-coordination measure describing the expected approach to be flown. If holding is required, the Approach Brief can be initiated after the Holding Brief is completed. If holding is not required, the Approach Brief should be initiated after the Descent Checklist and Field Brief are completed. If ATC assigns an approach other than what was expected, a new Approach Brief *shall* be given.

1. VOR, GPS, ILS, or LOC approaches initiating at an IAF can be briefed using the **TICARM** mnemonic:

- a. Title: Approach title (including page number).
- b. IAF: IAF name and/or radial/DME.

- c. **Course:** Initial and Final Approach Course (FAC) and arc description (as applicable).
- d. **Altitude:** First altitude change.
- e. **Restrictions:** First Restriction.
- f. **MDA/DA:** MDA or DA.

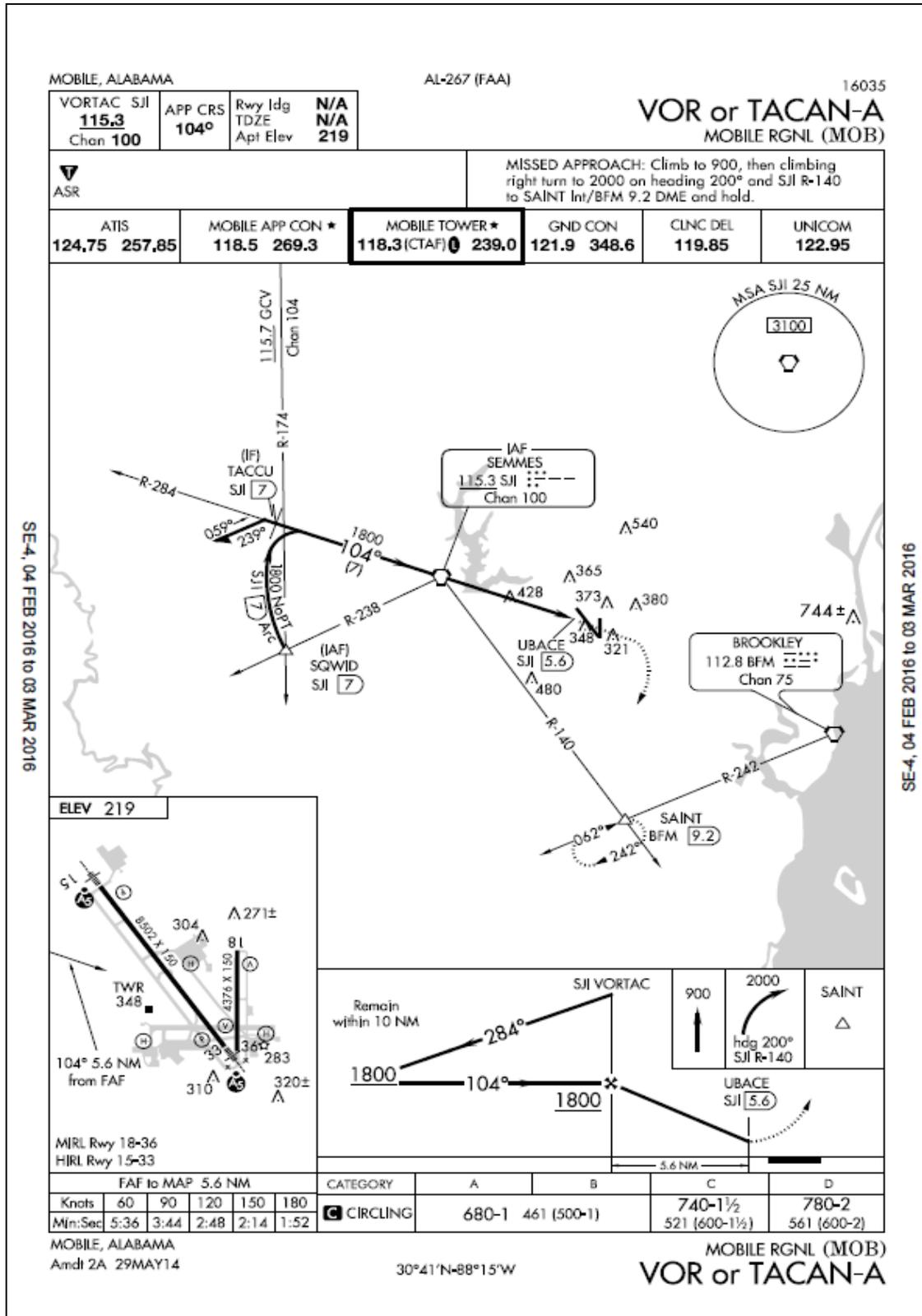


Figure 6-9 VOR A at KMOB (Mobile Regional Airport)

For example, the VOR-A at KMOB (Mobile Regional Airport) might be briefed as:

Student: *“Approach Brief. We will execute the VOR-A to Mobile Regional on page two fifty-nine. The IAF is SQWID, on the SEMMES two three eight at 7 DME. Initial Approach course is the seven DME arc, Final Approach Course is one zero four, at or above eighteen hundred until Final Approach Fix over the VOR, MDA is six eighty.”*

If you have not already done so, tune the approach NAVAID and dial the appropriate course as you are briefing them, unless it is not appropriate due to currently navigating to another fix or NAVAID.

2. VOR, GPS, ILS, or LOC approaches flown with radar vectors to FAC can be briefed using the **TCARM** mnemonic.

- a. **Title:** Approach title (including page number and).
- b. **Course:** FAC
- c. **Altitude:** First altitude change.
- d. **Restrictions:** Any restrictions, including FAF location.
- e. **MDA/DA:** MDA or DA.

For example, the VOR-A at KMOB with radar vectors to final might be briefed as:

Student: *“Approach Brief. We are on radar vectors to final for the VOR-A to Mobile Regional on page two fifty-nine. Final Approach Course is one zero four, at or above eighteen hundred until the Final Approach Fix over the VOR, MDA is six eighty.”*

3. GCAs can be briefed using the **TAG** mnemonic, normally initiated on the downwind leg of the radar pattern:

- a. **Title:** Approach title (including page number and backup NAVAID setup/backup approach).
- b. **Altitude:** MDA/DA.
- c. **Glideslope:** Glideslope and descent rate (PAR only).

For example, the PAR RWY 7L at KNPA (NAS Pensacola) might be briefed as:

Student: *“Approach Brief. We will execute the PAR Runway Seven Left at Navy Pensacola, backed up by the RNAV Runway Seven Left. DA is two twenty four. Glideslope is three degrees, with a descent rate of six hundred thirty-seven feet per minute.”*

612. STANDARD TERMINAL ARRIVALS

A Standard Terminal Arrival Route (STAR) is an ATC coded IFR arrival route established for application to arriving IFR aircraft destined for busier airport areas, and an ATC clearance containing a STAR may be issued whenever ATC deems it appropriate. The purpose is to simplify clearance delivery procedures and facilitate transition between enroute and instrument approach procedures. It is important to note the clearance given. A clearance of “*descend via XYZ ARRIVAL*” will require the pilot to meet the published altitude restrictions on the STAR. A clearance of “*cleared XYZ ARRIVAL*” requires the pilot to fly the depicted route but maintain assigned altitudes.

Procedure. STARs may be flown off of traditional NAVAIDs or by use of GPS navigation.

1. GPS

- a. Load the STAR into the GPS via the APT 7 page.
- b. Select GPS as the NAV source.
- c. Review the STAR.

2. Traditional NAVAIDs

- a. Select VOR as the NAV source.
- b. Review the STAR.

NOTES

1. STARs that list (RNAV) after the title are not authorized in the T-6A. Example, the JINGL ONE ARRIVAL (RNAV) is not authorized due to its exclusive use of GPS defined points in the procedure. STARs such as the TAYLOR TWO ARRIVAL that use a combination of ground based NAVAIDs and GPS points are acceptable for navigation in the T-6A.

2. Clearance to fly a STAR route is not clearance to fly the instrument approach the STAR may lead you to.

Common Errors

1. Inability to load the GPS properly.
2. Not understanding the clearance given by ATC (*descend via XYZ ARRIVAL* vice *cleared XYZ ARRIVAL*).

613. LOW ALTITUDE APPROACHES

Low altitude instrument approaches transition aircraft from the low altitude environment to a point where the runway can be visually acquired and a safe landing executed. These procedures ensure terrain clearance, separation from other IFR aircraft, and guide the aircraft to a published FAF where transition to an instrument final approach is accomplished. Varieties of instrument approaches are available and covered in detail in this FTI. Refer to paragraph 628 for detailed instructions on standardized ICS procedures.

614. PROCEDURE TURN APPROACHES

A Procedure Turn Approach is an instrument maneuver used to reverse direction and to establish an aircraft inbound on the intermediate or final approach course. Procedure Turns are depicted by a “barb” symbol on the approach plate that indicates which side of the outbound course to complete the turn (Figure 6-10). Headings are provided to reverse course using a 45/180° 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 include the 45/180° procedure turn, the racetrack pattern, the teardrop procedure turn, or the 80-260 degree course reversal. Do *not* execute a Procedure Turn when:

1. Radar vectors to the final approach course are provided.
2. When conducting a timed approach from a holding pattern.
3. When cleared by ATC for a straight-in approach.
4. The symbol “No PT (Procedure Turn),” is depicted.

Procedure. The following procedures assume clearance for the DAYTONA BEACH INTERNATIONAL VOR RWY 16 approach (Figure 6-10) has been received and you are proceeding to the IAF.

1. Approximately three minutes prior to the IAF, direct your IP to slow to 150 KIAS. At the IAF, indicated by station passage, execute the 6 Ts (basically an Over-the-Station Intercept):
 - a. **TIME** – Not required.
 - b. **TURN** – in the shortest direction to intercept the outbound course (336°)

Student: *“Left three three six.”*

- c. **TIME** – Start timing outbound when abeam the IAF, or if you cannot determine the abeam position, start timing when wings level outbound.

Student: *“Time start.”*

NOTE

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

- d. **TRANSITION** – If a descent is necessary at the IAF from a published altitude or an ATC assigned altitude, the descent must not begin until crossing over the IAF, or abeam the fix and proceeding outbound. Comply with any additional altitude restrictions imposed by ATC. Ensure you are at the correct airspeed for the approach.

Student: *“Descend sixteen hundred, at or above until Final Approach Fix.”*

e. **TWIST**

- i. Set CDI to the outbound course (336°).
 - ii. Use “Over-the-Station Intercept” procedures to establish the aircraft on the outbound course. The objective is to be established on the desired outbound course by the end of timing.
- f. **TALK** – Give the appropriate voice report if required.

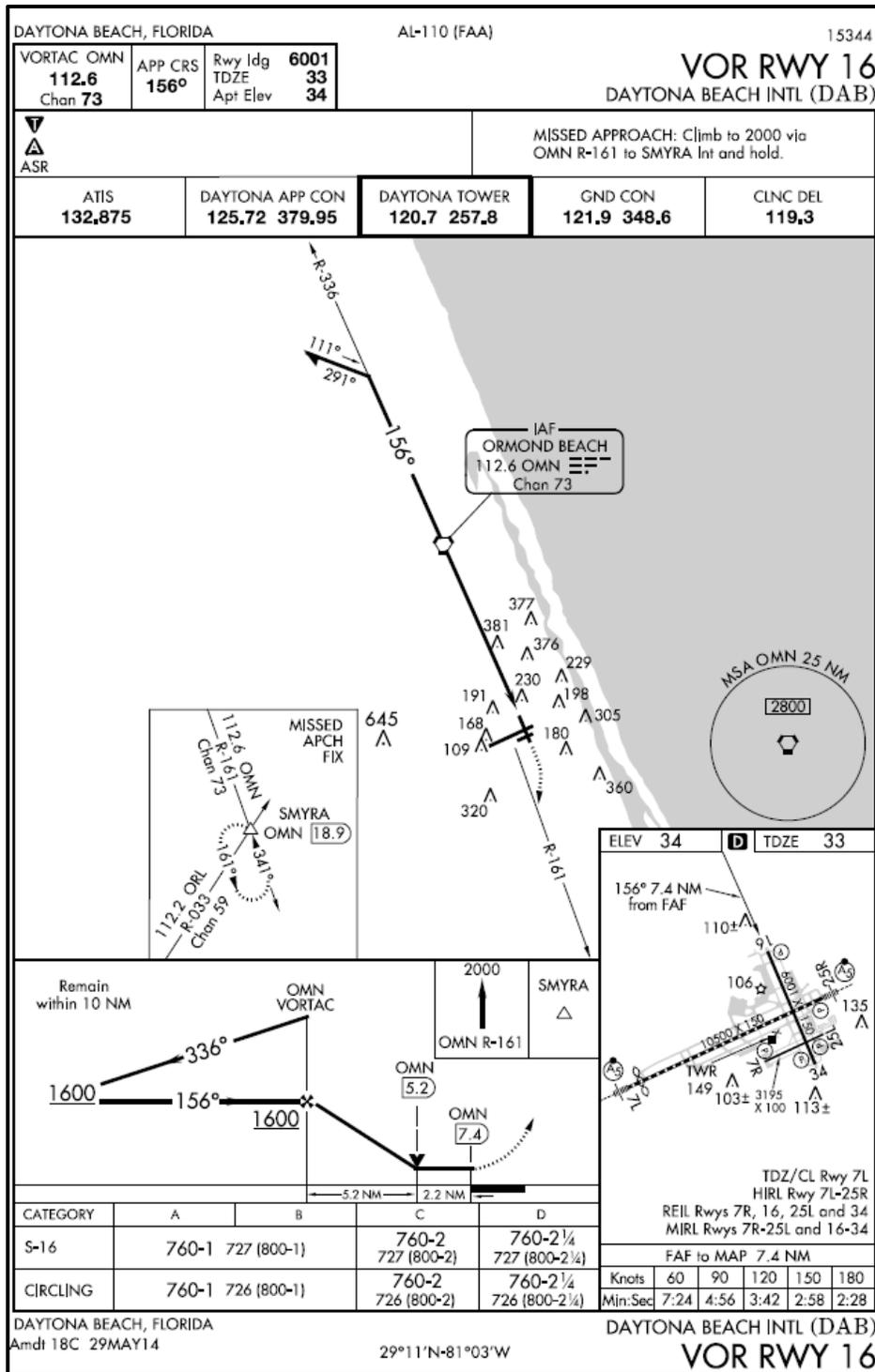


Figure 6-10 VOR RWY 16 at KDAB (Daytona Beach International)

2. **Level off** at Procedure Turn altitude (1600'). Maintain Procedure Turn altitude until you are established on the inbound course.

NOTE

The aircraft is considered “established on course” when it is within half-scale deflection, or in the case of the T-6A, one dot deflection on the EHSI, which equates to 5 radials for a VOR. 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° course reversal by turning to the heading depicted next to the “barb” symbol (291°). Start the clock as you roll wings level and maintain this heading for one (1) minute. Twist in the inbound course (156°) in the CDI.
4. At the end of one (1) minute timing, direct the IP to execute a 180° turn in a direction opposite the first turn (i.e., turn right, away from the station).
 - a. If the head of the needle 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, you should roll out with a DTA intercept. If you overshoot the inbound course, continue the turn and establish an intercept.
5. As you intercept the inbound course, turn and track inbound.
6. Once established on the inbound course, and within 3-5 NM of the FAF (when DME is available), configure to BAC and perform ***BEFORE LANDING CHECKS***.

NOTES

1. BAC for the T-6A is gear down, flaps Takeoff, and airspeed 110 KIAS minimum.
2. Aircraft ***shall not*** descend from the FAF altitude to MDA/DA until the aircraft is configured to land.
7. Define the MAP. If not planning to full stop, give the IP climbout instructions as issued by ATC. If you are VMC and planning to full stop, ATC will not issue climbout instructions, ask your IP if he requires you to give the published missed approach instructions. If weather is near minimums, read the missed approach instructions as published or amended by ATC.

Student: “*Missed approach point is seven point four DME. Climbout runway heading, two thousand.*”

NOTE

Missed Approach or climbout instructions issued by Approach Control or Tower supersede published instructions. If new instructions are issued, brief them to your instructor.

8. At the FAF Perform 6 Ts:

- a. **TIME** – Start timing, based on groundspeed, to identify the MAP, or as backup for DME.
- b. **TURN** – Turn in shortest direction to intercept and track the final approach course (156°).
- c. **TIME** – Not required.
- d. **TRANSITION** – Direct IP to descend to 760', double-check correct airspeed and configuration.

Student: *"Descend seven sixty, MDA."*

- e. **TWIST** – Set or confirm the FAC in the CDI (156°) and set an intercept heading as required.
- f. **TALK** – Report FAF inbound to ATC or tower.

Student: *"Tower, KATT 6XX, seven mile final VOR one six, gear down, low approach."*

NOTE

ATC may direct you to contact tower prior to the FAF or after you have reported the FAF, depending if there is an approach control facility. Regardless, your first contact with tower should state your position relative to the runway or the FAF, which approach you are executing, and your landing intentions.

9. Give 200 feet prior to MDA call over ICS and tell the pilot to level off upon reaching the published MDA (760'). Call out the location of the runway over the ICS.

Student: *"Nine sixty for seven sixty...level off seven sixty, runway is at twelve o'clock."*

10. Continue to navigate to the MAP. At the VDP or just prior to the MAP (7.4 DME), ask the IP if they have the field in sight. If the field is not in sight execute Missed Approach Procedures.

11. If field is in sight and a safe landing can be made, the IP will comply with Tower's instructions for the option, full stop, or low approach. Transition to an outside scan and back the pilot up on the landing. If performing a touch-n-go or full stop, prior to landing, verify the landing gear is down and locked, flap position, and clearance. Then verbalize it to the pilot.

Student: *"3 down and locked, flaps takeoff, cleared touch-n-go runway one six."*

NOTE

1. The Visual Descent Point (VDP) is a defined point on a straight-in, non-precision approach from which you can descend below the MDA, as long as you have the required visual reference. If a VDP is available, it will be indicated by a "v" on the profile view portion of the instrument approach procedure chart. **Do not** descend below MDA before reaching the published VDP, even if the field is in sight.
2. If no VDP is published, you may calculate one by dividing the HAT by 300. The result is the distance, in nautical miles, from the end of the runway from which to begin a 3 degree descent. If using a calculated VDP, be vigilant for obstacles.

Common Errors

1. Excessive corrections over or near the VOR (chasing the needle).
2. Failure to backup DME with timing.
3. Focusing only on the course and not making 200 feet prior and MDA level off calls to the IP.

615. ARCING APPROACHES

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

Arcing Speed. When executing Arcing approaches, maintain 150 KIAS until the lead turn onto the final approach course has been made, or 3-5 NM prior to FAF.

NOTE

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

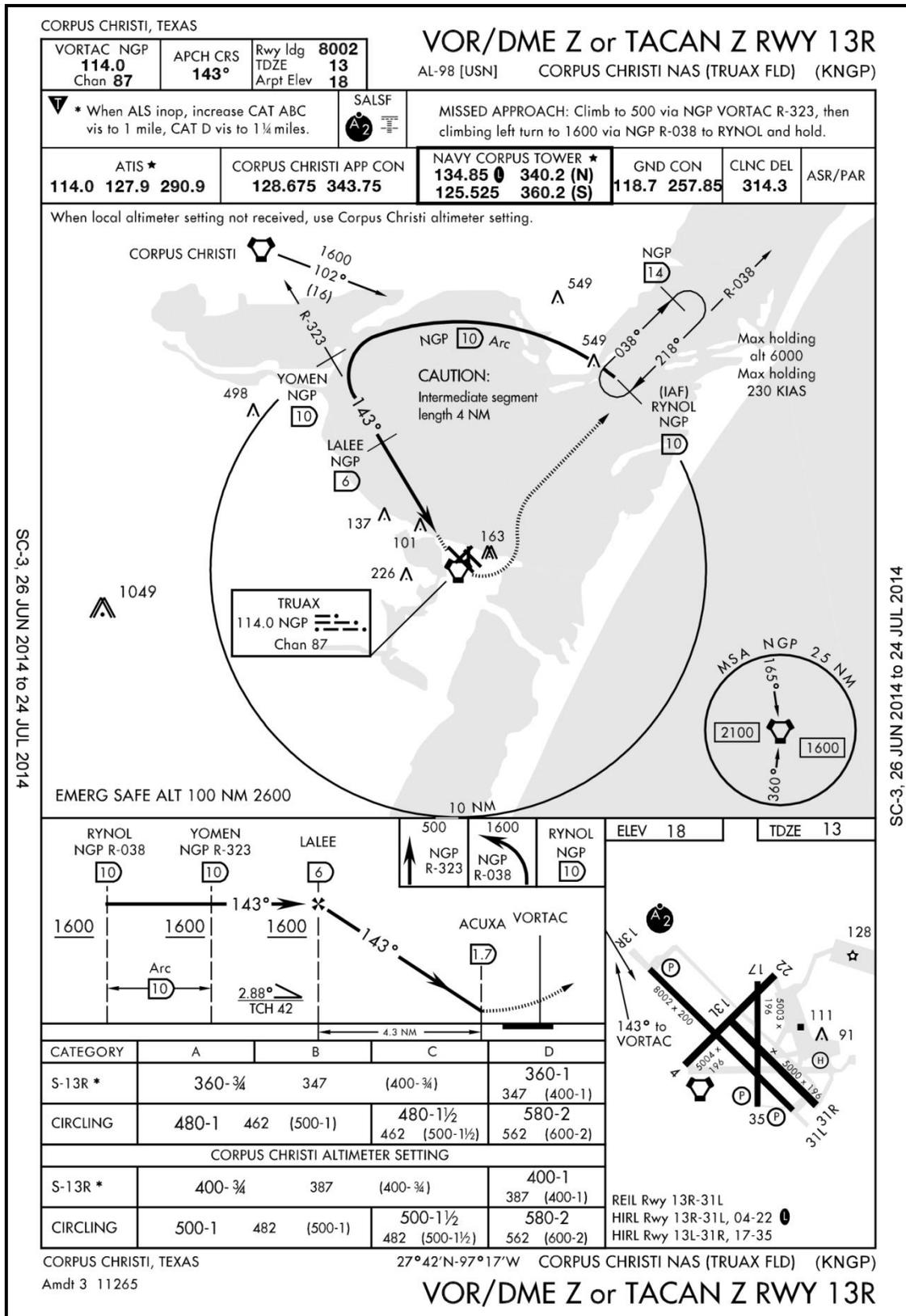


Figure 6-11 VOR/DME Z RWY 13R at KNGP (Corpus Christi NAS)

Procedure. The following procedures assume clearance for the VOR/DME Z RWY 13R (KNGP) (NAS Corpus Christi) approach (Figure 6-11) has been received and you are proceeding direct to the IAF.

1. At the IAF:
 - a. **TIME** – Not applicable.
 - b. **TURN** – Turn to place the VOR bearing pointer at the left 90° benchmark.
 - c. **TIME** – Not applicable.
 - d. **TRANSITION** – Comply with altitude restrictions as required.

NOTE

On some approaches, the transition at the IAF could involve a descent and/or a reduction in airspeed.

- e. **TWIST** – Set the inbound course (143°) in the CDI.
 - f. **TALK** – Give the appropriate voice report if required.
2. Anticipate interception of the final approach course (referencing the tail of the VOR needle and the CDI) while on the arc. Remember, the turn onto final approach course is a 90° arc-to-radial intercept.
3. When within 3-5 NM of FAF, direct the IP to transition to BAC, and perform Before Landing Checks.

NOTE

On some approach charts, a published lead radial (designated “LR–xxx”) is provided as an advisory point for turning onto the inbound course. On FAA instrument approach charts, a “LR” provides at least 2 NM of lead. For instance, at Eglin AFB, the approaches and lead radials were designed with the performance of the F-15 in mind. For this reason, published lead radials *shall not* be used in the T-6A. Aircrews must calculate an appropriate lead radial based on airspeed and distance from the NAVAID.

4. At the FAF, perform 6 Ts:
 - a. **TIME** – Start timing, based on groundspeed, to identify the MAP, or as backup for DME.
 - b. **TURN** – Turn in shortest direction to intercept and track the FAC (143°).

- c. **TIME** – Not required.
 - d. **TRANSITION** – Direct IP to descend to 340 feet.
 - e. **TWIST** – Set or confirm the FAC in the CDI (143°) and set an intercept heading as required.
 - f. **TALK** – Report FAF inbound to ATC or Tower.
5. Give 200 feet prior to MDA call over ICS and direct the pilot to level off upon reaching the published MDA (340 feet). Call out the expected location of the runway over the ICS (e.g., *“The runway should be at our eleven o’clock.”*)
 6. If the runway is not in sight, maintain the MDA and continue the approach. Just prior to the MAP (1.7 DME), ask the IP if field is in sight. If it is not in sight, execute the Missed Approach Procedures.
 7. If field is in sight and a safe landing can be made, the IP will comply with tower’s instructions for the option, full stop, or low approach.

Common Errors

1. Overshooting the arc or final approach course due to insufficient lead or slow scan of instruments.
2. Poor Arcing corrections, allowing the aircraft to exceed the arc DME.
3. Failure to descend to minimum altitudes for the various approach segments.

616. RADAR VECTORS TO FINAL APPROACH COURSE

Radar Vectors to Final Approach Course (RVFAC) is a procedure used by Approach Control to increase the arrival rate of aircraft and to establish aircraft on the final approach course via the most expeditious routes consistent with traffic situations. In most cases, this will be a boxed (or modified boxed) pattern. You should know your position relative to the FAC and landing runway, and be able to anticipate the direction of the next turn (turn to base, dogleg, or final).

Although this routing does expedite arrival at your destination, it has one characteristic of which you should be aware of – 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 their radar displays. The MVAs used by Approach Control provide at least 1000 feet of obstacle clearance in non-mountainous areas, and at least 2000 feet of obstacle clearance in designated mountainous areas.

Aircrew should never fully relinquish the responsibility for terrain clearance to an outside agency. Maintain situational awareness and crosscheck terrain clearance altitude by using all available NAVAIDS and your position. Never blindly follow vectors from a controller – be aware of what lies ahead on your assigned heading. If in doubt, query the controller.

Procedure. (Figure 6-12) Fly 150-200 KIAS on downwind, 120-150 KIAS on base, and 120-150 KIAS on final until transition to BAC or as directed by local instructions or ATC. Keep a high level of SA and know where the aircraft is in relation to the FAF.

1. Tune, identify and monitor the appropriate NAVAID.
2. Check the NAV source is configured properly.
3. Set the FAC into the CDI.
4. Follow radar vectors given by approach control.
5. If a lower altitude is assigned, direct IP to descend to assigned altitude.
6. Transition to BAC:
 - a. When within 3-5 NM of the FAF and aircraft heading is within 90° of the final approach course, or
 - b. Once established on final 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 FAC and track inbound, and descend or maintain altitude as appropriate to comply with the next altitude restriction.
8. Once established inbound and at the FAF, perform the 6 T's in accordance with the applicable Low Altitude Instrument Approach.

Common Errors

1. Poor orientation, loss of SA.
2. Not setting the correct NAV source with correct CDI course.
3. Not telling IP the airspeed to fly on downwind leg of radar pattern, or on base leg.
4. Failure to transition to BAC at the appropriate time.
5. 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.

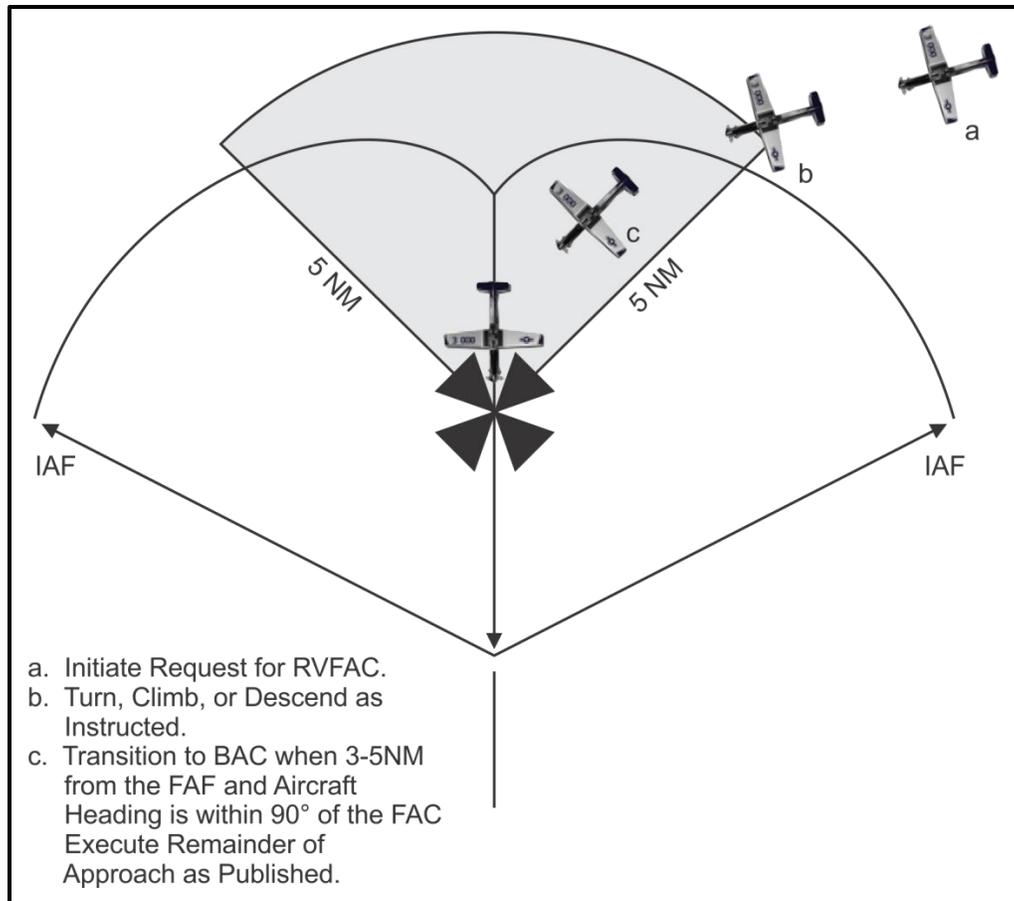


Figure 6-12 RVFAC (FAF Depicted)

617. INSTRUMENT LANDING SYSTEM (ILS)

The ILS is designed to provide an approach path for exact alignment and descent of an aircraft on final approach to a runway. The system can be divided functionally into three parts:

1. Guidance information: localizer, glideslope.
2. Range information: DME, marker beacon, GPS waypoint.
3. Visual information: approach lights, touchdown and centerline lights, runway lights.

NOTES

1. The point where the ILS glideslope is intercepted is the precision FAF. The approximate point where the glideslope is intercepted when at the published intercept altitude is indicated by a lightning bolt symbol. The localizer FAF is normally indicated by a Maltese cross. For many ILS approaches, the glideslope intercept point (FAF) and the localizer approach FAF are not

collocated. Whether executing the ILS or the localizer approach, you must start backup timing at the non-precision FAF (not glideslope intercept). This procedure allows you to identify the non-precision MAP (provided there is a timing block depicted on the approach plate) in the event the ILS glideslope fails during the approach.

2. If executing an ILS approach and glideslope indications fail, revert to localizer procedures and minimums.

Procedure. Use Figure 6-13 for the following example: the aircraft is being vectored on downwind for an ILS approach to Runway 14 at Gulfport-Biloxi International (KGPT). As a memory aid for the ILS and the LOC, use **D LIDS**.

Vector on Downwind: *“KATT 6XX, fly heading three two zero, descend and maintain three thousand.”*

1. Set NAVAIDs up for the ILS. Perform **D LIDS** check.

D – DME Hold – set to 109.0 for GPT VOR.

L – Localizer set 110.9 (I-GPT).

I – Inbound course, set CDI 133°.

D – Display: Set the NAV source to VOR. The EHSI NAV source will change from VOR to LOC when a localizer frequency is set in the VHF NAV primary position.

S – Speeds, fly downwind 200 KIAS.

Vector onto Base: ATC: *“KATT 6XX, fly heading zero five zero.”*

2. Direct IP to turn to new heading (set the heading bug on the EHSI) and to slow toward 150 KIAS (base leg airspeed).

Dogleg: On a dogleg to final, ATC will normally give clearance for the approach. Most clearances follow a standard format: Heading Altitude, Clearance. Your readback must include those items, but you should remove the extra wording for the sake of brevity. For example:

ATC: *“KATT 6XX, you are five miles from the final approach fix, fly heading one zero zero, maintain two thousand until established, cleared for the ILS Runway One Four Approach at Gulfport.”*

Student: *“KATT 6XX, one zero zero, two thousand, cleared ILS one four.”*

On final:

3. As the CDI comes alive, note the rate of movement of the CDI toward center and lead the turn onto final in order to capture the inbound course.
4. When established on final and within 3-5 NM of the FAF (this may occur on the dogleg), configure to BAC and perform Before Landing Checks.

Methods for determining when within 3-5 NM of the FAF

- a. DME (from ILS) or DME Hold (from a TACAN or VOR/DME NAVAID because not all ILSs provide DME).
 - b. GPS waypoint
 - c. Established at the published glideslope intercept altitude and the glideslope indication is “alive” (green diamond starts to move down from the top of the glideslope case).
 - d. Controller radar identification (you may ask ATC to tell you when within 5NM)
5. At glideslope intercept, direct the IP to descend on the glideslope.

NOTE

On an ILS approach, relay course/glideslope information to your instructor, similar to the way a GCA controller relays course/glideslope information during a PAR approach. If the aircraft deviates from course, state the aircraft’s position and the action required to correct back to course. For example, “*We are left/right of course, right/left XXX.*” If aircraft deviates from glideslope, student should state the aircraft’s position and the action required to correct back to glideslope. For example, “*We are above/below glideslope, increase/decrease descent rate.*” Specific power settings, nose attitudes, and descent rates in feet per minute are not required.

6. At the localizer FAF (6.5 DME), begin timing as a backup to the ILS should the glideslope fail.
7. Track the localizer inbound. Make small corrections. The localizer becomes very sensitive as the aircraft gets closer to the field.
8. Call 200 feet prior to DA and the relative location of the runway over the ICS.
9. At DA ask the IP if the runway environment is in sight. If so and a safe landing can be made, descend below the DA and transition for a landing. If not, execute a Missed Approach

Common Errors

1. Incorrect NAVAID/CDI setup.
2. Missed radio calls due to task saturation.
3. Flying through the FAC.
4. GS and or course corrections lagging deviations during the final approach phase of flight.

618. LOCALIZER APPROACHES

Description. A localizer approach uses the course guidance component of an ILS, the major difference being the lack of a glideslope indication.

NOTE

If executing a localizer approach and DME defines the MAP, use DME as the primary means of MAP identification. If DME indications fail, use timing from the non-precision FAF to identify the MAP (provided there is a timing block depicted on the approach plate).

Procedure. The procedures for a LOC approach are very similar to the ILS. For this discussion, use Figure 6-13.

Downwind: Fly the downwind vector at 200 KIAS.

1. Set NAVAIDS up for the LOC. Perform **D LIDS** check.

D – DME Hold – set to 109.0 for GPT VOR.

L – LOC set 110.9.

I – Inbound course, set CDI 133°.

D – Display: Set the NAV source to VOR. The EHSI NAV source will change from VOR to LOC when a localizer frequency is set in the VHF NAV primary position.

S – Speeds, fly downwind 200 KIAS.

Base: ATC: “*KATT 6 XX, Fly heading zero five zero.*”

2. Direct IP to turn to new heading (set the heading bug on the EHSI) and slow toward 150 KIAS (base leg airspeed) and descend when directed by ATC.

Dogleg: See ILS example above.

On final:

3. As the CDI comes alive, note the rate of movement of the CDI toward center and lead the turn onto final in order to capture the inbound course.
4. When established on final and within 3-5 NM of the FAF (be alert, this may occur on the dog leg), configure to BAC and perform the Before Landing Checklist.

At the FAF (6.5 DME)

5. Perform the 6 Ts.
 - a. **TIME** – Start timing, may be needed as a backup to ID the MAP.
 - b. **TURN** – Should not be required since the aircraft is on the final approach course.
 - c. **TIME** – Not required.
 - d. **TRANSITION** – Direct IP to descent to MDA (Do not follow the Glideslope on a LOC approach).
 - e. **TWIST** – Should already be done.
 - f. **TALK** – Report FAF inbound to ATC or Tower.
6. Call 200 feet prior to MDA over the ICS.
7. At MDA (440 feet) tell the IP to level off. Maintain the LOC course and at the MAP (timing of 2:57 at 120 KIAS GS) ask the IP if the runway environment is in sight. If so and a safe landing can be made, descend below the MDA and transition for a landing. If not, execute a missed approach.

Common Errors.

1. Incorrect NAVAID/CDI setup.
2. Missed radio calls due to task saturation.
3. Flying through the final approach course.
4. Course corrections lagging deviations during the final approach phase of flight.
5. Failure to backup DME with timing.

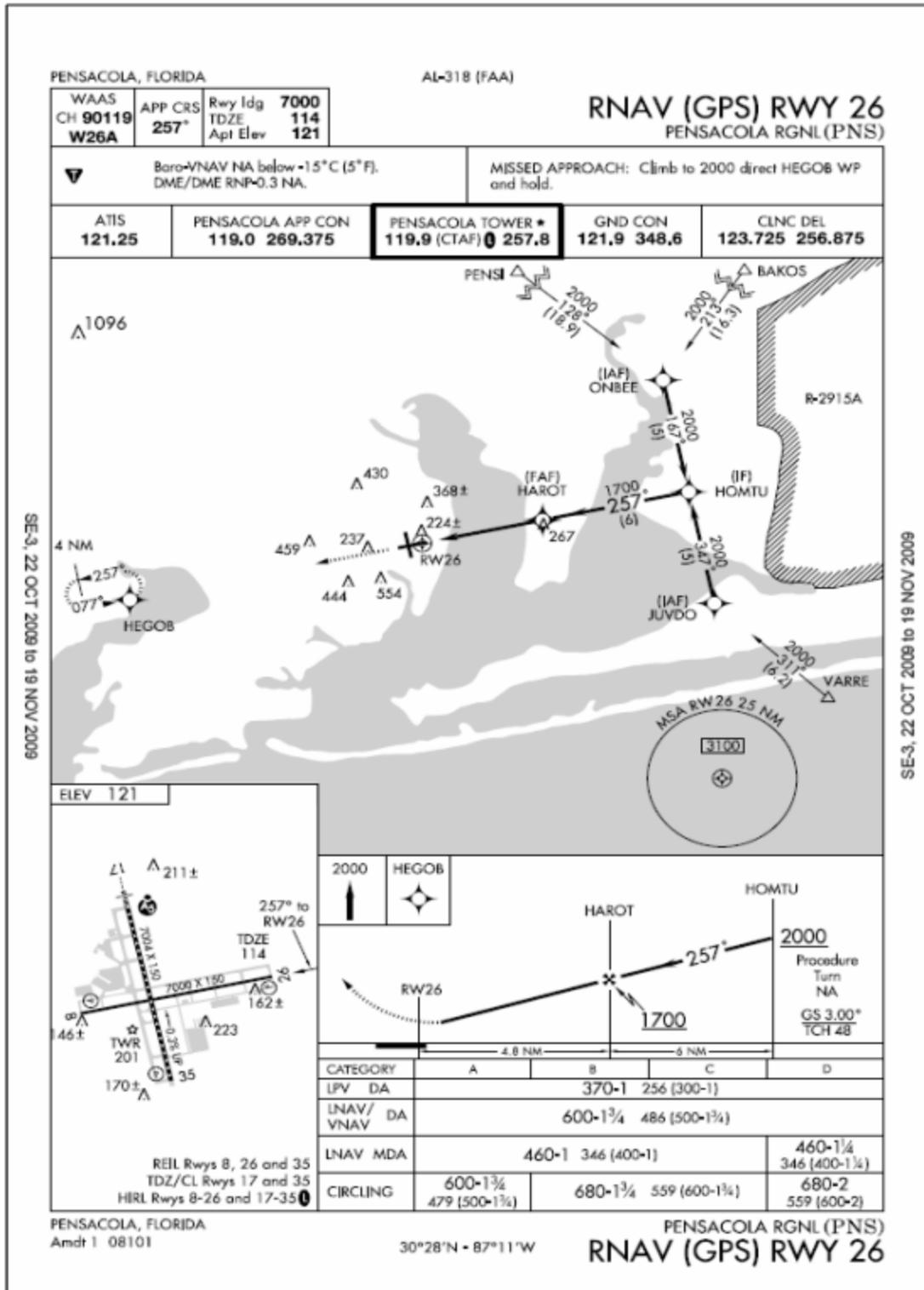


Figure 6-14 “T” Approach RNAV RWY 26 at KPNS (Pensacola Regional)

619. GPS APPROACHES

Prior to conducting any GPS approach training, it is essential that the student read the T-6A NATOPS Flight Manual GPS section and be thoroughly familiar with the components and operation of the GPS. Low altitude GPS approaches use waypoints to define the approach procedure. These waypoints include the IAF(s), FAF, and MAP and are stored in a flight plan data base that is selected by the user. GPS approaches are flown using the same low altitude approach procedures previously discussed. Many GPS approaches use a basic “T” design as depicted in Figure 6-14.

As shown in this example, the “T” approach is designed to maneuver the aircraft from one of two separate IAFs (ONBEE or JUVDO), through an intermediate fix (IF) (HOMTU), and then to the FAF (HAROT), and MAP (RWY 26).

Procedure: GPS approaches can be performed as a full approach or radar vectors to final.

1. Load the selected approach via the APT 8 page. You must load the approach 2 miles outside of the FAF, otherwise it will not go into approach mode.

NOTE

You will be presented with several IAF options. Select the option you have either been cleared to or the option you have requested if flying the full approach.

2. Once cleared to the IAF, select the IAF as the active waypoint and proceed direct (you may have to use the Direct/Enter).
3. Within 3-5 NM from the selected IAF, direct the IP to slow to 150 KIAS.
4. When cleared for and on a published portion of the approach, descend In Accordance With (IAW) the published procedure.
5. Once on the published procedure the CDI will lead your turns IAW the published procedure. The next Waypoint will begin to flash as you approach it. The Waypoint will stop flashing and the GPS CDI will cycle to the next course. This will lead the turn so that the aircraft will be centered on the course upon roll out of the turn. Direct the IP to turn when applicable and set the heading bug, as appropriate.
6. When established on FAC, take BAC within 3-5NM prior to FAF and complete the Before Landing Checklist. If on vectors to final, select OBS then set the FAF as the active waypoint. Have the inbound course to the FAF set in the EHSI using the CRS knob. Deselect OBS once established so that the GPS will automatically switch to approach active mode when the aircraft is within 2 NM of FAF. Report “*Approach Active*” to the IP.

NOTE

When the GPS transitions to approach active mode, the CDI scale begins to change from the 1 NM approach scale to a 0.3 NM final approach scale. The following conditions must be met to transition to approach active: LEG mode is active (not in OBS), aircraft is heading toward the FAF, FAF is the active waypoint, GPS confirms that monitoring is available to complete approach and RAIM is available at the FAF and MAP. In addition to the CDI scale deflection changing you will also notice the information on the EHSI changing from blue to green and APR ACT replacing APR ARM in the lower right corner of the display. If any of the conditions above are not met by FAF arrival, the GPS will not transition to APR ACT and a *Missed Approach shall be performed*.

7. At the FAF, ensure the GPS has transitioned to the approach active mode and perform the 6T's.
 - a. **TIME** – Not required.
 - b. **TURN** – Should not be required since the aircraft is on the final approach course.
 - c. **TIME** – Not required.
 - d. **TRANSITION** – Direct IP to descent to MDA.
 - e. **TWIST** – Should already be done.
 - f. **TALK** – Report FAF inbound to ATC or Tower.
8. Report 200 feet prior to LNAV MDA (460 feet) over the ICS.
9. At LNAV MDA (460 feet), tell the IP to level off. Continue course tracking to the MAP. At the MAP, ask the IP if the runway environment is in sight. If so and a safe landing can be made, descend below the MDA and transition for a landing. If not, execute a missed approach.

NOTE

1. If a missed approach is required prior to reaching the MAP, climb to the missed approach altitude and continue to the MAP. The aircraft *shall not* be turned prior to overflying the MAP published in the procedure. After the MAP, the GPS *will not* automatically sequence to the next waypoint. You must manually select the next waypoint in the missed approach procedure as the

active waypoint by selecting the Direct button, verify the waypoint displayed is the correct one, then select Enter.

2. If a RAIM failure is indicated at any time, execute the missed approach procedures.

620. RADAR APPROACHES

Radar approaches fall into two classes, Precision and Non-precision:

1. PAR approaches provide highly accurate course, range, and glideslope information.
2. ASR and Precision Approach Radar without Glideslope (PAR w/o GS) approaches provide course and range information only, and are thus non-precision approaches.

621. PRECISION APPROACH RADAR (PAR) APPROACHES

On a PAR approach a controller uses ground radar to guide an aircraft to a position to land. You were introduced to radar vectoring procedures in Section 616 (Radar Vectors to Final Approach Course). The goal was to vector the aircraft to join a segment of a standard Instrument Approach Procedure, and then clear the aircrew to complete the approach using the aircraft NAVAIDs. During a PAR approach, the controller directs the aircraft all the way to a position from which a safe landing can be made.

Preflight – Radar instrument approach minimums are published in the front of FLIP Terminal Instrument Approach Procedures (approach plates). Published information includes the DA, weather minimums, and glideslope angle. With glideslope angle and groundspeed, the pilot can determine the rate of descent required to maintain glideslope on final using the rate of descent table (in the back of the approach plates). Familiarize yourself with this information as part of your preflight planning when a radar approach (PAR or ASR) is available at your destination or alternate.

For the purposes of illustration, consider the PAR approach to RWY 19L at NAS Meridian MS (KNMM) (Figure 6-15).

NOTE

OPNAVINST 3710.7 considers tandem cockpit aircraft like the T-6 to be single-piloted. OPNAVINST 3710.7 requires that single-piloted aircraft use 200 feet ceiling/HAT and ½ mile/2400 feet RVR as absolute minimums for instrument approaches. Consider the above example. When you reach the published DA of 417 feet MSL, you will be at a HAT of 100 feet AGL. In order to meet the 200 feet HAT absolute minimum, you must increase the DA. In this case, an increase of 100 feet is necessary. This would result in a modified DA of 517 feet MSL, resulting in a

HAT of 200 feet AGL. In addition, the minimum visibility required to commence the approach becomes ½ mile instead of the published ¼ mile, and the minimum ceiling becomes 200 feet instead of 100 feet.

Procedure

1. Request a PAR approach. The following information will be provided by ATC.
 - a. Type of approach. ATC: *“This will be a PAR approach to Runway One Niner Left.”*
 - b. Altimeter setting. (May be omitted if current ATIS was reported at check-in with ATC.)
 - c. Ceiling and visibility if below 1000’ (or below highest circling minimum, whichever is greater) or visibility less than 3 miles. (May be omitted if current ATIS was reported at check-in with ATC.)
 - d. Special weather observations.
 - e. Lost Communication Procedures. (e.g., If no transmissions are received for one minute in the pattern or five seconds on final approach, attempt contact on (frequency) and proceed VFR. If unable, proceed with the ILS one niner left approach; maintain two thousand until established on the approach.
 - f. Missed Approach Instructions. The controller should issue verbal missed approach instructions since GCA missed approach procedures are not published. Climbout instructions will be issued in place of missed approach if the approach is not planned to end in a full stop landing.

NOTE

If these instructions are not provided by ATC, *you shall ask your instructor* if missed approach, climbout, and/or lost communications instructions are required.

RADAR INSTRUMENT APPROACH MINIMUMS						
MERIDIAN NAS (KNMM), (Mc CAIN FIELD), MS (12 JUL 01 USN)						ELEV 317
RADAR - (E) 134.1 266 8 300.4 310.8 322.0 325.2 328.4 346.0 363.6 ▽						
	<u>RWY</u>	<u>GS/TCH/RPI</u>	<u>CAT</u>	<u>DA/ MDA-VIS</u>	<u>HAT/ HATH/ HAA</u>	<u>CEIL-VIS</u>
PAR ⁴	19L ³	3.0°/45/1060	ABCDE	417- ¹ / ₄	100	(100- ¹ / ₄)
	1L ²	3.0°/34/744	ABCDE	455- ¹ / ₂	200	(200- ¹ / ₂)
	1R	3.0°/38/888	ABCDE	471- ³ / ₄	200	(200- ³ / ₄)
	19R	3.0°/36/854	ABCDE	495- ³ / ₄	200	(200- ¹ / ₄)
ASR ¹	19L ³		AB	780- ¹ / ₂	463	(500- ¹ / ₂)
			C	780- ³ / ₄	463	(500- ³ / ₄)
			D	780-1	463	(500-1)
			E	780-1 ¹ / ₄	463	(500-1 ¹ / ₄)
	1L ³		AB	740- ¹ / ₂	485	(500- ¹ / ₂)
			C	740- ³ / ₄	485	(500- ³ / ₄)
			D	740-1	485	(500-1)
			E	740-1 ¹ / ₄	485	(500-1 ¹ / ₄)
	28		ABC	680-1	374	(400-1)
			DE	680-1 ¹ / ₄	374	(400-1 ¹ / ₄)
	19R		AB	700-1	405	(400-1)
			CD	700-1 ¹ / ₄	405	(400-1 ¹ / ₄)
		E	700-1 ¹ / ₂	405	(400-1 ¹ / ₂)	
1R		AB	700-1	429	(400-1)	
		C	700-1 ¹ / ₄	429	(400-1 ¹ / ₄)	
		DE	700-1 ¹ / ₂	429	(400-1 ¹ / ₂)	
CIR ¹	19L/R, 1L/R, 28		AB	820-1	503	(600-1)
			C	820-1 ¹ / ₂	503	(600-1 ¹ / ₂)
			D	880-2	563	(600-2)
			E	980-2 ¹ / ₄	663	(700-2 ¹ / ₄)

¹CAT E Cir not auth W of Rwy 1L-19R. ²When ALS inop, increase vis ¹/₄ mile. ³When ALS inop, increase vis ¹/₂ mile. ⁴No-NOTAM MP sked: PAR Tue 1300-1700Z++, PAR apch not avbl dur this time.

Figure 6-15 Radar Instrument Approach Minimums

2. Comply with vectors provided by Approach Control and the final approach controller. Maintain SA at all times. Ensure NAVAIDS are setup for the back-up / lost communications instrument approach.
3. On downwind fly 200 KIAS.

NOTES

1. At some airfields, Army and Navy controllers are required to advise pilots to “Perform landing checks.” The GCA Controllers at NAS Pensacola and NAS Whiting Field are not required to do this; however, the Final Controller on a PAR approach will say “wheels should be down” after confirming radio communication is established with the aircraft.

2. Configurations and airspeeds may vary in the GCA pattern as dictated by local directives.
3. It is common to set the EHSI in the ARC mode for GCA approaches. Ask your IP before selecting ARC mode
4. Upon making the turn to base (set the heading bug), direct the IP to slow towards 150 KIAS.
5. Once established on final or on a dog-leg to final, configure to BAC and perform Before Landing Checks. (In some cases, you may configure to BAC on the base leg).
6. Expect a radio handoff to the final controller on final or dog-leg to final. (For single-piloted aircraft this will not require a frequency change.)
7. Repeat all ATC instructions and move the heading bug to the proper heading. Once ATC has stated “do not acknowledge further transmissions,” you will only move the heading bug with each update from the controller.
8. Direct IP to begin descent when the final controller advises that you are “on glidepath.”
9. For glidepath deviations, make appropriate recommendations. Maintain 120 KIAS and continue to comply with assigned headings.

NOTE

Glideslope deviations should be responded to with the deviation recognition and a solution. For example, Student: “*Above glideslope, increase descent rate*” or “*below glideslope, decrease descent rate.*”

10. Report 200 feet prior to DA over the ICS.
11. At DA ask the IP if the runway environment is in sight. If so and a safe landing can be made, descend below the DA and transition for a landing. If not, execute a Missed Approach (As a technique, make the DA call about 30 feet above DA so the IP can “decide” and respond by DA).

NOTE

If a non-radar approach (VOR, ILS, LOC, or GPS) is available, students should backup the GCA with the available approach to the max extent possible. For example, load a GPS approach for the runway you are on the GCA for or have an ILS or LOC frequency tuned with final approach course dialed should the GCA become unavailable for any reason.

Common Errors

1. Not setting NAVAIDS / CDI for backup approach.
2. Poor readback skills of vectors, missed approach, and lost communication information.
3. Late to configure and getting behind the aircraft.
4. Late or missed 200 feet prior to DA call, or the DA call.
5. Not responding to “cleared to land” radio call.

622. AIRPORT SURVEILLANCE RADAR (ASR) APPROACHES

A surveillance or PAR w/o GS approach is a non-precision approach in which the controller provides azimuth navigational guidance only. Airport surveillance radar is less precise than precision radar. This accounts for the higher minimums on ASR approaches. PAR w/o GS is more precise course guidance than the ASR approach and the minimums are normally slightly lower than ASR minimums.

Procedure:

1. Execute the same steps 2-6 as in the PAR.
2. Direct IP to begin descent when directed to “descend to your minimum descent altitude.”
3. Provide backup and ensure the IP complies with the assigned headings.
4. Call 200 feet prior to MDA over the ICS.
5. At MDA tell the IP to level off. Ensure the IP complies with course guidance.
6. The controller will tell you when you are at the MAP. If the runway is not in sight or you are not in a position to make a safe landing, execute the Missed Approach instructions.

Common Errors

1. Incorrect NAVAID/CDI setup for backup approach.
2. Poor readback skills of radar vectors, missed approach, and lost communications instructions.
3. Late to configure and getting behind the aircraft.
4. Late or missed 200 feet prior call or MDA call.

623. NO-GYRO APPROACHES

The No-Gyro approach is used when experiencing heading indicator malfunctions. In this case, the word “gyro” refers to your directional gyro, which provides heading input to the EHSI. It is conceivable that during flight your heading indication could fail, while all other systems essential to flight remain normal. Under such conditions, ATC can provide a No-Gyro approach.

The radar controller, seeing your track on radar, can direct your aircraft with timed turns. In this case, the controller tells you when to start and stop your turns. These No-Gyro vectors can be used to vector you to VFR conditions for a visual landing or vector you through a Ground Controlled Approach (GCA). The same glideslope and DA/MDA that apply to the standard GCA also apply to the No-Gyro approach. This information should be reviewed prior to any GCA.

Procedure.

Review the GCA Procedures from this chapter. No-Gyro Procedures are the same with the following exceptions:

1. Make a specific request for a “No-Gyro PAR/ASR” when you contact approach control.
2. Make all turns at standard rate until instructed by ATC to, "make half-standard rate turns."
3. Roll into turns promptly and verbally acknowledge ATC upon hearing the words “turn right” or “turn left.” Roll wings level and acknowledge on receipt of the words “stop turn.”

624. CIRCLING APPROACHES

A circling approach is a maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or desirable. It is your responsibility during a circling approach to direct the pilot’s initial turn to commence circling in compliance with ATC circling instructions. Additionally, you must backup the pilot with airspeed and altitude deviation calls. A circle only approach is generally named VOR A (or other letter) for a given airfield. Circling minimums will be given to fields that have approaches to a runway, but allow you to use that approach to circle to another landing runway.

There are three reasons for an approach to be considered a circling approach:

1. The final approach course is more than 30° off runway heading (15° for GPS).
2. The descent gradient from the FAF to field elevation is greater than 400 feet per NM.
3. The final approach course does not cross the extended runway centerline prior to the runway threshold.

Circling Categories

1. Category A: Speed less than 91 knots.
2. Category B: Speed 91 knots or more but less than 121 knots.
3. Category C: Speed 121 knots or more but less than 141 knots.
4. Category D: Speed 141 knots or more but less than 166 knots.
5. Category E: Speed 166 knots or more.

NOTES

1. The T-6A is considered a category B aircraft.
2. The circling MDA provides vertical clearance from obstacles when conducting a circle-to-land maneuver within the obstacle protected area. The Standard protected area for category B aircraft while circling is a radius of 1.5 NM from the ends of the runway. The FAA has also developed Expanded Circling obstacle protected areas that account for a higher TAS when circling at higher elevation airfields. Refer to the FLIP Instrument Approach charts legends pages for more information.
3. On final for the approach and before commencing the circle, you may descend to the circling MDA at T-6 final approach speed (110 KIAS minimum) or circling airspeed (120 KIAS). If you choose to fly 110 KIAS, you must accelerate to 120 KIAS before commencing the circle.

Circling Minimums:

Published circling minimums provide 300 feet of obstacle clearance when pilots remain within the appropriate area of protection (Figure 6-16).

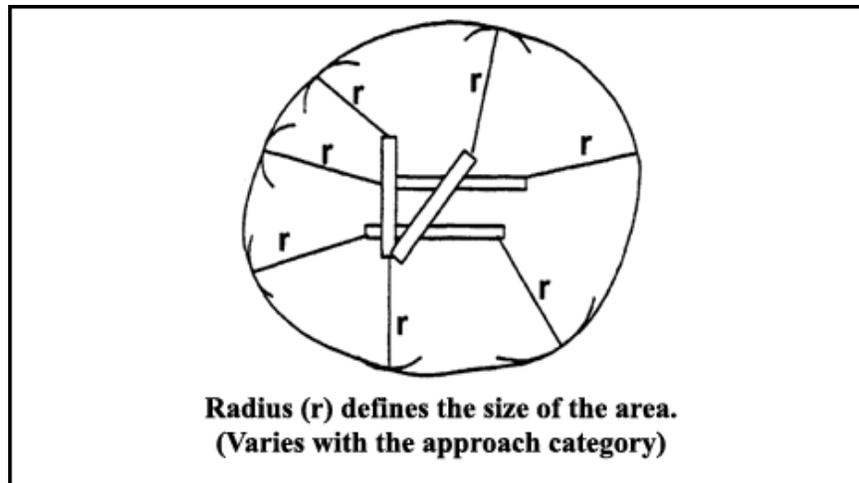


Figure 6-16 Circling Approach Area

Procedure:

Upon breaking out of the weather or when at the defined MAP (either by DME or timing), locate the intended runway in use. Remain at or above the circling altitude (MDA) until the aircraft is in a position to land. Every effort should be made to fly a normal VFR landing pattern (i.e., 180, 90, final), realize that the sight picture and references may look different at a lower altitude. You are legal to begin the circling maneuver when tower has cleared you to circle, you have the runway in sight, and you are within the protected airspace for the approach category (1.5 NM).

1. Fly the final portion of the low altitude instrument approach using previously discussed FTI procedures for the applicable approach.
2. When VMC but no later than the MAP (defined either by timing or DME) or when runway is in sight, direct the IP to turn in a direction that aligns the aircraft most closely to the normal VFR landing pattern while remaining in compliance with tower's circling instructions.
3. Maintain MDA until in a position to make a normal descent to landing.
4. If the field is not in sight by the MAP, visual reference is lost during the circling maneuver, or if directed by tower, execute a Missed Approach.

Missed Approach from a Circling Maneuver:

If visual reference with the runway environment is lost while circling to land from an instrument approach (unless the inability to see an identifiable part of the airport results only from a normal bank of the aircraft during the circling approach), the Missed Approach specified for that particular procedure must be followed (unless an alternate Missed Approach procedure is specified by ATC).

To get 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. Because there are many variations to the circle-to-land maneuver, different patterns may be required to become established on the prescribed Missed Approach course (Figure 6-16).

Adherence to these procedures will assure that an aircraft will remain within the circling and Missed Approach obstruction clearance areas.

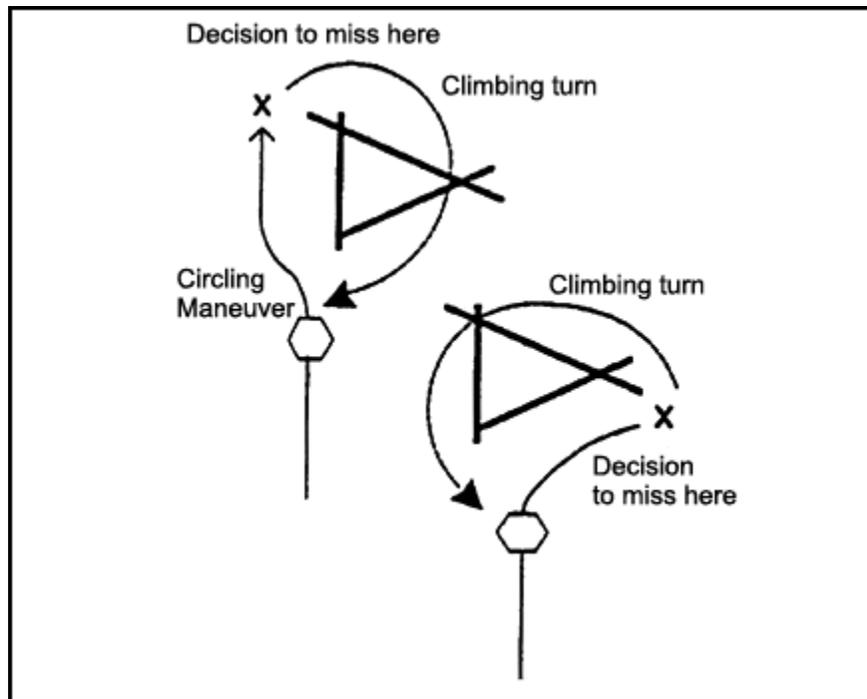


Figure 6-17 Missed Approach from a Circling Maneuver

NOTE

At locations where ATC Radar Service is provided, ATC may provide modified climbout instructions in lieu of the published Missed Approach procedure.

Common Errors

Not understanding or being able to direct tower's circling instruction. Example,

Tower: "Circle North for a left downwind Runway One Zero, I'll call your turn to base."

625. HIGH ALTITUDE APPROACHES

A high altitude instrument approach enables an aircraft to transition from the high altitude structure to a position on the final approach course for landing. These approaches are routinely executed by high performance military aircraft into military aerodromes for the following reasons: to maintain efficient fuel consumption, to maintain a 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 or Arcing approach). For this reason, High Altitude approaches normally require higher rates of descent and indicated airspeeds than Low Altitude approaches 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. (Figure 6-18, HI-VOR RWY 19 Forest Sherman Field Pensacola NAS)

1. Inbound to the IAF, complete the Descent Checklist.
2. At the IAF, execute the 6 Ts:
 - a. **TIME** – not required; time of commencing approach is not reported.
 - b. **TURN** – turn in the shortest direction to parallel the course.

NOTES

1. The penetration course is depicted on high altitude IAP charts by a bold-dotted track (Figure 6-18).
 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 directing the IP to reduce 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 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. Make required altitude warning calls. 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 altitude, direct the penetration turn in the published direction. Your IP should use a SRT, maximum of 30° AOB during the penetration. During the last half of the turn, note the position of the head of the bearing needle:

If the head of the needle *is not* within 5° of the inbound course, stop the turn with a 30° intercept.

If the head of the needle *is* within 5° of the inbound course, continue the turn and roll out with a DTA intercept.

b. **Penetration including an Arcing Maneuver**

When turning 90° onto an arc from a radial using a SRT, the amount of lead (in nautical miles) should be 0.5% of your groundspeed.

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-6As should use category C minimums.

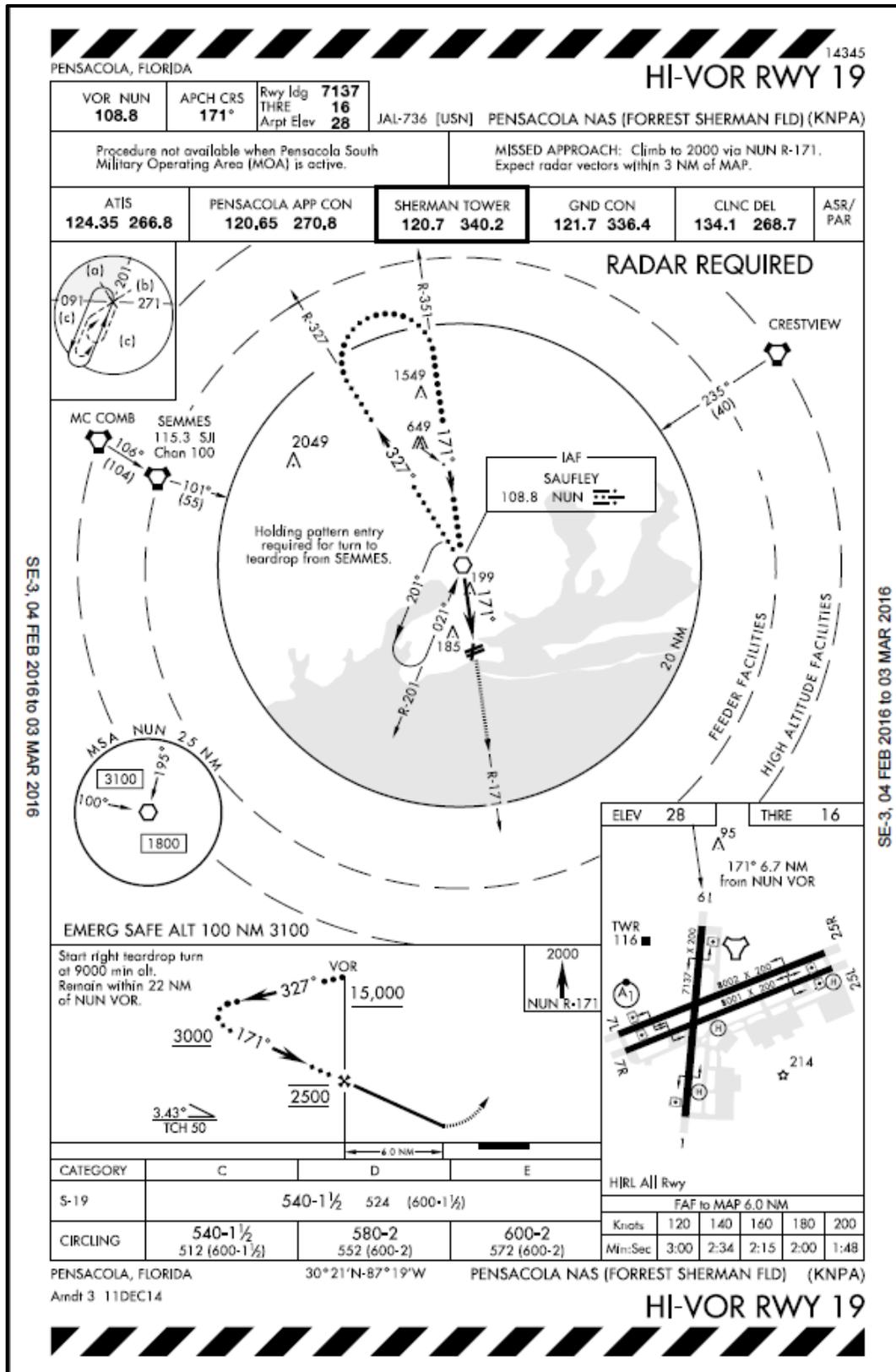


Figure 6-18 HI-VOR RWY 19 at KNPA (Pensacola NAS)

626. VISUAL GLIDESLOPE INTERPRETATION

The purpose of the preceding INAV procedures is to allow you to fly a mission from takeoff to landing in a variety of weather conditions. After correctly applying the INAV procedures and once you have guided your aircraft to a safe position to land at your destination, there will be plenty of visual glideslope indicators to safely guide your aircraft to the runway. The most common are Visual Approach Slope Indicator (VASI), Precision Approach Path Indicator (PAPI), Navy Improved Fresnel Lens Optical Landing System (IFLOLS), and the Fresnel Lens Optical Landing System (FLOLS). These lighting systems help the pilot to transition from an instrument scan to a visual scan.

VASI is a system of red and white lights arranged to provide visual descent guidance information during the approach to a runway (Figure 6-19). These lights are visible from 3-5 miles during the day and up to 20 miles or more at night. The visual glide path of the VASI provides safe obstruction clearance within plus or minus 10° of the extended runway centerline and within 4 NM from the runway threshold. Descent, using VASI, should not be initiated until the aircraft is visually aligned with the runway. The figure below depicts some common VASI indications the aircrew might experience. A helpful memory tool is “red over red, you’re dead,” “red over white is alright,” “white over white, out of sight.”

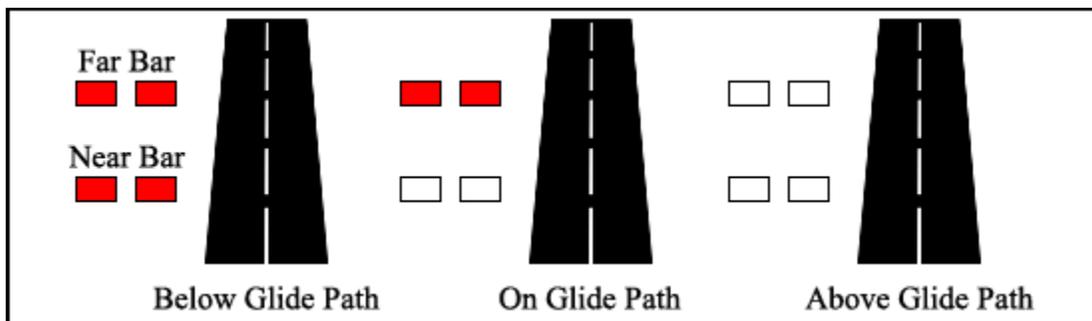


Figure 6-19 Common VASI Indications

PAPI uses light units similar to the VASI, but are installed in a single row of either two or four light units (Figure 6-20). These lights are visible from about 5 miles during the day and up to 20 miles at night. The visual glide path of the PAPI typically provides safe obstruction clearance within plus or minus 10° of the extended runway centerline and within 4 Statute Miles (SM) from the runway threshold. Descent, using the PAPI, should not be initiated until the aircraft is visually aligned with the runway. The row of light units is normally installed on the left side of the runway and the glide path indications are as depicted.

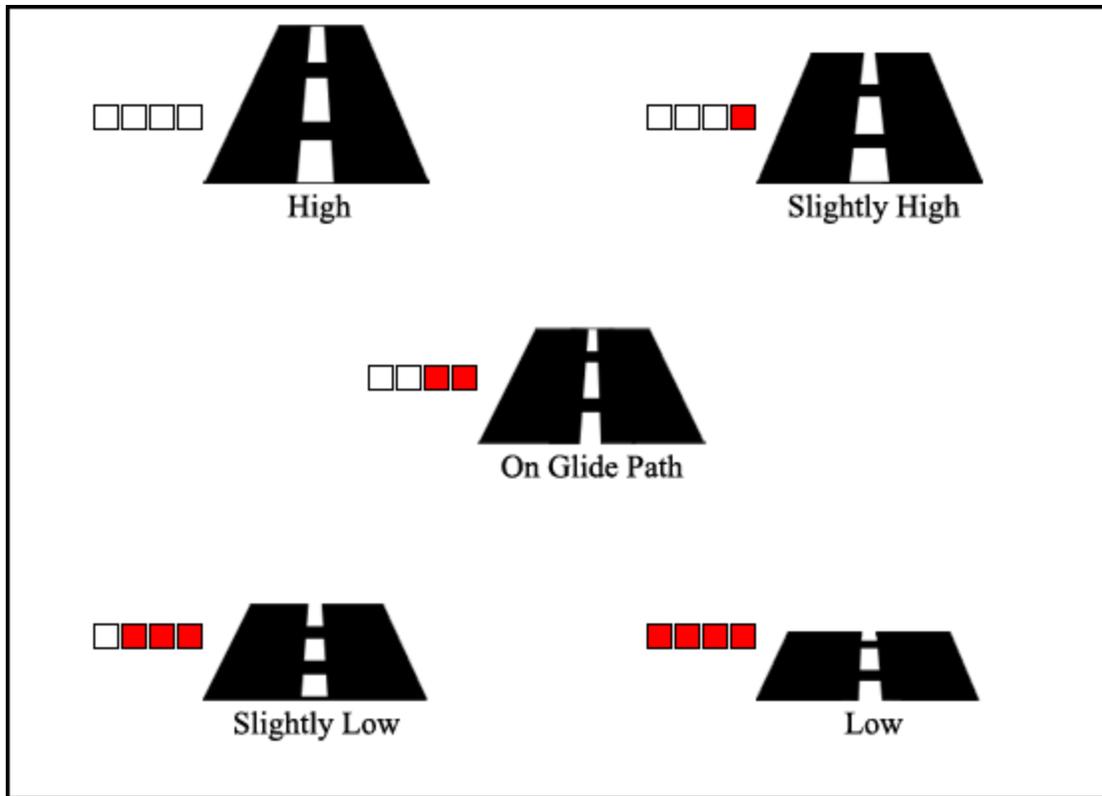


Figure 6-20 Common PAPI Indications

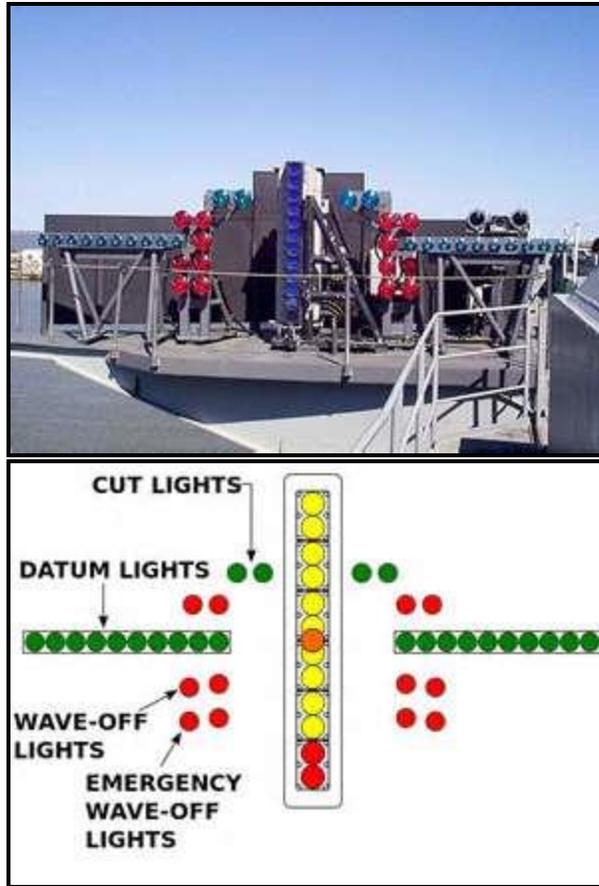


Figure 6-21 IFLOLS Assembly

The US Navy Optical Landing System (OLS) is depicted on airport diagrams because of its height of approximately 7 feet and proximity to the edge of the runway. The OLS is the Improved Fresnel Lens Optical Landing System (Fig 6-21) and is used to discern glideslope by tracking the up and down motion of the amber “meatball” in relation to a horizontal row of green “datum” lights. The IFLOLS generates its “meatball” through optical manipulation whereby a set of 12 stacked lights appear to produce a single ball shaped image. The top 10 lights are amber and the bottom two are red. The relative alignment of the amber/red cells with the row of green “datum” lights, as viewed from the aircraft, indicates your position relative to the optimum glideslope, i.e., above, on, or below glideslope. This glideslope is normally 3.5 degrees at the field. A pilot that lands while seeing amber will land on the runway surface, while a pilot seeing pink or red is well below optimum glideslope and should adjust the rate of descent to “move the ball” closer to the green datum lights. Maintaining a ball centered (between the green datum lights) ensures that the aircraft will land at the desired location on the runway.

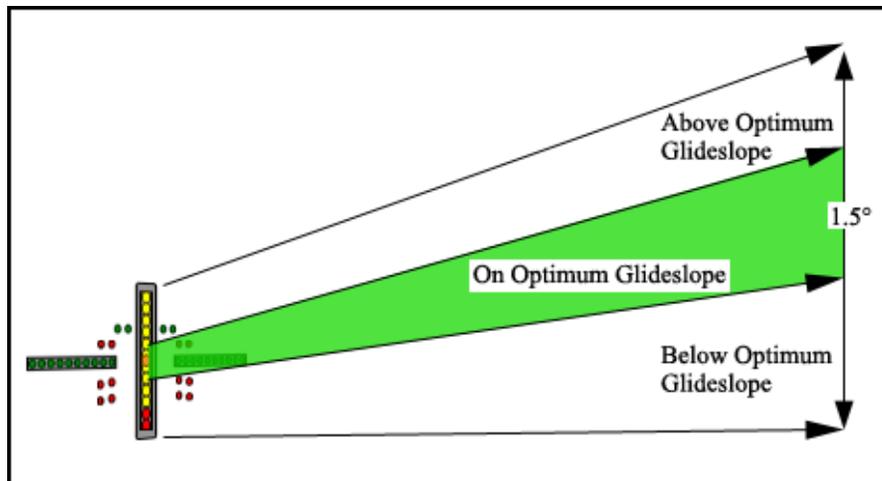


Figure 6-22 IFLOLS Visual Indications

Student Expectations:

Once the runway is in sight and the aircraft is in a safe position to land, your responsibilities as a student and effective crew member do not end. You need to be able to provide visual glideslope information and recommendations to your pilot if needed. Making the transition from instruments to visual and back to instruments is difficult for any aviator and may lead to physical disorientation. CRM is crucial when experiencing IMC in the terminal area. Based on the available information, you will need to be able to interpret the presented information and make an informative ICS call as follows:

Examples: “Above glideslope, increase descent rate,” “Below glideslope, decrease rate,” “On glideslope.”

Your instructor is ultimately responsible for the safe operation of the aircraft and will make the final determination with respect to glideslope deviations based on all available information. The instructor may elect to fly above or below the optimum glideslope to a runway for a variety of reasons; weather, wake turbulence, landing distance rollout, etc. Your instructor will keep you advised on their intentions for glideslope deviations.

627. MISSED APPROACH REVIEW

After completion of the Before Landing Checklist but prior to the MAP/DA, you should ask your instructor if he/she would like the Missed Approach procedures if in IMC, or brief the assigned climbout instructions if not making a full stop landing. The Missed Approach instructions are found in the profile view of the approach plate. You should make note of the following (the mnemonic **PHA** is helpful):

1. **Point:** MAP location.
2. **Heading:** Initial heading.

6-50 TERMINAL PROCEDURES

3. Altitude: First altitude restriction.

628. MISSED APPROACH EXECUTION

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 in the event of a Missed Approach. Your second priority should be to turn the aircraft (if required) to intercept the Missed Approach course or to the designated heading.

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 aircrew should make every attempt to return back onto course. If unable to reestablish the aircraft on course, do not descend below the FAF altitude. Instead inform ATC and follow their 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 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 MSA may be required.

Procedure. At the MAP, if sufficient visual cues are not available or a safe landing cannot be made, execute a Missed Approach as follows:

1. Student: “Execute Missed Approach, climb ____.”

2. When two positive rates of climb are observed:

Student: *“Two positive rates, gear up.”*

3. When speed is observed above 110 knots:

Student: *“Speed above one ten, flaps up.”*

4. After flaps are up:

Student: *“Gear, flaps up at ____ knots.”* (in accordance with the After Takeoff Checklist)

5. Direct a turn toward the Missed Approach course or heading.

Student: *“Right one five zero.”*

6. Establish an intercept to the Missed Approach course or continue the turn to the designated heading as required.

7. Make the report to Tower.

Student: *“Tower, KATT 6XX, Executing Missed Approach.”*

8. Level off at Missed Approach altitude.

9. If directed to contact approach control, inform them of your Missed Approach and state your intentions.

Options include:

a. ***Request the same approach.***

b. ***Request a different approach.***

c. ***Proceed to your alternate.*** If weather and/or fuel considerations dictate that you proceed to your alternate, coordinate with ATC to obtain clearance, be prepared to give ATC your DRAFT information.

10. Update the weather as appropriate.

NOTE

Reporting “Missed approach” to Tower is a required radio call if you were unable to proceed visually to land from the MAP or DA. When practicing approaches, no communication is required if you are complying with the missed approach or climbout instructions

given by ATC. When contacting ATC after a practice approach, make a normal check-in with altitude passing and altitude assigned.

Common Errors

1. Not initiating missed approach or climbout if full CDI deflection occurs inside the FAF.
2. Not calling for gear and flaps when climb is established, or not checking that they came up.
3. Not distinguishing the differences between a depicted heading and a radial outbound.
4. Calling Tower/Approach before initiating the climb.

629. ICS PROCEDURES

In an effort to standardize communications and enhance comm brevity, the following ICS calls shall be adhered to the max extent possible. Remember, these are ICS calls and not necessarily what you will respond with to ATC.

1. Altitude changes climbing: *“Climb one five thousand,” “Ten for fifteen,” “Fourteen for fifteen”* rather than *“Passing Ten thousand for one five thousand.”*
2. Heading changes: For turns greater than 10° *“Right one eight zero,” “Left three one zero.”* For changes under 10° *“Heading one eight zero,” “Heading three one zero.”*
3. Airspeed changes: *“Set one eighty five,” “Set two ten”* rather than *“Speed one eighty-five,” “Speed two one zero.”*
4. Altitude changes descending: *“Descend two thousand,” “Six for two,” “Five for two”* and each thousand prior to level-off.
5. Configuring to BAC: *“Slow to configure”* (directive) next call is *“Below one fifty, gear”* IP will lower gear at this point.
6. Starting Before Landing Checks: *“Defog (response), engine instruments (response). Do not verbalize “Before Landing Checklist.”*
7. 200 feet prior to MDA/DA: *“four twenty for two twenty, field in sight twelve o’clock (or relative position).”* If Pilot says *“Field in sight”* then, *“Proceed visually.”* Otherwise continue navigating to MAP or DA.
8. At MDA (and field position previously called): *“MDA, do you have field in sight?”* If yes, *“Proceed visually.”* If no, *“Continue.”* If at DA or MAP with field still not in sight *“Execute missed approach.”*

9. Missed Approach: “*Execute missed approach, climb ____ (altitude),*” when aircraft is climbing, “*Two positive rates, gear up*” when speed is above 110, “*Speed above one ten, flaps up,*” “*Gear/Flaps up at ____ knots.*” Comply with missed approach procedures.

CHAPTER SEVEN OUT-AND-IN/CROSS-COUNTRY PROCEDURES

700. INTRODUCTION

For all instrument flights and simulator events, routes *shall* be prepared with DD 175 flight plans and Flight Logs adjusted for winds. Normally, plan on flying the Pre-Filed NPA Routes (also called “canned” or “stereo” routes) found in the TW-6 IN-FLIGHT GUIDE on your initial INAV flights. (Routes for the simulator events are provided in the T-6A Flight Planning Ground School). Some instrument navigation flights will be either out-and-in or cross-country flights. On these flights, you will file and fly an IFR flight plan to an airfield out of the local area. *You shall contact your instructor the night prior to your flight for routing information.*

The flying environment outside of the local area will be somewhat unfamiliar. For example, you may be in the high altitude structure, Class Bravo airspace terminal area, and might operate out of a civil airfield with extensive commercial traffic.

701. PLANNING PROCEDURES

Fuel Packets

Prior to departing on an out-and-in flight, your instructor will need to get a fuel packet from Maintenance. The fuel packet may consist of a Jet Fuel Identaplate (DD Form 1896, used to pay for fuel at a military base) and a Government Air Card (used to pay for fuel at civilian air fields). Cross-country maintenance packets also include various government forms that can be used to pay for maintenance services and other official business expenses. At the completion of your flights, remind your instructor to turn in the fuel packet and fill out all required forms with receipts for all applicable expenses.

FLIP Publications

You will bring all necessary FLIP to cover your entire route of flight and any possible contingencies. These publications include, but are not limited to, low and high altitude enroute charts, low and high altitude approach plates, the IFR Supplement, the FIH, STARs, and area charts. Consult with your instructor to determine all necessary FLIP. Check publication currency for your entire enroute period; it is possible some FLIP publications will expire during a cross-country. Have a plan to adapt to this situation (i.e., take new FLIP with you or arrange to pick them up enroute).

Route of Flight

As you gain more experience, you will learn how to visualize your route of flight. Study the route to include a general overview and confirmation of your flight log data, so you will know which way the aircraft should turn after arriving at a given point. Check applicable NOTAMS, Temporary Flight Restrictions (TFR), the IFR Supplement, and the AP/1 for supplemental airport information, flight hazards, and preferred IFR routing.

Once airborne, refer to your chart frequently to confirm progress along your route. Know where suitable enroute airfields are in case unexpected problems arise. Referencing your position on your chart while airborne is one of the best things you can do to help yourself “stay ahead of the aircraft,” and maintain constant SA.

Mentally fly the approach from the IAF to the MAP and determine all lead points and procedures that apply during the approach. Identify the point where the aircraft should be configured for landing. Take note of courses, NAVAID frequencies and locations, and any published holding patterns.

Frequencies are listed at the top of each approach plate. The most commonly used frequencies and the name of the controlling ATC facility will be listed on the approach plate, so you can load the next applicable frequency into the RMU standby field. Be aware, that if ATC directs you to a frequency other than what is depicted on the approach plate, the ATC-issued frequency takes precedence. *Listen up* on the radios and when in doubt, *ask*.

Review the approach minima. You will need to know:

1. If you have the weather to attempt the approach.
2. Where to start descent(s).
3. How low to descend.

To find this information, you need to know which approach category you are in. Normally, the T-6A is a category “B” aircraft (final approach speed 91-120 KIAS), but becomes a category “C” aircraft when final approach speed increases to 121-140 KIAS. If you adjust your final approach speed for wind gusts, controllability, or any other factor, your approach minima may change.

Determine how to identify the FAF and the MAP. If you are flying an approach with timing depicted, note the time from the NON-PRECISION FAF to the MAP; if flying an ILS approach, you must begin backup timing at the non-precision localizer FAF when applicable. Remember, the timing is based on *groundspeed*, not Indicated Airspeed. Calculate your actual groundspeed using the known winds relative to your IAS, then look at the approach-plate timing table and interpolate to get accurate timing from the FAF to the MAP.

Flight Logs

Prepare a complete and accurate flight log for all portions of your flight (both primary and alternate route). During flight, compare estimated values for times, groundspeed, fuel flow, etc., with the actual values you observe. Modify your route as necessary when unexpected delays or in-flight winds will cause you to land at your destination below required fuel amounts. The flight logs SHALL be completed prior to arriving at the preflight brief. While flight logs are a good reference for preflight information, in the aircraft *use your charts as your primary navigation reference*.

7-2 OUT-AND-IN/CROSS-COUNTRY PROCEDURES

Prior Permission Required (PPR)

To land, refuel, or remain overnight at certain fields, prior arrangements must be made. This requirement will be indicated in the IFR Supplement (or AP/1) in the aerodrome remarks section. Assist your instructor as directed in securing this permission.

Operations from Non-Military Fields

Be aware certain procedures and services may vary from what you are used to at military fields (e.g., availability of fire guards, follow-me trucks, base ops, weather, etc.). You may notice some fields do not have ATIS but have AWOS or ASOS instead. Some airports may not have an operational Control Tower, but will have a Common Traffic Advisory Frequency (CTAF). Refer to the AIM for further amplification. Observe any restrictions set forth in the CTW-6 or VT-10 SOP.

At non-military fields, you may file your flight plan with FSS, generally contacted via telephone (1-800-WX BRIEF). For filing, you will need the civilian version of a flight plan; reference the rear cover of the IFR Enroute Supplement. When filing via FSS, request weather and NOTAM information as part of the FSS brief.

If the information locally available is not sufficient, contact the nearest suitable military base. Military weather and NOTAM briefing facilities are listed in the FIH and are available via telephone or internet connection. For more information, refer to the FIH, Section C.

High Altitudes

Cross-country and out-and-in flights may be flown at the upper altitude extreme of the Victor Airway structure or on jet routes. There are certain factors that vary with increasing altitude. Among them are decreasing Outside Air Temperature (OAT), decreasing IAS for a given TAS, and increasing wind velocity.

Remember, when flying at or above 18,000 feet MSL, altitudes are referred to as flight levels (FL). For example, 18,000 feet MSL is reported as “*Flight Level one – eight zero.*” Refer to the FIH Section B to determine when to switch from local altimeter setting to 29.92, and vice versa.

Gouge

Prepare your flight materials carefully. Gouge is *not allowed*, and if discovered may result in referral to the CO for failure to demonstrate officer-like qualities. The intent of this restriction is to push you to become proficient using published materials and confident in your ability to apply prescribed procedures. Gouge is defined as:

1. Enroute Charts: Anything other than the route of flight marked in a temporary fashion (erasable highlighter, highlighter tape, pencil). As you gain more experience, you will hopefully no longer need to trace your route.

2. STARS, Approach Plates, Terminal Change Notice (TCN), IFR Supplement, FIH, NATOPS PCL: Any marks other than NOTAMs or those specifically approved by your instructor.
3. Flight Logs: Any information other than that specified in the Flight Planning course.
4. Miscellaneous: Calculators, GPS devices, or any tabulated charts/tables not included in the TW-6 In-Flight Guide.

The following materials are approved for in-flight use. Any other written materials carried in flight will be treated as gouge:

1. T-6 NATOPS PCL and T-6A Checklists
2. TW-6 In-Flight Guide
3. Flight Logs, DD 175, DD 175-1, and NOTAMs
4. FLIP
5. CR Series “Whiz Wheel”
6. Scratch paper (blank at pre-flight)

702. CONCLUSION

Out-and-in and cross-country flights are a great exposure to the “real world” of aviation. It is important for you not to focus solely on the FTI as in past stages, but to incorporate information from all available sources, both military and civilian. Sample sources include but are not limited to OPNAVINST 3710.7, AIM, FIH, GP, and AP. All of these references contain information you will need to be familiar with in order to have a safe and successful flight.

FLIGHT LOG			
DEP ELEV	CLNC DELIV	GND CONT	TOWER
ATIS	WIND AT ALT	TAS	LBS/HR, LBS/MIN

Figure 8-2: Departure Section

DEP ELEV – Elevation of the departure airfield

CLNC DELIV – Clearance Delivery frequencies listed in IFR Enroute Supplement or approach plates.

GND CONT – Ground Control frequencies listed in IFR Enroute Supplement or approach plate.

TOWER – Tower Control frequencies listed in IFR Enroute Supplement or approach plates.

ATIS – ATIS frequencies listed in IFR Enroute Supplement or approach plates.

WINDS AT ALT – Forecast winds at flight planned altitude.

TAS – Preflight TAS (240 kts or 270 kts).

LBS/HR, LBS/MIN – Predicted fuel flow per hour and per minute (See Section 809).

802. CLEARANCE SECTION

The next four lines consist of space to copy your ATC clearance and takeoff information (Figure 8-3). You should develop a shorthand method of quickly and accurately copying the clearance because space is limited and clearances are generally issued rapidly.

CLEARANCE	
DEPARTURE	TIME OFF

Figure 8-3: Clearance Section

CLEARANCE – ATC issued departure clearance. All valid ATC clearances consist of the following items:

1. Aircraft identification
2. Clearance limit

8-2 FLIGHT LOGS

3. Departure procedures or SID
4. Route of flight
5. Altitude data
6. Departure instructions, frequency and IFF (transponder code) information

DEPARTURE – Abbreviated departure brief.

TIME OFF – Local takeoff (T/O) time.

803. DESTINATION SECTION

Next on the flight log, you will find spaces to use for destination airport information (Figure 8-4). Information for these blocks is found in the IFR Enroute Supplement and/or the approach plates.

DEST ELEV	APC CONT	TOWER	GND CONT
--------------	-------------	-------	-------------

Figure 8-4: Destination Section

DEST ELEV – Elevation of Destination airfield.

APC CONT – Approach Control frequencies listed in IFR Enroute Supplement or approach plates.

TOWER – Tower Control frequencies listed in IFR Enroute Supplement or approach plates.

GND CONT – Ground Control frequencies listed in IFR Enroute Supplement or approach plates.

804. ENROUTE NAVIGATION SECTION

The majority of your flight log consists of the Enroute Navigation Section, Figure 8-5, where the route of flight, courses, distances, times, fuels, and groundspeeds are recorded. Most blocks will be filled out during your pre-flight planning.

ROUTE TO – All points that identify the route of flight (i.e., Level Off (L/O) point, DP/SID Transition Point, NAVAIDs, named or unnamed fixes, and points with greater than 7° course change). Last point should always be the IAF of the destination airfield.

IDENT/CHAN – 3-letter identifier and frequency of VORs used to define each point.

CUS – Course measured or read from chart.

ALT ELEV – Alternate airfield elevation.

APC CONT – Approach Control frequency serving the alternate airfield.

TOWER – Tower Control frequency.

GRD CONT – Ground Control frequency.

Profile I – This profile is planned at your cruising altitude and TAS from destination IAF to alternate IAF. This information is recorded on the very last line of the Enroute Navigation Section, immediately above the Alternate Section. All courses, distances, times, and fuels are calculated in the same manner as in Enroute Navigation Section. Include the cruising level winds and fuel flow (PPH).

Profile II – This profile is planned at 5000 feet and cruise TAS, from destination IAF to alternate IAF. This information is recorded on the line immediately below the Alternate Section. All courses, distances, times, and fuels are calculated in the same manner as in Enroute Navigation Section. Include the winds at 5000 feet and fuel flow (PPH).

Profile III – Bingo profile. Bingo parameters are determined by using the Bingo chart in Section 809. The Bingo profile is planned from the destination airfield to the alternate airfield at 240 KTAS.

806. FUEL PLAN SECTION

The backside of the flight log contains fuel plan information, completed during your preflight planning to simplify in-flight decision-making. It consists of:

FLIGHT LOG	
FUEL PLAN	
1. CLIMB/ROUTE DEST IAF _____	6. START/TAXI _____
2. ROUTE ALT IAF (If required) _____	7. TOTAL REQUIRED (4, 5, & 6) _____
3. APPROACHES _____	8. TOTAL ABOARD _____
4. TOTAL (1, 2, & 3) _____	9. SPARE FUEL (8-7) _____
5. RES 10% OF 4 (Min 20 mins) _____	

Figure 8-7: Fuel Plan Section

CLIMB/ROUTE DEST IAF – Total fuel burned from T/O to arrival at the destination IAF. This number was calculated on front of flight log (The sum of all Leg Fuel entries).

ROUTE ALT IAF – Fuel required to fly from your destination IAF to your alternate IAF at cruising altitude. Calculated in Profile I, Alternate Section.

APPROACHES – Cumulative fuel required for all approaches planned at the destination airfield only. For preflight planning, use 50 lbs of fuel for each planned approach.

TOTAL (1,2,&3) – The sum of lines 1,2, & 3.

RESERVE 10% OF LINE 4 (MIN. 20 MINS) – OPNAVINST 3710.7 required reserve fuel; either 10% of the sum listed in line 4 or enough fuel to fly 20 minutes at 10,000 ft, at max endurance airspeed, whichever is greater. The T-6A computed fuel flying at max endurance, 10,000 ft for 20 minutes is 125 lbs. Notice this is above 10% of max fuel load (120 lbs) so ALWAYS use 125 lbs for reserve fuel in the T-6A.

START/TAXI – Fuel required for start and taxi; 50 lbs for the T-6A.

TOTAL REQUIRED (4, 5, & 6) – The sum of lines 4, 5, & 6.

TOTAL ONBOARD – Total fuel prior to engine start. In the T-6A, we plan for 1100 lbs onboard fuel, but we can over-wing fuel to 1200 lbs if needed.

SPARE FUEL – Line 8 minus line 7. This figure is the final fuel determinant for your “go” or “no go” decision-making. If you have at least zero pounds of spare fuel, you can legally fly your route under the conditions expected in preflight planning. If your spare fuel is less than zero, your flight as planned is not legal, and you must change your fuel load, route of flight, destination, alternate, altitude, etc., to improve your fuel plan.

807. EMERGENCY “BINGO” TO ALTERNATE SECTION

The Emergency “Bingo” to Alternate section, Figure 8-8, summarizes the flight profiles to your alternate airfield and the information entered here is taken directly from the Alternate Section on the front of the flight log, and from the Fuel Plan Section on the back of the flight log.

LAST CRUISING ALTITUDE – Numbers relating to Profile I. Required fuel is taken from front of flight log (Profile I). Approach fuel is 50 lbs and Reserve fuel is taken from Fuel Plan Section, line 5.

INITIAL APP ALT – Numbers relating to Profile II. Required fuel is taken from front of flight log (Profile II). Approach fuel is 50 lbs and Reserve fuel is taken from Fuel Plan Section, line 5.

EMERGENCY "BINGO" TO ALTERNATE							
	REQUIRED	+	APPROACH	+	RES	=	TOTAL
LAST CRUISING ALT	_____	+	_____	+	_____	=	_____
							(MCF)
INITIAL APP ALT	_____	+	_____	+	_____	=	_____
BINGO	_____	+	_____	+	_____	=	_____
CHECK LIST	DESTINATION		ALTERNATE				EMER FIELDS

Figure 8-8: Emergency "Bingo" to Alternate Section

BINGO - Numbers relating to Profile III or "Bingo" profile. In REQUIRED column, enter Bingo altitude. In APPROACH column, enter BINGO airspeed (always 240 kts TAS for the T-6). In RES column, enter descent point. In TOTAL column, copy IFR Bingo fuel computed from BINGO chart.

808. CHECKLIST/DESTINATION/ALTERNATE SECTION

This section of the flight log contains useful information you should know about your destination, alternate, and enroute emergency fields. Most information can be found in the IFR Enroute Supplement and approach plates.

Choose emergency divert fields close to your route of flight. You are looking for airfields with at least 4000 feet of hard surface runway and a compatible approach for the T-6A. These airfields should be spread along your route of flight and should not include your destination or alternate airfields. Choose military or civilian fields with services compatible to your aircraft.

RWY LENGTH – Length and width of runway on which you plan to land.

LIGHTING – Airfield lighting, described in plain English or with abbreviations and symbols shown on the airfield sketch. You must know the meaning of any abbreviations or symbols that you list.

FUEL/JASU/LOX – Services available, found in IFR Enroute Supplement. Refer to the NATOPS Flight Manual or PCL for the current list of approved Fuel Types. The JASU unit for the T-6A is the NC-5 or NC-8A at USN and USMC bases. We do not use LOX in the T-6A.

ATIS – Appropriate ATIS, ASOS, or AWOS frequency

METRO – *Frequency* and *name* for METRO/PMSV facilities along the route.

RAPCON – Approach Control frequencies for your destination and alternate airfields as listed on front of flight log.

8-8 FLIGHT LOGS

CHECK LIST	DESTINATION	ALTERNATE	EMER FIELDS
RWY LENGTH			
LIGHTING			ID
FUEL/JASU/LOX			CH
ATIS			PAGE NO.
METRO			
RAPCON			
PAR MINS			
TAC MINS			
ARR GEAR			
PUBS			
NOTAMS			
FUEL PACKET			
FLASHLIGHT WALLET, ETC.			

Figure 8-9: Checklist/Destination/Alternate Section

PAR MINS – PAR/ILS precision approach weather minimums (not the DA) for predicted runway. Adjust for single-pilot absolute minimums.

TAC MINS – ASR/VOR/LOC/GPS non-precision approach weather minimums for predicted runway. Cross out the TAC, write in NP (Non-Precision), then enter published NP minimums for predicted runway.

ARR GEAR – Location of arresting gear, found on airport sketch and entered in clear and understandable terms, e.g., App end and Dep end. If none, enter “None,” not “N/A.”

PUBS, NOTAMS, FUEL PACKET, FLASHLIGHT, WALLET, ETC. – Preflight inventory. Simply place check marks in these blocks if you are satisfied that you have everything you need for flight.

ID – Emergency airfield name and 3-letter identifier.

CH – VOR frequency serving emergency airfield.

PAGE NO. – Page on which you can find emergency field in the IFR Enroute Supplement and approach plates.

809. T-6A PLANNING DATA

Total Fuel	1100 lbs
Start/Taxi/T/O	50 lbs
Penetration/Approach (20 minutes)	50 lbs
Reserve (20 min @ 10,000 feet)	125 lbs

CLIMB ALT	TIME	FUEL	DISTANCE
5000	2	20	5
10,000	4	40	10
15,000	6	60	15
20,000	8	80	20
25,000	10	100	25
30,000	15	130	50
31,000	16	135	55

Figure 8-10: Climb Data

CRUISE ALT	FUEL FLOW 240 TAS	FUEL FLOW 270 TAS
S/L	600	N/A
5000	525	N/A
10,000	450	N/A
15,000	375	465
20,000	325	400
25,000	300	365
31,000	275	315

Figure 8-11: Cruise Data

T-6A BINGO CHART

DISTANCE TO BASE NM	FUEL REQUIRED POUNDS (1)	TIME REQUIRED MINUTES	CRUISE ALTITUDE FEET	DESCENT DIST NM (2)
50	224	15	10000	22
60	242	18	11000	24
70	259	21	12000	27
80	277	25	13000	29
90	294	28	14000	32
100	312	31	15000	34
110	314	33	18000	35
120	315	35	21000	37
130	317	37	25000	38
140	318	39	28000	40
150	320	41	31000	41
160	335	44	31000	49
170	349	47	31000	57
180	364	49	31000	65
190	378	52	31000	73
200	393	55	31000	81

STANDARD DAY, ZERO WIND, DEFOG OFF, GEAR AND FLAPS UP.

1. INCLUDES 105 POUNDS FUEL RESERVE
2. MAX RANGE DESCENT - CLEAN CONFIGURATION, POWER SET FOR 1500 FPM DESCENT AT 180 KIAS
3. ASSUME 240 KTS TAS FOR AIRSPEED

Figure 8-12: Bingo Data

NOTE

All information is extracted from the performance data section found in the back of the T-6A NATOPS or PCL.

810. CONCLUSION

A flight log is a preflight planning document that helps you with fuel planning and route familiarization. A flight seldom progresses as it is planned. However, a flight log used in the proper context helps you make decisions affecting your fuel, distance, altitude, etc., so you arrive at your destination with minimum problems. Additionally, the fuel log is a valuable tool, if properly maintained, for extracting information requested by ATC during flight.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER NINE

IN-FLIGHT WEATHER ANALYSIS

901. INTRODUCTION

Some weather conditions are hazardous to flight. It is essential that you know what these hazardous conditions are, where to find out about them, and how to report them. Unfortunately, there is nothing that can be done to prevent the hazardous weather conditions from developing. However, you can avoid these conditions and let others know about them.

This chapter is included in this FTI primarily as a discussion on weather analysis during instrument flight. Most of this information is excerpted from the NIFM.

902. PREFLIGHT ANALYSIS

When you prepare for a flight, you always conduct your own analysis of the weather. You are negligent in the performance of your duties if you accept an analysis or forecast that you do not completely understand.

The object of this analysis is to give you a complete picture of the weather conditions and developments affecting your route of flight. It also enables you to intelligently discuss any apparent discrepancies in the forecasts.

Once you are in the air, you cannot always consult the forecaster or the weather charts to understand the reasons for unexpected weather changes. You must be able to determine the corrective action to be taken. At these times, you rely on your knowledge, experience, and the information that you obtained before your departure.

Before going into a weather office, know exactly what information you want. The information you need includes the following:

1. Local weather at the time of takeoff (T/O)
2. Local weather during climb to altitude
3. Weather enroute, and its possible effect on aircraft performance
4. Weather at your destination
5. Weather at your alternate destination(s)

The type of information needed varies considerably depending upon if you are flying a jet aircraft, a turboprop, a piston-driven propeller aircraft, or a helicopter. The following is a general guide for your preflight weather analysis.

The Weather Depiction Chart readily delineates the location of IFR and MVFR areas and provides ceiling, visibility, and cloud cover information for individual stations.

4. Next, check both the existing and forecast local weather for your estimated time of departure. Check the bases and tops of cloud layers, freezing level, crosswind, and runway temperature or pressure (density) altitude, when required.

Do not neglect takeoff weather in flight planning. If the local weather dictates, plan for the measures that must be taken to prepare the aircraft for entry into freezing clouds such as probes anti-ice.

On days when the weather is below available approach minimums, discretion requires a plan for a suitable takeoff alternate airport where you can land safely should an emergency occur after takeoff. A minute of planning for this possibility may pay rich dividends later.

Enroute

Check the winds along the route of flight through a considerable range of altitudes. This procedure helps you select the best altitude for aircraft performance. It also gives you a feel for the change in aircraft performance that you can expect if you are given a change in altitude enroute.

Look specifically for the extent of clouds that may be present along the proposed route. Check the altitude of the tops and bottoms of the clouds. When clouds are present and flight is conducted on instruments along the route, keep in mind the location of the nearest area that is VFR for letdown and landing in the event of complete radio failure or other emergency.

You must carefully determine the possibility of any hazards to flight along your proposed route. Know the altitude of the freezing level and the likelihood of icing. Do not plan a flight for extended periods in clouds with a temperature just below freezing—this is the level of maximum icing. (T-6A NATOPS only authorizes transit through 5000' of light rime icing.)

Check for the likelihood of thunderstorms and turbulence; avoid them whenever possible. If avoidance is not possible, plan to minimize their effect. The presence of fog, low ceiling, and low-visibility areas along the route are additional hazards. Know the location of these areas before leaving the weather office. A look at the Weather Depiction Chart, or the sequence reports, will disclose areas that are near or below IFR minimums.

Destination

You must know, in detail, the weather to be expected at your destination. If the weather is forecast to be IFR, analyze it closely, and then carefully choose the alternate(s). Look for the following:

1. Ceiling and visibility

2. Precipitation
3. Amount of snow, if present
4. Runway condition reading (RCR) or equivalent runway braking action
5. Forecast wind and the likelihood of crosswinds to the runway
6. The effect of surrounding topography on weather conditions at the field
7. The possibility of a delay in landing due to the presence of heavy showers or squalls at the destination

Always try to choose an alternate with better weather than the destination.

903. WEATHER BRIEFINGS

Before obtaining a flight clearance, you must receive a verbal weather briefing in person, by telephone, or by Internet. Additionally, a DD 175-1, Flight Weather Briefing Form, will be completed for all IFR flights.

The verbal briefing contains a detailed analysis of present and forecast weather in the immediate vicinity of the departure point, the flight route, and at the destination and alternate airfield(s). All potential hazards to flight are included. The DD-175-1 flight route weather briefings will include briefing (flimsy) number and brief void time.

The DD-175-1 briefs are only valid for 3.0 hours past briefing/Flight Weather Brief (FWB) delivery time or Estimated Time of Departure (ETD) plus one-half hour. This time may be extended if, in the opinion of the meteorologist, the extension does not affect the quality of the forecast. The forecast is considered valid for a period from one hour before until one hour after the planned arrival time at the destination or alternate.

If you are departing from an airfield with no weather briefing facility, telephone and Internet briefings are available from both military and civilian facilities. Telephone numbers for military briefing facilities are listed in the FIH and may be called collect.

The four categories of information available for preflight planning in the weather-briefing office are listed below.

1. Information received via teletype
2. Information received via facsimile and or Internet
3. Information prepared by local weather personnel
4. Information that may be read from weather instruments

9-4 INFLIGHT WEATHER ANALYSIS

Aviation Severe Weather Watch Bulletin (WW)

The National Weather Service (via the Service Storm Prediction Center) issues unscheduled Weather Watch (WW), “Willy-Willy,” whenever there is a high probability of severe weather development. These WWs are used to forecast hazardous flying conditions for a designated area and for a specified time.

Valid WW bulletins are graphically displayed in all Navy and Marine Corp weather-briefing offices. Except for operational necessity, emergencies, and flights involving all-weather research projects or weather reconnaissance, pilots shall not fly into or through areas for which the National Weather Service has issued an Aviation Severe Weather Watch Bulletin unless one of the following exceptions applies:

1. Storm development has not progressed as forecast for the planned route. In such situations:
 - a. VFR filing is permitted if existing and forecast weather for the planned route permits such flights.
 - b. IFR flight may be permitted if aircraft radar is installed and operative, permitting detection and avoidance of isolated thunderstorms.
 - c. IFR flight is permissible in controlled airspace if VMC can be maintained, enabling aircraft to detect and avoid isolated thunderstorms.
2. Performance characteristics of the aircraft permit an enroute flight altitude above existing or developing severe storms.

NOTE

It is not the intent to restrict flight within areas encompassed by or adjacent to a WW area unless storms have actually developed as forecast.

904. IN-FLIGHT WEATHER INFORMATION

There are five types of in-flight weather advisories, AIRMET (WA), SIGMETs (WST or WS), Center Weather Advisories (CWA), and Severe Weather Forecast Alerts (AWW).

AIRMET

AIRMETs apply to lighter aircraft. They are issued to cover moderate, potentially hazardous weather, including the following:

1. Moderate icing or Freezing Data. (AIRMET ZULU)

2. Moderate turbulence over an extensive area or sustained surface winds of 30 knots or greater. (AIRMET TANGO)
3. Extensive areas where visibility is less than 3 miles and or ceilings are less than 1,000 feet affecting over 50% of the area, or for mountain obscurations. (AIRMET SIERRA)

SIGMET – Convective and Non-convective

SIGMETs apply to all types of aircraft; they are issued to cover the more severe types of weather.

Convective SIGMETs (WST) cover the following:

1. Tornadoes
2. Line of thunderstorms
3. Hail of 3/4 inch or more in diameter, and/or surface winds of 50 knots or greater
4. Embedded thunderstorms
5. Area of thunderstorms covering 40% or more of an area at least 3,000 square miles.

NOTE

Icing, turbulence, and low-level wind shear are implied with convective SIGMET.

Non-convective SIGMETs (WS) cover the following:

1. Severe or extreme turbulence, or clear air turbulence (CAT) not associated with thunderstorms.
2. Severe icing, not associated with thunderstorms.
3. Dust storms, sandstorms, or volcanic ash lowering surface or in flight visibility to below 3 miles.
4. Volcanic eruption.

Center Weather Advisories (CWA)

CWAs are unscheduled in-flight, flow control, air traffic and aircrew advisories. They are issued to supplement WS, WST and AIRMETs, and to advise when weather conditions are expected or observed which meet conditions for SIGMET/AIRMETs issuance, but the warnings have not been issued yet. CWAs are also issued when weather conditions do not meet WS, WST or WA

9-6 INFLIGHT WEATHER ANALYSIS

criteria, but will adversely affect the safe flow of air traffic within the ARTCC area of responsibility.

Severe Weather Forecast Alerts (AWW)

AWWs are preliminary messages used to alert aircrews that a Severe Weather Warning (WW) is being issued. The messages are unscheduled and are issued as required by the Aviation weather center in Kansas City, MO. The AWW will define the areas of severe thunderstorms or tornadic activity.

Since in-flight weather advisories are designed for in-flight planning, they must be transmitted to aircraft enroute. Federal Aviation Administration (FAA) Flight Service Stations (FSSs) broadcast inflight weather advisories when they pertain to an area within 150 NM of the FSS. In-flight weather advisories are transmitted at 15 and 45 minutes past the hour during the first hour of their valid time. In addition, convective SIGMETs are transmitted on the hour and at 30 minutes past the hour. After the first hour, only an altering broadcast is transmitted at 15 and 45 minutes past the hour.

An example of a transmission is, “Washington SIGMET, or AIRMET, BRAVO 3 is current.” Refer to the FIH for more information on SIGMETs and AIRMETs.

Frequencies available for receiving inflight weather advisories are found in the IFR or VFR Enroute Supplement. FSSs are responsible for transmitting inflight weather advisories. FSSs are indicated in the Enroute Supplement by the word RADIO.

Inflight weather advisories are transmitted over all frequencies that are listed after the word RADIO with the exception of those frequencies that are followed by the letter “R.” For example, the “R” in **122.3R** indicates the FSS is only equipped to receive on that particular frequency.

FSSs

Direct pilot-to-weather briefer service is available by making radio contact with any FAA FSS on frequencies found in the Enroute Supplement or on the IFR enroute charts. Flight Service Specialists may not make original weather forecasts; however, they have the latest weather reports and terminal forecasts (PLATES or TAFORS) available for relay. They are authorized to interpret weather reports and describe the weather conditions you can expect to encounter.

Similar pilot-to-weather briefer service can usually be obtained from the ARTCC controller. Remember, FSSs are not weather forecasters.

Scheduled Weather Broadcasts

NAVAIDs that provide scheduled weather broadcasts are indicated by radio class B. For example, if the RADIO/NAV REMARKS section of the IFR Enroute Supplement listed a NAVAID as a BVORTAC, then it is a VORTAC providing scheduled weather broadcasts.

These stations broadcast weather information at 15 minutes past the hour. An ABVORTAC provides continuous automatic-transcribed weather broadcasts. Exceptions to these broadcast times are listed in the RADIO/NAV REMARKS.

NOTE

Remember voice reception is only possible over VOR frequencies.

Pilot-to-METRO Service (PMSV)

Direct PMSV is available at most major Air Force bases and Naval and Marine Corps Air Stations. Consult the IFR Enroute Supplement or the Flight Information Handbook (FIH) for the location and frequencies of these stations.

Communications are established by calling “<Base name> METRO,” e.g., “Oceana Metro.” When you utilize PMSV, you are generally talking directly to a military-weather forecaster who can assist you with any meteorological service available in his/ her office. They are authorized to update forecasts or issue new forecasts.

Maximum use of METRO briefing service when airborne is encouraged. METRO’s hours of operation are included in the FIH.

Pilot Reports

When ceilings are at or below 5000 feet, visibility is below 5 miles, or thunderstorms are reported (or forecast), FAA agencies are required to solicit pilot reports (PIREPs).

Aircrew members are urged to furnish information about cloud tops, cloud layers, location of thunderstorms, icing, and turbulence. The FAA uses this information to expedite traffic, to advise other aircraft of conditions, and to aid in forecasting. Additionally, PIREPS are usually requested by and given to METRO facilities.

NOTE

In accordance with OPNAVINST 3140.32, PIREPs are given under the following conditions:

1. When requested
2. When any unforecasted weather conditions are encountered

3. When the IFR approach and the actual weather differ from what was reported
4. When a missed approach is due to weather below minimums
5. When wind shear is encountered on approach or departure

PIREPs do not have to deal specifically with weather. A PIREP is essentially a report that is given in order to inform others of any hazards to aviation. A PIREP may be a simple report to the control tower that a runway has standing water or that the braking action on a certain runway is good, poor, etc.

A separate PIREP may be given to Ground Control informing them and all other aircraft that loose gear, foreign object debris (FOD), etc., is obstructing the taxiway.

Remember PIREPs are informative. If you experience an unusual phenomenon or note any situations that may be hazardous to any aircraft, tell someone!

905. WEATHER AVOIDANCE SERVICES

Because of radar-advisory service information, the pilot may decide to alter their route of flight to avoid severe weather areas; however, if the pilot is on an IFR Flight Plan, before doing so, he/she must first obtain a clearance from ATC to deviate from their present clearance.

There are two methods of receiving radar vectors to avoid thunderstorms and other severe weather while proceeding on an IFR Flight Plan.

Method One

First, request to switch to PMSV for radar-weather advisories. If you want to divert around the weather, permission must be obtained from ARTCC to fly off the airway in a specified direction and distance.

In low-density traffic areas, ARTCC may approve flight off the airway for this purpose. The aircrew must return to the ARTCC frequency immediately upon completion of the diversion.

Method Two

Radar vectors around areas of severe weather may be obtained in some situations directly from the ARTCC. This method is the more common of the two; however, the primary purpose of the center's radar is aircraft separation. The controller normally uses reduced video gain to eliminate weather from the scope.

Upon request, severe weather can sometimes be painted on the radar receiver, and the controller may give vectors to direct the aircraft around it or through the less severe sections of the storm. It should be noted that vectoring service is only offered when it does not interfere with the controller's primary duty of maintaining flight separation.

906. WEATHER CRITERIA FOR FILING

Flight plans are filed based on the following OPNAVINST 3710.7 criteria:

1. The enroute, destination, and alternate weather forecasts for a period of one hour prior until one hour after your ETA at your destination and the actual weather at the point of departure at the time of clearance
2. Meteorological conditions notwithstanding, IFR Flight Plans are filed and flown whenever practicable as a means to reduce midair collision potential. In any case, forecast meteorological conditions must meet the weather minima criteria (Figure 9-3) for filing IFR Flight Plans, and are based on the pilot's best judgment as to the runway that will be in use upon arrival.
3. IFR Flight Plans may be filed for destinations where the weather is forecast below the appropriate minimums, if a suitable alternate airfield is available during the period one hour before and one hour after the ETA. The suitable alternate airfield is defined as one that is forecast to have at least a 3000 foot ceiling and 3 statute miles visibility.
4. A suitable alternate must include a published approach compatible with installed aircraft navigational equipment, or forecast ceiling and visibility that permit descent from the minimum enroute altitude, approach, and landing under VMC.
5. When filing flight plans to a destination lacking a published approach that is compatible with operable aircraft navigation equipment, pilots shall ensure an alternate is selected that will permit execution of a published approach and landing in the event of lost radio communications.
6. An alternate airfield is not required when the weather at the destination is forecast to be equal to or better than a 3000 foot ceiling and 3-statute miles visibility during the period one hour before or one hour after ETA. Otherwise, an alternate field is required. The weather minima in parenthesis at the bottom of the approach plate are used for the filing of flight plans and the commencement of instrument approaches. In the case of single-piloted aircraft, absolute minimum weather is a 200 foot ceiling and ½ statute mile visibility. If the published minimums are lower than that, they must be adjusted to ensure that the ceiling is at least 200 feet and visibility is 1/2 mile. In Figure 9-2, 100 feet must be added to the PAR ceiling to ensure that it meets single-piloted minimums of 200 feet – 1/2 mile.

RADAR INSTRUMENT APPROACH MINIMUMS

PENSACOLA NAS (KNPA), (FORREST SHERMAN FLD), FL (Amdt 2, 15344 USN)
RADAR¹ - (E) 128.25 239.05 285.625 288.325 305.2 314.0 318.8 348.725 383.8 ELEV **28**

	<u>RWY</u>	<u>GS/TCH/RPI</u>	<u>CAT</u>	<u>DH/</u> <u>MDA-VIS</u>	<u>HAT/</u> <u>HATh/</u> <u>HAA</u>	<u>CEIL-VIS</u>
PAR	7L ²	3.0°/55/1078	ABCDE	124-¼	100	(100-¼)
	1 ⁵	3.0°/39/744	ABCDE	128-½	100	(100-½)
	7R	3.0°/55/1040	ABCDE	124-½	100	(100-½)
	19 ⁴	3.0°/40/737	ABCDE	116-½	100	(100-½)
	25L ⁵	3.0°/39/744	ABCDE	115-½	100	(100-½)
	25R ⁵	3.0°/38/745	ABCDE	116-½	100	(100-½)

Figure 9-2: Radar Instrument Approach Minimums for NAS Pensacola

7. Utilizing the OPNAVINST 3710.7 IFR Filing Criteria chart (Figure 9-3), you can easily determine the weather needed when choosing an alternate airfield. You can see that in the case where your destination has a 3000 feet ceiling and 3-miles visibility, or better, during the period one hour before and one hour after your ETA, you do not need an alternate airfield. However, aircrews should be familiar with CNATRAINST 3710.2 (Series) for alternate airfield fuel requirements for cross-country flights.

If your destination weather is 0 – 0, up to, but not including, published weather minimums, your alternate has to have at least a 3000 foot ceiling and a minimum of 3 miles visibility.

If the weather at your destination is at or above the minimums for the runway in use adjusted for single-piloted aircraft, but below a 3000 foot ceiling and/ or 3 miles visibility, you determine your alternate by adding 300 feet and 1 mile to that airfield’s lowest non-precision weather minimums (LOC or VOR), or 200 feet and ½ mile to that airfield's ILS minimums.

Next, compare this adjusted-weather minimum to your alternate airfield’s forecast weather. If the forecast weather is at or above these adjusted minima plus or minus one hour of your alternate ETA, you can use it as an alternate.

8. To clarify the use of PAR minimums when determining destination and alternate weather requirements, remember to do the following:

- a. Look at the weather forecast for your destination (ETA +/- 1 hour).
- b. Look for the lowest weather minimums for the runway in use, including PAR minimums.
- c. Compare the two and enter the information in the chart in Figure 9-3 with destination weather.

Remember that PAR minimums are taken into account for the destination-weather side of the chart, but not for the alternate-weather side of the chart. Also, note that if the PAR is NOTAM'd down for the runway in use, then you will not be able to use PAR minimums to determine your alternate weather. You would then use LOC/VOR/GPS minima.

For example, your destination is NAS Pensacola, and you are planning an approach to RWY 25R. Your forecast weather is 200 – 1/2. Your possible minima for this RWY (Category B) are LNAV MDA RWY 25R (500-1) and PAR RWY 25R (100 – 1/2).

Adjusted for single-piloted minima, the PAR-weather minimums become (200 – 1/2). Your lowest possible minima, after ensuring that the PAR is not NOTAM'd down at NAS Pensacola, is for the PAR 25R of (200 – 1/2).

You enter the destination-weather side of the chart (Figure 9-3). Look at the first row: 0 – 0 up to but not including published minimums. Your destination weather of 200 – 1/2 does not fall into this first category. It does, however, fall into the second category, which requires 300-1 above published non-precision approach minimums or 200-1/2 above published precision approach minimums. Note the * and footnote that says PAR/ASR approach minimums may not be used for selection of an alternate airfield by single-piloted aircraft.

DESTINATION WEATHER ETA plus and minus 1 hour	ALTERNATE WEATHER ETA plus and minus 1 hour	
0 — 0 up to but not including Published minimums	3,000 — 3 or better	
Published minimums up to but not including 3,000 — 3 (single — piloted absolute minimums 200 — 1/2) (single — piloted helicopter/tilt — rotor absolute minimums 200 — 1/4)	NON-PRECISION	PRECISION
	*Published minimums plus 300 — 1	*Published minimums plus 200 — 1/2
3,000 — 3 or better	No alternate required	
*In the case of single — piloted or other aircraft with only one operable UHF/VHF transceiver, radar/airport surveillance approach (PAR/ASR) minimums may not be used as the basis for selection of an alternate airfield.		

Figure 9-3: IFR Filing Criteria

T-6A aircraft are always considered single-piloted and PAR/ASR minima may not be used to choose an alternate. The PRECISION section is reserved for aircraft equipped with Instrument Landing System (ILS) or for aircraft intending to use PAR if they are dual-piloted and have at least two radios.

Takeoff Minima

If a pilot possesses a special instrument rating, no takeoff ceiling or visibility minima apply. Takeoff depends on the judgment of the pilot and the urgency of flight. If a pilot possesses a standard instrument rating, takeoff minimums must be published minimums for the available non-precision approach, but not less than a 300 foot ceiling and 1 statute mile visibility for the runway in use.

When a precision approach, compatible with installed and operable aircraft equipment is available, takeoff is authorized provided the weather is at least equal to the published precision-approach minimums but not less than a 200-foot ceiling and 1/2-statute mile visibility or 2400 feet RVR for the landing runway in use.

Section Takeoff/Approach

A two-plane formation of aircraft is defined as a section. Two-plane formation takeoffs and approaches are authorized provided the weather (ceiling and visibility) is at or above the published circling minimums for the runway in use. These conditions shall apply at the actual time of takeoff or landing and not the filing time. If the airfield does not possess circling minima, then basic VFR (1000 – 3) shall apply.

Approach Criteria for Single-Piloted Aircraft

Do not commence an instrument approach if the reported weather is below published minima for the type of approach to be performed at your destination airport. During a turbojet enroute descent, the approach is considered to commence when the aircraft descends below the highest initial penetration altitude established for the high-altitude instrument approach procedures for the destination airport.

Once an approach commences, a pilot may, at his or her discretion, continue the approach to the approved published landing minima as shown in the appropriate FLIP for the type approach being conducted.

The approach minima for a single-piloted aircraft executing an approach are absolute minimums of a 200 foot ceiling HAT and a visibility of 1/2 statute mile/2400 feet RVR or published minima, whichever is higher.

OPNAVINST 3710.7 allows single-piloted aircraft to execute practice approaches (no landing intended) at a facility where weather is reported below published minimums when operating with an appropriate ATC clearance. The facility in question must not be the filed destination or alternate and the weather at the filed destination and alternate must meet published filing criteria.

Approach Criteria for Multi-Piloted Aircraft

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

907. CONCLUSION

The aviator who is filing a flight plan must ensure that all essential weather elements are included in his or her briefing. They shall request clarification or additional information when any doubt exists.

How easy it is to successfully complete all-weather flights is directly proportional to the aircrew's preparation and their understanding of the flight's operating environment.

CHAPTER TEN EMERGENCY PROCEDURES

1000. INTRODUCTION

As you learned in the T-6A Contact stage, emergencies require more from us than merely reciting boldface procedures or blindly following checklists. Every emergency must be considered in context; emergencies under IFR are no different. As you study your boldface and other emergency procedures in preparation for instrument sorties, take the time to think about how IFR flying (in both IMC and VMC) will change the way each emergency is handled. If an emergency procedure calls for you to execute a Precautionary Emergency Landing (PEL) and the PEL procedure directs you to intercept the Emergency Landing Pattern (ELP), where are you going to intercept the pattern? How are you going to navigate to that point of intercept? Will the ceiling and visibility permit flying the ELP in VMC? How soon are you going to want to land, and which airfield is best suited to handle your emergency? How and when are you going to coordinate with ATC?

This chapter addresses some common IFR emergency considerations, but it is by no means a catalog of every contingency you might face. Good judgment, SA, preflight preparation, and a thorough knowledge of flight regulations, procedures, and aircraft systems are your best assets in any emergency.

1001. EMERGENCY FIELD SELECTION

A good aircrew always looks for suitable emergency landing fields before an emergency happens. Under IMC, factors determining field suitability include not only runway length and availability of maintenance services, but also approach availability and lighting. The enroute charts depict aerodromes with DoD published approaches in blue. The charts also give field elevation, runway length, and lighting information. To determine whether the approaches are compatible with your NAVAIDs, you should be familiar with the approach plates for suitable fields along your intended route of flight. If an emergency occurs, perform the immediate action items prescribed by NATOPS, and contact ATC to inform them of your situation and intentions. If necessary, ATC can assist in selection of and navigation to the nearest suitable field. Remember, performing accurate operations checks can lead to early detection of potentially large problems and help to keep them smaller and more manageable.

1002. LOST COMMUNICATIONS

Refer to the FIH, Section A, for lost communication procedures. It is virtually impossible to provide regulations and procedures applicable to all possible situations associated with two-way radio communications failure; good judgment and SA are among your best assets in determining how to handle this type of emergency.

Once you have verified that you have lost communications, squawk 7600, and comply with the FIH. In all circumstances, monitor all available communication frequencies; including voice-capable VORs, and make radio calls “in the blind.”

1003. ICING

Refer to NATOPS icing discussions (Chapters 5 and 7). The SOP prohibits filing into areas where icing conditions are forecast. Since instrument flight may involve prolonged operation through areas of visible moisture, you must note the OAT, particularly during climbs and descents, in order to avoid prolonged flight in icing conditions.

NOTE

Actual OAT is roughly 15° less than indicated OAT. Reference the T-6A NATOPS PCL to find an accurate, actual OAT.

The probes anti-ice and windshield defogger are the only devices available to combat icing, and are of limited value in removing ice. Use them when entering visible moisture, before ice has a chance to accumulate. Fly over, under, or around any known icing conditions. If ice has formed despite all precautions, climb or descend to get out of the icing conditions. If you must land with ice on the aircraft, increase your airspeed as necessary during the approach to maintain positive control of the aircraft and consider a no-flap landing.

1004. AIRCRAFT EMERGENCIES UNDER IFR

Although NATOPS provides procedural guidance for specific emergency situations, it does not provide precise guidance for all situations. You must develop the ability to recognize and analyze emergency situations, and then determine a course of action that will ensure the safety of the crew and aircraft. Remember the golden rule: “**AVIATE, NAVIGATE, COMMUNICATE, CHECKLISTS.**” Continue to perform your flying duties while executing the emergency procedures in a timely manner. Determine the nature of the emergency and the urgency with which you should land. Then devise a plan and execute it. Notify ATC by declaring an emergency and advise them of your intended action (requesting priority handling as necessary). The following factors will influence your decision: severity of the emergency, weather conditions, fuel remaining, aircraft status and position, airfield proximity, approach availability, and terrain. If you are lost, state your last known position, time, and heading since that known position.

In an emergency requiring immediate action, your instructor may deviate from any rule or regulation as necessary to maintain safety of flight. If this emergency authority is exercised and will result in a deviation from an ATC clearance, you must notify ATC as soon as possible and get an amended clearance.

Emergencies are generally classified under one of two categories:

1. **Distress:** A condition of being threatened by serious and/or imminent danger and requiring immediate assistance.
2. **Urgency:** A condition of being concerned about safety and requiring timely (but not immediate) assistance, although the potential for a distress situation exists.

10-2 EMERGENCY PROCEDURES

NOTE

If in radio contact with ATC, continue squawking the assigned transponder code. If unable to immediately establish two-way radio communications with ATC, squawk code 7700.

If possible, remain or gain VMC while executing the appropriate emergency procedures. Notify ATC of the nature of your emergency and your intended course of action. It is your instructor's decision to continue the flight or land as soon as possible. When communicating with ATC, consider your terminology. ATC will probably be unfamiliar with the term PEL; however, they will certainly understand the request for a "precautionary approach" or an "emergency landing."

In a situation that requires a PEL under IMC, you may not be able to intercept the ELP at a point sooner than short final. Determine your present position relative to the nearest IAF compatible with the navigational equipment installed on your aircraft. **Do not hesitate** to declare an emergency if priority handling would expedite your approach and landing. Use good headwork when requesting an approach; radar vectors to FAC are expeditious but not always available. SA is essential to good headwork and the expeditious handling of any emergency.

Examples of emergency approach requests are:

1. *"Pensacola Approach, KATT 6XX, declaring an emergency, low oil pressure. Request immediate clearance for the RNAV One approach into Navy Sherman."*
2. *"Pensacola Approach, KATT 6XX, declaring an emergency, experiencing fuel fumes in the cockpit. Request radar vectors for an ILS One Seven approach at Pensacola Regional Airport."*

Other considerations may include:

1. Requesting a crash crew or ambulance to be standing by.
2. Maintaining airspeed and/or altitude until closer to the FAF or runway, especially in the case of low fuel or impending engine failure.
3. Ejecting if you cannot reach or navigate to a suitable landing surface.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A GLOSSARY

This list is not intended to be all-inclusive. Refer to the current version of the AIM, FLIP, GP and the 7110.65 ATC Manual.

AIRPORT SURVEILLANCE RADAR (ASR) APPROACH - Radar providing position of aircraft by azimuth and range data but without elevation data. It is designed for a maximum range of 60 miles. Used for terminal approach control. Also used for surveillance approaches. The ASR approach is conducted in accordance with directions issued by a controller referring only to the surveillance display. Also see GCA.

AIR ROUTE TRAFFIC CONTROL CENTER (ARTCC) - A facility established to provide traffic control service to IFR flights operating within controlled airspace and principally during the enroute phase of flight.

ATC CLEARANCE - Authorization by ATC facilities for an aircraft to proceed under specified traffic conditions within controlled airspace.

ALTITUDE RESTRICTION - An altitude or altitudes, stated in the order flown, which are to be maintained until reaching a specific point or time. Altitude restrictions may be issued by ATC due to traffic, terrain, or other airspace considerations.

APPROACH CONTROL FACILITY - A terminal ATC facility that provides approach control service in a terminal area.

NOTE

Approach control service is provided by an Approach Control facility for arriving and departing aircraft. At some airports not serviced by an Approach Control facility, the ARTCC provides limited Approach control service.

AUTOMATIC TERMINAL INFORMATION SERVICE (ATIS) - The continuous broadcast of recorded non-control information in selected terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information.

CEILING - The height above the earth's surface of the lowest layer of clouds or obscuring phenomena that is reported as "broken," "overcast," or "obscuration."

CIRCLE-TO-LAND MANEUVER - A maneuver initiated by the pilot to align the aircraft with a runway for landing when a straight-in landing from an instrument approach is not possible or is not desirable.

CLEARANCE LIMIT - The fix to which an aircraft is cleared.

COMPULSORY REPORTING POINTS - Reporting points, which must be reported to ATC when not in radar contact. They are designated on aeronautical charts by solid triangles or filed in a flight plan as fixes selected to define direct routes. These points are geographical locations, which are defined by navigation aids/fixes. Pilots should discontinue position reporting over compulsory reporting points when informed by ATC that their aircraft is in “radar contact.”

COURSE - A magnetic direction to fly in relation to a radio navigational facility. Note that a course is not only a magnetic direction over the ground. If flying inbound on a radial, the course is the reciprocal of the radial. If flying outbound, the course is the same as the radial.

DECISION ALTITUDE (DA) - With respect to the operation of the aircraft means the altitude (MSL) at which a decision must be made, using an ILS or PAR instrument approach, either to continue the approach or to execute a missed approach.

DEPARTURE CONTROL - ATC service provided to departing aircraft.

DEPARTURE PROCEDURES (DPs) - A DP is a preplanned, coded IFR departure route. It provides the following advantages:

1. Graphic portrayal of departure route.
2. Reduces time delay and radio communications required to issue clearances.
3. Provides approved ATC departure route clearance in the event of radio failure.

DIRECT - Straight line flight between two NAVAIDs, fixes, points, or any combination thereof. When used by pilots in describing off-airway routes, points defining direct route segments become compulsory reporting points unless the aircraft is under radar contact.

DME FIX - A geographical position determined by reference to a NAVAID. It is defined by a specified distance in NM and a radial in degrees magnetic from that aid. Example: A point 10 NM west of the NSE VORTAC on the 270° radial would be written as: NSE 270010.

EMERGENCY SAFE ALTITUDE - An altitude expressed in 100-foot increments providing 1000 feet of clearance (2000 feet in designated mountainous areas) over all obstructions/terrain within 100 miles.

EMERGENCY FUEL - A declaration made by the pilot to inform ATC that the aircraft fuel status is dangerously low. The pilot is requesting priority handling and cannot accept any delays for the approach.

ESTABLISHED ON COURSE - When the aircraft position is within five radials of the selected course and the aircraft's movement is in the same direction as the selected course. A shallow intercept to course will be defined as aircraft heading within 30° of the desired course.

EXPECTED FURTHER CLEARANCE (EFC) (TIME) - The time aircrew can expect to receive clearance beyond a clearance limit.

FINAL APPROACH SEGMENT - The segment of an instrument approach between the FAF and the MAP.

FINAL APPROACH FIX (FAF) - The fix from or over which final approach (IFR) to an airport is executed.

FIX - A geographical position determined by reference to one or more radio NAVAIDs. A fix can be defined as the actual location of the NAVAID, a distance and radial from a NAVAID, the crossing point of two different radials from two different NAVAIDs, or a GPS waypoint.

FLIGHT PLAN - Specified information provided to ATC facilities, relative to the intended flight of an aircraft.

FLIGHT SERVICE STATION (FSS) - A facility operated by the FAA to provide flight assistance service. (Their callsign is “_____ Radio,” Example: “Anniston Radio”)

GLOBAL POSITIONING SYSTEM – The worldwide positioning, navigation, and timing determination capability available from the U.S. satellite constellation.

GROUND CONTROLLED APPROACH (GCA)/ RADAR APPROACHES (RA) - A radar approach system whereby a controller interprets a radar display, transmitting approach instructions to the pilot by radio, to place the aircraft in position for landing. The approach may use ASR providing course and range information, or PAR providing course, range, and glideslope information. Usage of the term “GCA” by aircrews is discouraged. Aircrews should specifically request a “PAR” or Surveillance approach.

HEADING - The direction the longitudinal axis of the aircraft is pointed, usually expressed in degrees magnetic.

HEIGHT ABOVE AIRPORT (HAA) - The height of the MDA above the published airport elevation. Published in conjunction with circling minimums.

HEIGHT ABOVE TOUCHDOWN (HAT) - The height of the DA or MDA above the highest runway elevation in the touchdown zone (first 3000 feet of the runway). HAT is published on instrument approach charts in conjunction with all straight-in minimums.

INITIAL APPROACH FIX (IAF) - The fix depicted on an IAP chart that identifies the beginning of the initial approach segment.

INITIAL APPROACH SEGMENT - The part of an instrument approach between the IAF and the intermediate or FAF or point.

INITIAL CONTACT - The first radio call you make to a given facility or the first call to a different controller.

INSTRUMENT DEPARTURE PROCEDURE (DP) - A preplanned instrument flight rule (IFR) ATC departure procedure printed for aircrew use in graphic and/or textual form. DPs provide transition from the terminal to the appropriate enroute structure.

INSTRUMENT METEOROLOGICAL CONDITIONS (IMC) - Weather conditions (visibility, ceiling and cloud clearance) below the minimums for flight under visual flight rules (VFR).

INTERMEDIATE APPROACH SEGMENT - The part of an IAP from the first arrival at the first navigational facility or predetermined fix, to the beginning of the final approach.

INTERSECTION - An intersection is a point defined by a combination of two or more radials from two or more NAVAIDs. An intersection may also be defined as a radial and DME. Intersections may be used to indicate fixed positions along the airways.

JET ROUTES - A high altitude route system extending from 18,000 feet MSL to FL 450, inclusive. The routes are predicated by high altitude NAVAID.

LNAV - Lateral Navigation - A function of area navigation (RNAV) equipment which calculates, displays, and provides lateral guidance to a profile or path. Essentially, course guidance provided by GPS.

MANDATORY ALTITUDE (INSTRUMENT APPROACH) - The MSL altitude vertical to a geographic location, which an aircraft must maintain during a portion of an instrument approach. The requirement for such may be created by airspace separation criteria or airspace separation criteria in conjunction with obstruction clearance criteria. A mandatory altitude will be depicted as an underlined number with a line above it.

MANEUVERING AIRSPACE - Airspace used at an IAF to allow an aircraft to maneuver for a favorable alignment with the initial approach course.

MAXIMUM ALTITUDE (INSTRUMENT APPROACH) - The MSL altitude vertical to a geographic location above which an aircraft may not be flown during an instrument approach until after passing the location. The requirement for a maximum altitude may be created by airspace separation criteria. On the approach plate, a maximum altitude will be depicted as a number with a line above it.

MINIMUM CROSSING ALTITUDE (MCA) - The lowest altitudes at certain fixes at which an aircraft must cross when proceeding in the direction of a higher Minimum Enroute IFR Altitude.

MINIMUM DESCENT ALTITUDE (MDA) - The lowest altitude, expressed in feet above MSL, to which descent is authorized on final approach or during circling-to-land maneuvering in execution of a standard IAP where no electronic glideslope is provided.

MINIMUM ENROUTE ALTITUDE (MEA) - The altitude established between NAVAIDs or reporting points on airways, air routes, or advisory routes, which will meet obstruction clearance requirements, and which will also assure acceptable navigational signal coverage.

MINIMUM FUEL - Indicates an aircraft's fuel supply has reached a state where, upon reaching the destination, it can accept little or no delay. This is not an emergency situation but merely indicates an emergency situation is possible should any undue delay occur. The pilot is not to expect priority handling unless specifically requested or declares "emergency fuel."

MINIMUM OBSTRUCTION CLEARANCE ALTITUDE (MOCA) - The lowest published altitude in effect between radio fixes on VOR airways, off-airway routes or route segments, which meets obstruction clearance requirements for the entire route segment and which assures acceptable navigational signal coverage only within 25 SM/22 NM, of a VOR.

MINIMUM RECEPTION ALTITUDE (MRA) - The lowest altitude required to receive adequate signals to determine specific VOR/VORTAC/TACAN fixes.

MINIMUM SAFE ALTITUDE (MSA) - An altitude expressed in 100-foot increments providing 1000 feet of clearance over all obstructions/terrain within 25 NM of the NAVAID on which the instrument approach chart is centered. These altitudes will be identified as minimum sector altitudes or emergency safe altitudes.

MINIMUM SECTOR ALTITUDE - Altitude that provides 1000 feet of obstacle clearance within 25 NM of a NAVAID. It is designated for sectors of at least 90° and found on the plan view of IAPs. These altitudes are for emergency use only and do not assure acceptable NAVAID sector coverage.

MINIMUM VECTORING ALTITUDE (MVA) - The lowest altitude, (expressed as an MSL altitude) an aircraft will be vectored by a radar controller. This altitude assures communications radar coverage and meets obstruction clearance criteria. It may be lower than the MEA.

MISSED APPROACH - A maneuver conducted by a pilot when an instrument approach cannot be completed to a landing.

MISSED APPROACH POINT (MAP) - A point on an instrument approach at which missed approach procedures shall be executed if required visual reference does not exist.

NAVAID - An electronic device that provides position data to aircraft in flight. NAVAIDs are normally located at fixed positions on the ground. The NAVAIDs most commonly used by the T-6A are VOR and VORTAC.

NON-PRECISION APPROACH - A standard IAP in which no electronic glideslope is provided (e.g., VOR, LOC, GPS, or ASR approaches).

PRECISION APPROACH RADAR (PAR) - A standard IAP in which an electronic glideslope is provided. In this type of approach, the pilot is provided with course and altitude information. A PAR approach is a precision approach. (See GCA.)

PUBLISHED ROUTE - A route for which an IFR altitude has been established and published (e.g., federal airways, jet routes, area navigation routes, specified direct (feeder) routes).

PROCEDURE TURN (PT) - A maneuver used to reverse direction to establish an aircraft on the intermediate approach segment or FAC of an instrument approach. The outbound course, direction of turn, distance within which the turn must be completed, and minimum altitude are specified in the procedure; 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.

RADAR BEACON - A radar system in which the object to be detected is fitted with cooperative equipment in the form of a radio receiver/transmitter (transponder). Radio pulses transmitted from the searching transmitter/receiver (interrogator) site are received in the cooperative equipment and used to trigger a distinctive transmission from the transponder. This latter transmission, rather than a reflected signal, is then received back at the transmitter/receiver site.

RADAR ENVIRONMENT - An area in which radar service may be provided.

RADAR IDENTIFICATION - The process of ascertaining that a radar target is the radar return from a particular aircraft.

RADAR VECTOR - A heading issued to an aircraft to provide navigational guidance by radar.

RADIAL - A radial is a magnetic bearing extending from a VOR, VORTAC, or TACAN.

RADIO MAGNETIC INDICATOR (RMI) - A navigation instrument that indicates both magnetic heading and magnetic bearing to a selected radio navigation facility.

REPORTING POINT - A specified geographic location in relation to which the position of an aircraft can be reported.

RUNWAY VISUAL RANGE (RVR) - The horizontal distance a pilot will see down the runway from the approach end. RVR is determined with electronic instruments and is reported in hundreds of feet. RVR, in contrast to prevailing or runway visibility, is based on what a pilot in a moving aircraft should see looking down the runway. RVR is horizontal visual range (*NOT* slant range).

STANDARD INSTRUMENT DEPARTURE / SID - A preplanned Instrument Flight Rule (IFR) Air Traffic Control departure procedure printed for pilot use in graphic and/or textual form. SIDs provide transition from the terminal to the appropriate enroute structure.

SHORT RANGE CLEARANCE - A clearance issued to a departing IFR flight which authorizes IFR flight to a specific fix short of the destination while ATC facilities are coordinating and obtaining the complete clearance.

STANDARD TERMINAL ARRIVAL (STAR) - A preplanned instrument flight rule (IFR) ATC arrival procedure published for pilot use in graphic and/or textual form. STARS provide transition from the enroute structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area.

STATION - A radio navigational aid (see NAVAID).

STEPDOWN FIX - A fix permitting additional descent while on a segment of an instrument approach. The fix identifies a point at which a controlling obstacle has been safely over flown.

STRAIGHT-IN APPROACH - IFR - An instrument approach wherein final approach is begun without first having executed a procedure turn. This type of approach is not necessarily completed with a straight-in landing or made to straight-in landing minimums.

STRAIGHT-IN LANDING - A landing made on a runway aligned within 30° of the FAC following completion of an instrument approach.

TERMINAL ARRIVAL AREA (TAA) - The TAA provides a very efficient method for routing RNAV (GPS) equipped traffic into the terminal environment with less ATC interface, and with minimum altitudes depicted that provide 1,000 feet of obstacle clearance (or more as necessary in mountainous areas). The TAA will not be found on all RNAV (GPS) procedures, particularly in areas of heavy concentration of air traffic. When the TAA is published, it replaces the MSA for that approach procedure.

TRACK - The actual flight path of an aircraft over the surface of the earth.

TRANSPONDER - The airborne radar beacon receiver/transmitter portion of the ATC Radar Beacon System. (See Radar Beacon.)

VICTOR AIRWAYS - A route system established in the form of a corridor on controlled airspace. The routes are predicated solely on VOR/VORTAC NAVAIDS. Victor airways include airspace at least 1200 feet above the surface (sometimes higher) up to but not including 18,000 feet MSL.

VISUAL DESCENT POINT (VDP) - A defined point on the FAC of a non-precision straight-in approach procedure from which normal descent from the MDA to the runway touchdown point may be commenced, provided the approach threshold of that runway, or approach lights, or other markings identifiable with the approach end of that runway are clearly visible to the pilot.

WAYPOINT - A predetermined geographical position used for route or approach definition that is defined relative to a VORTAC station or in terms of latitude/longitude coordinates.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX B ACRONYMS

ADF	Automatic Direction Finder
ADI	Attitude Direction Indicator
AFR	Actual Fuel Remaining
AGL	Above Ground Level
AHRS	Attitude Heading and Reference System
AIM	Aeronautical Information Manual
AOA	Angle of Attack
AOB	Angle of Bank
AP	Area Planning
API	Aviation Preflight Indoctrination
ARP	Airport Reference Point
ARTCC	Air Route Traffic Control Centers
ASOS	Automated Surface Observation System
ASR	Airport Surveillance Radar
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATIS	Automated Terminal Information Service
AWOS	Automated Weather Observation System
BAC	Basic Approach Configuration
CAT	Clear Air Turbulence
CB	Course to the Bearing pointer
CDI	Course Deviation Indicator
CI	Climbout Instructions

CRM	Crew Resource Management
CTAF	Common Traffic Advisory Frequency
CTS	Course Training Standards
DA	Decision Altitude
DME	Distance Measuring Equipment
DoD	Department of Defense
DP	Departure Procedures
DTA	Double The Angle
DTK	Desired Track
EADI	Electronic Attitude Direction Indicator
EFAS	Enroute Flight Advisory Service
EFC	Expect Further Clearance
EFIS	Electronic Flight Instrument System
EFR	Estimated Fuel Remaining
EHSI	Electronic Horizontal Situation Indicator
ELP	Emergency Landing Pattern
ET	Elapsed Time
ETA	Estimated Time of Arrival
ETE	Estimated Time Enroute
FAA	Federal Aviation Administration
FAC	Final Approach Course
FAF	Final Approach Fix
FAR	Federal Aviation Regulations
FIH	Flight Information Handbook
FL	Flight Level

FLIP	Flight Information Publications
FLOLS	Fresnel Lens Optical Landing System
FOD	Foreign Object Damage; Foreign Object Debris
FPM	Feet Per Minute
FPNM	Feet Per Nautical Mile
FSS	Flight Service Station
FTI	Flight Training Instruction
FWB	Flight Weather Brief
GCA	Ground Controlled Approach
GMT	Greenwich Mean Time
GP	General Planning
GPS	Global Positioning System
GS	Groundspeed; Glideslope
HAA	Height Above Airport
HAT	Height Above Touchdown
HSI	Horizontal Situation Indicator
IAF	Initial Approach Fix
IAP	Instrument Approach Procedure
IAS	Indicated Airspeed
IAW	In Accordance With
ICS	Intercommunications System
IF	Intermediate Fix
IFG	In-Flight Guide
IFLOLS	Improved Fresnel Lens Optical Landing System
IFR	Instrument Flight Rules

ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
INAV	Instrument Navigation
IP	Instructor Pilot
ISS	Inter Seat Sequencer
ITO	Instrument Takeoff
KGS	Knots Groundspeed
KIAS	Knots Indicated Airspeed
KTAS	Knots True Airspeed
LC	Lost Communications
LOC	Localizer
LOX	Liquid Oxygen
LNAV	Lateral Navigation
LR	Lead Radial
LT	Local Time
MAB	Missed Approach Brief
MAP	Missed Approach Point
MCF	Mission Completion Fuel
MCG	Master Curriculum Guide
MDA	Minimum Descent Altitude
MHA	Minimum Holding Altitude
MOT	Mark On-Top
MSA	Minimum Safe Altitude
MSL	Mean Sea Level
MVA	Minimum Vectoring Altitude

NAS	Naval Air Station
NAVAID	Navigational Aid
NIFM	NATOPS Instrument Flight Manual
NM	Nautical Miles
NOTAM	Notice to Airmen
NP	Non-Precision
OAT	Outside Air Temperature
ODP	Obstacle Departure Procedure
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
PCL	Pocket Checklist
PEL	Precautionary Emergency Landing
PIC	Pilot in Command
PMSV	Pilot-to-Metro Service
PPR	Prior Permission Required
PT	Procedure Turn
PTP	Point-to-Point
R	Right
RAPCON	Radar Approach Control
RCR	Runway Condition Rating
RMU	Radio Management Unit
RNAV	Radar Navigation
RVR	Runway Visual Range
RWY	Runway
SA	Situational Awareness

SID	Standard Instrument Departure
SM	Statute Miles
SOP	Standard Operating Procedures
SRT	Standard Rate Turn
STAR	Standard Terminal Arrival Route
TAA	Terminal Arrival Area
TACAN	Tactical Air Navigation
TAS	Traffic Avoidance System; True Airspeed
TCN	Temporary Change Notice; Terminal Change Notice
TDC	Tail to Desired Course
TFR	Temporary Flight Restrictions
TPP	Terminal Procedures Publication
UHF	Ultrahigh Frequency
UMFO	Undergraduate Military Flight Officer
USAF	United States Air Force
USN	United States Navy
VASI	Visual Approach Slope Indicator
VCOA	Visual Climb Over the Airport
VDP	Visual Descent Point
VHF	Very High Frequency
VMC	Visual Meteorological Conditions
VOR	VHF (Very High Frequency) Omni-directional Radio-range
VOT	VOR Test
VSI	Vertical Speed Indicator
WW	Weather Watch