NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-1265 (Rev. 10-10) PAT**

FLIGHT SUPPORT LECTURE GUIDE

RADIO INSTRUMENT FLIGHT PROCEDURES

T-45C

2010

DEPARTMENT OF THE NAVY
CHIEF OF NAVAL AIR TRAINING
CNATRA
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Subj: FLIGHT SUPPORT LECTURE GUIDE, RADIO INSTRUMENT FLIGHT PROCEDURES, T-45C

1. CNATRA P-1265 (Rev. 10-10) PAT, "Flight Support Lecture Guide, RADIO INSTRUMENT FLIGHT PROCEDURES, T-45C" is issued for information, standardization of instruction, and guidance for all flight instructors and student aviators within the Naval Air Training Command.

2. This publication shall be used as an explanatory aid to support the T-45C Flight Training 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 CNATRA TCR form 1550/19 in accordance with CNATRAINST 1550.6E.

4. CNATRA P-1265 (05-99) PAT is hereby cancelled and superseded.

Thomas E. Broderick
THOMAS E. BRODERICK
Chief of Staff

Distribution:
CNATRA N7 (5) Plus Original
COMTRAWING ONE (200)
COMTRAWING TWO (200)

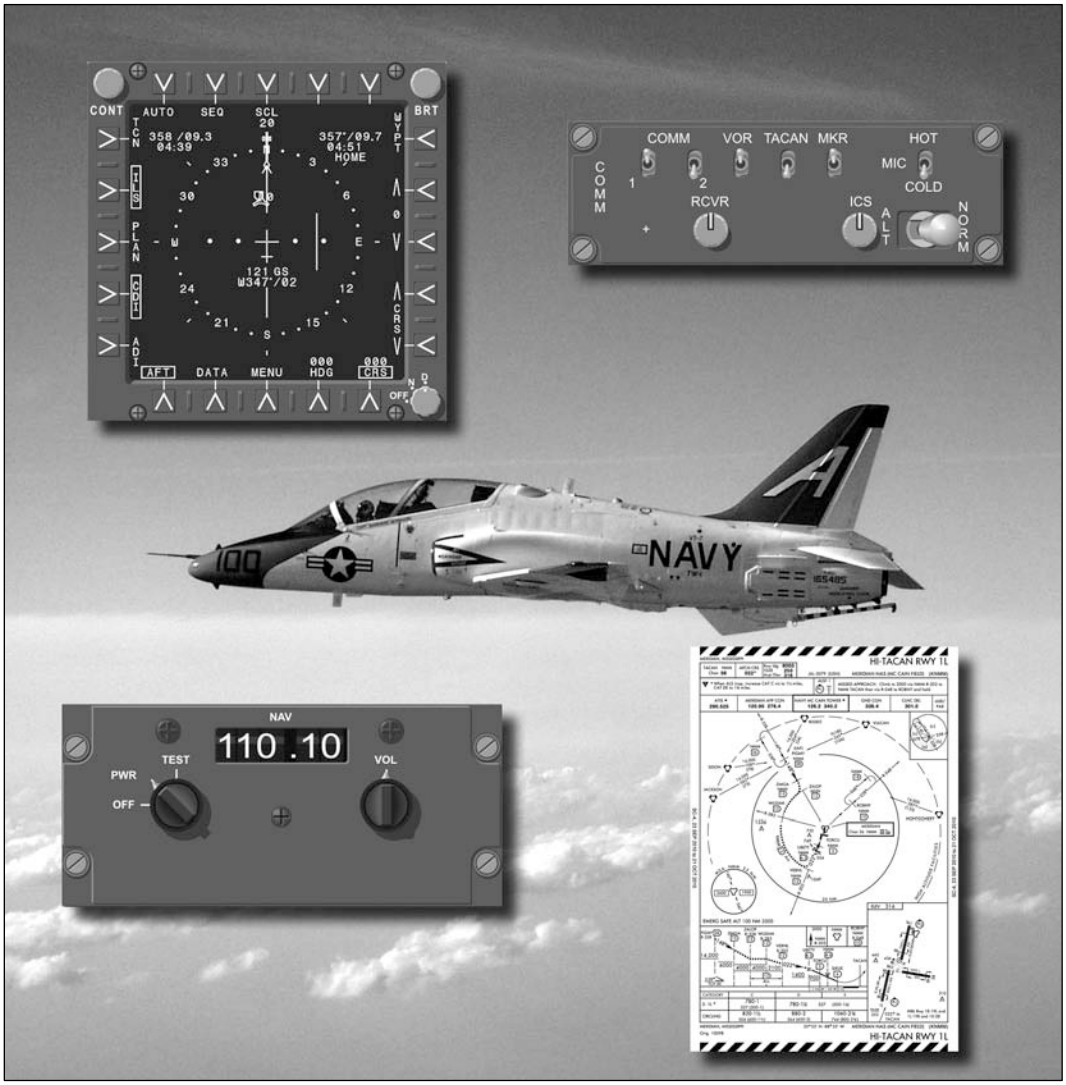
FLIGHT SUPPORT LECTURE GUIDE

FOR

RADIO INSTRUMENT FLIGHT PROCEDURES

T-45C

Q-2A-0192, Q-2A-0196, Q-2A-0197



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CHAPTER ONE
INTRODUCTION TO RADIO INSTRUMENTS

100. INTRODUCTION – N/A

COURSE/STAGE:

- T-45C TS, ADV, & IUT/Radio Instrument Flight Procedures (RIFP)

LESSON TITLE:

- Introduction to Radio Instruments

LESSON IDENTIFIER:

- T-45C TS, ADV, & IUT RIFP-01

LEARNING ENVIRONMENT:

- Classroom

ALLOTTED LESSON TIME:

- 2.5 hr

STUDY RESOURCES:

1. NATOPS Instrument Flight Manual, NAVAIR 00-80T-112

2. T-45C Instrument FTI

LESSON PREPARATION:

1. Review the following sections in NATOPS Instrument Flight Manual, NAVAIR 00-80T-112:

   a. 20.3 through 20.3.12

   b. 21.2.3 through 21.2.3.9

   c. 27.2.2

2. Review Flight Procedures from Instrument FTI.

REINFORCEMENT:

- N/A

LESSON EXAMINATION:

- The objectives in this lesson will be tested in TS and IUT RIFP-05X and ADV RIFP-06X.

101. LESSON OBJECTIVES

1. Recall procedures for a standard instrument departure

2. Recall procedures for performing radial intercepts

3. Recall indications of station passage on the TACAN/VOR/VOR DME

4. Recall procedures for flying TACAN/VOR DME arc

5. Recall voice procedures associated with instrument navigation

6. Recall procedures for computing ground speed using TACAN/VOR DME

7. Recall procedures for correcting wind drift using TACAN/VOR/VOR DME

8. Recall procedures for performing TACAN/VOR DME point-to-point navigation (and update)

9. Recall procedures for performing direct routing

10. Recall procedures /IAS for flying TACAN/VOR DME holding

11. Recall procedures/IAS for flying VOR holding

12. Recall (flight path) information for an ILS approach

13. Recall procedures for an ILS approach

14. Recall procedures for performing back course (LOC) approach

15. Recall procedures for performing transition from instrument to visual scan

16. Recall procedures for performing a circling approach

17. Recall procedures for performing missed approach

18. Recall procedures for climb, cruise, and descent profiles

1-2 INTRODUCTION TO RADIO INSTRUMENTS

19. Recall procedures for performing partial panel approaches

20. Recall procedures for performing minimum fuel/emergency fuel instrument approach

21. Recall procedures for performing emergency oil instrument approach

22. Recall procedures for coping with NAVAID failures

102. MOTIVATION

To prepare you for the RI hands-on lessons and the Airways Navigation block, this lesson will review several TACAN/VOR procedures already presented in previous BI and INav lessons. Your return to the ship at night will be facilitated by a TACAN, ACLS, or ILS pickup. The requirement to fly the approach with precision is paramount to a safe recovery, and the first step in achieving the needed precision is a thorough knowledge of the procedures.

103. OVERVIEW

After this lesson, you will have reviewed the basic enroute radio navigation procedures for SIDs, radial/bearing intercepts, arcing, point-to-point navigation, ground speed checks, time/distance checks, voice procedures, and direct routing.

In this lesson we will be reviewing procedures for:

1. Standard Instrument Departures (SIDs)

2. Radial intercepts

3. Indications of station passage on the VOR – TACAN/VOR/VOR DME

4. Flying a TACAN/VOR DME arc

5. Voice procedures

6. Computing ground speed using TACAN/VOR DME

7. Correcting for wind drift using TACAN/VOR/VOR DME

8. Performing TACAN/VOR DME point-to-point navigation

9. Performing direct routing

10. VOR – TAC/VOR DME holding

11. Elements of ILS approach system

12. ILS approach procedures
13. Transition from instrument to visual scan
14. Circling approach procedures
15. Missed approach procedures
16. Climb, cruise, and descent profiles
17. Safety/emergency procedures

104. DISPLAYS

HSI and ADI display setup

1. On start, the navigation system initializes to:
    a. NAV Control = FWD
    b. No selected steering mode
    c. Command course = 000
    d. Last entered waypoints, waypoint 0 active
    e. Waypoint 0 – last valid position (present position)
    f. CRS option boxed
    g. HSI = Plan mode
    h. Compass rose scale = 40 nm
    i. Command heading = 000
    j. LAW = 500 ft
    k. BNGO = 900 lbs

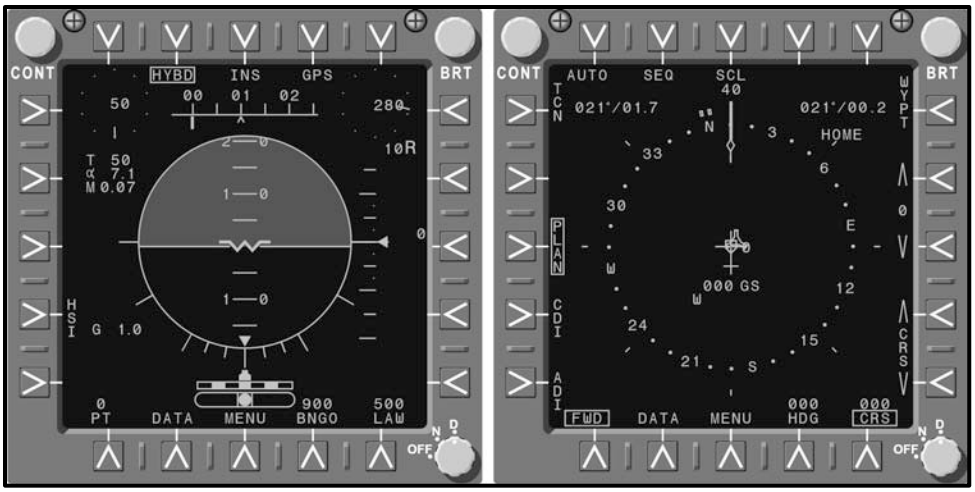

Figure 1-1 Cold Start Initial Condition

2. After start, set up navigation data for departure

Climb/Cruise Profile

1. Normal

   a. 250 KIAS to 10,000 Feet

   b. 300 KIAS to .75 Mach

   c. Power – MAX Range ~ 12 Units AOA

2. BINGO

   a. 300 KIAS to .75 Mach

   b. Power – Max Range ~ 12 Units AOA

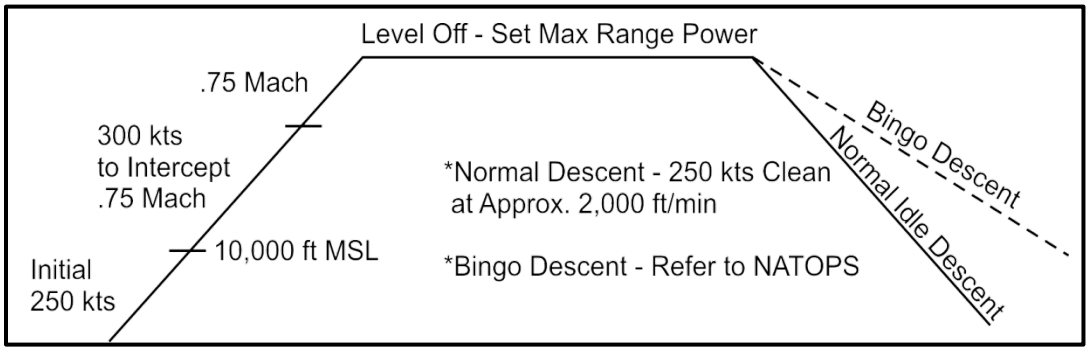

Figure 1-2 Climb, Cruise and Descent

Enroute Descent

1. Normal – 250 KIAS clean, Idle power

    a. Altitude to loose converted to DME + 30

    b. Altitude to loose X 2.5 = DME

    c. Altitude to loose X 2.0 + 10 = DME

2. BINGO Profile Descent

    a. 14 Units, Idle, Clean at ~ 180 KIAS

    b. Altitude to loose X 3 = DME

Descent Comparison
T-45C, No Wind, 2000# Fuel

Fuel Flow (PPH)	Airspeed (KIAS)	VSI (FPM)	DME to Lose 1K
500 (Idle)	250	-2,500	2
500 (Idle, Speedbrakes)	250	-6,000	1
500 (Idle)	Max Range	-1,500	3-4
700 (75%)	250	-2,000	2.5

Figure 1-3 Descent Comparison

Performing a standard instrument departure (SID)

1. Types

   a. Pilot nav

      i. Provides published instruction

         (a). Top of departure plate: pictorial description

         (b). Bottom section of departure plate: textual description

      ii. Pilot's responsibility to comply with published instructions

      iii. Requires minimal controller time/communication with pilot

      iv. Provides several transition options depending on pilot's route

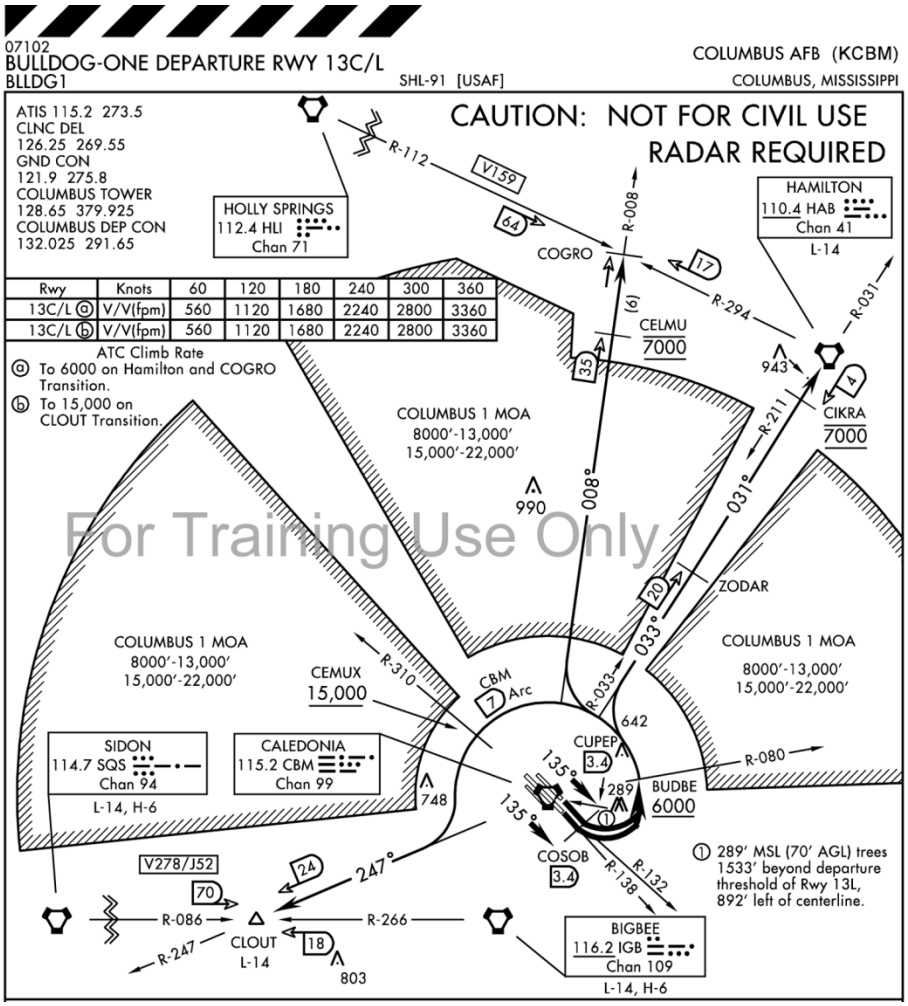

Figure 1-4 CBM Bulldog One Departure

DEPARTURE ROUTE DESCRIPTION

NOTE: Rwy 13C departure will be towards a raised MA-1A barrier 110' into the overrun approximately 3' high.

TAKE-OFF RWY 13C: Climb on track 135° to intercept CBM VORTAC R-138 direct COSOB (CBM R-138/3.4 DME). Turn left to intercept CBM 7 DME Arc, arc northwest. Cross CBM R-080 at or above 6000 then via assigned transition or ATC instruction.

TAKE-OFF RWY 13L: Climb on track 135° to intercept CBM VORTAC R-132 direct CUPEP (CBM R-132/3.4 DME). Turn left to intercept CBM 7 DME Arc, arc northwest. Cross CBM R-080 at or above 6000 then via assigned transition or ATC instruction.

HAMILTON TRANSITION (BLLDG1 • HAB): Intercept CBM R-033 direct ZODAR (CBM R-033/20 DME) then direct HAB VORTAC via HAB R-211. Cross HAB R-211/4 DME at 7000.

COGRO TRANSITION (BLLDG1 • COGRO): Intercept CBM R-008 direct COGRO (CBM R-008/41 DME). Cross CBM R-008/35 DME at 7000.

CLOUT TRANSITION (BLLDG1 • CLOUT): Cross CBM R-310 at or above 15,000. Intercept CBM R-247 direct CLOUT (CBM R-247/24 DME).

BULLDOG-ONE DEPARTURE RWY 13C/L
BLLDG1
COLUMBUS, MISSISSIPPI
COLUMBUS AFB (KCBM)

Figure 1-5 Departure Route Description

b. Vector

i. Provides navigational guidance by ground radar to an airway or fix on the pilot's route

(a). Top of departure plate: pictorial description

(b). Bottom section of departure plate: textual description

ii. Departure control's responsibility to provide instructions

iii. Requires more controller time/communication

iv. Allows controller flexibility to deal with changing flight and traffic conditions

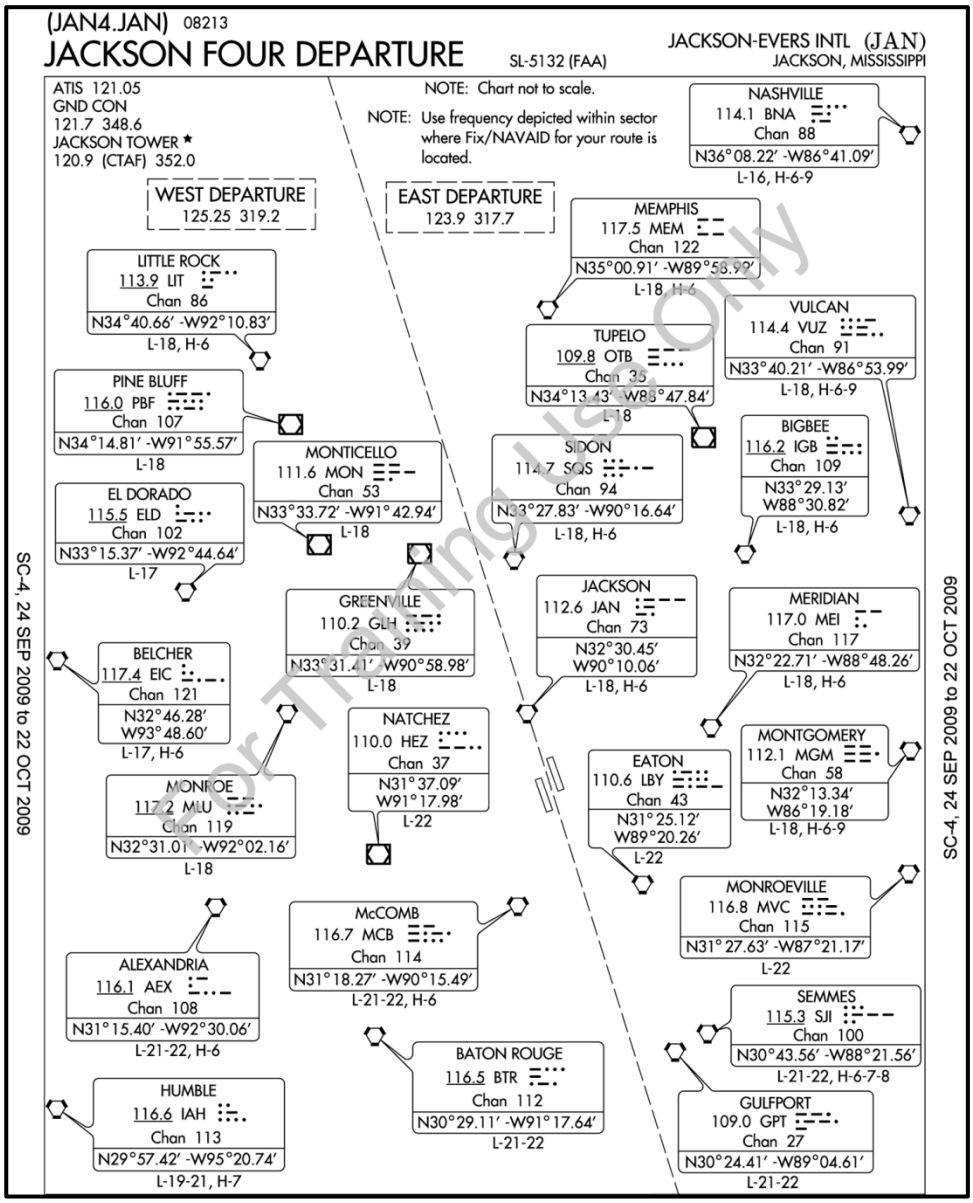

Figure 1-6 JAN Four Departure 1

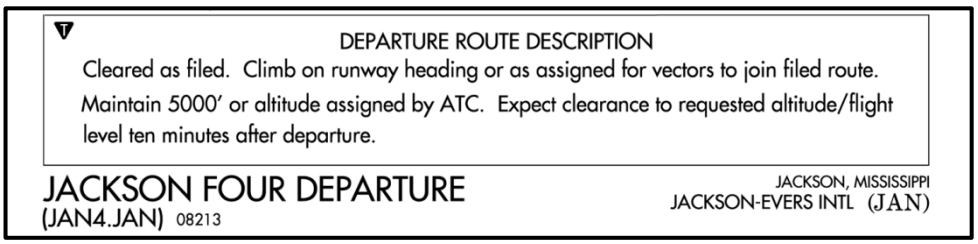

Figure 1-7 JAN Four Departure 2

2. Procedures

   a. Preflight and pre-takeoff preparation

      i. Identify frequencies used by ATC and ensure compatibility with communication equipment

      ii. Determine if your aircraft's performance is adequate to adhere to all restrictions

      iii. Identify routes, altitude, and specific restrictions

NOTE

When accepting a SID, you must comply with all requirements and restrictions unless ATC amends it.

   b. Changes to clearance

      i. Amendments to initial clearance will be issued anytime ATC deems such action necessary to avoid possible conflict between aircraft, hazardous weather, etc

NOTE

When a SID is changed, confirm what part of the SID is still in effect.

      ii. Cancellation: to reinstate, departure control must state portion of SID routing that still applies and restate altitude restrictions

Radial intercepts

1. Double angle off bow method (Inbound)

   a. Tune and identify station

   b. Enter the desired course

   c. Look from desired course to head of the bearing pointer and an equal number of degrees beyond (this is your intercept heading)

   d. Turn aircraft to the intercept heading (Max 45° so you will not exceed 90 degrees true intercept angle)

   e. Maintain intercept heading to lead point andthen complete intercept of desired course

   f. Lead Turn Technique

i. “Touch” turn in Planemetric Display

ii. 60:1 Rule

LESSON NOTES

Steps b & c of the double angle, 30-degree and 45-degree intercept procedures are accomplished in order at point “B” on the graphic.

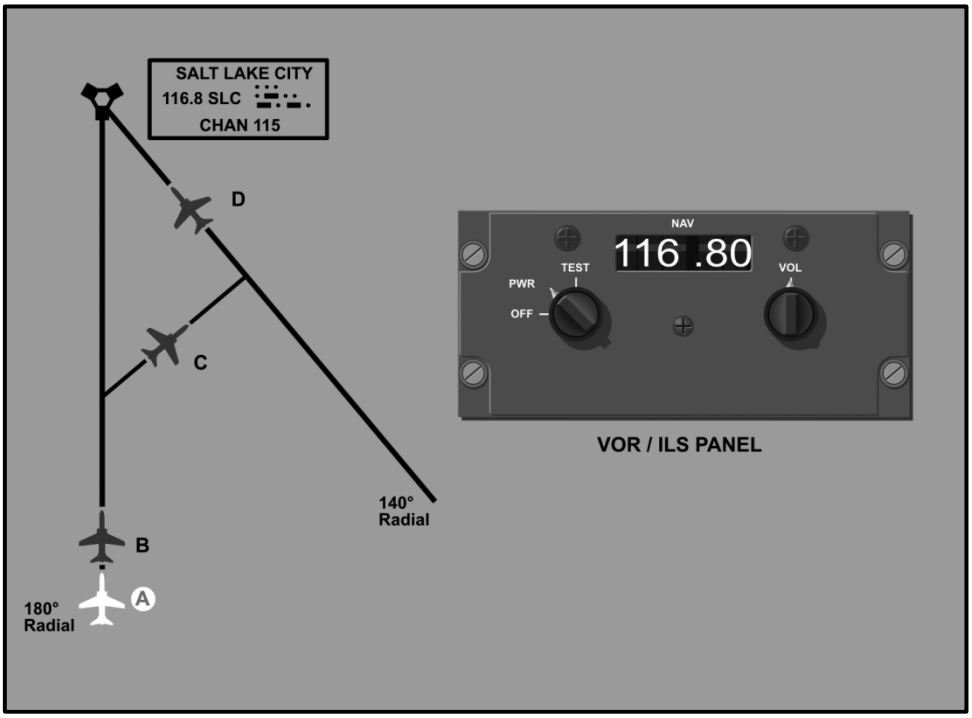

Figure 1-8 Double Angle Off the Bow 1

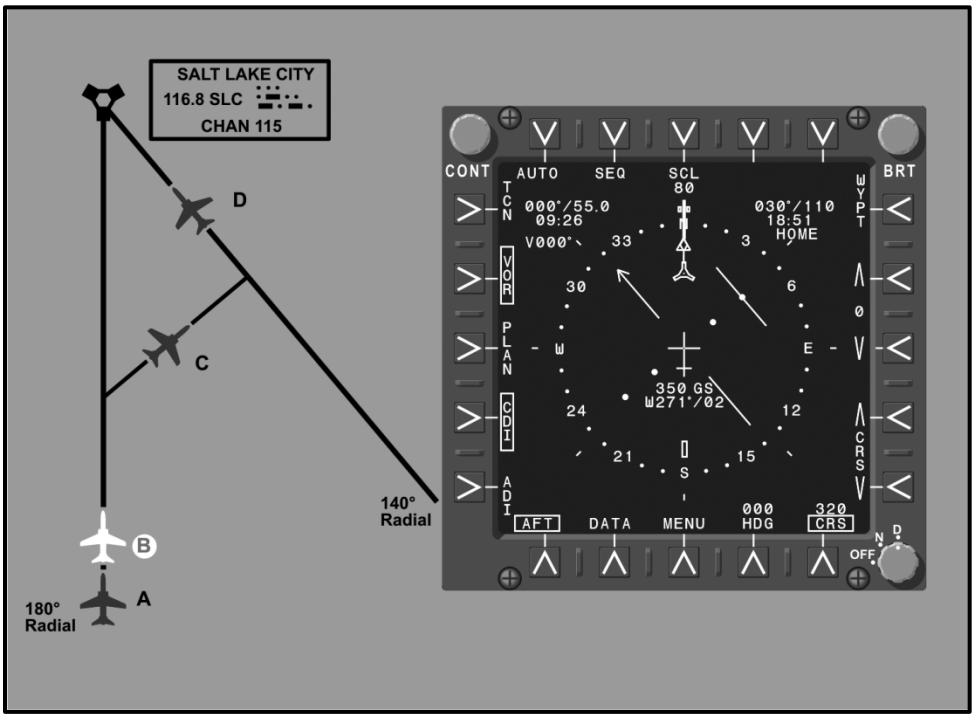

Figure 1-9 Double Angle Off the Bow 2

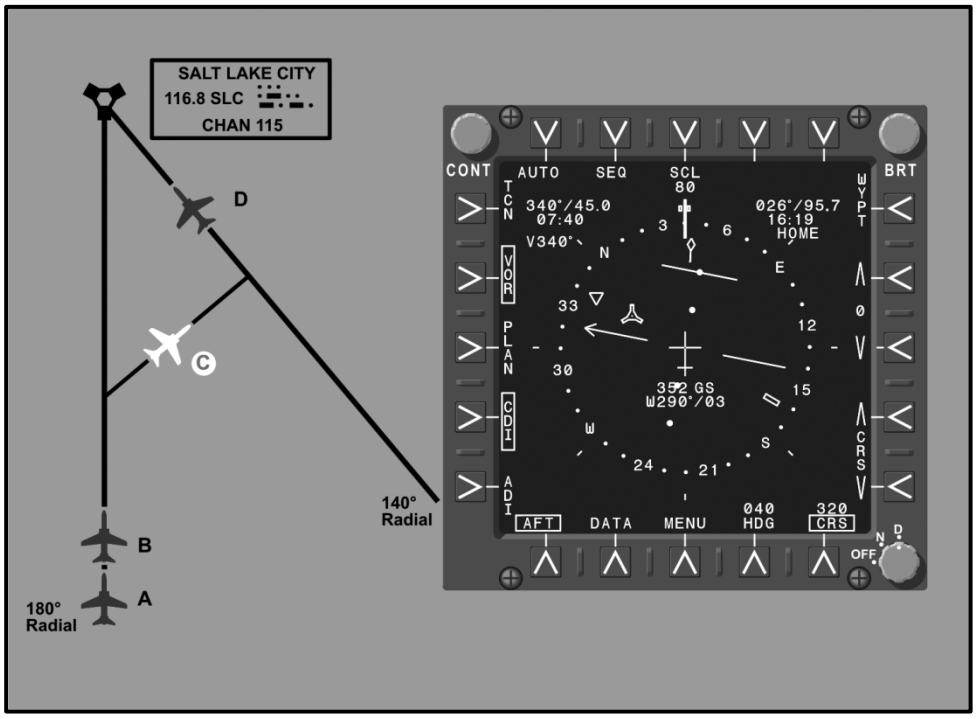

Figure 1-10 Double Angle Off the Bow 3

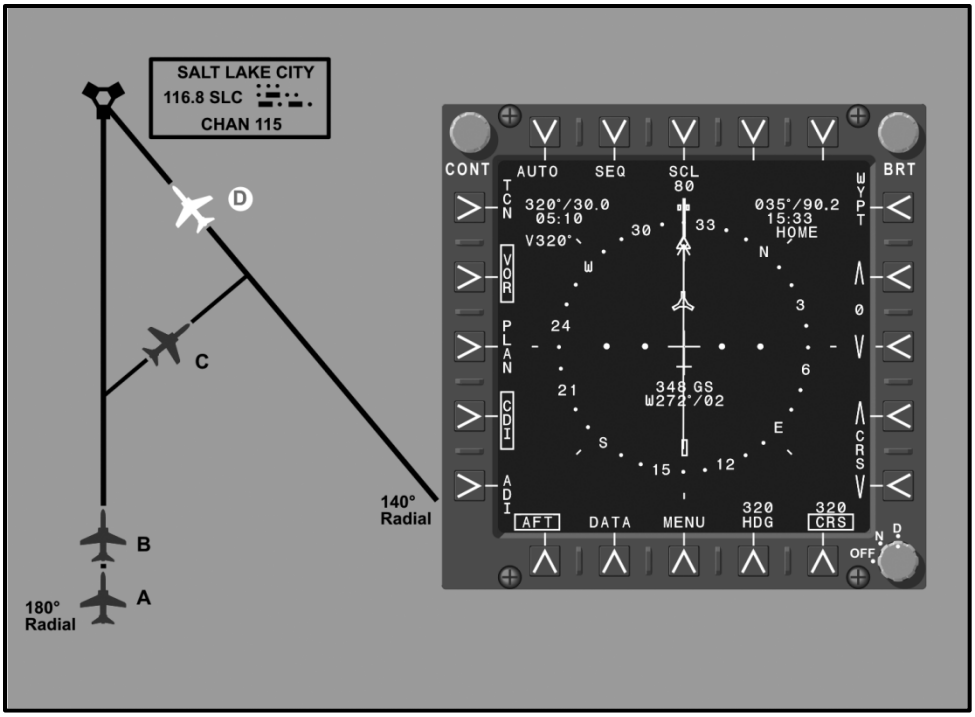

Figure 1-11 Double Angle Off the Bow 4

2. 30-degree angle of intercept (Inbound)

   a. Tune and identify station

   b. Enter the desired course

   c. Look from desired course to head of the bearing pointer used and 30 degrees beyond (this is your intercept heading)

   d. Turn aircraft to the intercept heading

   e. Maintain intercept heading to lead point and then complete intercept of desired course

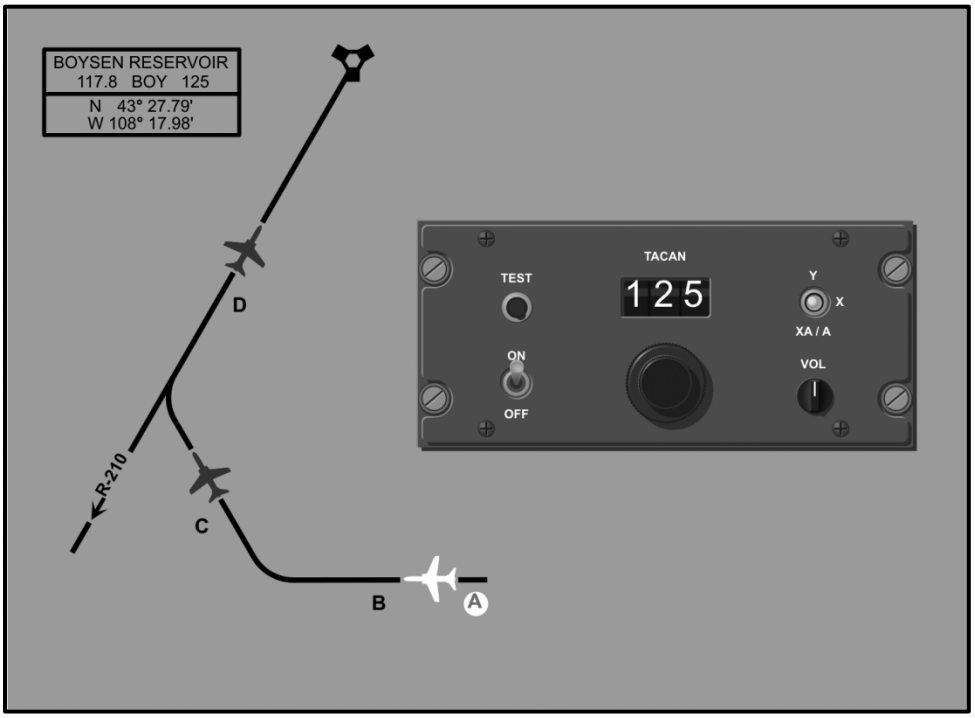

Figure 1-12 30 Degrees Angle of Intercept 1

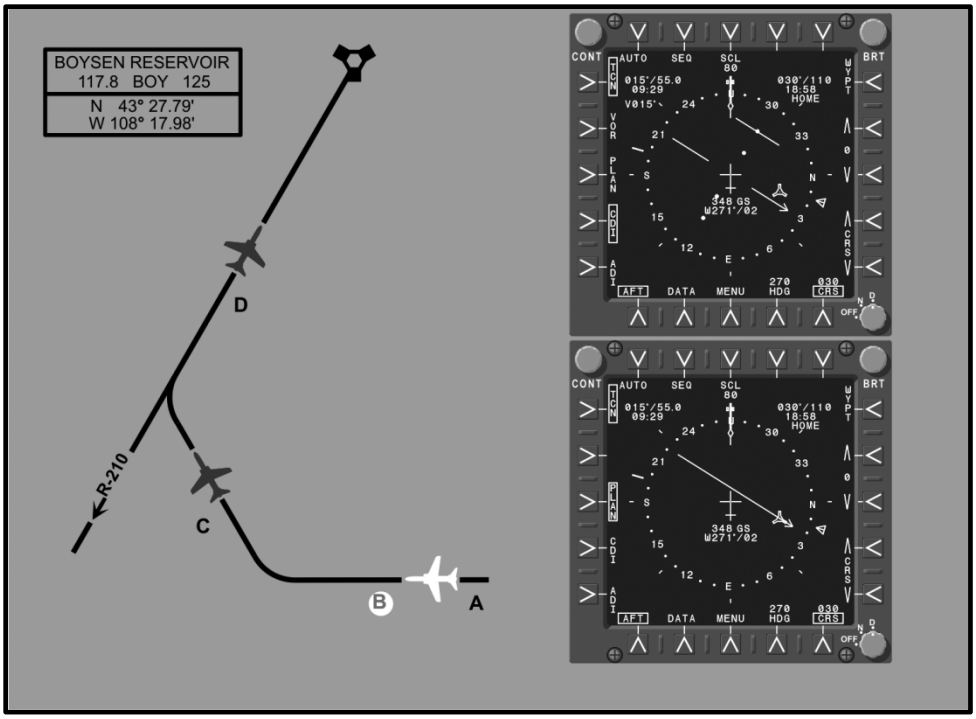

Figure 1-13 30 Degrees Angle of Intercept 2

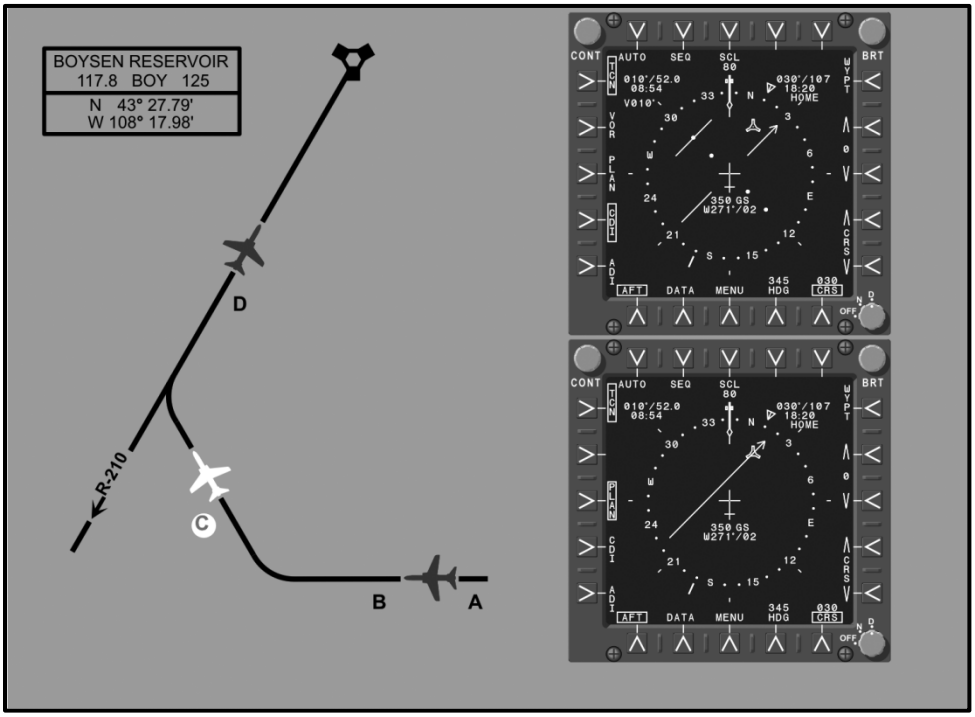

Figure 1-14 30 Degrees Angle of Intercept 3

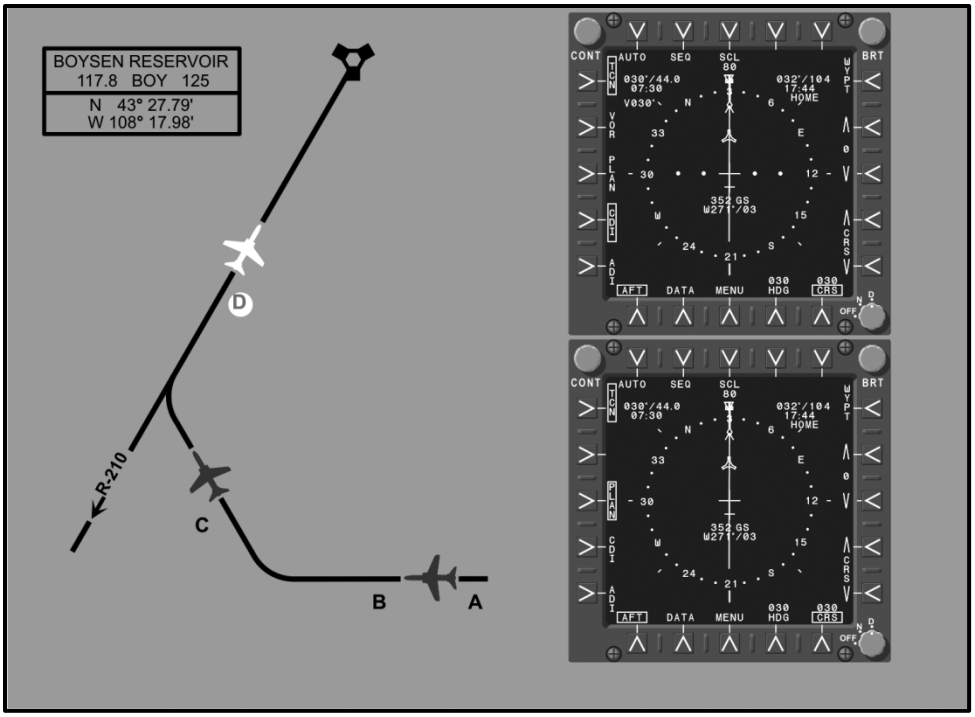

Figure 1-15 30 Degrees Angle of Intercept 4

3. 45-degree angle of intercept (Outbound)

   a. Tune and identify station

   b. Enter the desired course

   c. Look from tail of the bearing pointer used to desired course and 45 degrees beyond (this is your intercept heading)

   d. Turn aircraft to the intercept heading

   e. Maintain intercept heading to lead point and then complete intercept of desired course

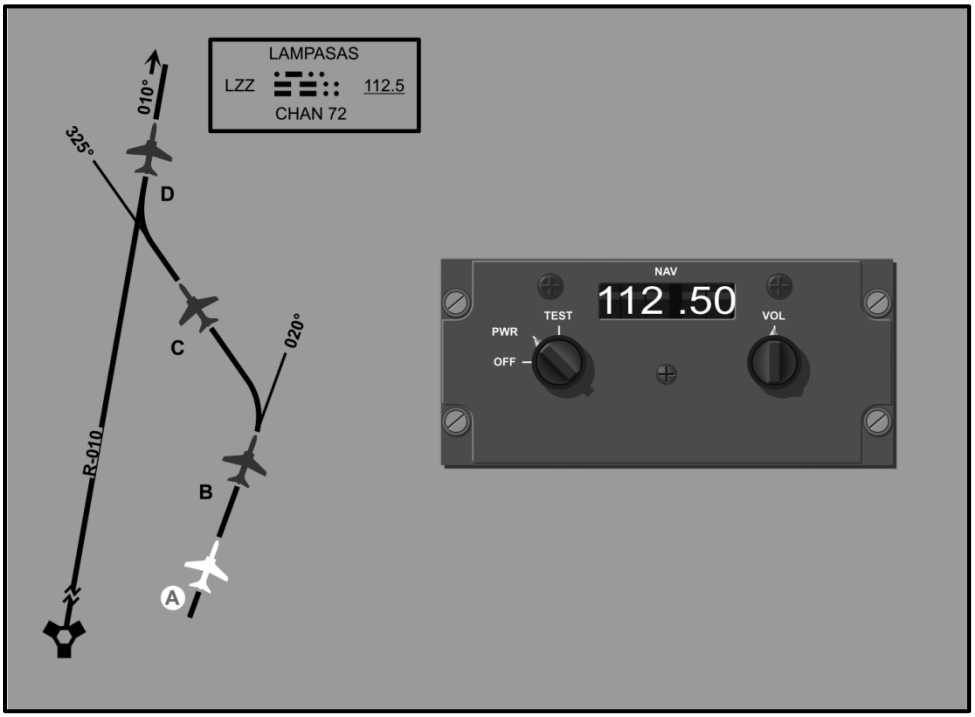

Figure 1-16 45-Degree Intercept 1

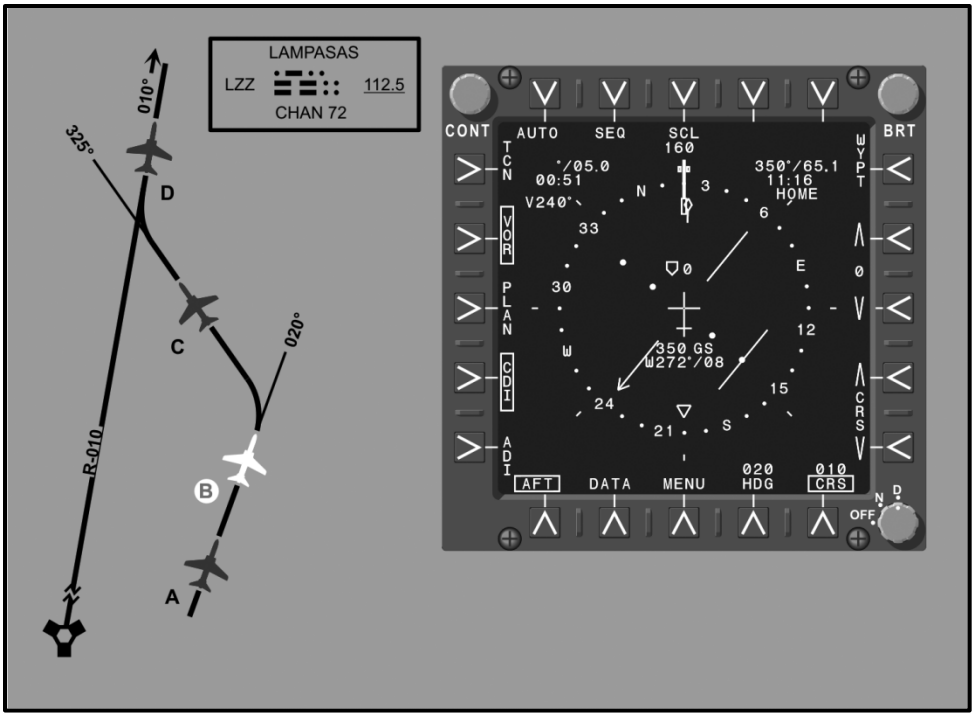

Figure 1-17 45-Degree Intercept 2

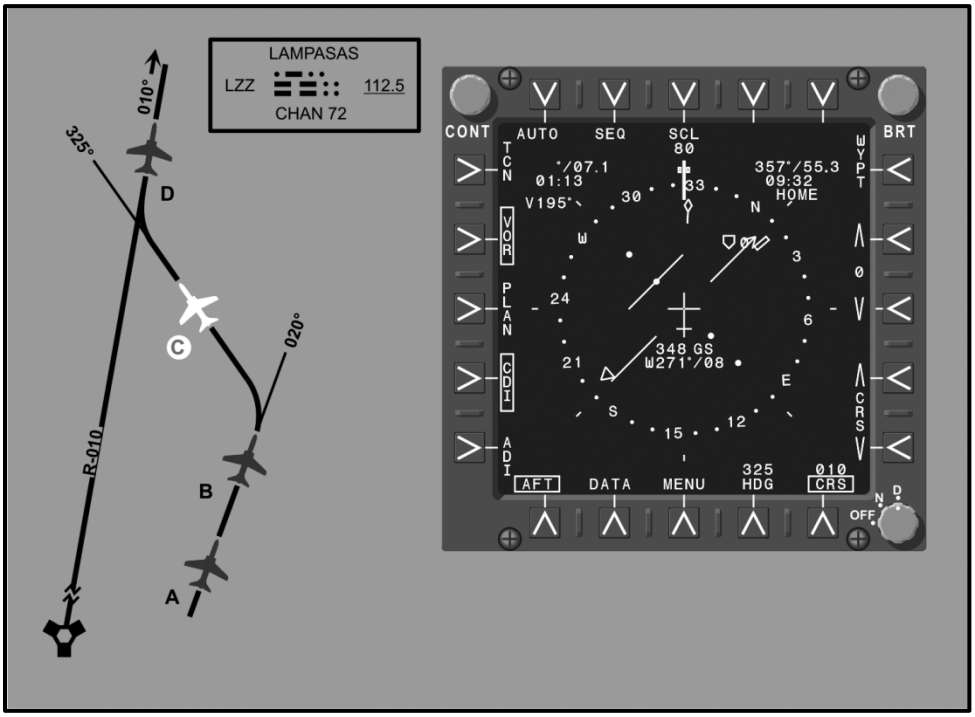

Figure 1-18 45-Degree Intercept 3

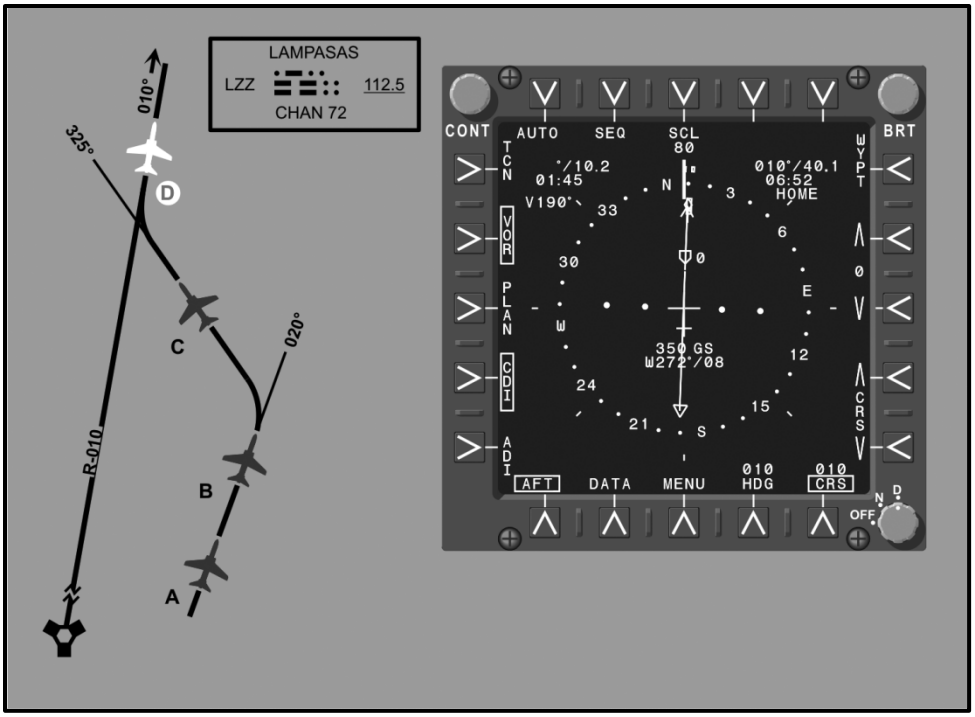

Figure 1-19 45-Degree Intercept 4

4. Immediately after station passage (Outbound)

   a. Turn to parallel desired course

   b. Enter the desired course

   c. Look from tail of the bearing pointer used to desired course and an equal number of degrees beyond, but not more than 45 degrees (this is your intercept heading)

   d. Turn aircraft to the intercept heading

   e. Maintain intercept heading to lead point and then complete intercept of desired course

Indications of Station Passage

1. TACAN/VOR DME: Due to increased size of the cone of confusion associated with TACAN stations, time of station passage is noted when “minimum” DME is reached. Use same procedure for VOR/DME station passage

2. VOR: Upon entering the cone of confusion the bearing pointer, CDI and other data disappear.

3. Overhead Station Turn Lead Points

   a. 90 degrees or larger: Altitude in DME + 1% of Groundspeed

   b. 60 – 90 degrees: Altitude in DME + 2/3 of 1% of Groundspeed

   c. 30 – 60 degrees: Altitude in DME + 1/3 of 1% of Groundspeed

   d. 30 degrees or less: Altitude in DME

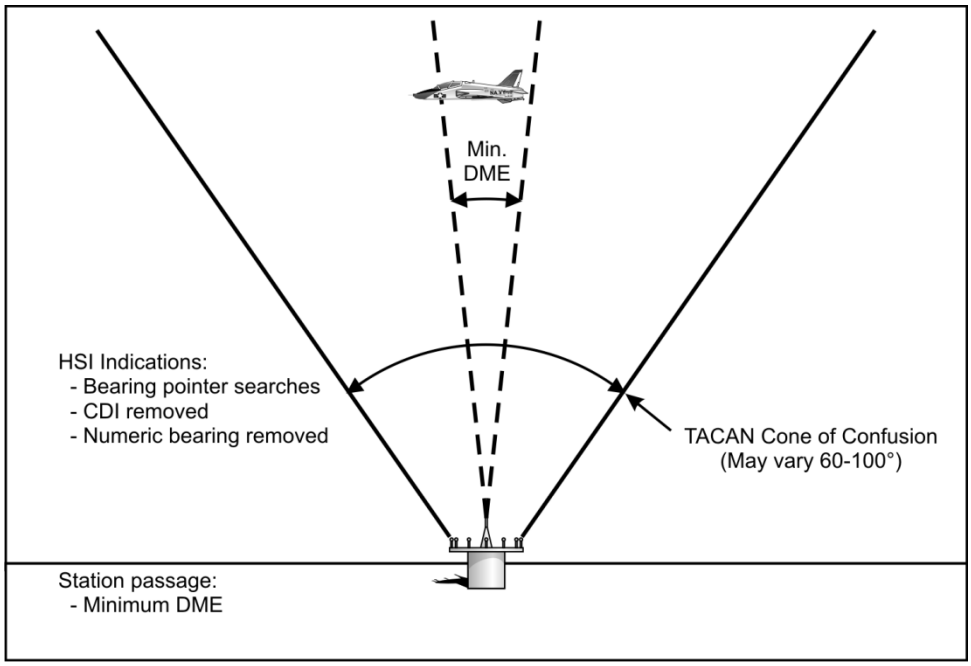

Figure 1-20 TACAN Cone of Confusion

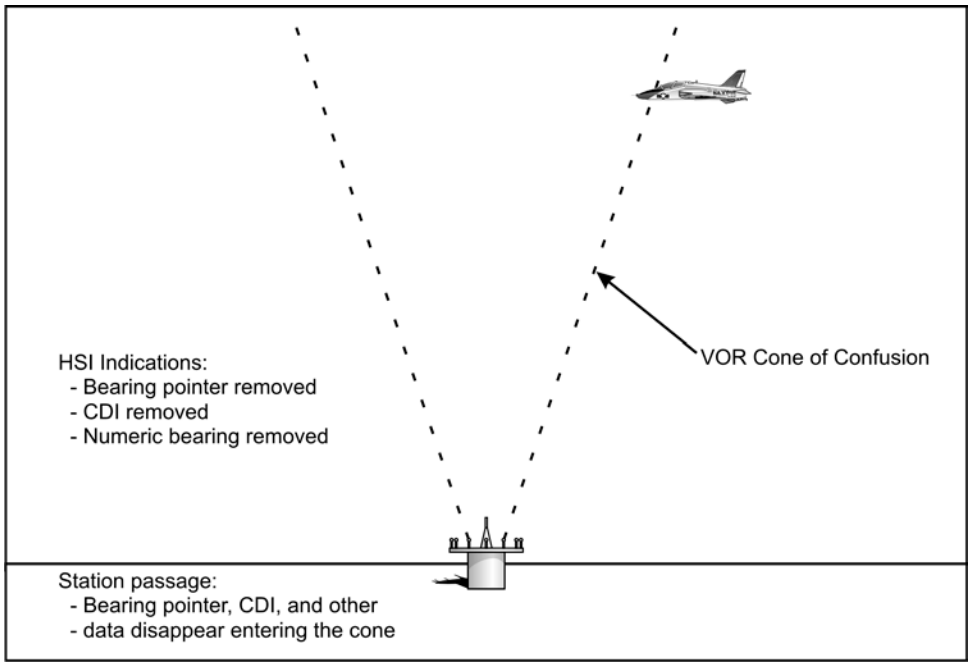

Figure 1-21 VOR Cone of Confusion

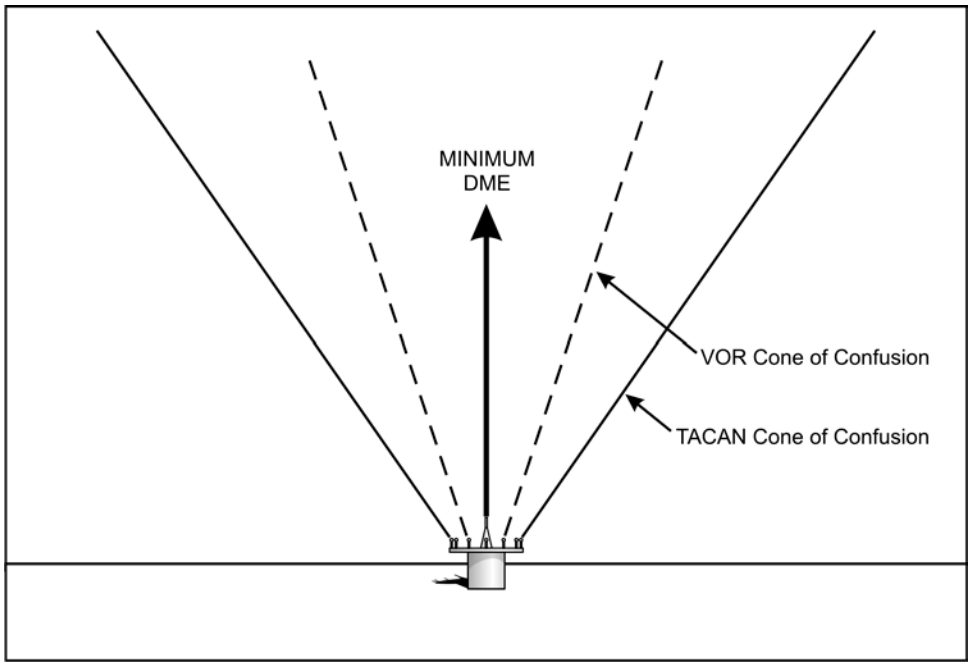

Figure 1-22 VOR/TACAN Cones of Confusion

Flying TACAN/VOR DME arc

1. Intercepting an arc from a radial lead point calculation

a. For a 90-degree intercept: approximately 1% of ground speed = DME lead point using 1/2 SRT

b. For intercepts of less than 90 degrees: use a proportional distance lead point of less than 1 %

NOTE

Radial to Arc LPT Calculation – Ground Speed X 1% = DME to Arc LPT (using ½ SRT)

Inbound – **Add** 1% of GS to the arc DME

Outbound – **Subtract** 1% of GS from the arc DME

2. Arcing - chord method

NOTE

The chord method is usually used when the aircraft is more than 12 miles DME from the station.

a. Tune and identify station and select TACAN steering

b. Determine direction to turn

c. Determine desired lead point

d. Initiate turn when DME equals radius of arc plus or minus desired lead using a 1/2 SRT AOB

e. Monitor bearing pointer and DME to determine roll-out

f. Position aircraft so that head of bearing pointer is between 5 and 10 degrees ahead of wingtip position

g. Fly straight short legs allowing head of bearing pointer to reposition between 5 and 10 degrees behind wingtip position

h. Turn aircraft to reposition the head of bearing pointer from behind to between 5 and 10 degrees ahead of wingtip position

NOTE

If a crosswind makes the DME difficult to maintain, increase or decrease the number of degrees you let the head of the pointer move ahead or behind the wingtip position.

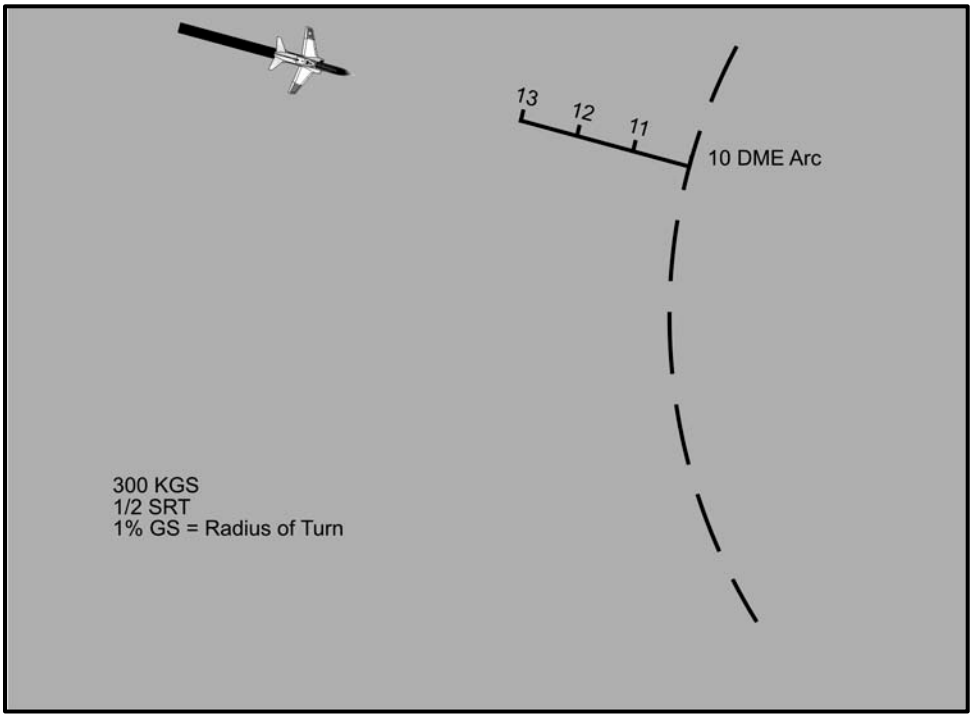

Figure 1-23 Radial to Arc Intercept Procedure 1

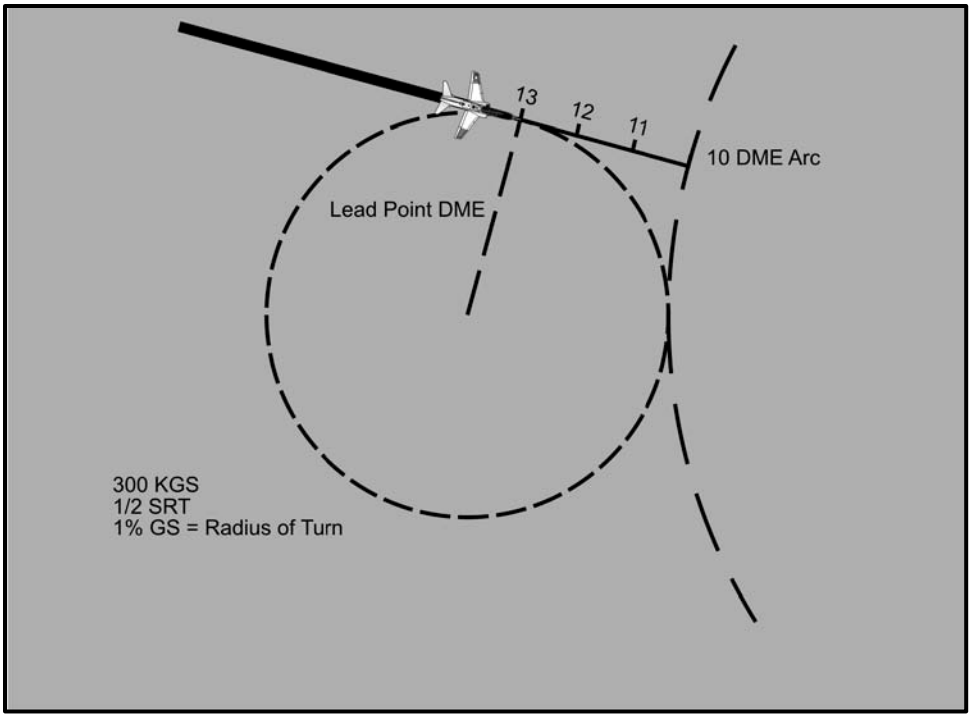

Figure 1-24 Radial to Arc Intercept Procedure 2

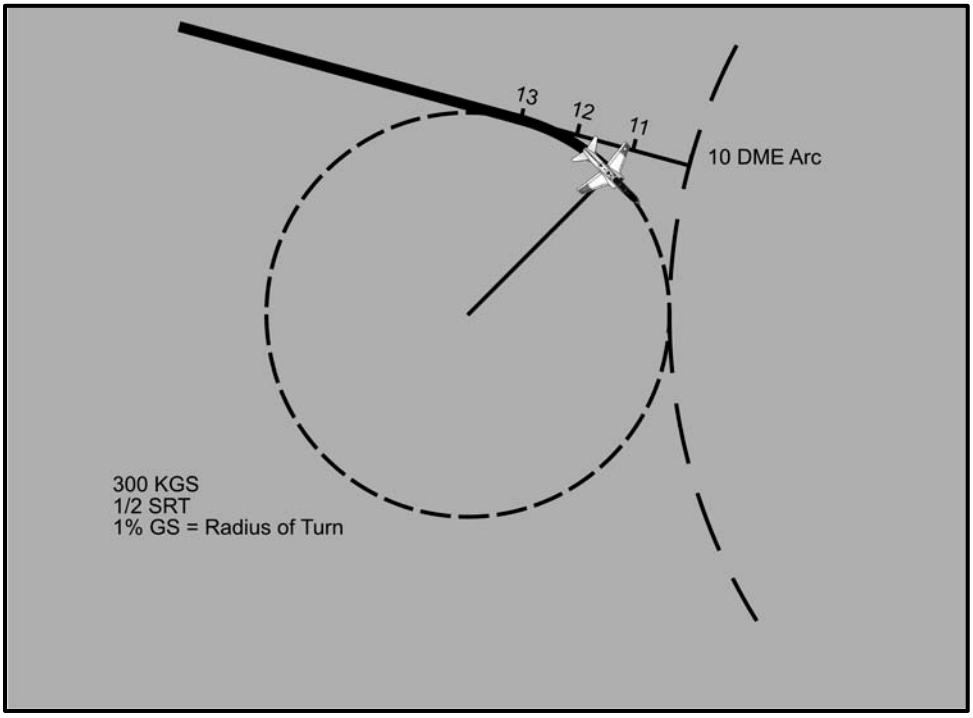

Figure 1-25 Radial to Arc Intercept Procedure 3

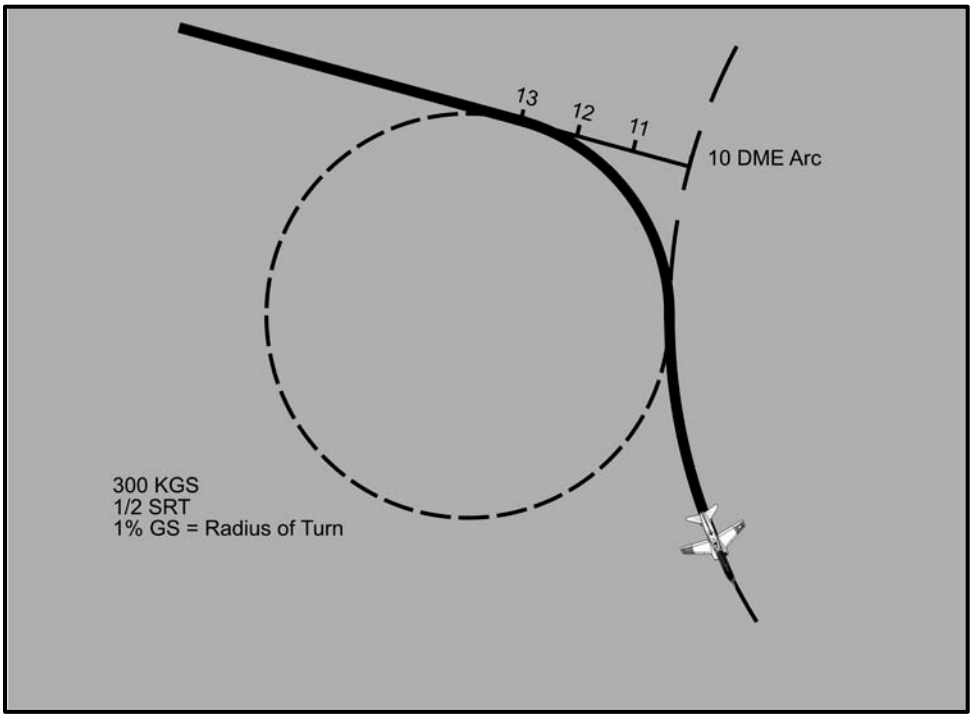

Figure 1-26 Radial to Arc Intercept Procedure 4

3. Arcing - angle-of-bank method

NOTE

The angle-of-bank method is usually used when the aircraft is within 12 DME of the station. Although each method has been identified according to DME limits, you can use either anytime.

a. Tune and identify station and select TACAN steering

b. Determine direction to turn

c. Determine desired lead point (refer to Lead Point Calculation)

d. Initiate turn when DME equals radius of arc plus or minus desired lead

e. Established on the arc, adjust angle of bank (AOB) to maintain proper distance and keep the bearing pointer on HSI 90-degree benchmark (wingtip)

NOTE

Adjustments to the position of the head of the bearing pointer will have to be made relative to the 90-degree benchmark to

compensate for the position of the wind relative to the position of the aircraft on the arc.

4. Intercepting a radial from an arc lead point calculation

   a. Estimate the ground speed

   b. Apply the following formula to determine lead radials: "60/DME x 1% ground speed = lead radials"

   c. Begin 1/2 SRT at the determined lead radial and vary AOB as required to intercept the outbound/inbound radial

   d. Check status of turn and vary AOB to intercept desired radial

$$\frac{60}{\text{ARC DME}} \times 1\% \text{ GS} = \text{NUMBER OF LEAD RADIALS}$$

(USING 1/2 SRT)

Vary AOB to intercept desired inbound/outbound radial

Figure 1-27 Arc to Radial Lead Point Calculation

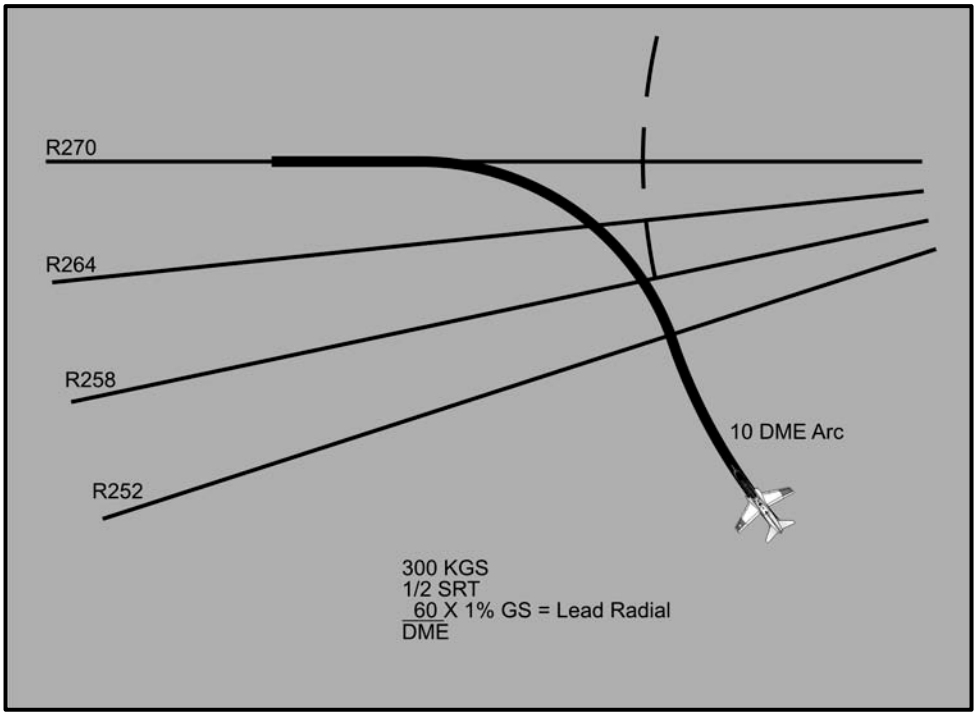

Figure 1-28 Arc to Radial Intercept 1

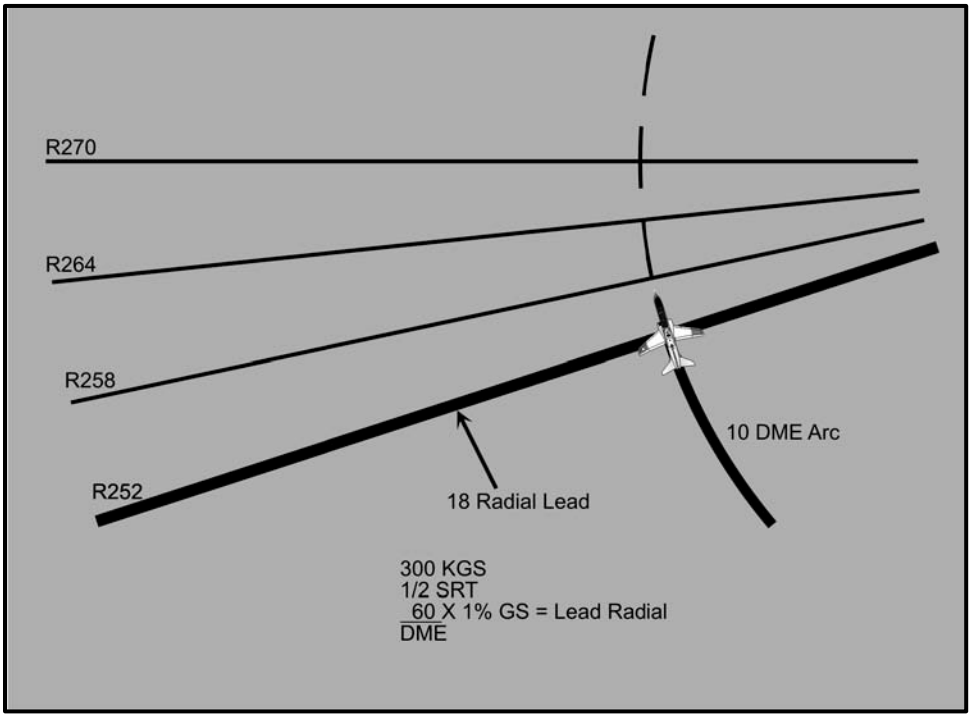

Figure 1-29 Arc to Radial Intercept 2

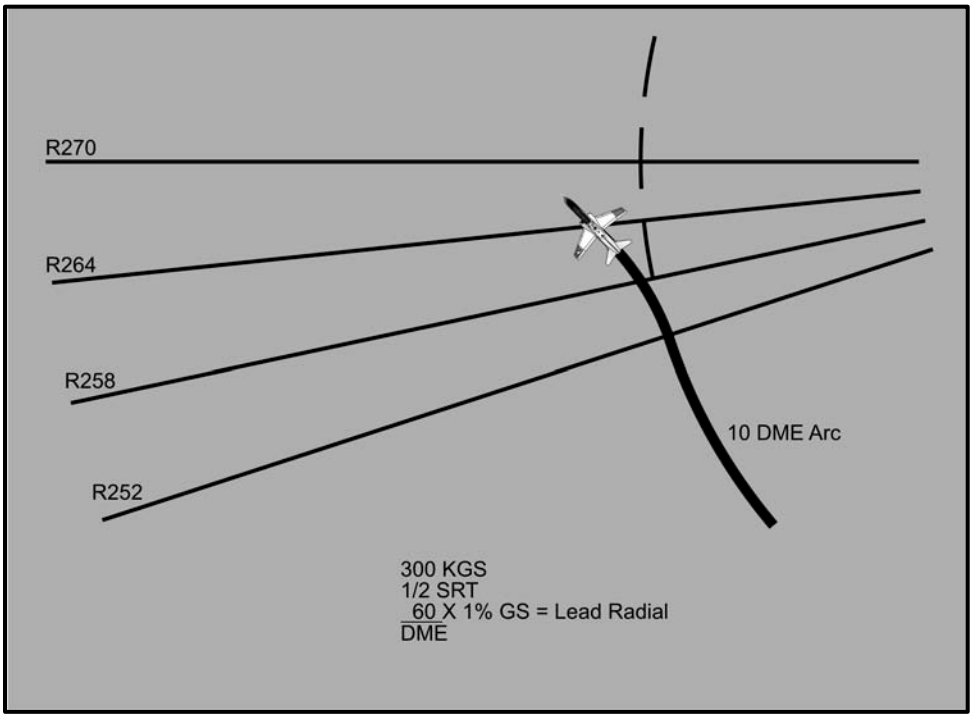

Figure 1-30 Arc to Radial Intercept 3

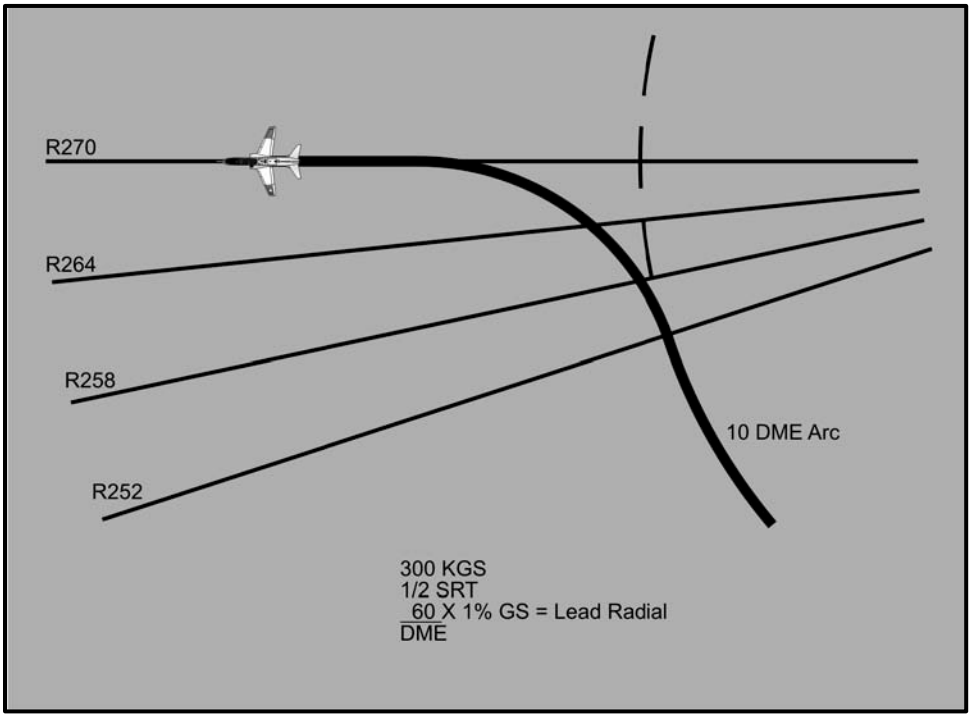

Figure 1-31 Arc to Radial Intercept 4

5. Adjustment techniques (Arc to Radial - Radial to Arc)

   a. Arc to radial intercept

      i. Inbound radial intercepts will require a greater lead than outbound because the aircraft is turning more than 90 degrees

      ii. For radial intercepts from arcs less than approximately 10 DME, an adjustment must be applied to the arc to radial formula to compensate for turns outbound of less than 90 degrees and turns inbound of more than 90 degrees

         (a). Degrees to turn outbound are equal to 90 minus the number of lead radials determined by formula

         (b). Degrees to turn inbound are equal to 90 plus the number of lead radials determined by formula

         (c). As a rule of thumb, reduce or increase the lead radials determined by formula by one-third

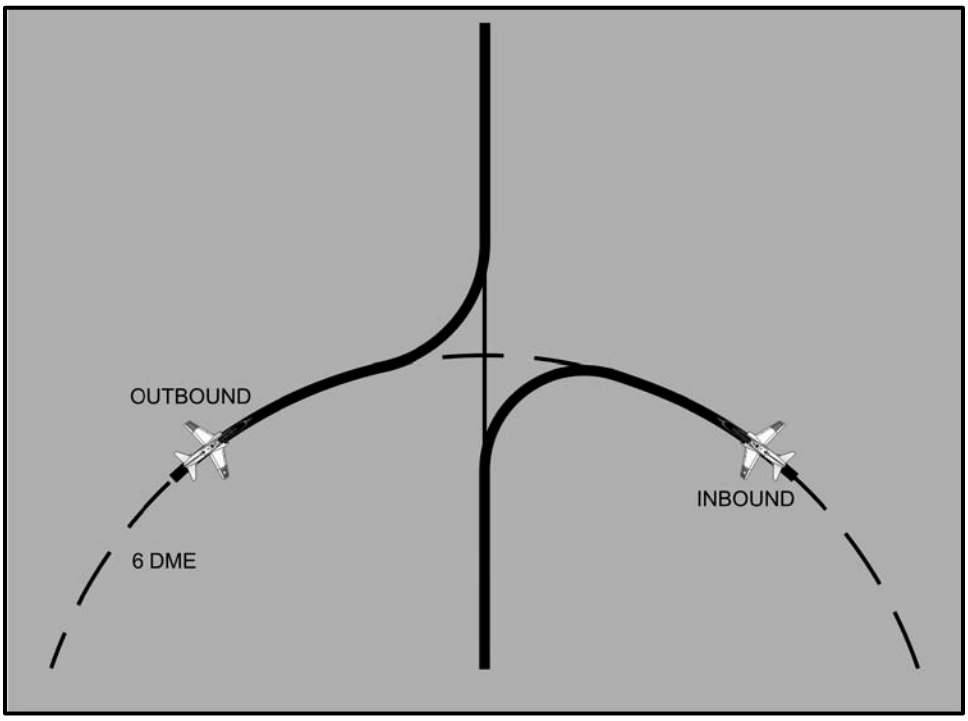

Figure 1-32 Arc to Radial Intercept Adjustments 1

b. Radial to arc intercept

i. When intercepting an arc from a heading significantly more or less than 90 degrees from the arc, an adjustment should be made to the result of the formula for arc intercepts

(a). Use 1% for a turn of approximately 90 degrees

(b). For a turn of approximately 45 degrees, use 1/3 of that required for 90 degrees

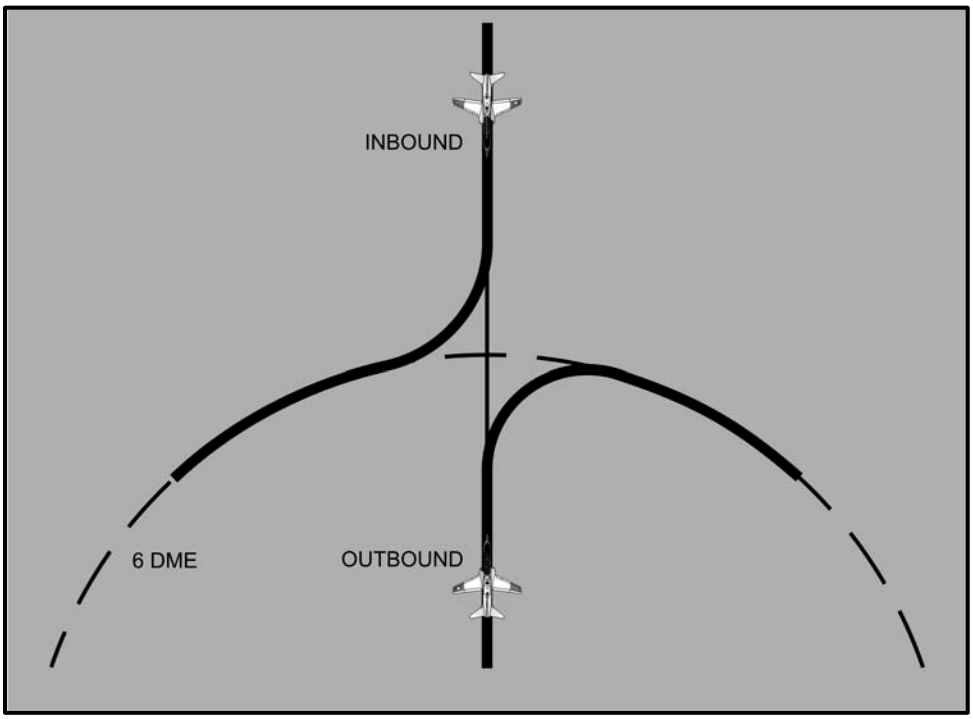

Figure 1-33 Radial to Arc Intercept Adjustments 2

(c). For a turn of approximately 60 degrees, use 2/3 of that required for 90 degrees

(d). For turns of less than 30 degrees, very little lead is required

ii. When intercepting an arc from a radial closer than approximately 12 DME, an adjustment should be made to compensate for outbound turns greater than, and inbound turns less than, 90 degrees

(a). Outbound radial to arc, add approximately 1/2 DME to 1% ground speed

(b). Inbound radial to arc, subtract approximately 1/2 DME to 1% ground speed

Voice Procedures

NOTE

Enroute voice procedures begin at the point you switch from departure control to ARTCC (Center).

1. Non-radar environment

a. Initial contact

- Courtesy call

(a). Identification

(b). Altitude

(c). Estimate to next reporting point

NOTES

1. If controller responds with, “Roger,” no further communication is necessary until at a compulsory reporting point, i.e., end of a direct leg, a solid triangle fix along the route, or as requested by the controller.

2. There are no compulsory reporting points in the HI ALT route structure in the continental U.S.

b. Subsequent Reports

i. If the controller states, “Go Ahead,” the following reports are required for the non-radar environment.

ii. Position reports

(a). Not at a fix

(1). Identification

(2). Estimate to next fix (compulsory reporting point)

(3). Altitude

(b). At a fix

(1). Identification

(2). Position

(3). Time

(4). Altitude/FL

(5). Position

(6). Time

(7). Name only of next succeeding reporting point

iii. Other reports

(a). Leaving FAF inbound on non- precision approach

(b). Leaving OM or fix used in lieu of OM inbound on precision approach

(c). Corrected estimate as previously submitted when in error in excess of three minutes

2. Radar environment

NOTE

Radar has greatly reduced the requirement for pilot to controller communications. The one item that the controller must confirm to ensure proper spacing for traffic is that the transponder is transmitting an accurate altitude. On all initial contacts with ATC under radar conditions, the initial contact call from the pilot shall include “altitude” along with ID.

a. Initial contact enroute ATC

i. Identification

ii. Altitude, Climbing to or Descending to

b. Initial contact with approach control

i. Identification

ii. Altitude

iii. ATIS information

iv. Request for approach

3. Reports that are made at all times (radar and non-radar)

a. When vacating an assigned altitude or FL for a newly assigned altitude or FL

b. When changing altitude if operating on a clearance specifying VFR-on-top (below FL180 or above FL600)

c. When unable to climb/or descend at a rate of 500 ft per minute

d. When approach has been missed (include in report request for specific action, e.g., another approach, proceed to the alternate, etc.)

e. Change in average true airspeed (at cruising altitude) by 5% or 10 kts, whichever is greater

f. Time and altitude/FL upon reaching a holding fix or point to which cleared

g. When leaving any assigned holding fix or point

NOTE

Items "f" and "g" may be omitted by pilots of aircraft involved in instrument training at *military terminal area facilities* when radar service is provided.

h. Loss of any navigation or communication capability (Report should include the following: identification; equipment affected; degree of affected capability to operate IFR; request for ATC assistance if required)

i. Any information relating to safety of flight, i.e., BASH

j. Encountering WX conditions not forecast or hazardous conditions which have been forecast, i.e., Wind Shear, Icing, CAT

k. Beginning and end of direct route (off airway) between two navigational points of fixes, regardless of altitude of flight level, including when operating on an ATC clearance specifying VFR ON-TOP. Additionally, if a pilot is handed off while in transit on a direct leg, state present position to new controller on initial contact

4. When operating under IFR clearance, you may not deviate from the clearance unless:

a. You obtain an amended clearance or

b. Safety of flight considerations prohibit compliance

5. When cleared to climb or descend at pilot's discretion, you may not return to an altitude once you have vacated

NOTE

Clearance short of destination will require an expected further clearance (EFC) time. Request EFC if not provided by ATC. If cleared to a point not on your route, you must receive expected further routing (EFR) at least 5 minutes prior to reaching your clearance limit.

Computing Ground Speed Using TACAN/VOR DME

NOTE

To be able to compute ground speed while maintaining a course to or from a TACAN/VORTAC station, the DME from station must be greater than or equal to the aircraft altitude in thousands of feet.

$$\frac{DISTANCE\ (NM)}{TIME\ (MIN)} \times 60 = GROUND\ SPEED$$

Rule: DME must be greater than or equal to the aircraft altitude in thousands of feet.

EXAMPLE: If the altitude is 30,000 ft (FL 300), DME should be 30 nm or greater.

1. Start timing with a whole number in DME indicator

2. After predetermined time (in minutes), check and note DME

3. Determine distance flown (every 1/10 nm equals 6 kts) and multiply distance by a number that corresponds to the amount of time traveled to get ground speed

EXAMPLE: Your distance flown is 6 on the DME indicator. Elapsed time is 1 minute, so 6 times 60 equals 360. Ground speed is 360 kts (6 nm/min times 60 min/hr equals 360 nm/hr).

NOTES

1. The ground speed check requires tracking directly to or from the station.

2. To increase accuracy, check ground speed for more than 1 minute.

4. The current calculated ground speed is shown on the HSI display and the HUD navigation cruise display

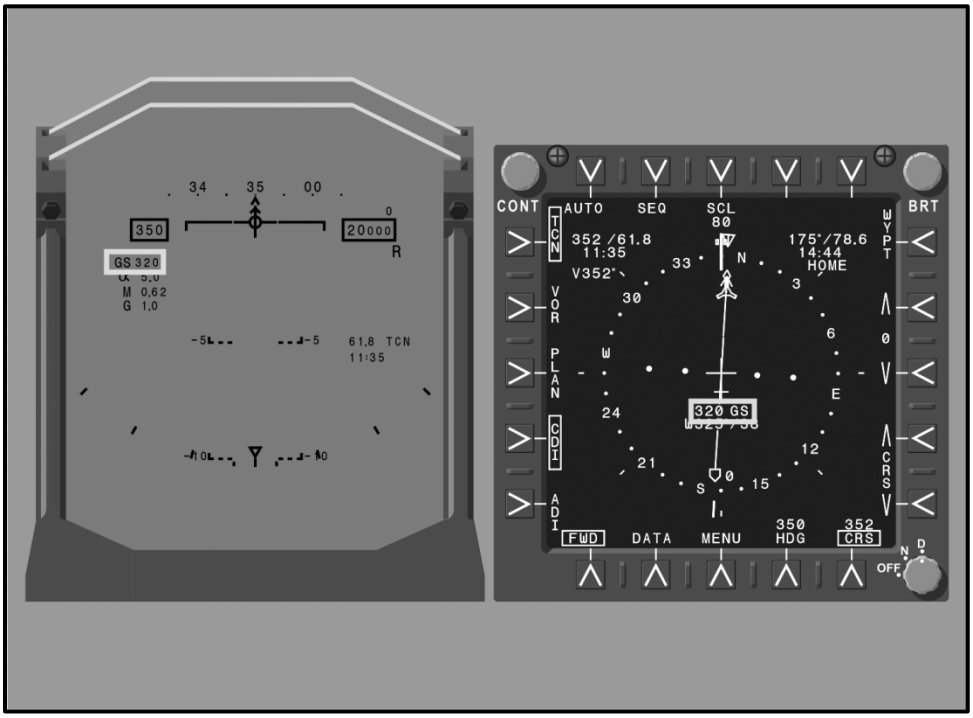

Figure 1-34 Ground Speed

Correcting for Wind Drift using TACAN/VOR/VOR DME

NOTE

To compensate for wind, use a wind corrected heading (WCH) that stops drift from your course. The difference between WCH and desired course is called “crab angle.”

1. Determining WCH and crab angle

   a. Establish radial track on course (CDI centered)

   b. Check for drift from course due to wind

   c. Turn the aircraft sufficiently back into the wind to reintercept the course (CDI centered)

d. Reduce intercept heading to maintain track on course (enough crab angle to keep CDI centered)

COMMON ERRORS:

1. Making too small a correction to return to the desired course.

2. Not applying a correction into wind to slow and/or stop drift when first detected to minimize drift from course.

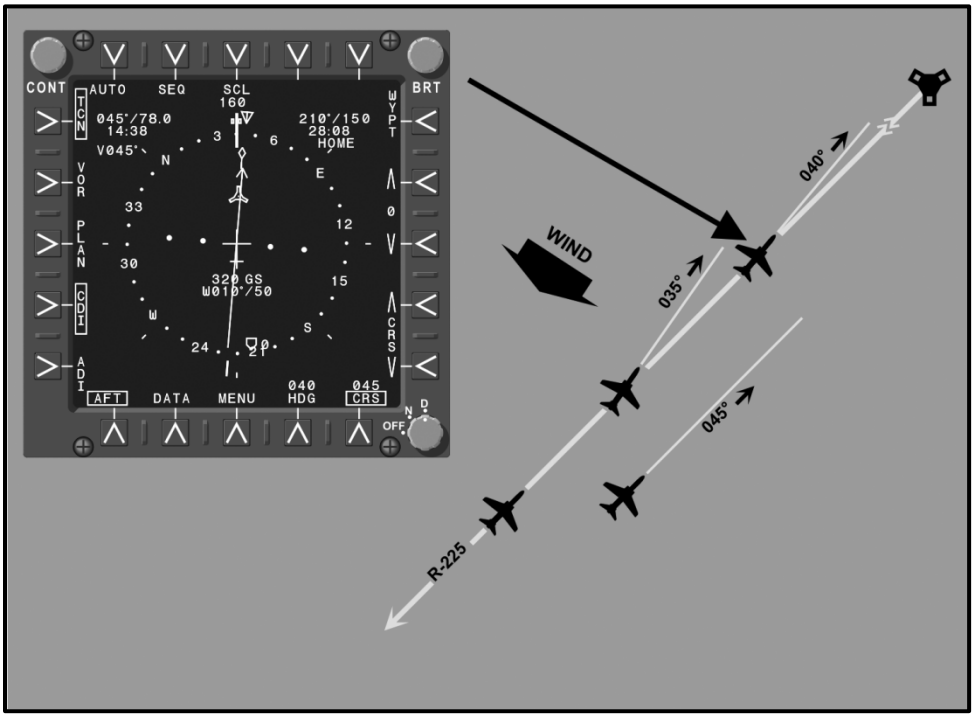

Figure 1-35 Wind Correction Procedures

2. Determine WCH with the ground track marker

a. Note location of ground track marker

b. Turn to a heading that moves the ground track marker directly over the end of the course line

c. Adjust heading to keep the ground track marker over the course line and maintain track on course

TACAN/VOR DME Point-to-point Navigation

NOTE

Use this procedure to fly from one TACAN fix to another via a direct track. If ATC clears you direct to the fix, you may be radar-vectored or required to use point-to-point navigation.

1. Tune and identify the station and select desired steering

2. Visualize HSI compass card as compass rose with station at center

3. Picture fix having greater distance from station on its radial at outside edge of HSI compass card, disregard HSI scale

4. Visualize fix with lesser distance (determined from previous step) at a proportional distance from center of HSI on its radial

NOTE

The aircraft is always positioned on the tail side of the navigation pointer. Where depends on the distance of the aircraft from the station when compared to the distance of the pt-to-pt fix relative to the station.

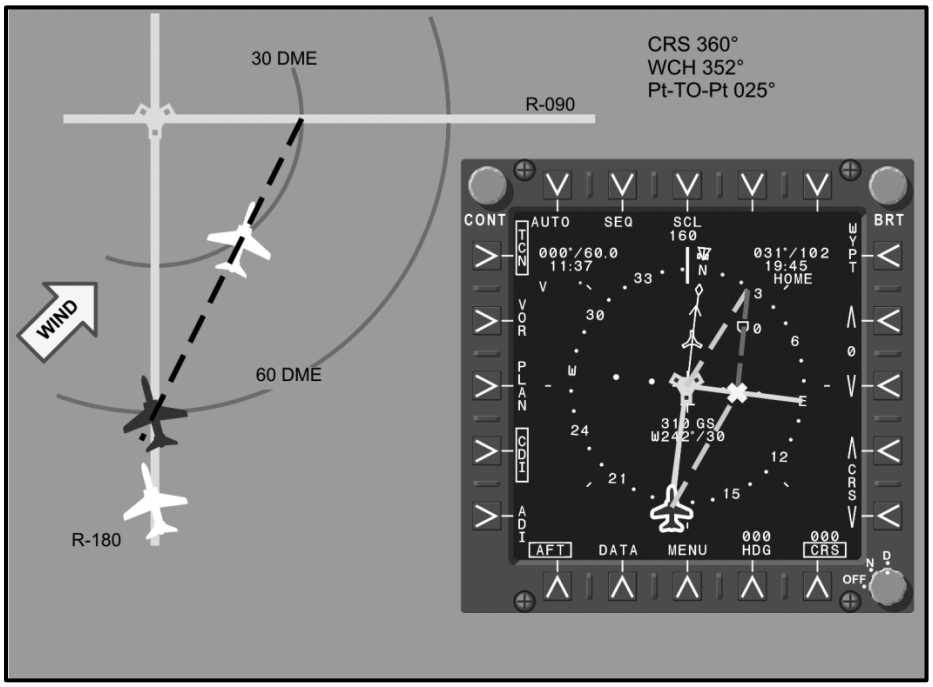

Figure 1-36 Point-to-Point Navigation Procedure 1

5. Connect two fixes with imaginary line or with aid of straight edge

6. “Move” line to center of HSI, paralleling original imaginary line and read the course to the fix off the compass rose

7. Turn to new course (plus wind correction if known); top of imaginary line where it crosses compass rose, ground track marker

8. Update course and make corrections to pt-to-pt fix periodically en route

NOTE

Address Co-DME solutions

COMMON ERRORS:

1. Not applying wind correction to initial course to pt-to-pt fix if known.

2. Not placing new line exactly parallel to original line.

3. Not updating the course and WCH periodically approaching second fix due to wind.

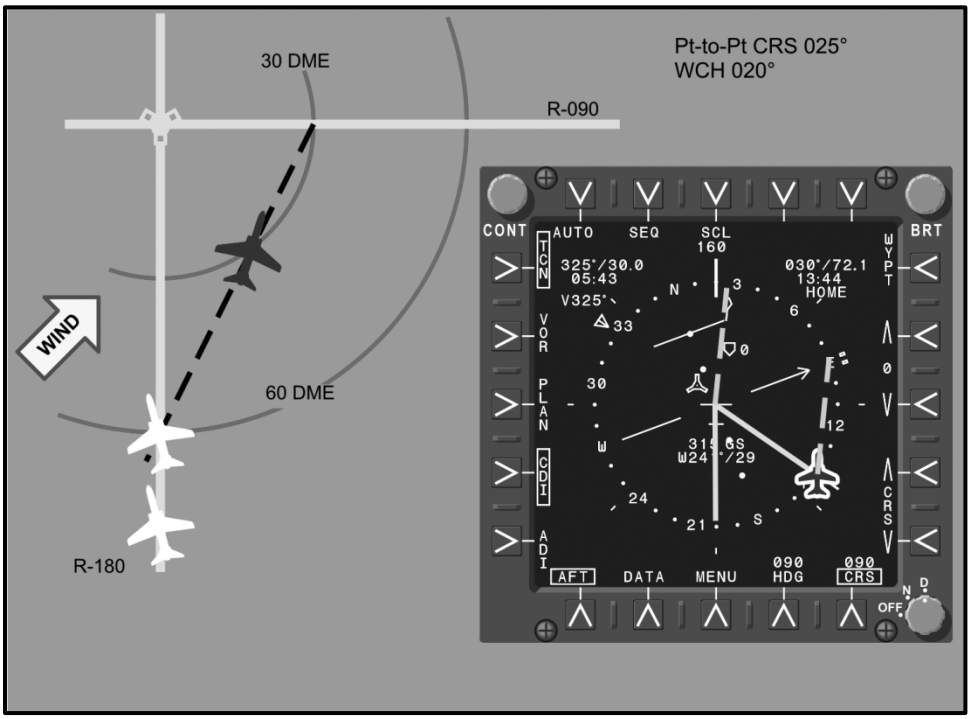

Figure 1-37 Point-to-Point Navigation Procedure 2

Direct Routing

NOTE

ATC occasionally amends a clearance, or you can request direct routing from ATC.

1. Tune and identify station

2. Turn in shortest direction to place bearing pointer under HSI heading index

3. Set course to center the CDI with course line pointing at the station

4. Note the course and maintain a wind-corrected heading that will track the inbound course selected, make heading corrections for wind drift as necessary

COMMON ERROR: Homing on station instead of proceeding direct on a set course.

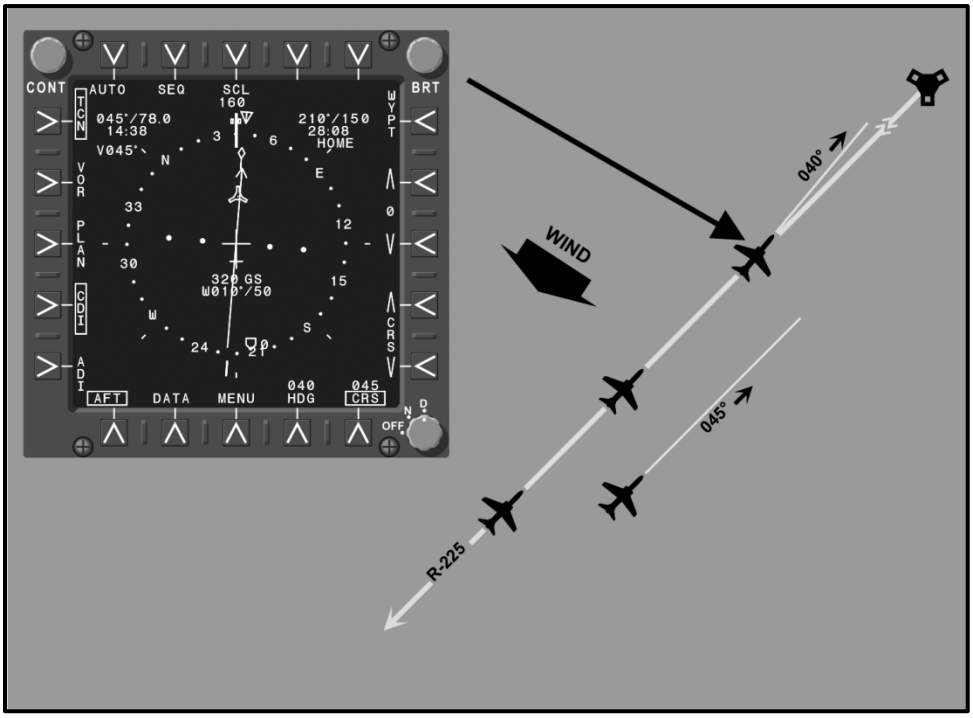

Figure 1-38 Direct to NAVAID

VOR - TACAN/VOR DME Holding Procedures

NOTE

Published holding patterns may be depicted on an enroute chart or as an integral part of an approach. Pilots are expected to hold as depicted unless specifically advised otherwise by ATC. Holding instructions may be amended anytime by ATC or provided by ATC when no holding pattern is depicted. In the absence of holding instructions and in a situation where holding is necessary, the pilot is expected to enter a standard holding pattern.

1. Holding clearance

   a. Direction of holding from the fix (e.g., W, NE, E)

   b. Radial and DME of the holding fix

   c. Leg length or the outer limit of the pattern in nm if DME vs timing

   d. Altitude

   e. Direction of turns (if nonstandard, pilot request or controller considers information necessary)

   f. Expected further clearance (EFC) time

NOTES

1. Unless a nonstandard pattern is published or designated by the controller by stating, “left turns,” in the clearance, the pattern is always standard.

2. During entry and while holding, all turns are performed at 3 degrees per second (SRT), not to exceed 30 degrees AOB.

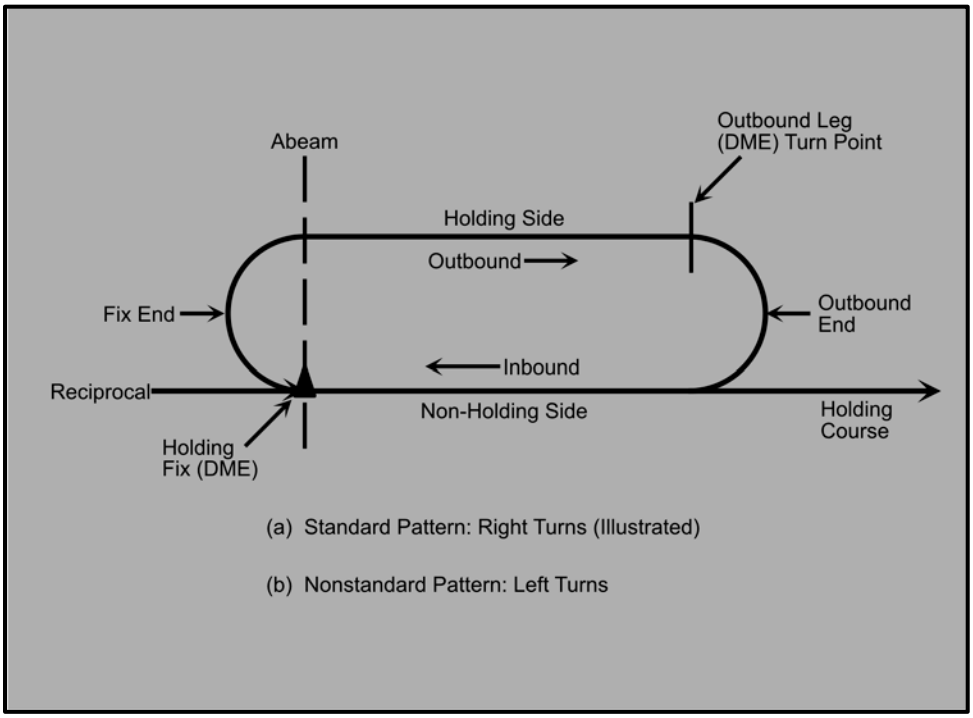

Figure 1-39 Standard Holding Pattern (TACAN)

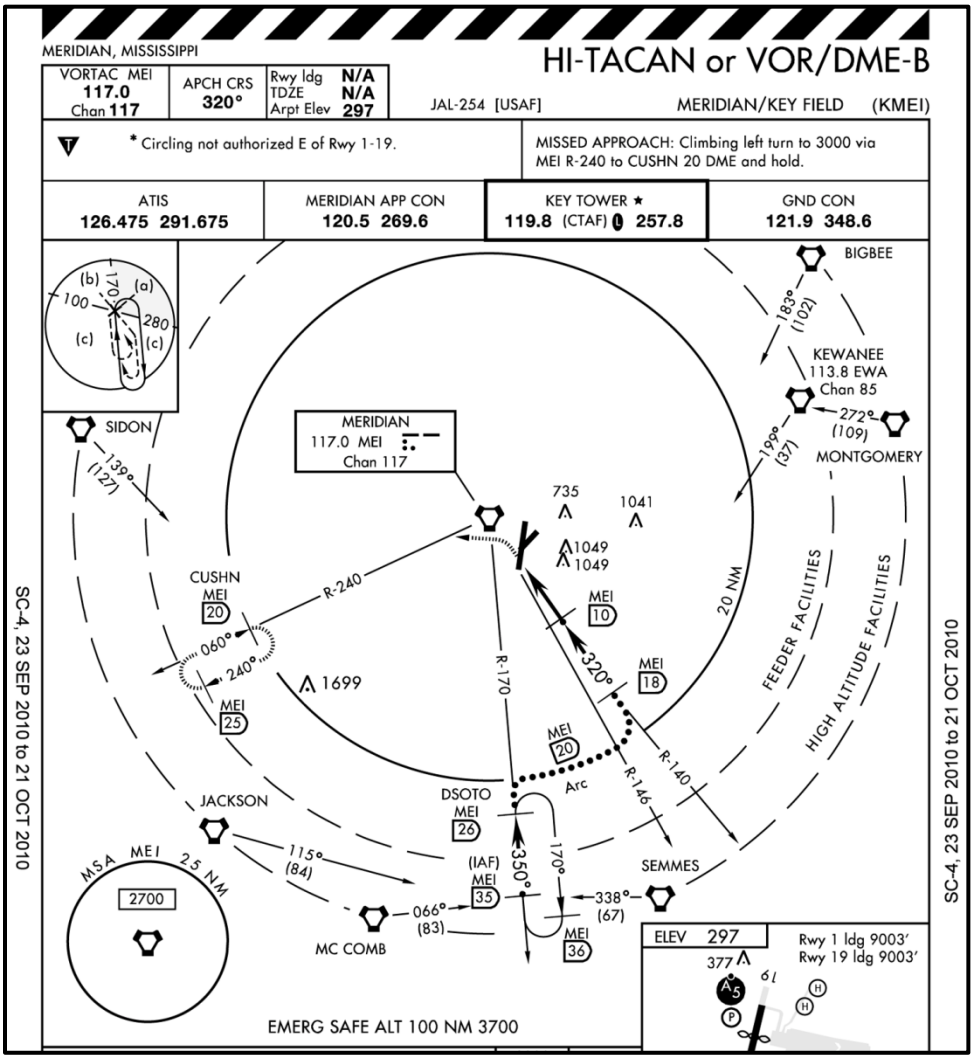

Figure 1-40 TACAN Holding

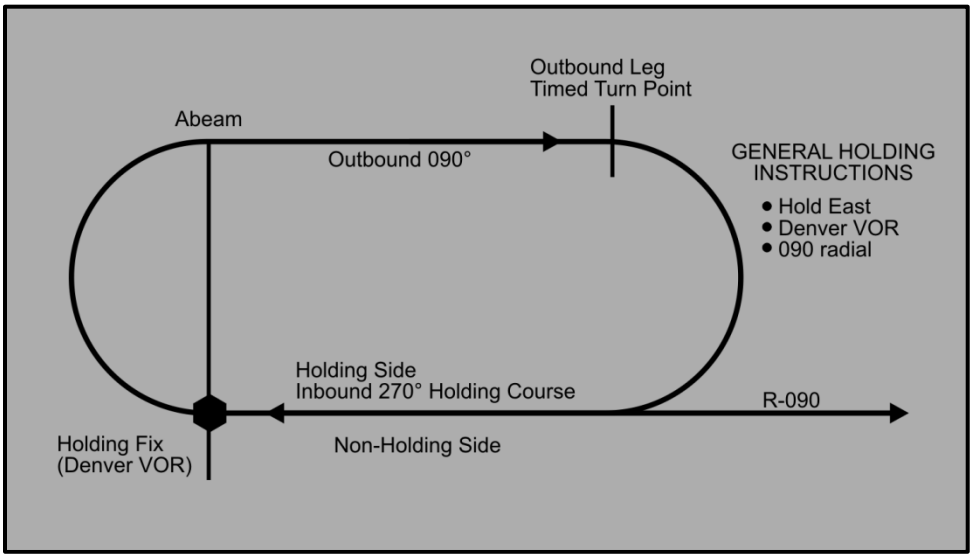

Figure 1-41 Non-DME Holding Pattern

2. Commence slowing to holding speed when within 3 minutes prior to crossing holding fix at or below max holding speed

- T-45C procedural holding speed: 200 KIAS not to exceed 14 units AOA; the NATOPS turbulence penetration airspeed for the T-45C is 250 KIAS

NOTE

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

ALTITUDE (MSL)	AIRSPEED (KIAS)
MHA--6,000 ft	200
6,001 ft--14,000 ft	230
14,001 ft and above	265

The following are exceptions to the maximum holding airspeeds:

1. Holding patterns at USAF airfields only- 310 KIAS maximum unless otherwise depicted.

2. Holding at Navy fields only-230 KIAS maximum, unless otherwise depicted.

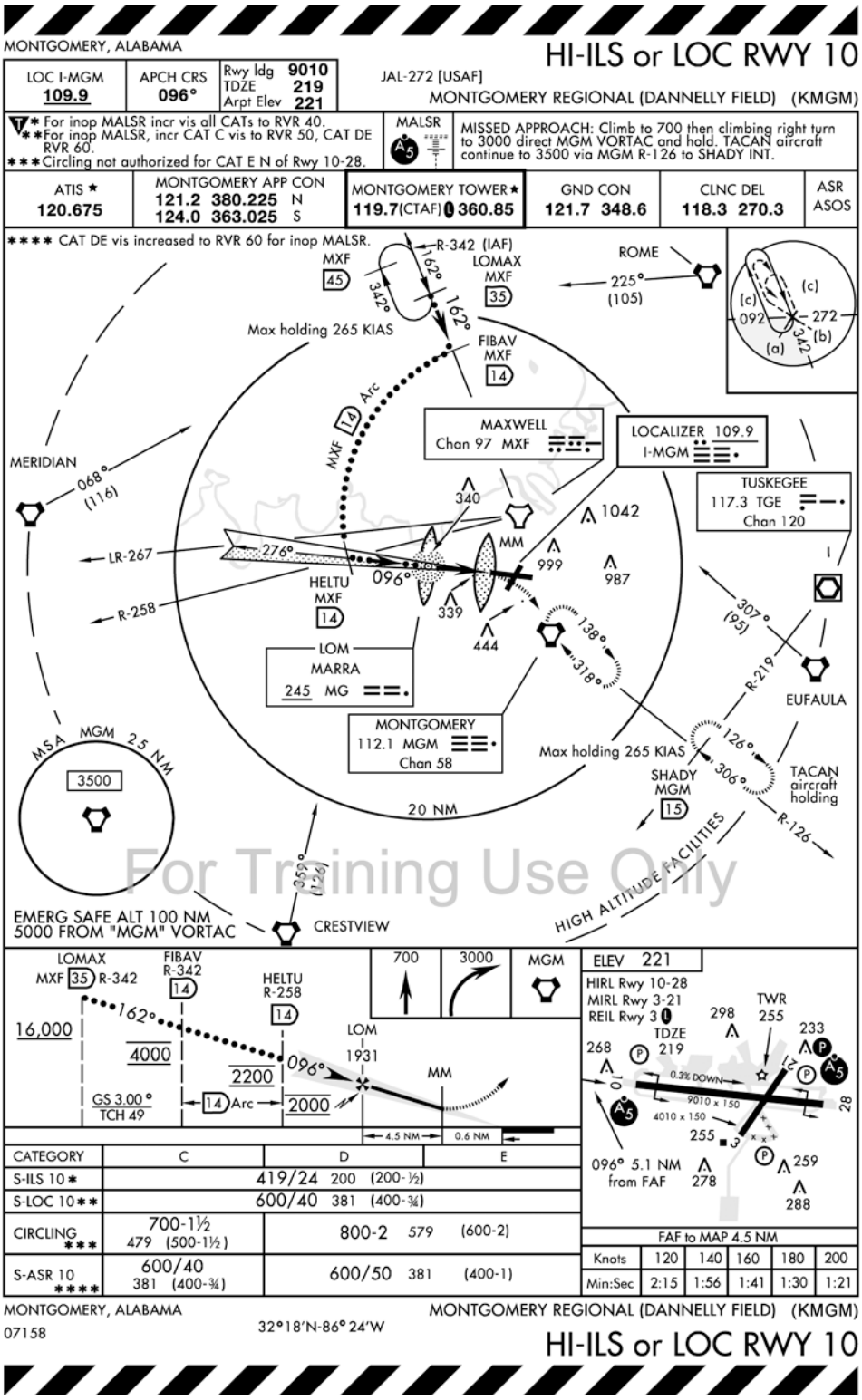

Figure 1-42 MGM HI ILS 10 Approach

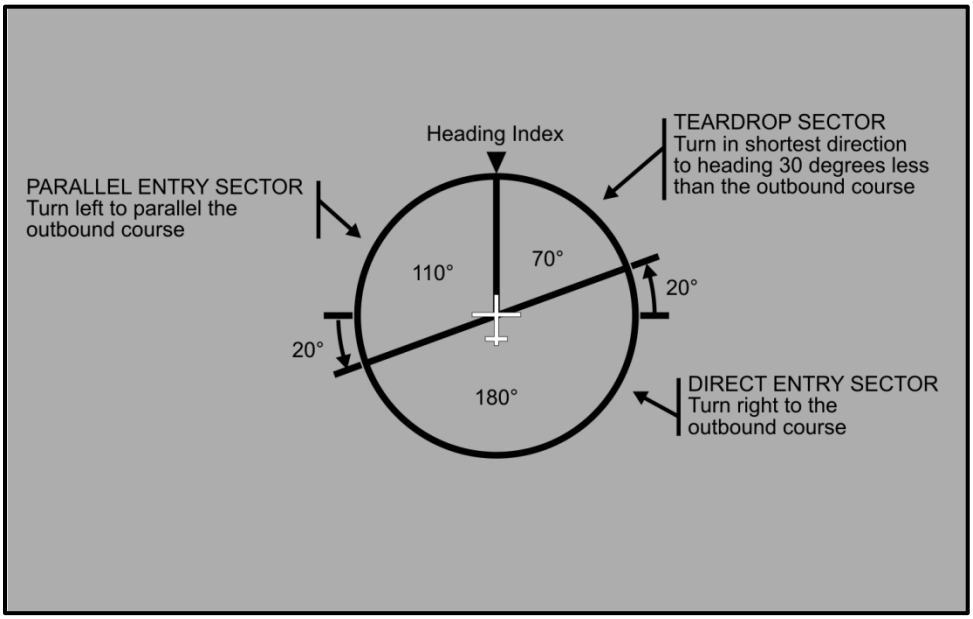

Figure 1-43 Holding Entry Procedure (Standard)

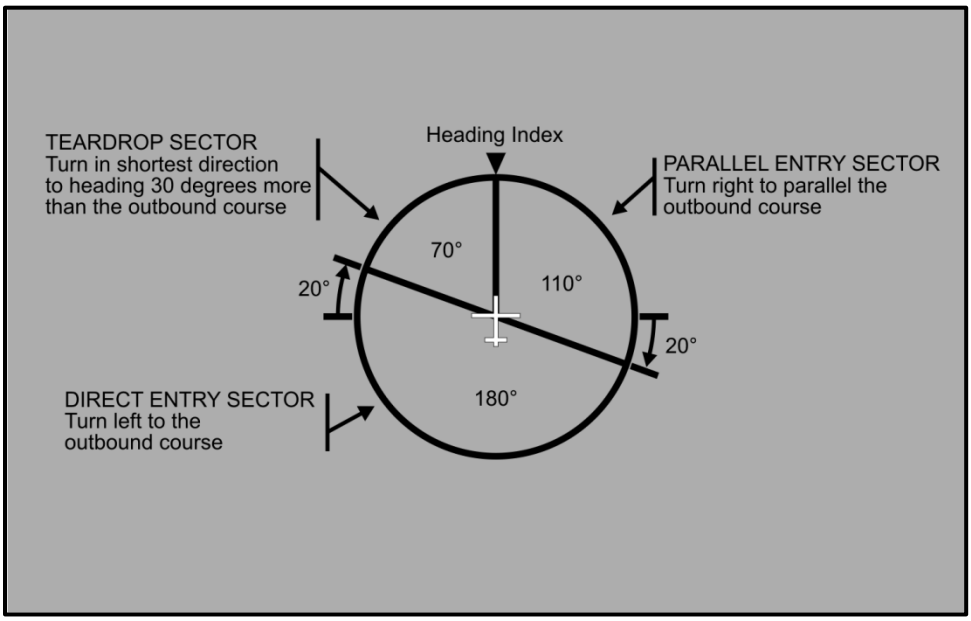

Figure 1-44 Holding Entry Procedure (Nonstandard)

3. Determine entry

   a. Visualize a straight line on HSI from aircraft heading to center of instrument

b. Visualize appropriate entry procedure plot superimposed on top of the HSI and locate the holding radial to determine entry procedure to be used

NOTE

If the holding radial is within +/- 5 degrees of the entry plot quadrant division points, either entry procedure associated with the point may be used. The most appropriate entry is determined by consideration of known wind, holding airspace, etc.

4. Holding entry procedures for TACAN, VOR, VOR/DME

a. Teardrop - Perform teardrop entry if holding radial is within 70 degrees right of heading

i. At holding fix, turn outbound on heading 30 degrees from reciprocal of holding course (radial)

NOTE

For standard holding, subtract 30 degrees from assigned holding radial to determine entry heading for teardrop. For nonstandard pattern, add 30 degrees.

ii. Note time or DME

iii. Enter holding course on HSI or DEP

iv. After desired time or DME is reached, turn in direction of holding radial to intercept inbound holding course

v. Return to holding fix

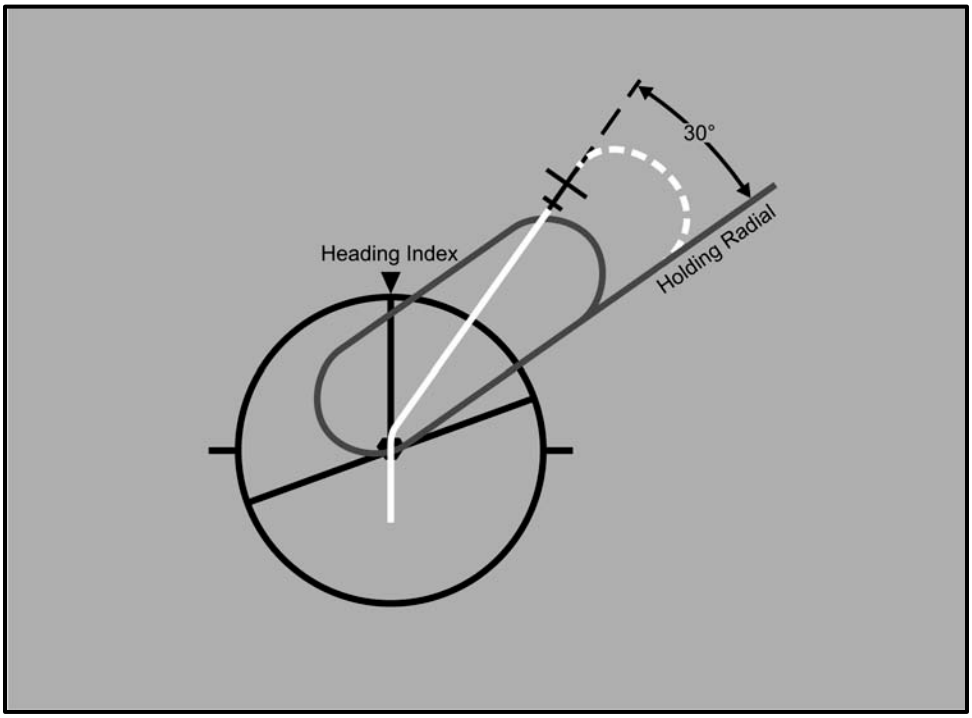

Figure 1-45 Teardrop Entry (Standard)

b. Parallel - Perform parallel entry if holding radial is within 110 degrees left of heading

i. At holding fix, turn in shortest direction to parallel holding course

ii. Note time or DME

iii. Enter holding course on HSI or DEP

iv. After desired time or DME is reached, turn in direction of holding radial to intercept inbound holding course

v. Return to holding fix

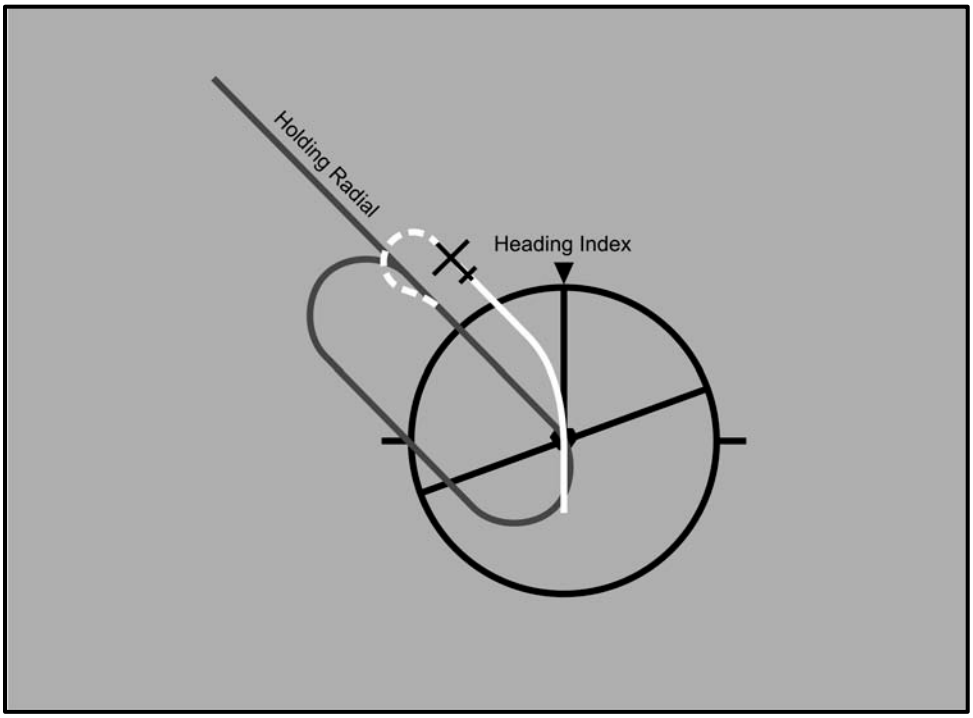

Figure 1-46 Parallel Entry (Standard)

c. Direct - Perform direct entry if holding radial is outside an area of 110 degrees (to the left) and 70 degrees (to the right) of heading

i. At holding fix, turn to the outbound holding heading on the pattern side of the fix

ii. Note time or DME

iii. Enter holding course on HSI or DEP

iv. After desired time or DME is reached, turn in direction of holding radial to intercept inbound holding course

v. Return to holding fix

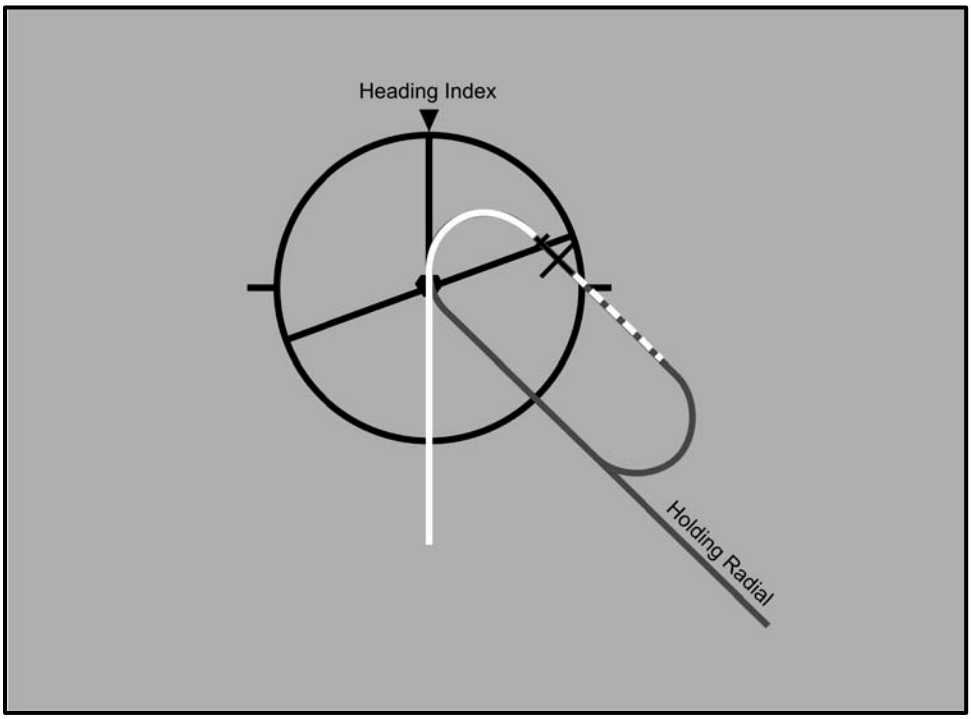

Figure 1-47 Direct Entry (Standard)

NOTE

1. When holding utilizes a timed pattern at altitudes at or below 14,000 ft MSL the pattern inbound leg is 1 min. Above 14,000 ft MSL, the inbound leg is 1.5 min.

2. Timing outbound for all holding is commenced wings level or abeam, whichever occurs last. Timing inbound is commenced wings level inbound on intercept or on course.

5. Holding pattern wind correction

a. Crosswind correction

i. Used while in holding pattern

ii. Apply wind correction crab angle that is 2 to 3 times the angle that holds the aircraft on course inbound

iii. Use SRT in pattern

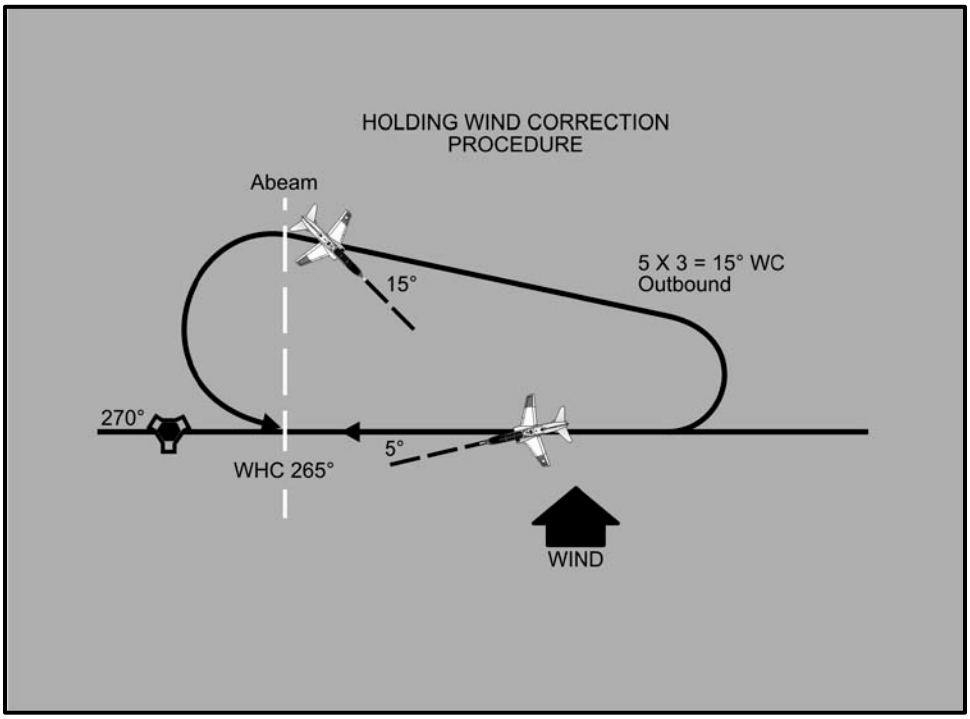

Figure 1-48 Correction Applied to Crab Angle Outbound

b. Head winds and tail winds

i. Affect only timed holding patterns

ii. Adjust outbound time for correct inbound timed

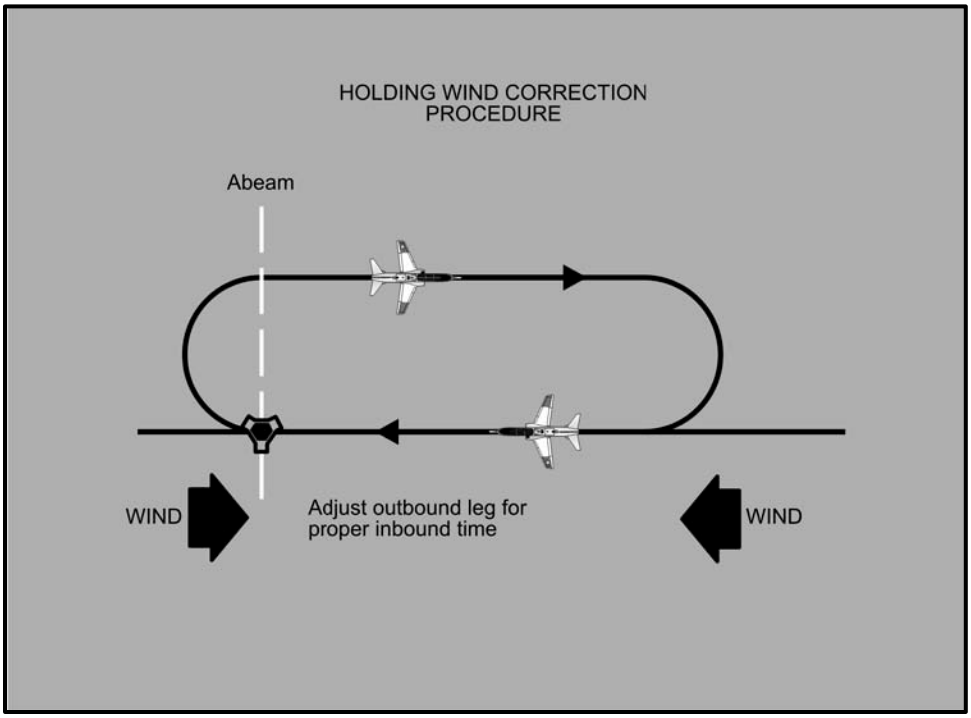

Figure 1-49 Correction for Head/Tail Wind on Timed Leg

6. Lost communication procedures

   a. EFC time received

      i. If holding fix and initial approach fix (IAF) are the same: leave fix at EFC time

      ii. If holding fix and IAF are not the same: leave holding fix at EFC time and commence approach

   b. EFC not received: Continue on assigned route. Do not hold but proceed to initial approach fix. Plan arrival at IAF at ETA

7. When holding at a fix and instructions are received specifying the time of departure from the fix, the pilot should adjust the aircraft's flight path within the limits of the established holding pattern in order to leave the fix at the exact time specified. After departing the holding fix, normal speed is to be resumed with respect to other governing speed requirements, such as terminal area speed limits, specific ATC requests, etc. Where the fix is associated with an instrument approach and time approaches are in effect, a procedure turn shall not be executed unless the pilot advises ATC, since aircraft holding are expected to proceed inbound on final approach directly from the holding pattern when approach clearance is received.

Elements of an ILS Approach

1. Localizer

   a. Provides azimuth for front and back course approach (unless antenna shielded from back course)

   b. Usable range: 35 degrees within 10 nm and 10 degrees within 18 nm of course centerline unless published approach depicts a transition beyond this range

   c. Beam width is 5 degrees wide, 2 1/2 degrees either side of centerline

   d. Transmits on odd tenths from 108.1 MHz through 111.9 MHz - Aural Morse code identifier will include the letter "I" preceding the normal 3-letter identifier

NOTE

The localizer sensing equipment displays aboard the aircraft are four times as sensitive as TACAN and VOR displays.

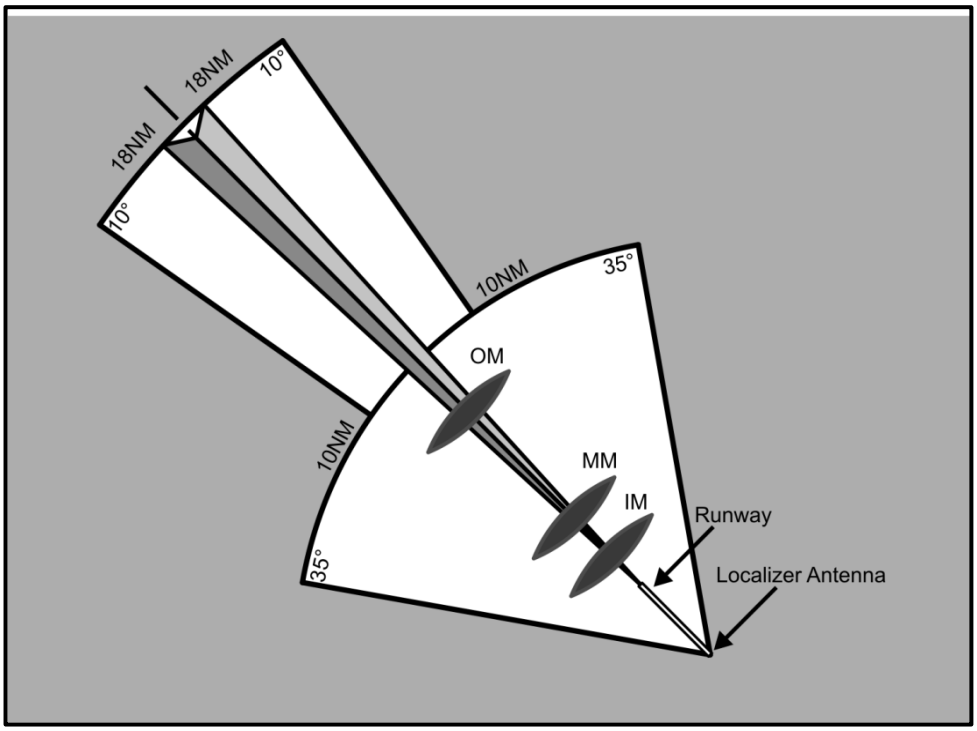

Figure 1-50 Localizer Signal Usable Range

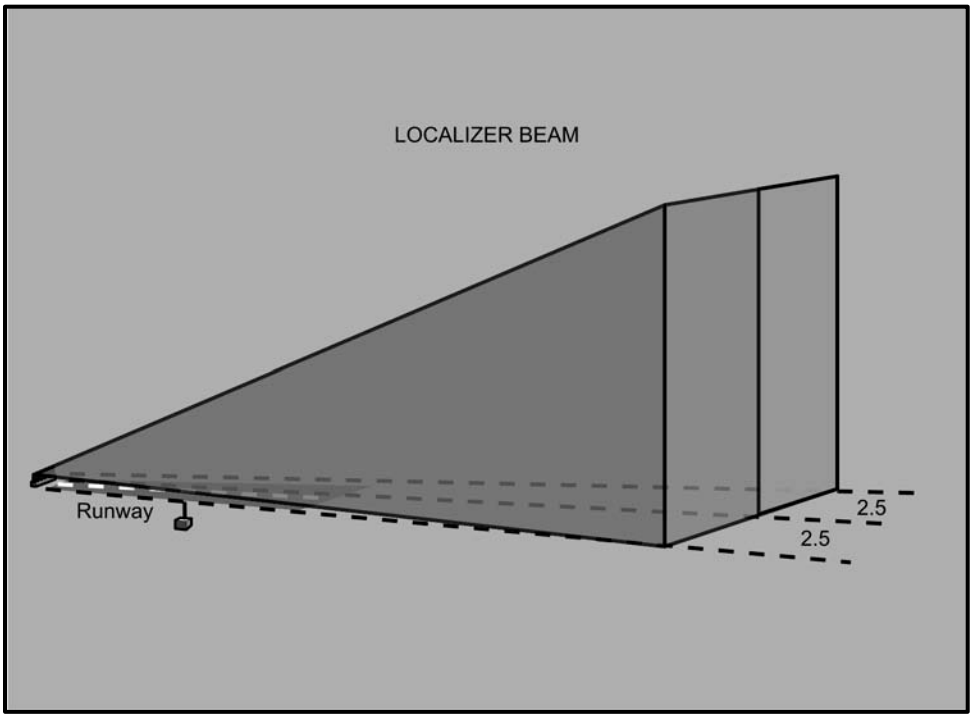

Figure 1-51 ILS Localizer Components 1

2. Glideslope transmitter

   a. Produces a navigational signal which provides vertical guidance for the pilot (glidepath) along the localizer approach course

NOTES

1. The ILS beam gradient (glideslope) is normally set for a 3-degree glidepath. However, the angle may be set to other gradients due to terrain or obstacle clearance and/or reception requirements.

2. "Glideslope" is defined as the descent angle assigned to an approach for a given runway for the reasons stated above. Normally the term is associated with the final descent angle of an ILS or PAR approach. "Glidepath" is defined as that portion of a precision approach where the glideslope <u>intersects</u> the localizer beacon of an ILS or FAC of a PAR.

   b. Located 750 ft - 1,250 ft down the designated ILS runway offset 250 ft - 600 ft from centerline

NOTE

Glideslope frequencies are paired to localizer frequencies and are automatically tuned upon selection of localizer frequency.

c. The beam usable range: 10 nm, provided aircraft is on localizer course (may be certified for extended service volume which exceeds 10 nm)

i. Intersects inner marker beacon approximately 100 ft above runway elevation

ii. Intersects middle marker beacon approximately 200 ft above runway elevation

iii. Intersects outer marker beacon approximately 1,400 ft above runway elevation

d. Transmits on frequencies from 329.15 MHz through 335.0 MHz in direction of final approach

WARNING

Never use displayed glidepath information on missed approach.

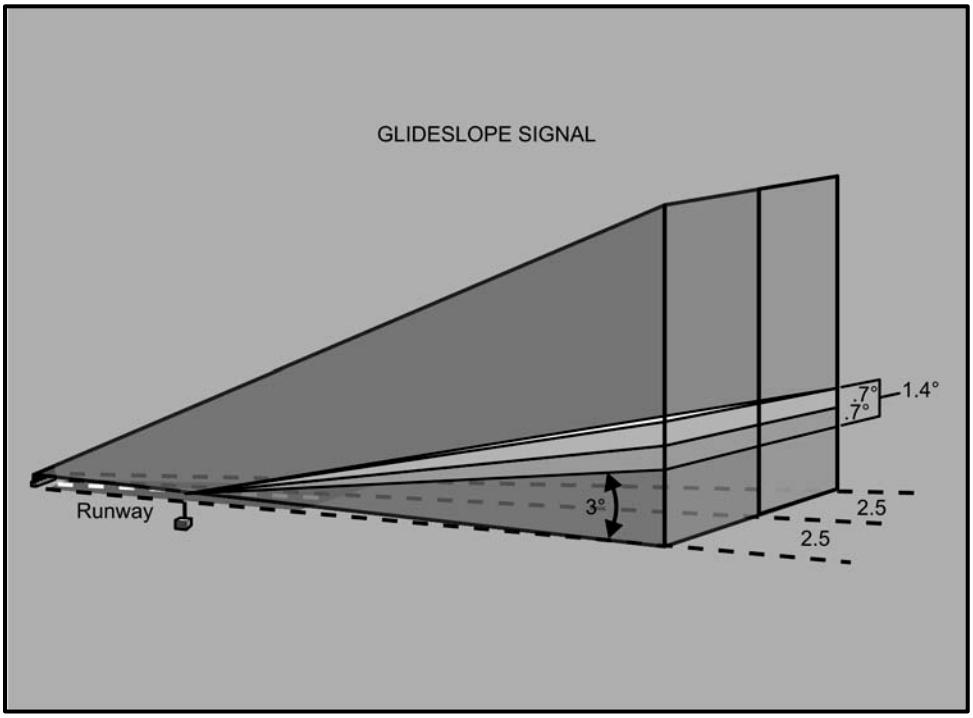

Figure 1-52 ILS Localizer Components 2

3. Marker beacons

a. Outer

i. Provides range/distance reference point (beacon signal indicates aircraft passage over beacon)

ii. Often marks FAF

NOTE

Not all ILS approaches have an outer marker at the FAF. On some ILS approaches, DME, radar, or crossing radial is used to mark the FAF.

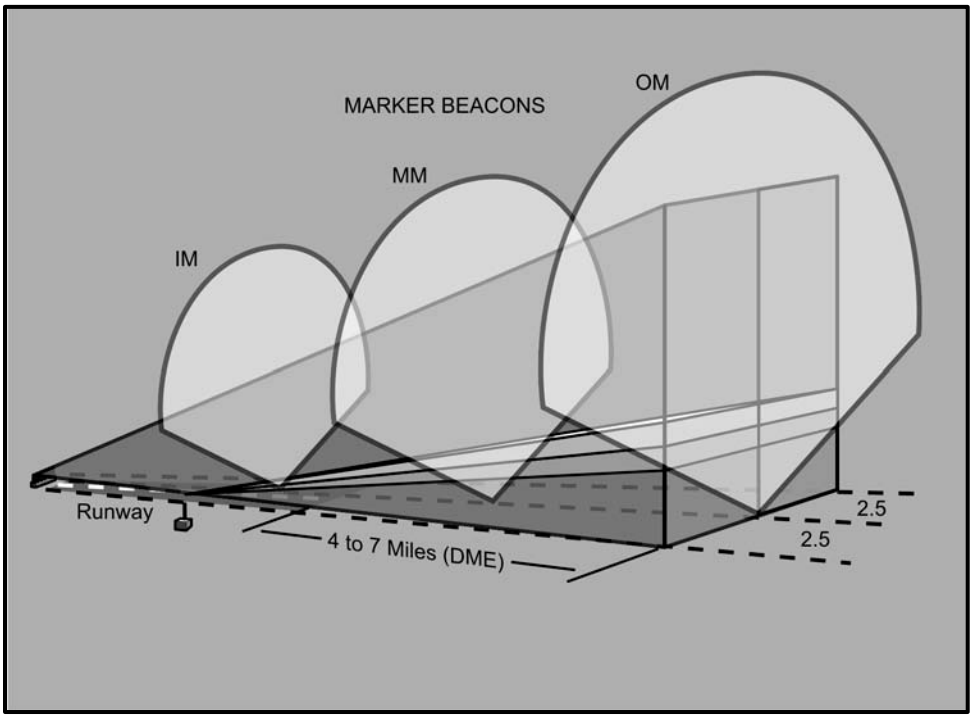

Figure 1-53 ILS Localizer Components 3

b. Middle

i. The MM indicates a position approximately 3,500 feet from the landing threshold. This is also the position where an aircraft on the glidepath will be at an altitude of approximately 200 feet above the elevation of the touchdown zone.

ii. ILS Minimums

The lowest authorized OPNAV Category I ILS weather minimums, with all required ground and airborne system components operative, are: Decision Height (DH) 200 feet and ½ Mile or Runway Visual Range (RVR) 2,400 feet.

NOTES

1. T-45C is only equipped for Category I ILS approach.

2. Category I ILS Missed Approach Point is defined as Decision Altitude (DA = DH + TDZE).

CATEGORY	C	D	E
S-ILS 13R	250-3/4	200	(200-3/4)
S-LOC 13R	420-1 370 (400-1)	420-1 1/4 370	(400-1 1/4)
CIRCLING*	500-1 1/4 450 (500-1 1/4)	600-2 550 (600-2)	620-2 570 (600-2)
S-PAR 13R	150-1/2 100 (100-1/2) GS 3.0		
HI-ILS/DME RWY 13R			

Figure 1-54 Minimums for Approach

c. Inner

i. Indicates decision height point for Category II approach (100 ft RVR 1200)

ii. Provides progress reference point for Category III approach (RVR 700). Special authorization and equipment are required for Category II and IIIA ILS approaches

Minimums for Approach

1. You may not commence an actual or practice Instrument approach at your destination/alternate when the weather is reported below approach minimums.

2. If the airfield goes below minimums after an approach has been commenced pilots may, at their discretion, continue the approach to published minimums.

3. Practice approaches to minimums may be conducted at enroute airfields (destination/alternate not included) regardless of weather minimums and you have no intent to land.

4. Formation Minimums

a. Approach weather minimums for two aircraft must be at least published circling minimums or 1000-3 if circling approach is not authorized.

b. Instrument approaches with or without intent to land in IMC by formations of more than two aircraft are not authorized.

c. Penetration of IMC to obtain VMC by formations of more than two aircraft is authorized.

4. Aircraft instrument indications (ILS)

a. ADI

i. The localizer needle is centered in azimuth on the waterline symbol and ranges +/- 1/2 (+/- 2.5 degrees)

ii. The glideslope needle is centered in elevation on the waterline symbol and ranges +/- 1/2 inch (+/- 0.7 degrees)

iii. When limited, the appropriate needle will flash

iv. The command heading bug displays the selected ILS course

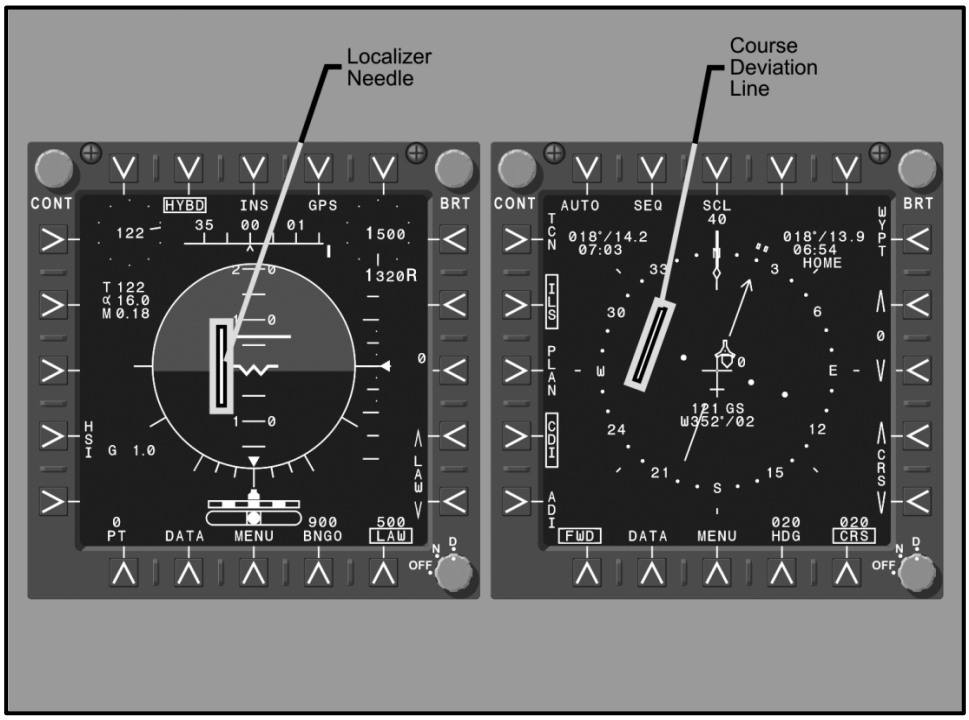

Figure 1-55 ILS Azimuth Indications

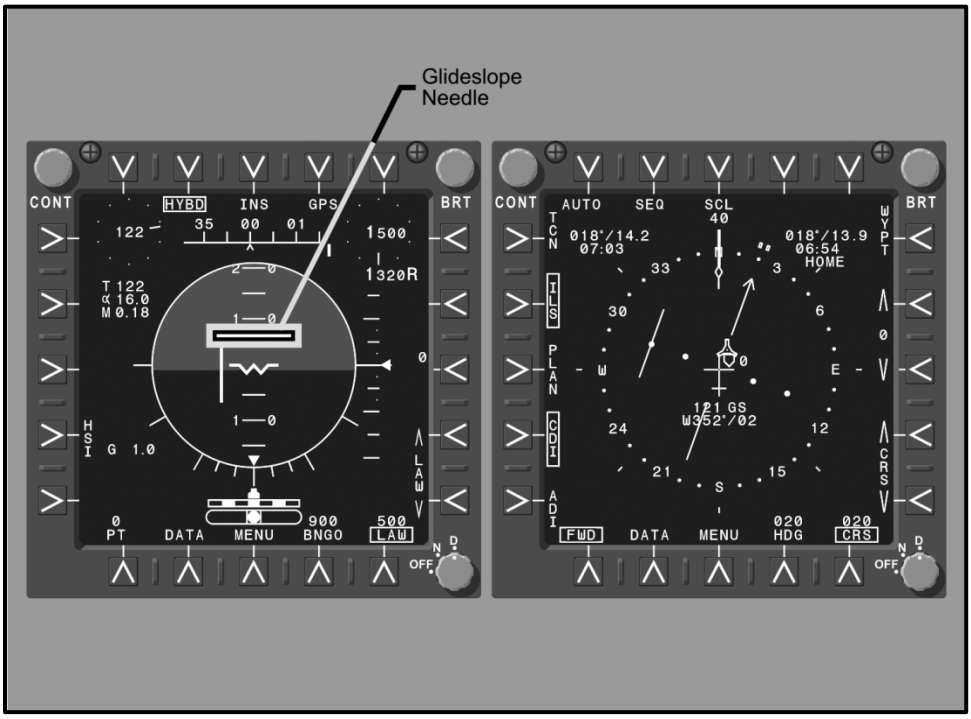

Figure 1-56 ILS Glideslope Indications

b. HSI

- With ILS as the only selected steering source, the CDI deviation line must be interpreted by the pilot based on the width of the localizer course

STAN NOTES

On ILS Final HSI shall be in ILS/CDI mode. Waypoint & TACAN UN-BOXED

c. HUD

i. When the ILS needles are displayed on the ADI, they are also displayed on the HUD

ii. The needles are referenced to the velocity vector and the scaling is commensurate with the ADI display

NOTE

When a valid ILS channel is selected, ILS steering is selected and a valid ILS signal is received, the localizer and glideslope needles are displayed. Needles for invalid inputs will not be displayed.

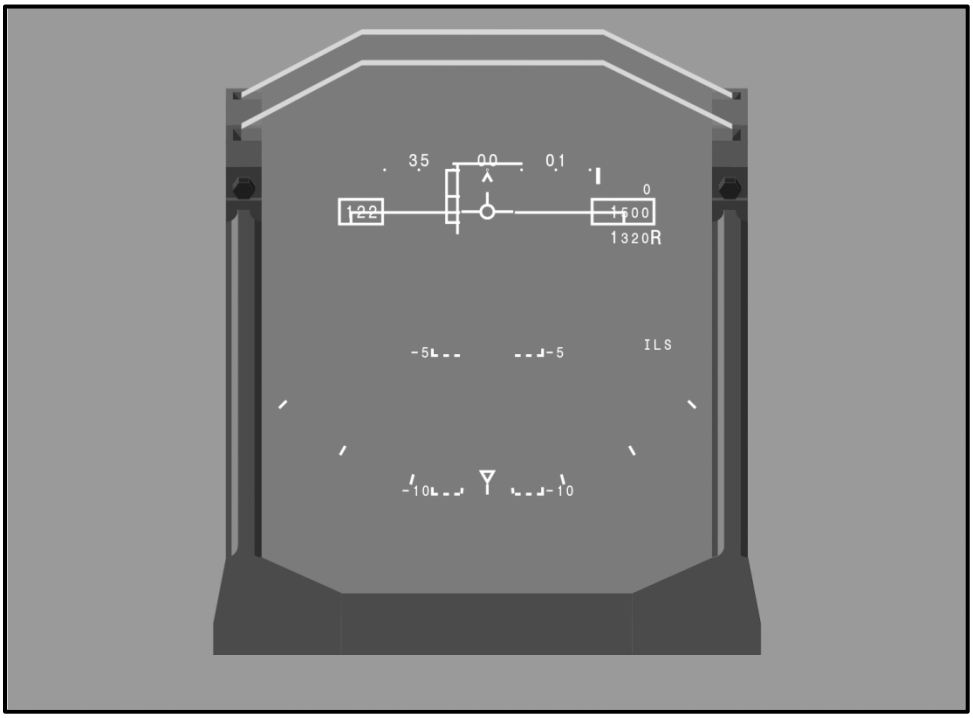

Figure 1-57 NAV Approach Display - ILS

d. ILS advisory windows

- Flashing advisory windows displayed on all MFDs

  (a). GLIDESLOPE -- glideslope signal invalid, glideslope needle masked

  (b). LOCALIZER -- localizer signal invalid, localizer and glideslope needles masked

  (c). ILS -- glideslope and localizer signal invalid, localizer and glideslope needles masked

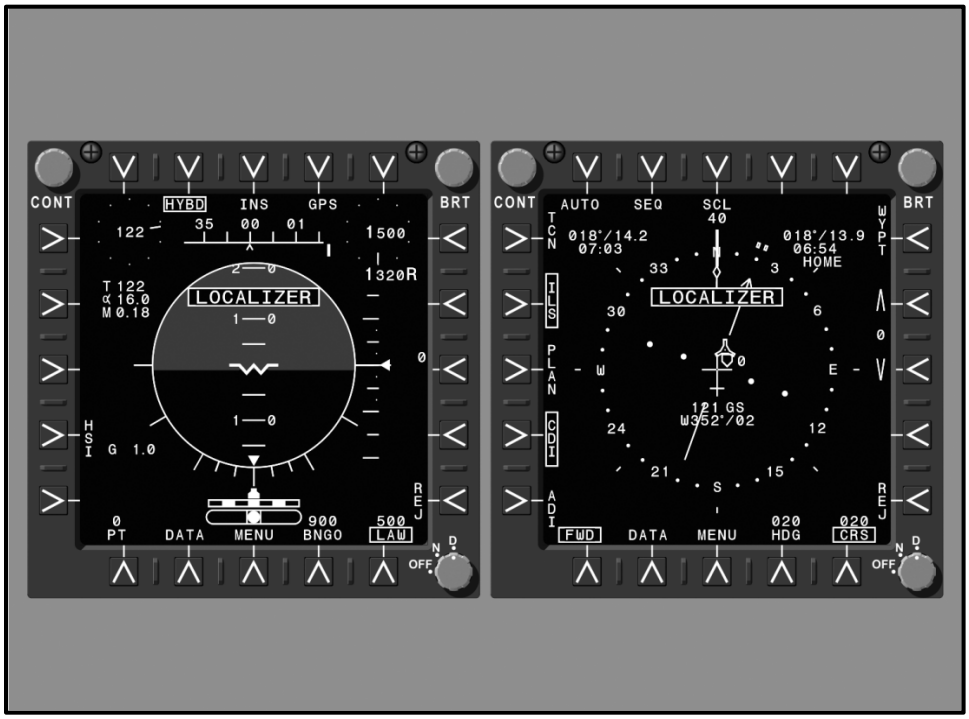

Figure 1-58 Advisory Window

e. Marker beacon lights are synchronized with audio identification

i. Outer marker passage

(a). Blue light

(b). Tone is two dashes per second at 400 Hz

ii. Middle marker passage

(a). Amber light

(b). Tone is dots and dashes at 1,300 Hz

iii. Inner marker passage

(a). White light

(b). Tone is six dots per second at 3,000 Hz

ILS Approach

1. Initial entry to localizer intercept

   a. Procedure

      i. Tune and identify the ILS frequency, select ILS steering and enter inbound course

      ii. Select MARKER and VOR on COMM panel

NOTE

It is recommended that when flying an ILS approach, the LOC audio signal be selected.

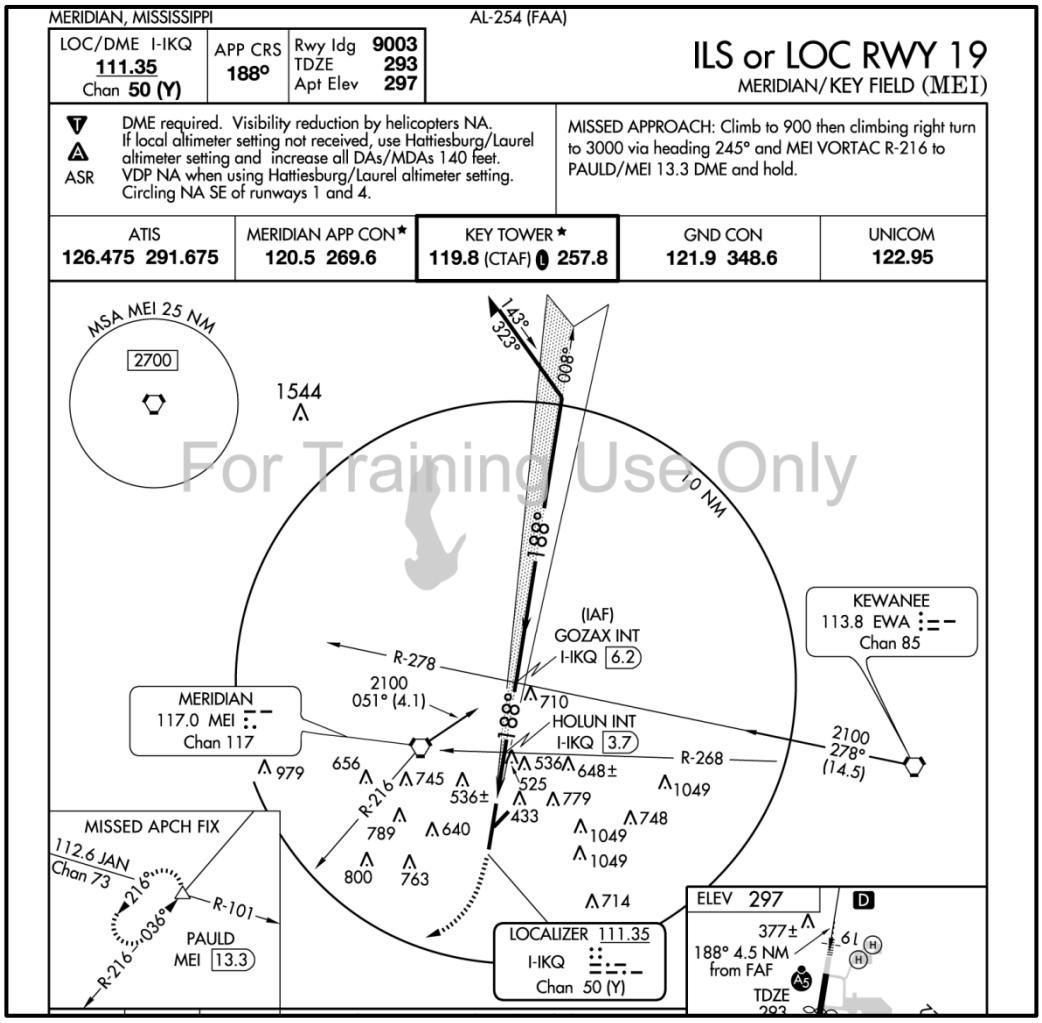

Figure 1-59 ILS Approach Procedures (Plan View)

iii. Begin slowing to landing configuration 5 – 7 miles prior to final approach fix. Be trimmed, on speed, landing checks complete except for speed brakes, buy the final approach fix.

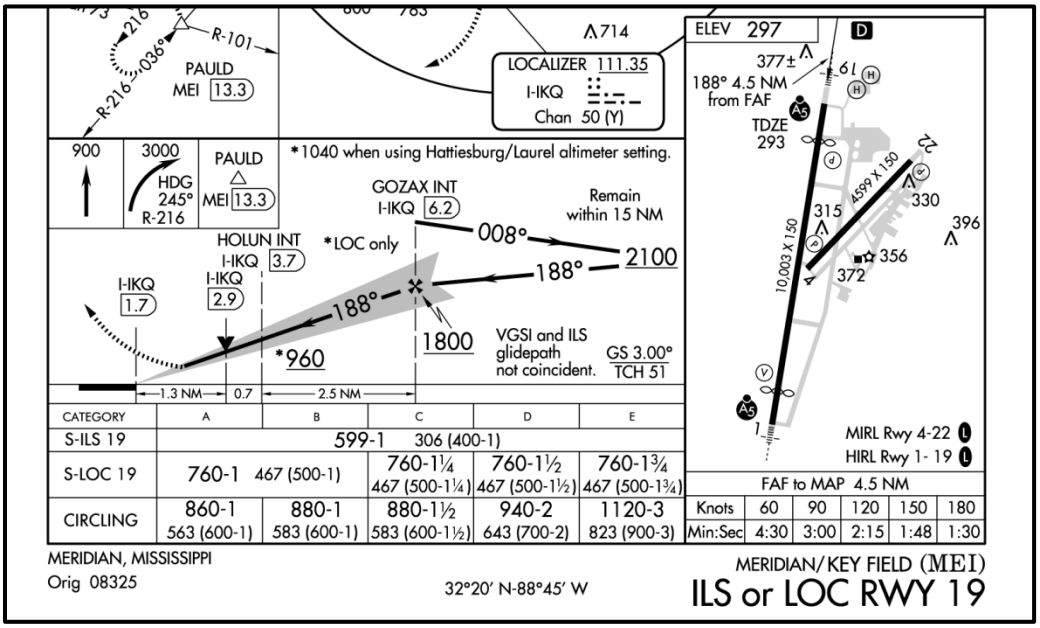

Figure 1-60 ILS Approach Procedure (Profile View)

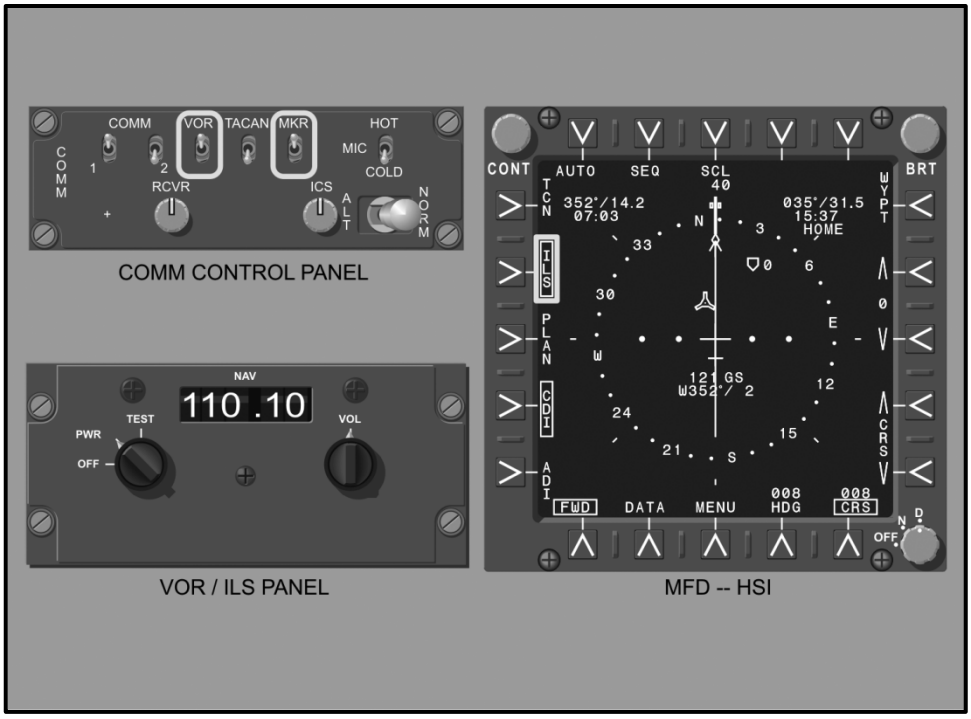

Figure 1-61 Cockpit ILS Navigation Setup

NOTE

You are considered established on the approach once the azimuth deviation needle or CDI course deviation line starts movement off full deflection.

b. Scan

i. Use azimuth deviation needle and CDI course deviation line to establish/ maintain localizer course

ii. Use glideslope deviation needle and HSI DME to monitor progress to intercept point of ILS glidepath

2. Localizer/glidepath intercept to DA/MAP

a. Procedure

i. Maintain localizer course

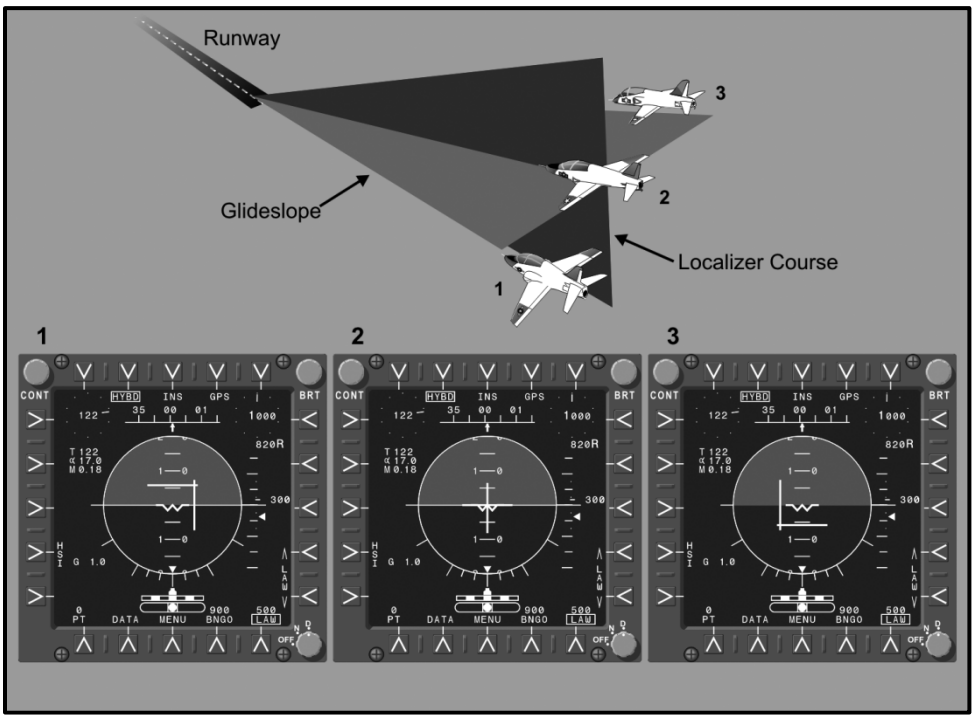

Figure 1-62 ADI-ILS LOC/GS Functional Displays

NOTE

The localizer is only 5 degrees wide vs 20 degrees for a TACAN or VOR signal. Heading corrections once on the localizer should be limited to +/- 5 degrees from WCH to maintain course. Once established inside the outer marker (OM), initial heading corrections should be limited to the number of degrees off course with consideration of the known WCH. Reference Ground Track Marker (GTM) for WCH.

ii. Maintain on-speed AOA (verify against airspeed) when glideslope pointer/deviation bar are approaching on glidepath position

iii. Extend speed brakes at glidepath intercept

iv. Start clock at FAF

v. Maintain on-speed descent on localizer course and glidepath

vi. Increase inside outside scan

vii. DA execute land or execute missed approach

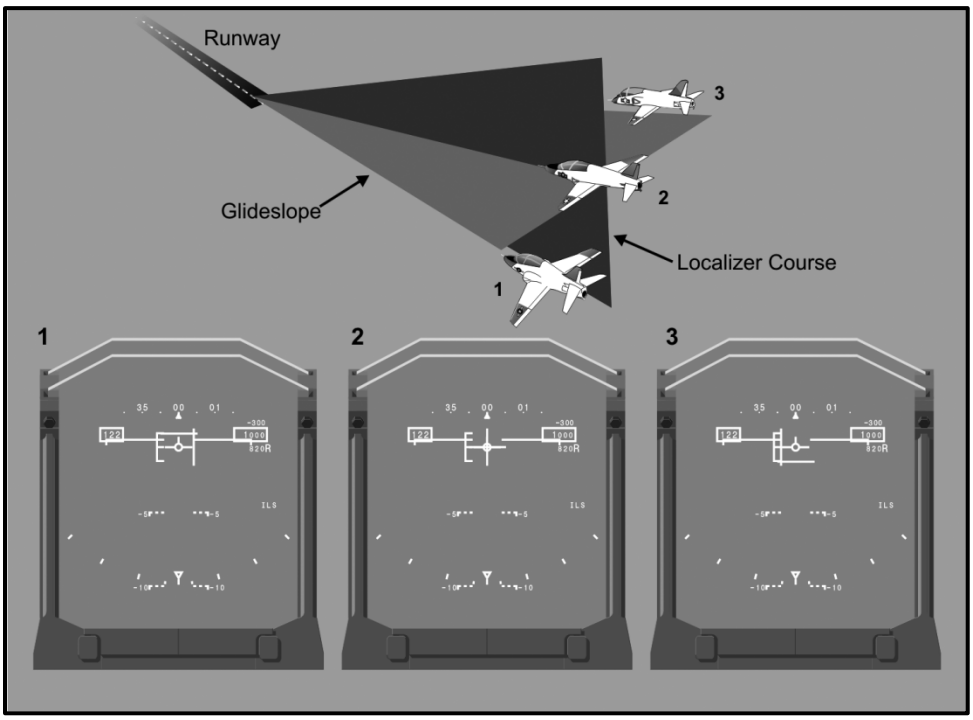

Figure 1-63 HUD-ILS LOC/GS Functional Displays

b. Control

i. Upon intercepting glidepath, extend speed brakes and adjust power as required to maintain on-speed and establish desired rate of descent on glidepath

ii. Make GS corrections using power

iii. Make AOA adjustments using attitude

iv. Make small heading corrections +/- WCH to maintain LOC course

COMMON ERRORS:

1. Reversing control of pitch and power.

2. Using too large heading change to correct to course and chasing the localizer FAC.

v. Start clock at FAF if timing depicted

vi. Maintain descent

vii. Increase out-of-cockpit scan frequency

viii. DA

(a). Transition to out-of-cockpit scan at DA if runway/field environment in sight

(b). Execute missed approach if runway environment not in sight or you determine that a safe landing is not possible

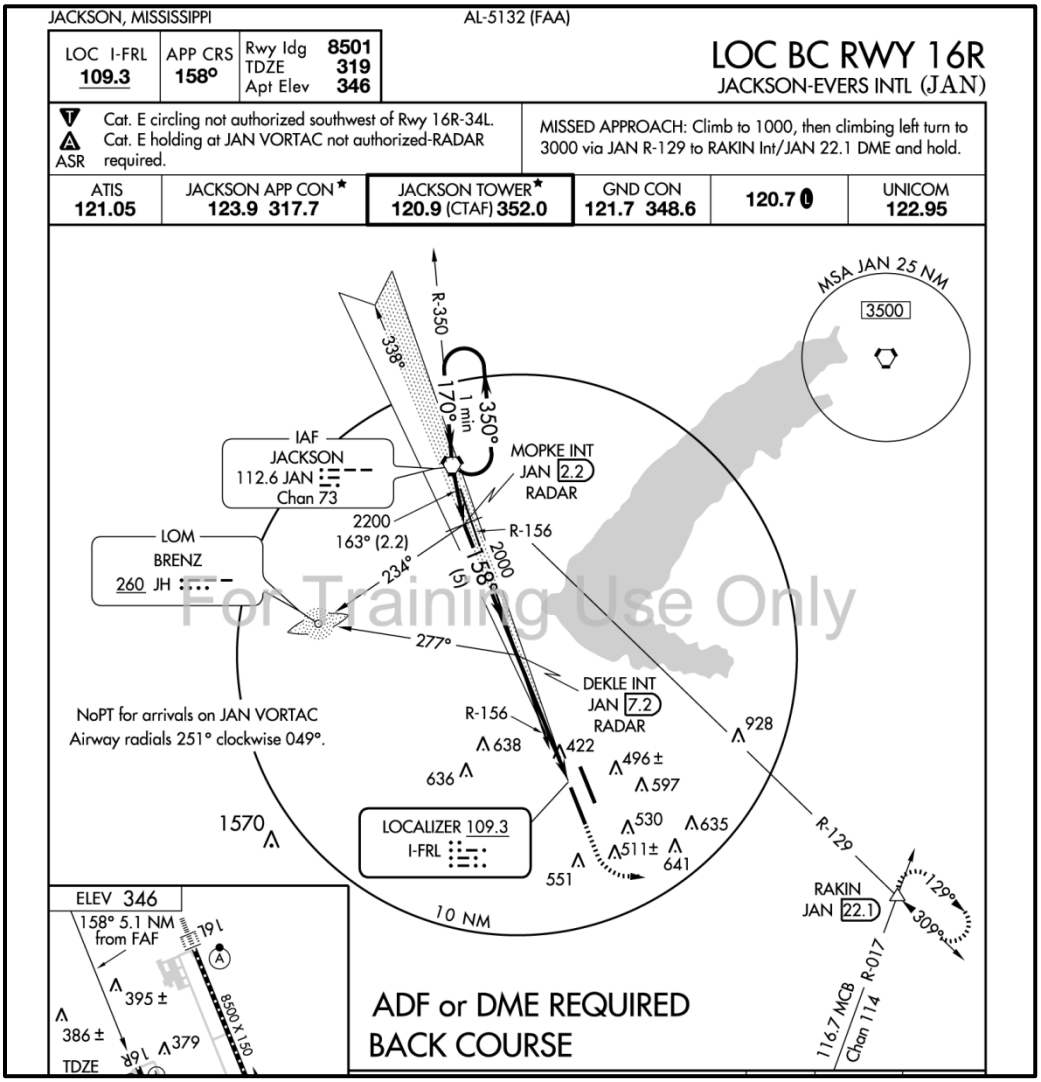

Figure 1-64 Localizer Back Course Approach Procedure (Plan View)

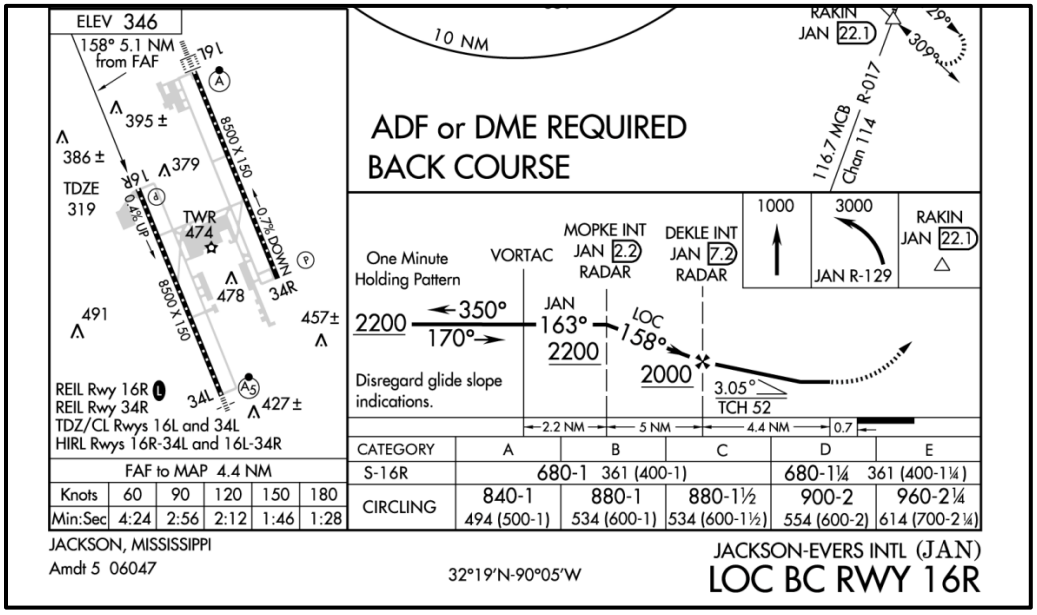

Figure 1-65 Localizer Back Course Approach Procedure (Profile View)

c. Scan

i. Maintain course and glidepath

(a). Use azimuth deviation needle and CDI course deviation line to maintain localizer course

(b). Use glideslope deviation needle to establish glidepath

ii. Monitor attitude and performance instruments

(a). Cross-check vertical velocity, A/S, and AOA

(b). Monitor barometric altitude for decision altitude (DA)

COMMON ERRORS:

1. Fixating on the azimuth and glideslope deviation needles while neglecting attitude and performance instruments.

2. Fixating on azimuth and glideslope deviation needles, and thus dropping altitude out of scan and descending below minimums.

3. Back course LOC approach

NOTE

The T-45C is not equipped with automatic reverse sensing equipment which would provide a normal sensing display on the ADI, HUD, and HSI when executing a back course LOC. When flying a back course LOC in this aircraft, the pilot will always experience reverse sensing on the ILS displays when the back course inbound course to the field is selected. In this situation, to correct to course, the pilot will have to "**fly away**" from the ADI azimuth deviation needle and HSI CDI course deviation line. An alternate procedure is to set the front course into the HSI. This will induce a normal sensing display in the HSI. Caution should be taken because the azimuth needle on the ADI will continue to display reverse sensing.

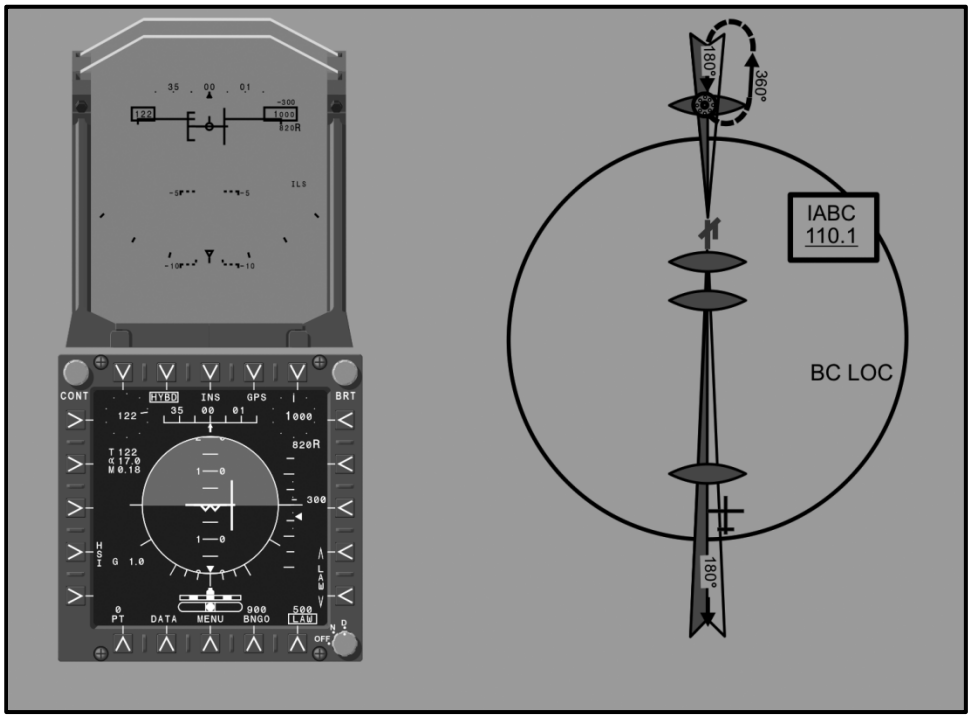

Figure 1-66 Reverse Sensing 1

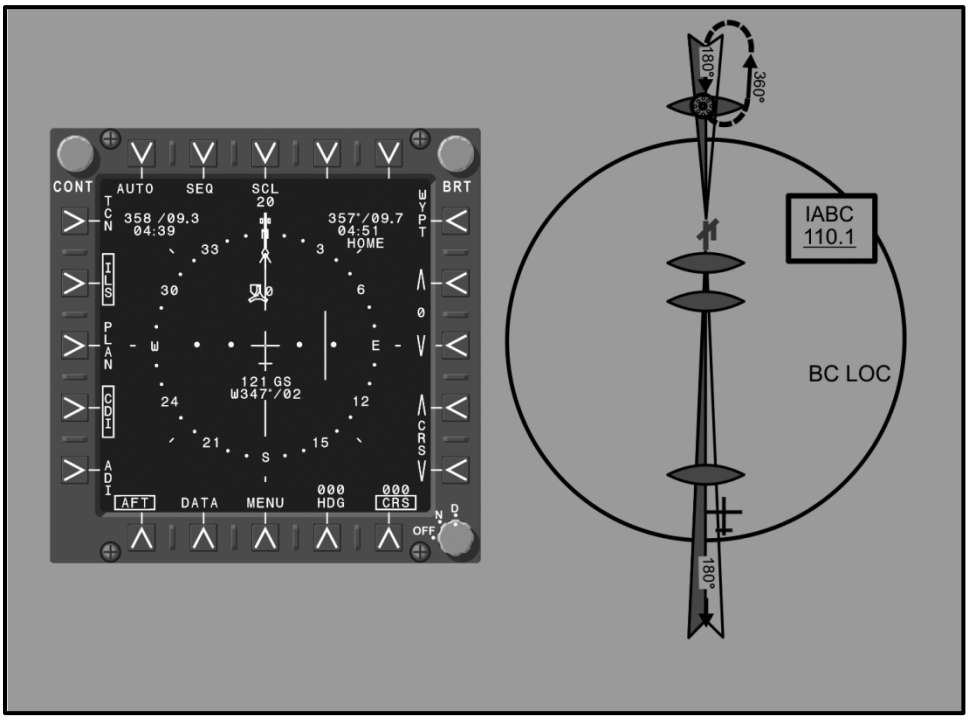

Figure 1-67 Reverse Sensing 2

CAUTION

1. Do not use back course signals for approach unless a back course approach procedure is published for that particular runway and the approach is authorized by ATC.

2. False glideslope signals may exist in the area of the localizer BC approach which can cause the glideslope needle to be displayed. Disregard all glideslope signal indications when making a localizer BC approach.

Transition to Visual Scan

1. Incrementally shift to out-of-cockpit scan as visibility improves

   COMMON ERROR: Shifting to out-of-cockpit scan before visual references are adequate.

2. Control: maintain steady course, AOA, and glidepath during transition

3. **Visual Descent Points (VDPs)** are being incorporated in nonprecision approach procedures. The VDP is a defined point on the final approach course of a nonprecision straight-in approach procedure from which normal descent from the MDA to the runway

touchdown point may be commenced, provided visual reference required by 14 CFR Section 91.175(c)(3) is established. The VDP will normally be identified by DME on VOR and LOC procedures and by along-track distance to the next waypoint for RNAV procedures. The VDP is identified on the profile view of the approach chart by the symbol: **V**.

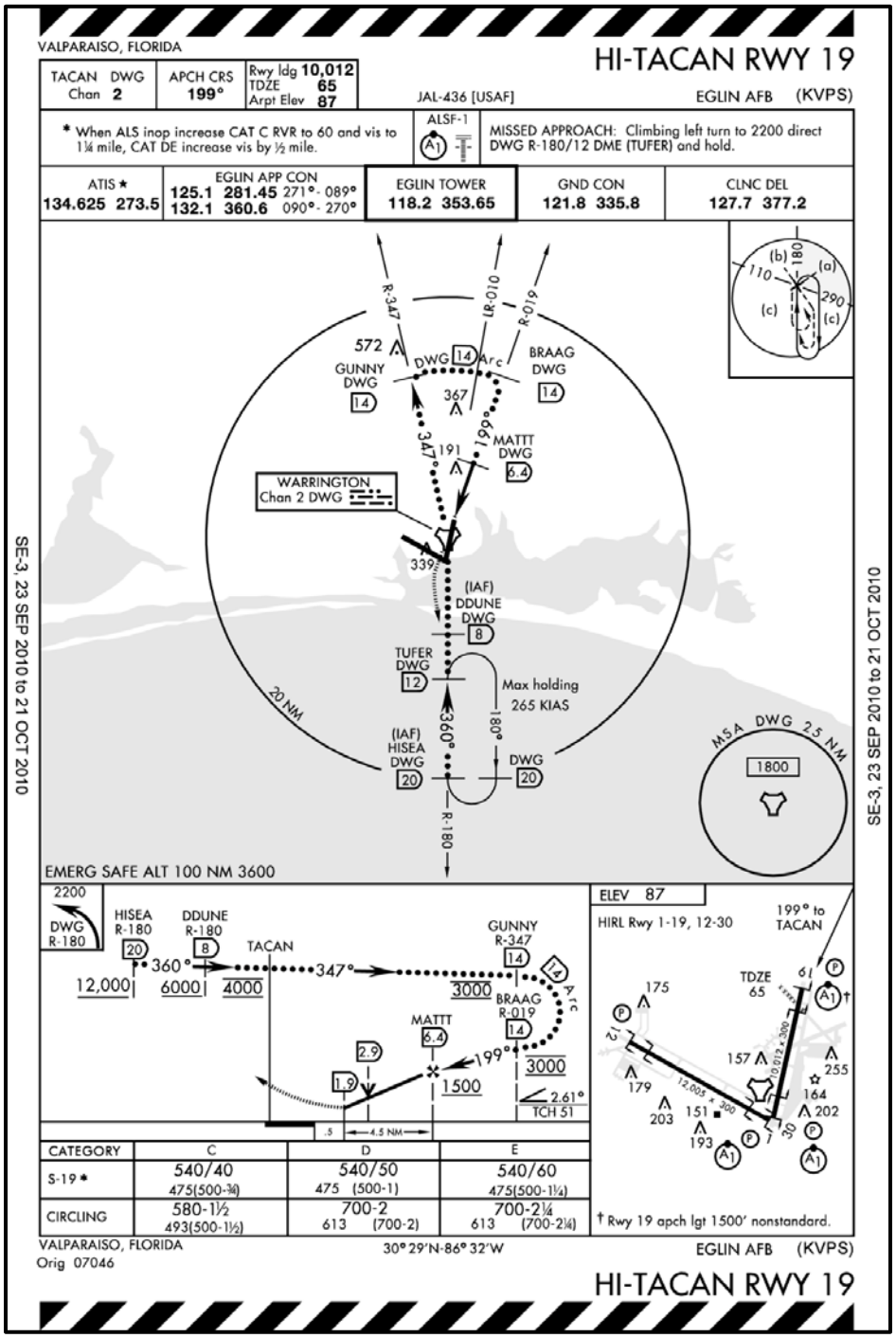

Figure 1-68 Transition from Instrument to Visual Scan

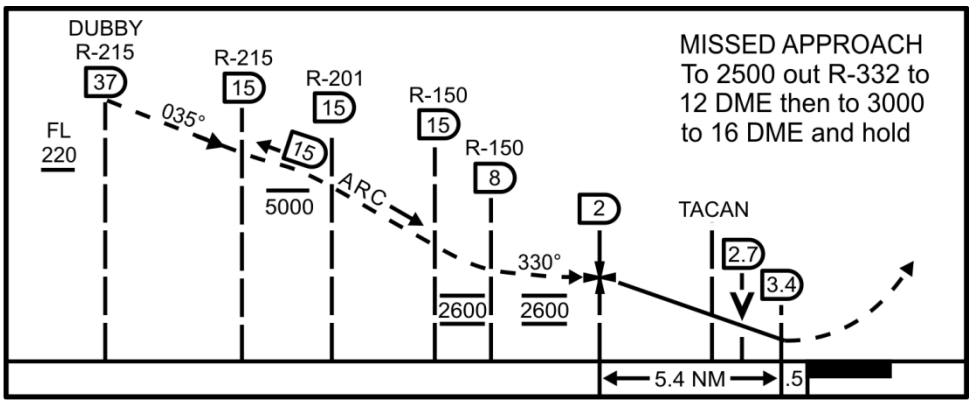

Figure 1-69 Visual Descent Point

Circling Approach

1. Description

   a. Visual maneuvers

   b. Used to align aircraft with runway other than depicted for straight-in instrument approach

   c. Pilot must have specific clearance to circle to land

2. Procedure

   a. Descend to circling minimums

NOTES

1. The circling MDA and weather minimums to be used are those for the runway to which the instrument approach is flown, not the landing runway.

2. Since the MDA is a minimum altitude, a higher altitude may be maintained during the maneuver. If weather permits, fly the approach at the normal VFR traffic pattern altitude.

   b. When runway environment is in sight, determine if visibility sufficient for circling maneuver

NOTE

Consider the airport environment to consist of the runway(s), lights, and markings.

c. Choose landing pattern best suited to situation

i. Select a pattern that is displaced far enough from runway to allow for a turn to final without overbanking or overshooting

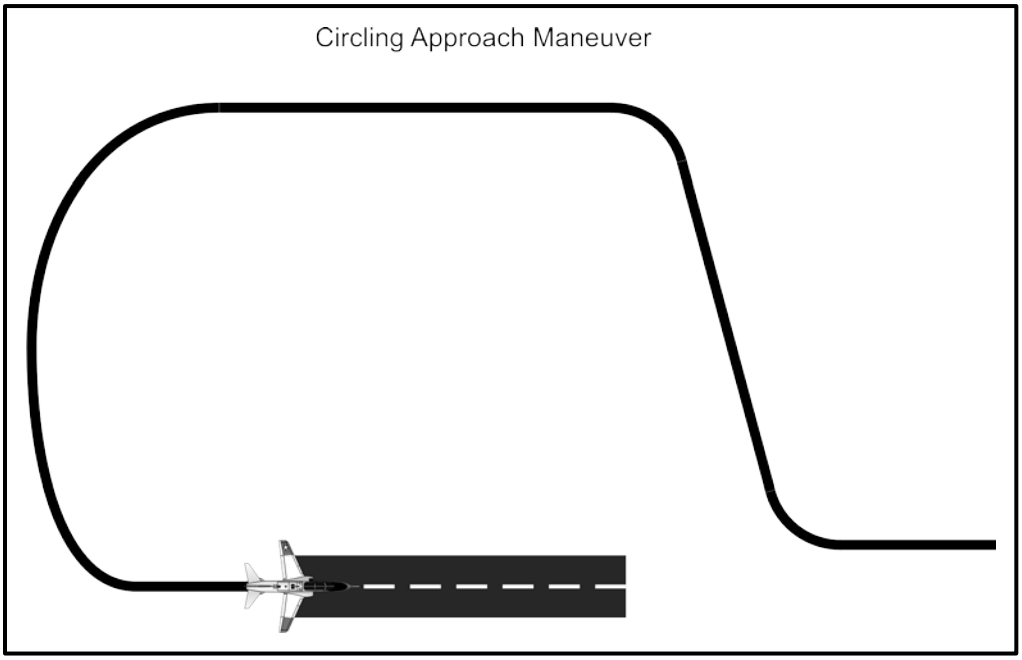

Figure 1-70 Close-in Contact Circling Approach

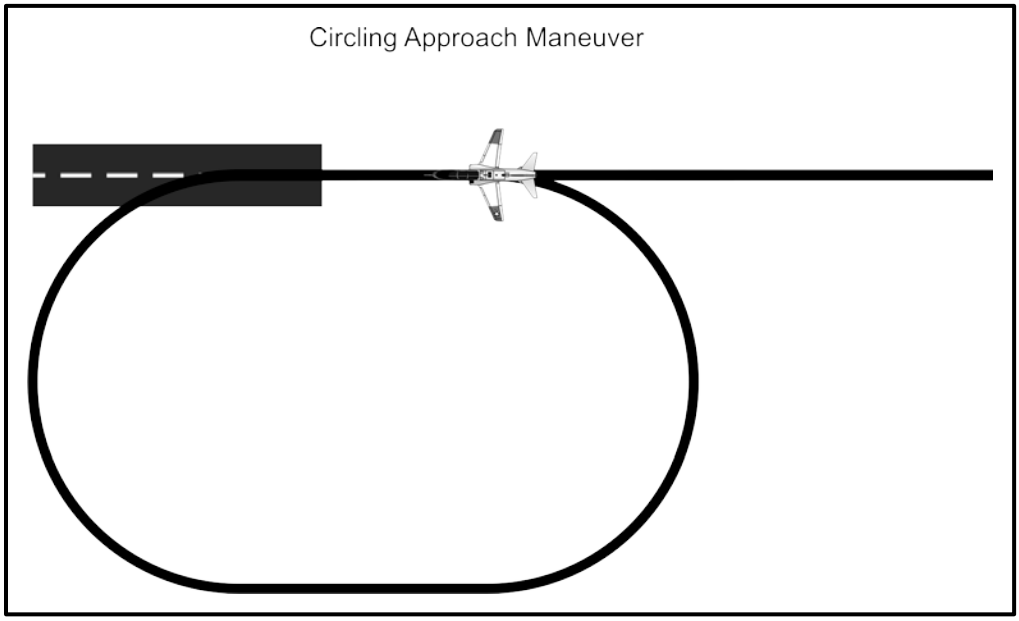

Figure 1-71 Too High for Straight-in or Late Sighting of Runway

COMMON ERROR: Maneuvering too close to the runway when flying at altitudes lower than the normal VFR pattern because you are using the same visual cues you would use when flying at the normal pattern altitude.

ii. Keep runway environment in sight

iii. Left or right turns to final are allowed unless

(a). Directed by controller to do otherwise

(b). Restricted by IFR supplement or approach chart

iv. Stay at or above MDA until aircraft is in position to execute a normal safe landing

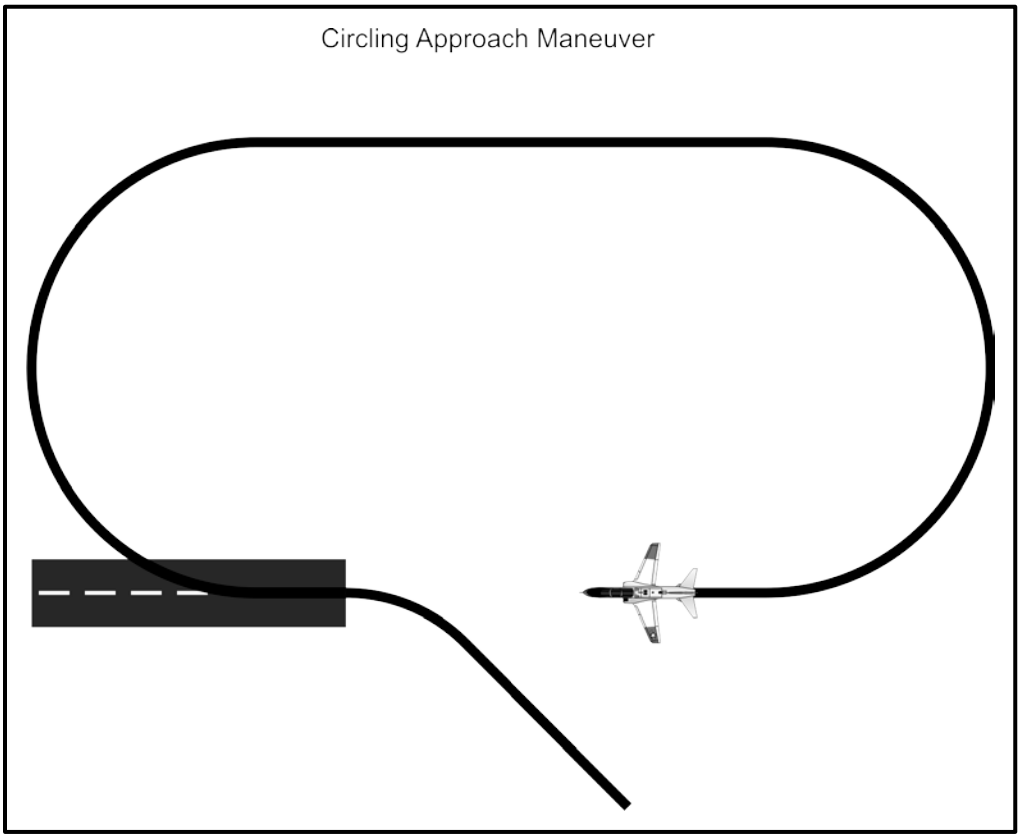

Figure 1-72 Runway Sighted Too Late for a Base Leg Turn

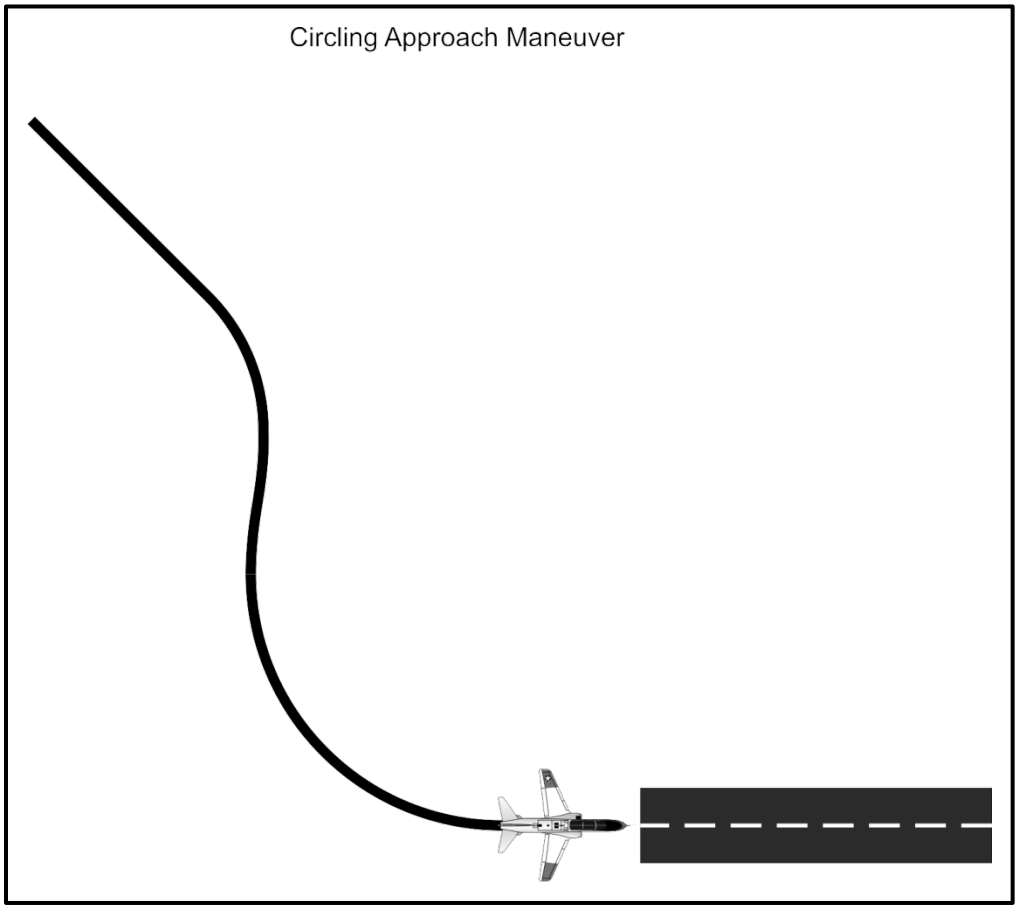

Figure 1-73 Runway Sighted in Time to Set Up Base Leg

d. Land

i. Descend when in position to place aircraft on a normal glidepath to the landing runway

ii. If you have any doubt whether aircraft can be safely maneuvered to landing, execute missed approach

NOTE

Missed approach procedures are those of the runway for which the approach was flown.

iii. If you execute a missed approach while circling to land, turn to fly over the airport center, then fly the published missed approach

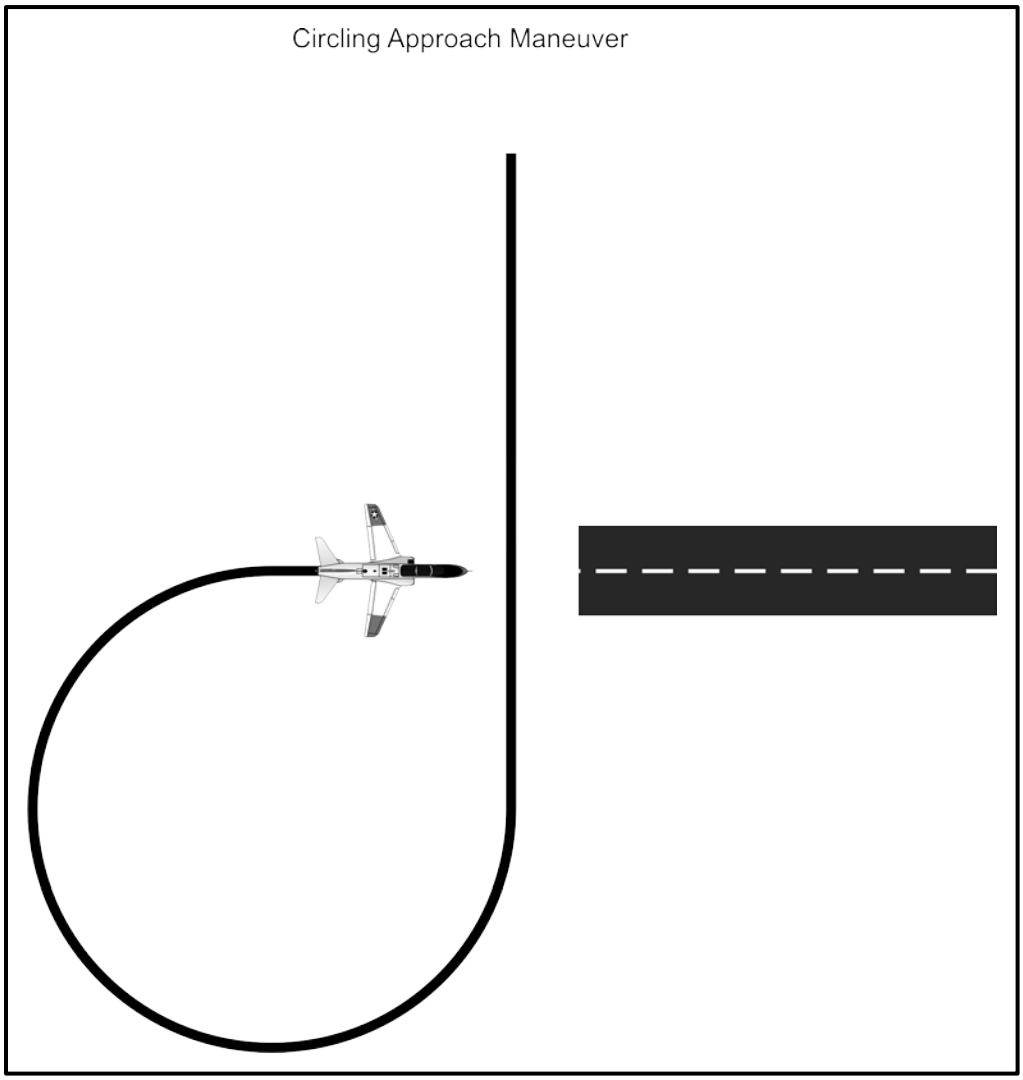

Figure 1-74 Approach Course Crosses Landing Runway Near Threshold

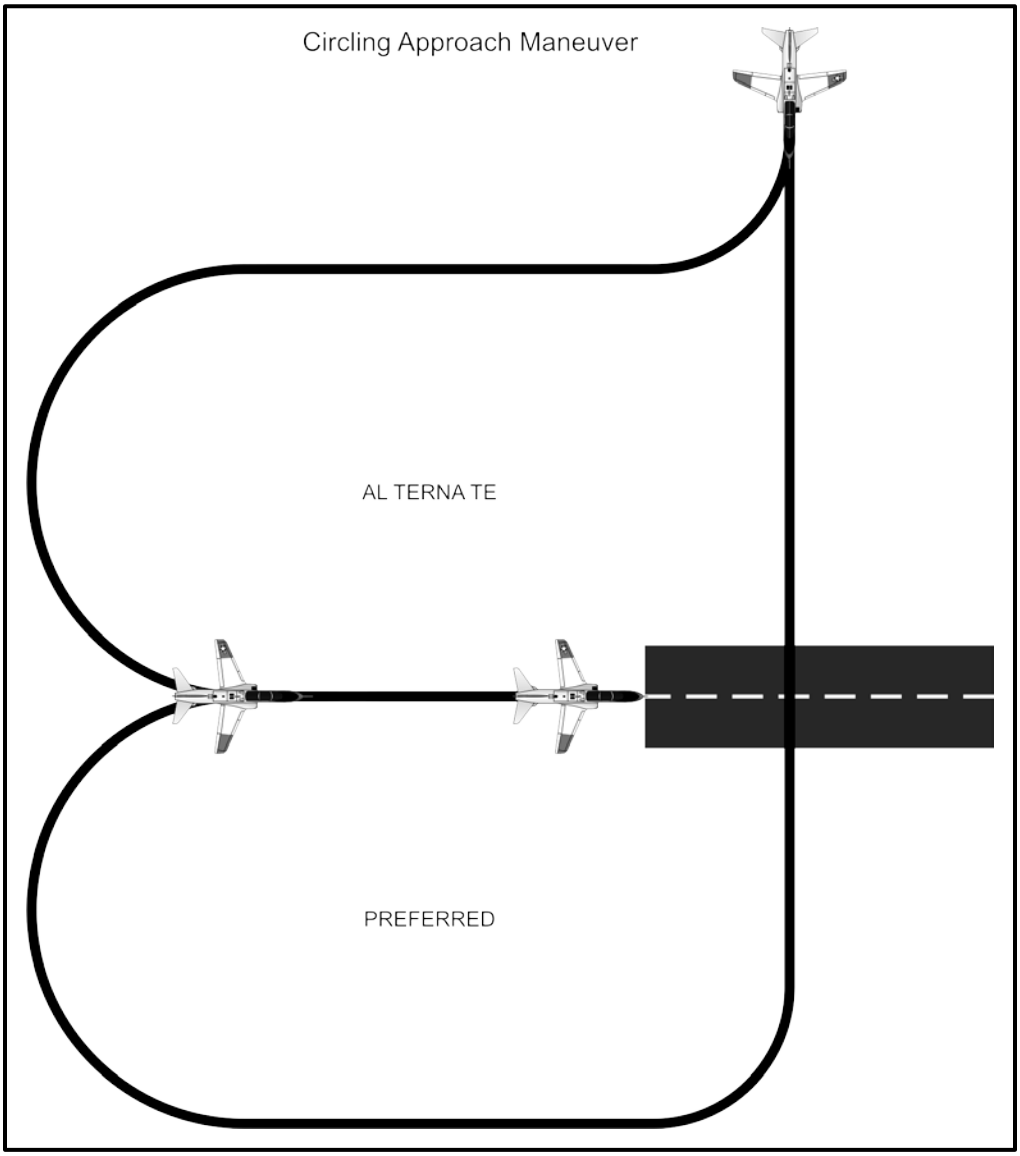

Figure 1-75 Right Angle to Approach Course

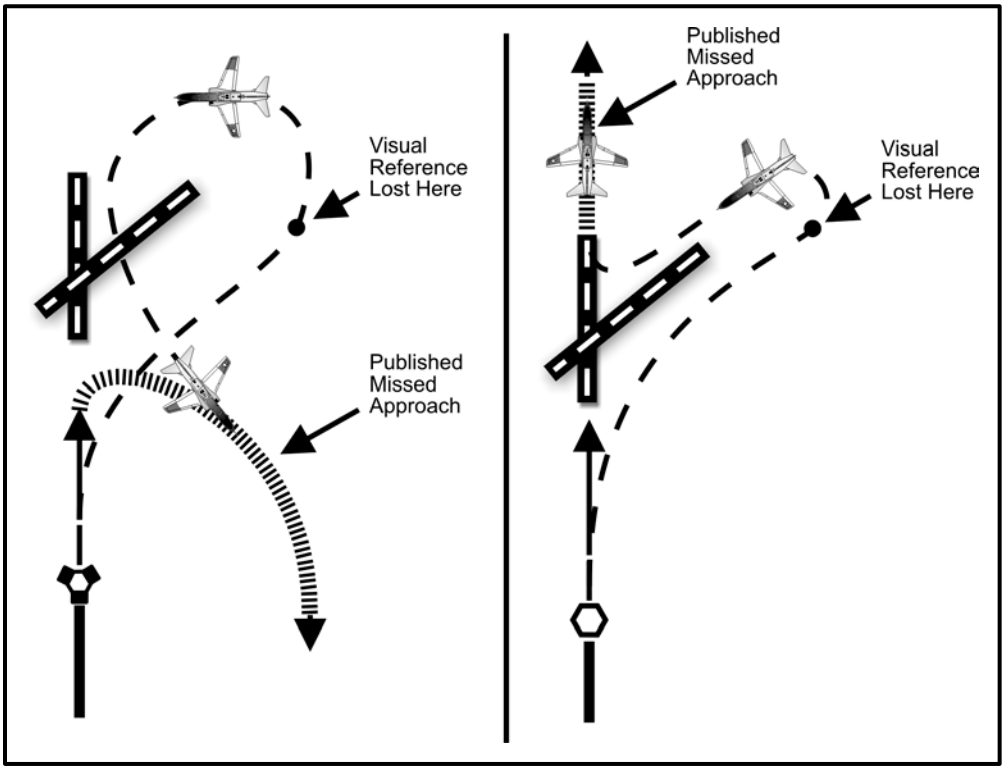

Figure 1-76 Circling Approach

If visual reference is lost, execute MAP for original approach.

1. Initiate an immediate climb.

2. Make an initial turn toward the landing runway to ensure remaining within the obstruction clearance area.

3. Continue to turn until established on the missed approach course.

Missed Approach Procedures

1. Criteria for initiating missed approach

   a. MAP on non-precision or DH on precision is reached without visual contact with runway/field environment

      COMMON ERROR: Executing missed approach when MDA is reached, prior to MAP.

b. Loss of visual contact with runway environment after DH/MAP

c. Determine that a safe landing not possible

d. Instructed by ATC to execute a missed approach

2. Conducted when established at Minimum Descent Altitude and a visual reference does not exist when reaching the missed approach point (MAP).

3. It is mandatory to inform ATC when executing a missed approach at all times.

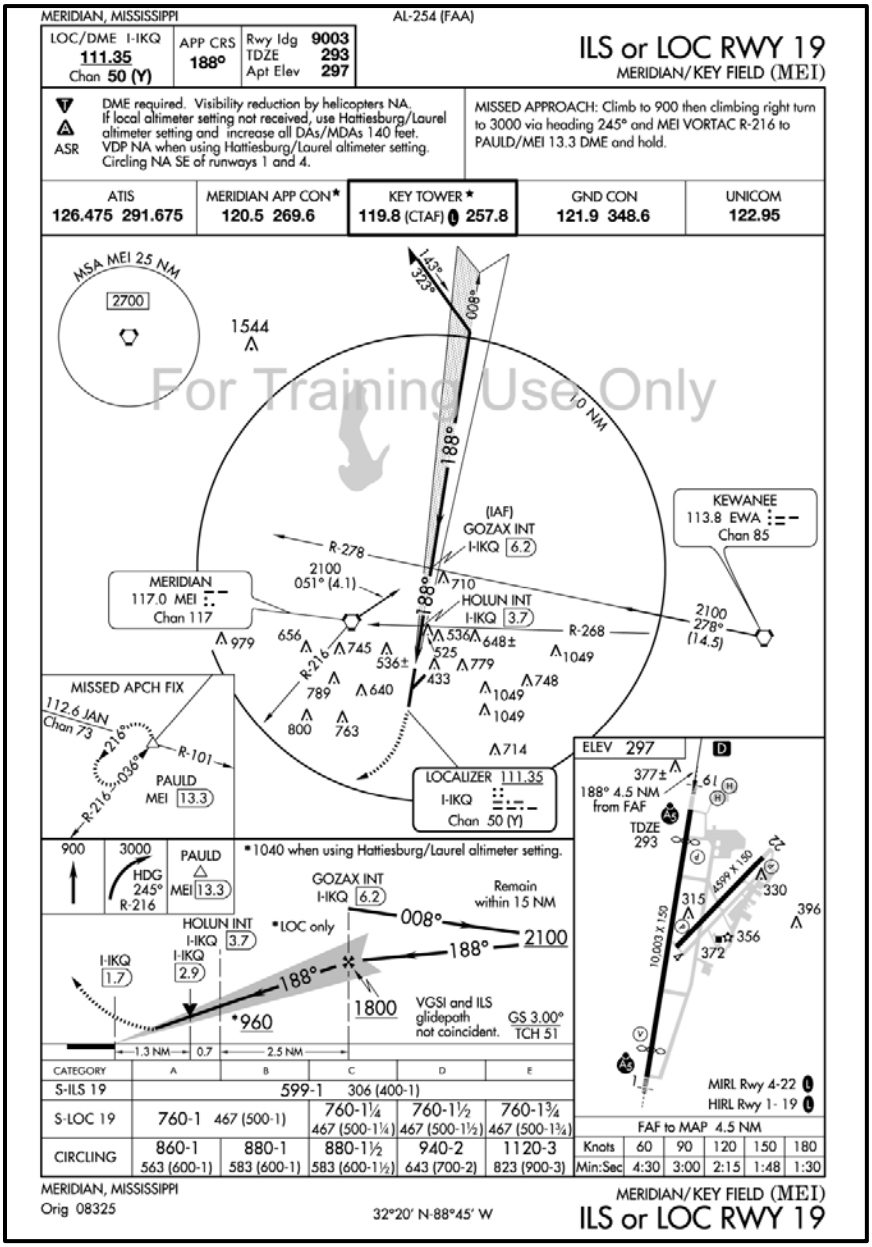

Figure 1-77 ILS or LOC RWY 19

CAUTION

Do not use a back course localizer signal unless called for in the missed approach procedures.

Never use a glideslope signal on missed approach i.e., “Fly up the glideslope.” The signal is a reflection of the front course and is not calibrated to anything!

4. Procedure

a. Simultaneously:

i. Set throttle to MRT (if required)

ii. Retract speed brakes

iii. Adjust nose to maintain optimum AOA at approximately 10-12 degrees nose-up

b. Confirm climb on both altimeter and vertical velocity

c. Raise gear (minimum 100 ft AGL)

COMMON ERROR: Raising gear without both climb indications.

d. Raise flaps/slats at 140 KIAS, wings level and 300 ft AGL

e. Make missed approach call to controlling agency once stabilized in missed approach

f. Accelerate to 200 KIAS if remaining in pattern or 250 KIAS if leaving pattern

COMMON ERROR: Accelerating beyond 200 KIAS in pattern.

g. Comply with controllers and or published missed approach procedures

NOTE

Standard level off procedures apply.

Visual Approach

An ATC authorization for an aircraft on an IFR flight plan to proceed visually and clear of clouds to the airport of intended landing

1. Pilot or controller may request

2. 1000-3 required at airport of intended landing

3. Must have airfield or preceding traffic in sight

4. Not an instrument procedure

5. No MAP

6. Radar ends once following traffic

7. Does not cancel a flight plan by its acceptance

8. ATC expects you to proceed visually in the most direct and safe manner to a normal straight-in final approach.

Contact Approach

1. Only pilot may request

2. May proceed by visual reference to the surface if 1 mile visibility reported

3. Remain outside of clouds

4. Reasonable expectation of continuing to the airfield in these conditions

5. MAP will be provided

6. Radar separation provided

Safety/emergency Procedures

1. Partial panel approaches

   All attitude and NAV information is still available, but you will now have to get:

   a. Attitude information from the standby AI

   b. Heading and ILS localizer information from the HSI

2. Minimum fuel/emergency fuel

You are required to advise ATC when your fuel status has reached a state where, upon reaching your destination, you cannot accept any undue delay.

a. This advisory does not reflect an emergency situation

b. Nor will it result in special handling or a traffic priority

c. ATC will ensure that you are handled so as to avoid any delays requiring excess fuel consumption

If, however, your fuel state reaches the point that you need special handling and/or priority handling (emergency fuel) to land safely, you should declare “emergency fuel” to ATC. ATC will then provide priority handling to assist you in expediting your approach and landing.

NOTE

Advise subsequent controllers that you are “Emergency Fuel.”

d. Remain in clean configuration until 30 seconds before glidepath intercept.

e. Select gear down, flaps to half, and speed brakes retracted in transition to optimum AOA

f. Simulated GCA minimum fuel

i. ATC will give vectors for a normal box pattern with a glidepath intercept point 6 miles from touchdown

ii. Expect 200 KIAS in pattern to final

iii. ATC should provide 30-second gear warning

NOTE

The “perform landing checks” call from the controller is a required USN/USMC advisory call on base leg in the GCA pattern. It DOES NOT mean to dirty up or reduce airspeed in a minimum fuel situation.

g. Simulated minimum fuel ILS

i. Request vectors to ILS final

ii. Advise ATC that you will maintain 200 KIAS until ILS glidepath intercept

iii. Transition to landing configuration when the GS pointer emerges from the top of the HSI (30-second warning) to glidepath

h. Simulated emergency fuel GCA

NOTE

This GCA is designated to get an aircraft from altitude to the deck without any undue delay. It is a practice procedure for dealing with emergency fuel situations.

i. Expect vector direct to a short final, approximately 4 miles to the runway

ii. Glidepath intercept will be approximately 800 ft AGL

NOTE

The controller will ask you how much fuel is remaining and will attempt to get you on the deck prior to fuel exhaustion.

iii. Request 30-second warning call to glidepath intercept

iv. Remain clean until 30-second call

v. Transition to landing configuration, speed brakes retracted, and adjust for optimum AOA

NOTE

Due to the reduced distance/time from glidepath intercept to the runway, establish proper on-speed descent rate as expeditiously as possible.

3. Emergency oil instrument approach

NOTE

The emergency oil instrument approach, like the emergency fuel instrument approach, is designed to get you on the deck without any delays.

a. Set power to 86-88% RPM.

NOTE

88% should be used with extreme flying conditions such as high elevations or hot summer days.

b. If outside the GCA box pattern - maintain 200 KIAS to 250 KIAS (use speed brakes as necessary)

NOTE

Do not exceed 300 KIAS.

c. Maintain 200 KIAS in GCA box (Use speed brakes if necessary)

NOTE

Expect vector to short final with glidepath intercept at approximately 6 miles from the field.

d. Lower the gear and retract speed brakes at “up and on glidepath” call or as GS needle center

e. Maintain 175 KIAS on glidepath

f. Lower flaps to 1/2 as desired

NOTE

If airspeed bleed to 160 decelerating, raise flaps immediately to reduce drag and regain airspeed.

g. Lower flaps to full with field in sight and runway made but no later than commencing the flare

h. Extend speed brakes and reduce power to idle if full stop (no intentions to go missed approach)

4. NAVAID failure

- Total navigation aid failure is unlikely as the T-45C is equipped with both TACAN and VOR, and supplemented with waypoints

  i. Loss of either system requires that you must notify ATC of any loss of a primary navigation system

ii. If you lose both systems, notify ATC and request assistance. Usually, they will be able to give you radar vectors to VMC or to a landing site

105. SUMMARY

1. Standard instrument departures (SIDs)
2. Radial intercepts
3. Indications of station passage on the VOR - TACAN/VOR/VOR DME
4. Flying a TACAN/VOR DME arc
5. Voice procedures
6. Computing ground speed using TACAN/VOR DME
7. Correcting for wind drift using TACAN/VOR/VOR DME
8. Performing TACAN/VOR DME point-to-point navigation
9. Performing direct routing
10. VOR - TAC/VOR DME holding
11. Elements of ILS approach system
12. ILS approach procedures
13. Transition from instrument to visual scan
14. Circling approach procedures
15. Missed approach procedures
16. Climb, cruise, and descent profiles
17. Safety/emergency procedures

106. CONCLUSION

This lesson has been both a review of RI procedures and information already learned from the INAV and BI stages. The review covered TACAN/VOR procedures. You were introduced to ILS approach procedures.

The procedures learned and practiced in the RI stage and later in the AN stage will be used again and again in your career as a Naval aviator. Your knowledge and proficiency in instrument flight is essential for you as well as the Navy to fulfill its required combat readiness role and worldwide mobility in adverse meteorological conditions.

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CHAPTER TWO
TACAN AND VOR PROCEDURES

200. INTRODUCTION – N/A

COURSE/STAGE:

- T-45C TS, ADV, & IUT/Radio Instrument Flight Procedures (RIFP)

LESSON TITLE:

- TACAN and VOR Procedures

LESSON IDENTIFIER:

- T-45C TS, ADV, & IUT RIFP-02

LEARNING ENVIRONMENT:

- CAI

ALLOTTED LESSON TIME:

- .5 hr

TRAINING AIDS:

- Figures:

    a. Figure 2-1 Kingsville Two Departure (NQI2 NQI)

    b. Figure 2-2 Midland Four Departure

STUDY RESOURCES:

1. NATOPS Instrument Flight Manual, NAVAIR 00-80T-112

2. T-45C Instrument FTI

LESSON PREPARATION:

1. Review the following sections in NATOPS Instrument Flight Manual, NAVAIR 00-80T-112:

    a. 20.3 through 20.3.12

b. 21.2.3 through 21.2.3.9

c. 27.2.2

2. Review Flight Procedures from Instrument FTI.

3. Have FLIP Enroute HI ALTITUDE Chart H-5/6 available when taking this lesson

REINFORCEMENT:

- N/A

LESSON EXAMINATION:

- N/A

201. LESSON OBJECTIVES

1. Recall procedures for standard instrument departure

2. Recall procedures for performing radial intercepts

3. Recall procedures for flying TACAN/VOR DME arc

4. Recall indications of station passage on the TACAN/VOR/VOR DME

5. Recall procedures for computing ground speed using TACAN/VOR DME

6. Recall procedures for correcting wind drift using TACAN/VOR/VOR DME

7. Recall procedures for performing TACAN/VOR DME point-to-point navigation (and update)

8. Recall procedures for performing direct routing

202. MOTIVATION

To prepare you for the RI hands-on lessons and the Airways Navigation block, this lesson will review several TACAN/VOR procedures already presented in previous BI and INav lessons. Your return to the ship at night will be facilitated by a TACAN, or ACLS. The requirement to fly the approach with precision is paramount to a safe recovery, and the first step in achieving the needed precision is a thorough knowledge of the procedures.

203. OVERVIEW

After this lesson, you will have reviewed the basic enroute radio navigation procedures for SIDs, radial/bearing intercepts, arcing, point-to-point navigation, ground speed checks, time/distance checks, voice procedures, and direct routing.

In this lesson we will be reviewing procedures for:

1. Standard Instrument Departures (SIDs)
2. Radial intercepts
3. Flying a TACAN/VOR DME arc
4. Indications of TACAN/VOR/VOR DME station passage
5. Computing ground speed using TACAN/VOR DME
6. Correcting for wind drift using TACAN/VOR/VOR DME
7. TACAN/VOR DME point-to-point navigation
8. Proceeding direct to a station

204. PRESENTATION

Performing a Standard Instrument Departure (SID)

1. Types
    - a. Pilot nav
        - i. Provides published instructions
            - (a). Top of departure plate: pictorial description
            - (b). Bottom section of departure plate: textual description
        - ii. Pilot’s responsibility to comply with published instructions
        - iii. Requires minimal controller time/communication with pilot
        - iv. Provides several transition options depending on pilot’s route

b. Vector

i. Provides navigational guidance by ground radar to an airway or fix on the pilot's route

(a). Top of departure plate: pictorial description

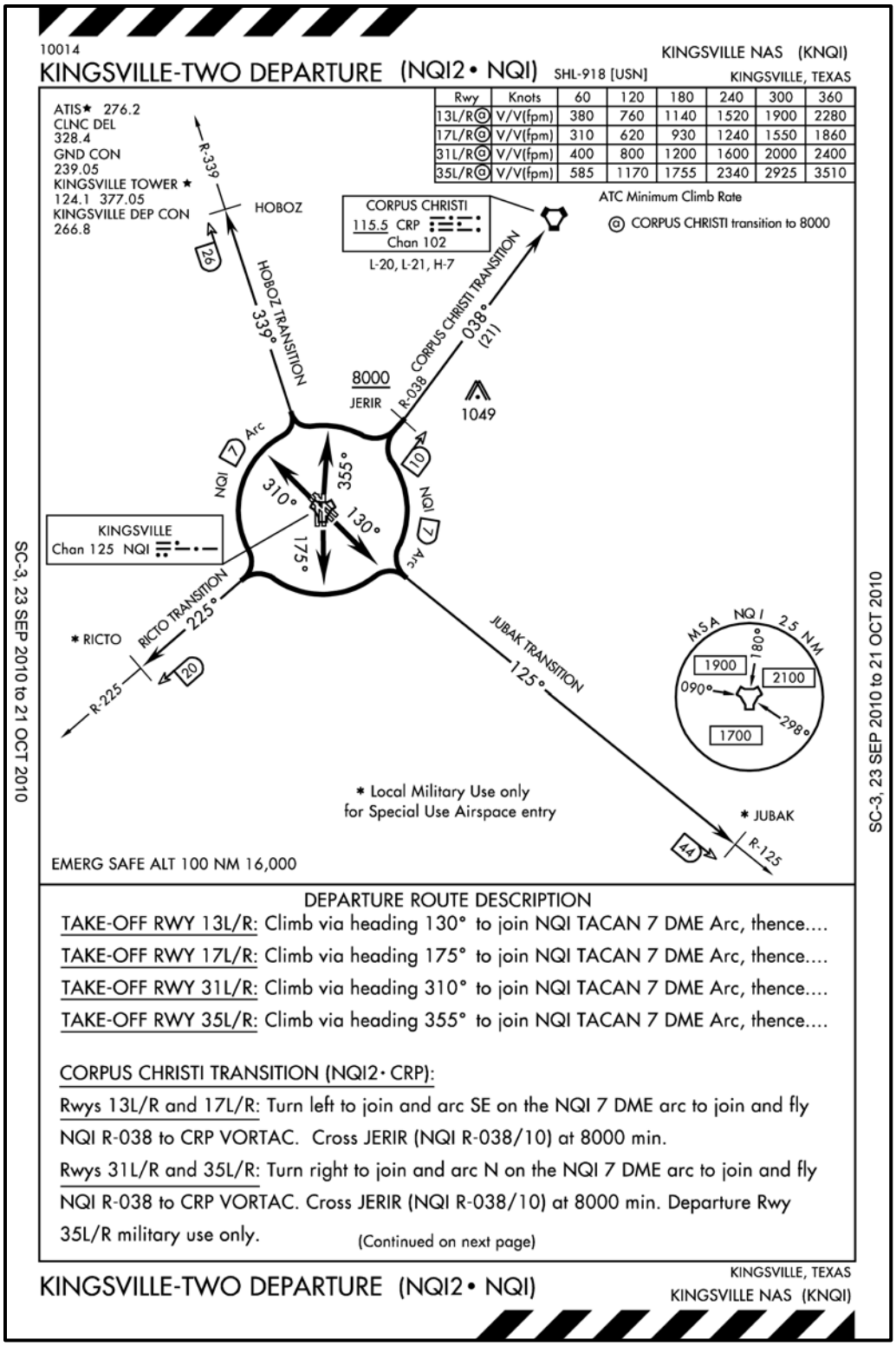
(b). Bottom section of departure plate: textual description

ii. Departure control's responsibility to provide instructions

iii. Requires more controller time/communication

iv. Allows controller flexibility to deal with changing weather, flight, and traffic conditions

2-4 TACAN AND VOR PROCEDURES



Rwy	Knots	60	120	180	240	300	360
13L/R ⓒ	V/V(fpm)	380	760	1140	1520	1900	2280
17L/R ⓒ	V/V(fpm)	310	620	930	1240	1550	1860
31L/R ⓒ	V/V(fpm)	400	800	1200	1600	2000	2400
35L/R ⓒ	V/V(fpm)	585	1170	1755	2340	2925	3510

Figure 2-1 Kingsville Two Departure (NQI2 NQI)

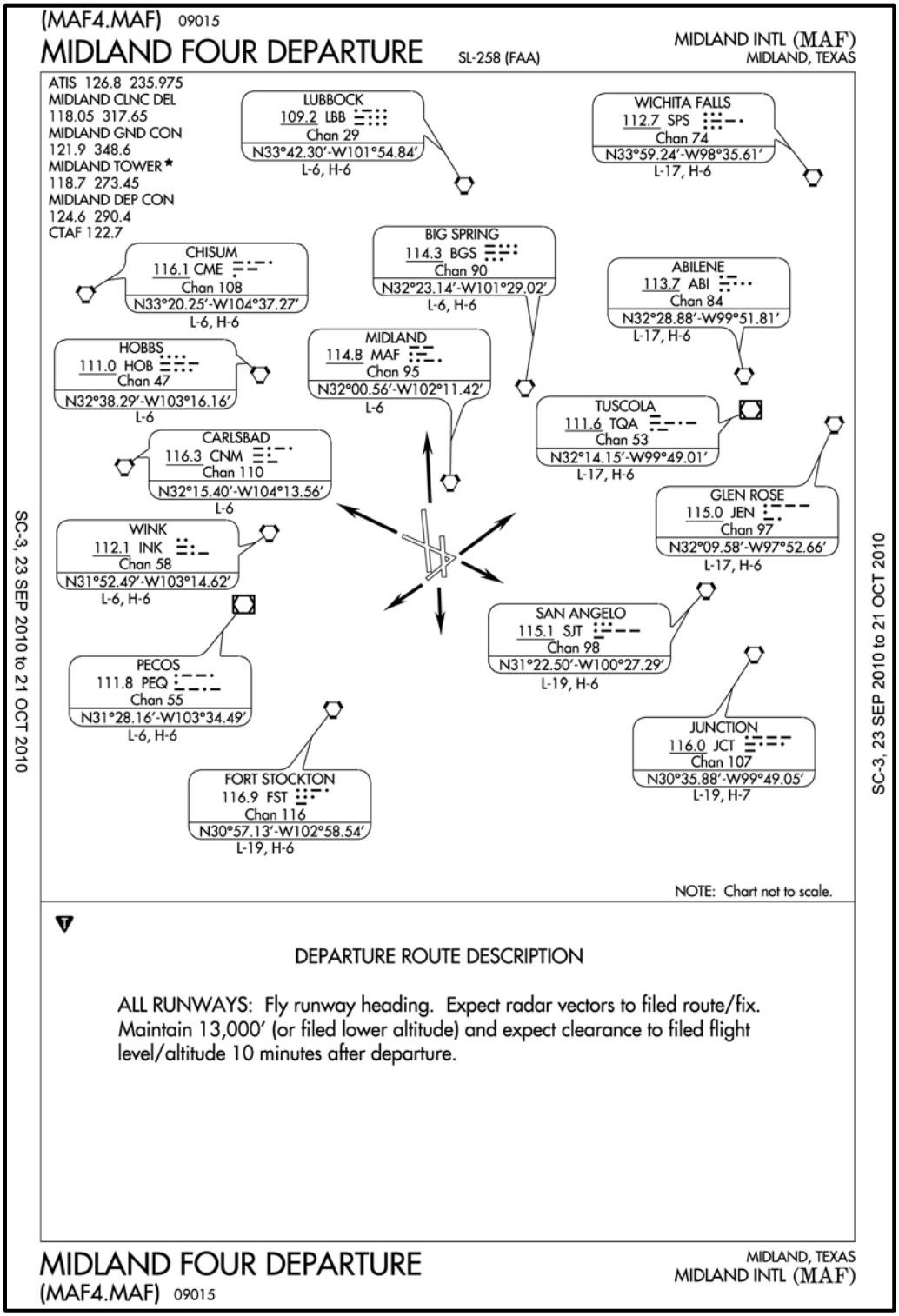


Figure 2-2 Midland Four Departure

2-6 TACAN AND VOR PROCEDURES

2. Procedures

   a. Preflight and pre-takeoff preparation

      i. Identify frequencies used by ATC and ensure compatibility with communication equipment

      ii. Determine if your aircraft's performance is adequate to adhere to all restrictions

      iii. Identify routes, altitude, and specific restrictions

NOTE

When accepting a SID, you must comply with all requirements and restrictions unless ATC amends it.

   b. Changes to clearance

      i. Amendments to initial clearance will be issued any time ATC deems such action necessary to avoid possible conflict between aircraft

NOTE

When a SID is changed, confirm what part of the SID is still in effect.

      ii. Cancellation: to reinstate, departure control must state portion of SID routing that still applies and restate altitude restrictions

Radial Intercepts

1. Double angle off bow method

   a. Tune and identify station

   b. Set desired course in CRS window

   c. Look from desired course to head of bearing pointer used and an equal number of degrees beyond (this is your intercept heading)

   d. Turn aircraft to the intercept heading (max 45 degrees)

   e. Maintain intercept heading to lead point and then complete intercept of desired course

2. 30-degree angle of intercept

a. Tune and identify station

b. Set desired course in course selection window

c. Look from desired course to head of the bearing pointer used and 30 degrees beyond (this is your intercept heading)

d. Turn aircraft to the intercept heading

e. Maintain intercept heading to lead point and then complete intercept of desired course

3. Immediately after station passage

a. Turn to parallel desired course

b. Set desired course in course selection window

c. Look from tail of the bearing pointer used to desired course and an equal number of degrees beyond, but not more than 45 degrees (this is your intercept heading)

d. Turn aircraft to the intercept heading

e. Maintain intercept heading to lead point and then complete intercept of desired course

4. 45-degree angle of intercept

a. Tune and identify station

b. Set desired course in course selection window

c. Look from tail of the bearing pointer used to desired course and 45 degrees beyond (this is your intercept heading)

d. Turn aircraft to the intercept heading

e. Maintain intercept heading to lead point and then complete intercept of desired course

Flying TACAN/VOR DME Arc

1. Lead point calculation (LPC)

a. For a 90-degree intercept: approximately 1% of ground speed = DME lead point using 1/2 SRT

i. Inbound to the station add 1% of ground speed to the DME of the arc

ii. Outbound from the station, subtract 1% of ground speed from the arc

b. For intercepts of less than 90 degrees: use a proportional distance lead point of less than 1%

2. Chord method

NOTE

The chord method is usually used when the aircraft is more than 12 miles DME from the station.

a. Tune and identify station

b. Determine direction to turn

c. Determine desired lead point

d. Initiate turn when DME equals radius of arc plus or minus desired lead using 1/2 SRT AOB

e. Monitor the bearing pointer and DME to determine roll-out

f. Position aircraft so that head of the bearing pointer is between 5 and 10 degrees ahead of wingtip position

g. Fly straight short legs allowing head of the bearing pointer to reposition between 5 and 10 degrees behind wingtip position

h. Turn aircraft to reposition the head of the bearing pointer from behind to between 5 and 10 degrees ahead of wingtip position

NOTE

Crosswind can make holding the DME difficult. You may need to increase or decrease the number of degrees the bearing pointer is placed relative to the wingtip position to affect a wind correction that will hold the aircraft on DME as the aircraft moves around the arc. Refer to the ground track marker for wind drift.

3. Angle-of-bank method

NOTE

The angle-of-bank method is usually used when the aircraft is within 12 miles DME of the station. Although each method has

been identified according to DME limits, you can use either at any time.

a. Tune and identify station

b. Determine direction to turn

c. Determine desired lead point (refer to LPC)

d. Initiate turn when DME equals radius of arc plus or minus desired lead

e. When established on the arc, adjust angle of bank (AOB) to maintain proper distance and keep the pointer on HSI 90-degree benchmark (wingtip)

NOTE

Adjustments to the position of the head of the bearing pointer will have to be made relative to the 90-degree benchmark to compensate for the position of the wind relative to the position of the aircraft on the arc. Refer to the ground track marker for wind drift.

4. Arc to radial intercept procedure

a. Set the desired course in the course selection window of the HSI

b. Determine the lead point calculation

c. At lead point, turn the aircraft toward the intercept course using 1/2 SRT

d. Vary AOB in turn with CDI movement to roll out on course (CDI centered)

NOTE

Do not exceed 30 degrees AOB.

5. Intercepting a radial from an arc lead point calculation (LPC) procedure

a. Estimate the ground speed

b. Apply the following formula to determine lead radials: "60/Arc DME x 1% ground speed = lead radials"

c. Begin 1/2 SRT at the determined lead radial and vary AOB as required to intercept the outbound/inbound radial

d. Check status of turn and vary AOB to intercept desired radial

6. Adjustment techniques (Arc to Radial - Radial to Arc)

a. Arc to radial intercept

i. Inbound radial intercepts will require a greater lead than outbound because the aircraft is turning more than 90 degrees

ii. For radial intercepts from arcs less than approximately 10 DME, an adjustment must be applied to the arc to radial formula to compensate for turns outbound of less than 90 degrees and turns inbound of more than 90 degrees

(a). Degrees to turn outbound are equal to 90 minus the number of lead radials determined by formula

(b). Degrees to turn inbound are equal to 90 plus the number of lead radials determined by formula

(c). As a rule of thumb, reduce or increase the lead radials determined by formula by one-third

b. Radial to arc intercept

i. When intercepting an arc from a heading significantly more or less than 90 degrees from the arc, an adjustment should be made to the result of the formula for arc intercepts

(a). Use 1% for a turn of approximately 90 degrees

(b). For a turn of approximately 45 degrees, use 1/3 of that required for 90 degrees

(c). For a turn of approximately 60 degrees, use 2/3 of that required for 90 degrees

(d). For turns of less than 30 degrees, very little lead is required

ii. When intercepting an arc from a radial closer than approximately 12 DME, an adjustment should be made to compensate for outbound turns greater than, and inbound turns less than 90 degrees

(a). Outbound radial to arc, add approximately 1/2 DME to 1% ground speed

(b). Inbound radial to arc, subtract approximately 1/2 DME to 1% ground speed

Indications of TACAN/VOR/VOR DME Station Passage

1. VOR: When the VOR breaks its "inbound" lock and quickly relocks "outbound" as indicated by the VOR bearing pointer and digital VOR bearing display

NOTE

The T-45C does not have a TO/FROM indicator.

2. TACAN/VOR DME: Due to large size of the cone of confusion associated with TACAN stations, time of station passage is noted when minimum DME is reached. Use same procedure for VOR/DME station passage

NOTE

Limit your heading or corrections to within ten degrees of inbound wind corrected heading when in close to avoid overshooting.

Computing Ground Speed using TACAN/VOR DME

NOTE

You can check ground speed while maintaining a course to or from a TACAN/VORTAC station by ensuring that the DME from station is greater than or equal to aircraft altitude in thousands of feet.

$$\frac{DISTANCE\ (NM)}{TIME\ (MIN)} \times 60 = GROUND\ SPEED$$

EXAMPLE: If the altitude is 30,000 ft (FL 300), DME should be 30 nm or greater.

1. Start timing with a whole number in DME indicator

2. After predetermined time (in minutes), check and note the exact DME

3. Determine distance flown (every 1/10 nm equals 6 kt) and multiply distance by a number that corresponds to the amount of time traveled to get ground speed

EXAMPLE: Your distance flown is 6 on the DME indicator. Elapsed time is 1 minute, so 6 times 60 equals 360. Ground speed is 360 kts (6 nm/min times 60 min/hr equals 360 nm/hr).

NOTES

1. The ground speed check requires tracking directly to or from the station. Refer to the ground track marker.

2. To increase accuracy, check ground speed for more than 1 minute; preferably, 3 minutes.

Correcting for Wind Drift using TACAN/VOR/VOR DME

NOTES

1. To compensate for wind, use a wind-corrected heading (WCH) that stops drift from your course. The difference between WCH and desired course is called "crab angle."

2. The T-45C displays aircraft drift via the ground track marker on the HSI. Nonetheless, you should be able to correctly derive drift angles using the following basic method.

1. Determining WCH and crab angle

   a. Establish radial track determining WCH and crab angle on course (CDI centered)

   b. Check for indication of drift on using the CDI

   c. Turn the aircraft sufficiently back into the wind to reintercept the course (CDI centered)

   d. Reduce intercept heading to maintain track on course with enough crab angle to keep CDI centered. Readjust until the drift is "killed

COMMON ERRORS:

1. Making too small a correction to return to the desired radial.

2. Not applying a correction into the wind to slow and/or stop drift when first detected to minimize drift from course.

TACAN/VOR DME Point-to-point Navigation

NOTE

Use this procedure to fly from one TACAN fix to another via a direct track. If ATC clears you direct to the fix, you may be radar-vectored or required to use point-to-point navigation.

1. Tune and ID the station

2. Visualize HSI compass card as compass rose with station at center

3. Picture fix having greater distance from station on its radial atop the HSI compass card

4. Visualize fix with lesser distance (determined from previous step) at a proportional distance from center of HSI on its radial

NOTE

The aircraft is always positioned on the tail side of the applicable navigation pointer. Where it is positioned, depends on the distance of the aircraft from the station when compared to the distance of the point-to-point fix relative to the station.

5. Connect the two fixes with imaginary line or with aid of straight edge

6. Move the imaginary line to center of HSI, paralleling original line and read the course to the fix on the compass card corresponding with the direction of intended flight

7. Turn to new course and apply an appropriate drift correction

8. Periodically, update course calculation and make heading/ drift corrections when needed

COMMON ERRORS:

1. Not placing new line exactly parallel to original line.

2. Not applying wind drift correction to initial heading to the point-to-point fix.

3. Not rechecking the course as approaching the destination fix, and making required corrections.

Proceeding Direct to a Station

NOTE

ATC occasionally amends a clearance, or you can request direct routing from ATC.

1. Tune and identify station

2. Turn in shortest direction to place the subject bearing pointer atop the ground track marker. This neutralized wind drift

3. Using CRS increment/decrement push-buttons, set the inbound CRS that centers the CDI

4. Keep the bearing pointer aligned with the ground track marker. Wind direction and speed may vary, necessitating heading changes

COMMON ERROR: Homing to the station instead of proceeding direct on a set course. Under significant cross-wind conditions, homing will result in a curved ground track approach.

205. SUMMARY

This lesson has focused on the following topics:

1. Standard instrument departures (SID)
2. Radial intercepts
3. Flying a TACAN/VOR DME arc
4. Indications of station passage on the TACAN/VOR/VOR DME
5. Computing ground speed using TACAN/VOR DME
6. Correcting for wind drift using TACAN/VOR/VOR DME
7. TACAN/VOR DME point-to-point navigation
8. Proceeding direct to a station

206. CONCLUSION

This lesson discussed several enroute TACAN/VOR procedures which you have seen before in BI and INav blocks. Reviewing these procedures has prepared you well for the Airways Navigation block.

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CHAPTER THREE
TACAN AND VOR HOLDING PROCEDURES

300. INTRODUCTION – N/A

COURSE/STAGE:

- T-45C TS, ADV, & IUT/Radio Instrument Flight Procedures (RIFP)

LESSON TITLE:

- TACAN and VOR Holding Procedures

LESSON IDENTIFIER:

- T-45C TS, ADV, & IUT RIFP-03

LEARNING ENVIRONMENT:

- CAI

ALLOTTED LESSON TIME:

- .5 hr

TRAINING AIDS:

- Figures:
    - Figure 3-1 HI-ILS or LOC/DME RWY 33

STUDY RESOURCES:

1. NATOPS Instrument Flight Manual, NAVAIR 00-80T-112
2. T-45C NATOPS Flight Manual, A1-T45AC-NFM-000

LESSON PREPARATION:

Read:

1. Section 20.3.12 in the NATOPS Instrument Flight Manual, NAVAIR 00-80T-1 12
2. Section 2.4.3 and 21.3.1 in the T-45C NATOPS Flight Manual, A1-T45AC-NFM-000

3. INAV lesson concerning entry procedures, airspeeds, timing, and distances for holding

4 Figure 3-1, this lesson guide, HI-ILS RWY 33, Kelly AFB approach plate

REINFORCEMENT:

- N/A

LESSON EXAMINATION:

The objectives in this lesson will be tested in, Radio Instruments Flight Procedures 05X.

301. LESSON OBJECTIVES

1. Recall procedures/IAS for flying TACAN/VOR DME holding

2. Recall procedures/IAS for flying VOR holding

302. MOTIVATION

During your flying career, you will, at times, be required to hold (at the ship, it's a standard practice). You will often be required to hold for traffic sequencing or fouled deck. Your knowledge of entry and pattern procedures will ensure you remain in the holding pattern airspace.

303. OVERVIEW

This lesson continues the scenario presented in RIFP-02, which dealt with ground, departure, and enroute procedures. In the RIFP-03 scenario you will be expected to hold at the Kelly HI-ILS RWY 33 IAF, holding procedures to include:

1. Holding clearance

2. Holding entry determination

3. Holding entry procedures for TACAN, VOR, VOR/DME

4. Maintaining holding

5. Communication procedures for holding

You will interpret and respond to instructions given by the controller. In addition to performing TACAN holding, you will also review procedures and techniques related to VOR holding. RIFP-03 concludes as you depart holding and commence the approach.

304. PRESENTATION

Holding Clearance

1. Direction of holding from the fix (e.g., W, NE, E)

2. Radial and DME of the holding fix

3. *Outbound* leg length or the outer limit of the pattern in nm if DME vs timing

4. Altitude

5. Direction of turns (if nonstandard, pilot request, or controller considers information necessary)

6. Expected further clearance (EFC) time

NOTES

1. Unless a nonstandard pattern is published or designated by the controller by stating "left turns" in the clearance, the pattern is always standard.

2. During entry and while holding, all turns are performed at 3 degrees per second (SRT) not to exceed 30 degrees AOB.

3. Commence slowing to holding speed when within 3 minutes prior to crossing holding fix at or below max holding speed.

   a. T-45C procedural holding speed: 200 KIAS not to exceed 14 units AOA

   b. T-45C turbulence penetration airspeed is 250 KIAS. If the situation requires an airspeed greater than 230 KIAS, request approval from ATC. Once higher airspeeds are no longer required, report slowing to normal holding to ATC

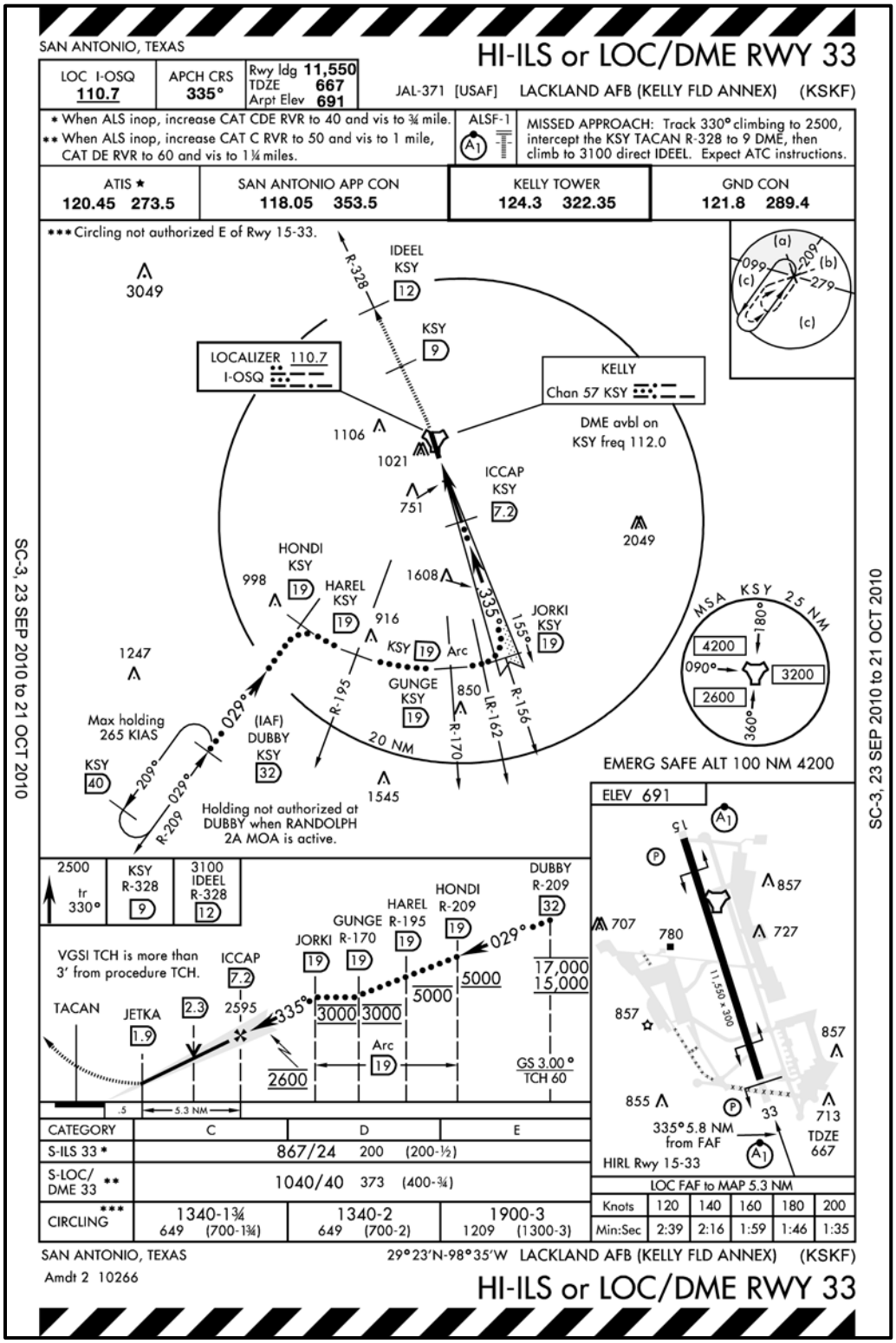


Figure 3-1 HI-ILS or LOC/DME RWY 33

3-4 TACAN AND VOR HOLDING PROCEDURES

Holding Entry Determination

NOTE

The following procedures govern a standard (right hand) holding pattern. For a non-standard (left hand) pattern, the directions are reversed.

1. Visualize a straight line on HSI display from aircraft heading to center of instrument

2. Visualize appropriate entry procedure plot superimposed on top of the HSI display and locate the holding radial to determine entry procedure to be used

NOTE

If the holding radial is within +/- 5 degrees of the entry plot quadrant division points, either entry procedure associated with the point may be used. The most appropriate entry is determined by consideration of known wind, holding airspace, etc.

Holding Entry Procedures for TACAN, VOR, VOR/DME

NOTE

It is recommended that CDI mode be used for increased visual accuracy.

1. Parallel - Perform parallel entry if holding radial is within 110 degrees left of heading *(standard holding)*

   a. At holding fix turn in shortest direction to parallel holding course/*radial outbound on the nonholding side*

   b. Note time or DME wings level or abeam whichever occurs last as appropriate

   c. Set in holding course on HSI display

   d. After desired time or DME is reached, turn in direction of holding pattern *through more than 180 degrees* to return to the holding fix or intercept the holding course inbound

   e. Return to holding fix or intercept the holding course inbound

2. Teardrop - perform teardrop entry if holding radial is within 70 degrees right (standard) or left (nonstandard) of heading

NOTE

In the T-45C, as with most high performance aircraft, when holding at a fix away from the NAVAID, you will have to compute the outside corner to stay within the holding pattern. At holding airspeed the ground speed of the T-45C is approximately 250 kts. At that ground speed a 180 degree turn will require approximately 5 nm. Determine the radial that will identify the outside corner of the holding pattern based on radial spread at the distance of the turn inbound. On the entry, use plus or minus 30 degrees as appropriate for type of holding until intercepting the outside corner radial. At that point, track outbound on the radial until the inbound turn point. If the radial is not intercepted during the 30 degree entry, turn inbound on time or DME as appropriate.

a. At holding fix turn outbound *on a heading plus or minus 30 degrees from the holding radial within the pattern (on the holding side)*

NOTE

For standard holding, subtract 30 degrees from assigned holding radial to determine entry heading for teardrop. For nonstandard pattern add 30 degrees to holding radial.

b. *Wings level* note DME or time

c. Set *inbound* holding course on HSI display

d. After desired DME or time is reached, turn in direction of the holding *pattern* to intercept inbound holding course *or proceed directly to the fix*

e. Return to holding fix

3. Direct - Perform direct entry if holding radial is outside an area of 110 degrees (to the left) and 70 degrees (to the right) of heading

a. At holding fix, turn to the outbound holding heading on the pattern side of the fix

b. Note *DME or time wings level or abeam whichever occurs last*

c. Set in holding course on HSI display

d. After desired time or DME is reached, turn in direction of holding *pattern to follow the holding pattern* and intercept inbound holding course

e. Return to holding fix

3-6 TACAN AND VOR HOLDING PROCEDURES

NOTES

1. When holding utilizes a timed pattern at altitudes at or below 14,000 MSL the pattern inbound leg is 1 min. Above 14,000 MSL the inbound leg is 1.5 min.

2. Timing outbound for all holding is commenced wings level or abeam, whichever occurs last. Timing inbound is commenced wings level inbound on intercept or on course.

Maintaining Holding

1. Distance

   a. DME length

      i. Published

      ii. Specified by controller

      iii. May be requested by pilot

2. Timing

   a. Outbound leg (whichever occurs last)

      i. Abeam fix

      ii. Wings level

   b. Inbound leg (length)

      i. At or below 14,000 ft MSL: 1 minute

      ii. Above 14,000 ft MSL: 1-1/2 minutes

3. T-45C procedural holding speed: 200 KIAS not to exceed 14 units AOA unless in turbulence when holding speed is flown at NATOPS turbulence penetration of 250 KIAS

NOTE

If situation requires an airspeed greater than 230 KIAS (MAX FAR holding speed for category), request approval from ATC.

4. Wind correction

a. Crosswind correction

i. Used while in holding pattern

ii. Apply wind correction crab angle that is 2 to 3 times the angle that holds the aircraft on course inbound

iii. Use SRT in pattern

b. Head winds and tail winds

i. Affect only time holding patterns

ii. Adjust outbound time for correct inbound time

Communication Procedures for Holding

1. Normal

a. Holding instructions (provided by controller)

i. If charted--instructions omitted except direction, unless

(a). Pilot requests

(b). Controller considers instructions necessary

ii. If not charted

(a). Fix

(b). Direction from fix

(c). Radial or bearing

(d). Leg length if DME

(e). Altitude if different than present assigned

(f). Turn direction only if

(1). Left turns

(2). Pilot requests

(3). Controller considers necessary

3-8 TACAN AND VOR HOLDING PROCEDURES

(g). Expect further clearance (EFC) time

(h). Expect approach clearance (EAC) time

NOTES

1. Unless a nonstandard pattern is published or designated by the controller by stating "left turns" in the clearance, the pattern is always standard.

2. During entry and while holding, all turns are performed at 3 degrees per second (SRT) not to exceed 30 degrees AOB.

b. Clearance

i. To enter holding

(a). Non-charted

EXAMPLE: (Controller to pilot) “Cleared to Crane, hold south on one seven five radial, left turns, maintain one five thousand, expect further clearance one niner two zero.”

(b). Charted

EXAMPLE: (Controller to pilot) “Cleared to Crane, hold south of BIGFT intersection as published, maintain one five thousand, expect approach clearance one niner two zero.”

ii. To leave holding

EXAMPLE: (Controller to pilot) “Cleared for HI-V-O-R-D-M-E, runway three four left approach."

iii. The pilot is required to report the time and altitude or flight level upon reaching a holding fix to which cleared and to report leaving the holding fix

NOTE

These reports may be omitted by pilots involved in instrument training <u>at military facilities</u> when radar service is being provided.

2. Lost communication procedures

a. EFC time received

i. If holding fix and initial approach fix (IAF) are the same: leave fix at EFC time

ii. If holding fix and IAF are not the same: leave holding fix at EFC time and commence approach at initial approach fix

b. EFC not received: Continue on assigned route and do not hold but proceed to IAF. Plan arrival at IAF at ETA

305. SUMMARY

This lesson covered:

1. Holding clearance

2. Holding entry determination

3. Holding entry procedures for TACAN, VOR, VOR/DME

4. Maintaining holding

5. Communication procedures for holding

306. CONCLUSION

You will perform holding in later hands-on lessons and quite often at the ship. To understand the procedures is to ensure your safety and that of other aviators.

CHAPTER FOUR
TACAN/VOR/ILS/PAR/ASR APPROACH PROCEDURES

400. INTRODUCTION – N/A

COURSE/STAGE:

- T-45C TS, ADV, & IUT/Radio Instruments Flight Preparation (RIFP)

LESSON TITLE:

- TACAN\VOR\ILS\PAR\ASR Approach Procedures

LESSON IDENTIFIER:

- T-45C TS, ADV, & IUT RIFP-04

LEARNING ENVIRONMENT:

- CAI

ALLOTTED LESSON TIME:

- 1.0 hr

TRAINING AIDS:

- Figures:

    a. Figure 4-1 HI-ILS or LOC/DME RWY 33

    b. Figure 4-2 VOR/DME or TACAN RWY 32L

    c. Figure 4-3 HI-TACAN RWY 1L

STUDY RESOURCES:

1. NATOPS Instrument Flight Manual, NAVAIR 00-80T-112

2. T-45C Instrument FTI

3. FLIP Enroute HI ALTITUDE Chart H-5/6

LESSON PREPARATION:

1. Read:

   - Chapters 21.2.4, 23, 24.3, and 29 in NATOPS Instrument Flight Manual, NAVAIR 00-80T-112

2. Review:

   a. Flight Procedures from Instrument FTI

   b. Have FLIP Enroute HI ALTITUDE Chart H-6/7 available when taking this lesson

REINFORCEMENT:

- Break the approach maneuvers presented in this lesson down into the basic flight maneuvers we have covered in previous lessons.

LESSON EXAMINATION:

- The objectives in this lesson will be tested in Radio Instruments Flight Preparation 05X.

401. LESSON OBJECTIVES

1. Recall communication procedures for approach

2. Recall procedures for performing missed approach

3. Recall procedures for performing transition from instrument to visual scan

4. Recall (flight path) information provided for an ILS approach

5. Recall procedures for an ILS approach

6. Recall procedures for performing VOR approach

7. Recall procedures for performing a circling approach

8. Recall procedures for performing TACAN/VOR DME approach

9. Recall procedures for a PAR approach

10. Recall procedures for flying an ASR approach

402. MOTIVATION

Your ability to fly instrument approaches as published is essential both ashore and at the carrier where you will encounter a variety of instrument approaches and weather conditions.

403. OVERVIEW

During this lesson you will apply approach procedures learned in INav and BI.

404. PRESENTATION

Approach Control Communications

1. Pilot communication (P-A-R format)

    a. Present position

    b. Present assigned altitude

    c. Request for type approach

    d. ATIS letter identifier

NOTE

A prudent pilot would have already tuned and copied ATIS and based his approach request on that information. If it is not included, then the controller is required to give you the weather. If the letter identifier is no longer current the controller will automatically provide you with updated weather information.

2. Provides current weather if ATIS not available or pilot does not indicate the ATIS letter identifier on initial contact

3. ATIS information should include

    a. Weather

    b. Altimeter setting

    c. Duty runway

4. Pilot repeats

    a. Headings

b. Altitudes

c. Altimeter settings

Approach Plates

1. Plan ahead, review approach plates before arriving at the IAF

2. Study and prepare to use all compatible NAVAIDS should primary recovery plan change

3. VOR instrument approaches use direct overflight of transmitter during penetration and approach

4. TACAN DME allows pilot to determine exact points, e.g., IAF, FAF, MAP, intersections, holding limits, etc

PAR and ASR Approach Procedures

1. ASR and PAR patterns identical up to final approach

2. ASR and PAR provide course and range information

3. ASR is a non-precision approach

4. PAR provides glidepath guidance

5. ASR provides less precise guidance due to lower resolution Final Approach Course (FAC) radar

ILS Approach

1. ILS approach usually follow enroute descent or begin with a HI-TACAN or VOR penetration

2. Tune and identify ILS and set final approach course before localizer intercept

3. Marker beacons are often provided as progress reference points

4. Primary ILS reference is the ADI display ILS steering needles

5. Start timing at FAF for another method of determining MAP if glideslope signal lost and DME not available

6. ILS can only be selected in CDI mode

a. Once ILS selected PLAN mode may be chosen

4-4 TACAN/VOR/ILS/PAR/ASR APPROACH PROCEDURES

b. ILS only steering -- CDI on HSI indicates deviation form ILS localizer

c. When ILS and TCN, WYPT, or WO/S steering selected at same time, the CDI course deviation indicator shows TCN, WYPT, or WO/S deviation, not ILS localizer deviation.

7. HUD

a. Selected steering mode indications

i. TILS: TACAN and ILS steering

ii. TCN: TACAN steering

iii. W##: Waypoint/AUTO steering

iv. O##: Waypoint Offset steering

v. VOR: VOR steering

vi. ILS: ILS steering

vii. WILS: Waypoint and ILS steering

viii. OILS: Waypoint Offset and ILS steering

b. Distance and time-to-go displayed next to selected steering

NOTE

Time-to-go not shown for VOR or ILS only steering.

c. Situation steering arrow and course deviation dots only appear when TACAN, Waypoint, or Waypoint Offset steering is selected

d. ILS deviation needles indicate relative deviation from localizer and glideslope in same manner as ILS steering needles on ADI

e. Glideslope is defined as the descent angle assigned to an approach to a given runway for terrain or obstacle clearance and/or reception purposes

f. Glidepath is defined as the portion of a precision approach where the glideslope intersects the localizer beacon of an ILS or the FAF of a PAR

Circling Approach

1. Flown at end of approach

2. Aircraft visually maneuvered for landing on approach runway or another runway

3. IFR minimums and missed approach procedures are for the approach runway not the landing runway

Missed Approach

1. Key element -- establish a positive rate of climb

2. Missed approach procedures (perform steps 1-3 simultaneously)

   a. Set throttle to MRT (if required)

   b. Retract speed brakes

   c. Rotate at optimum AOA to approximately 10-12 degrees nose up

   d. Confirm climb on both altitude and vertical velocity displays

   e. Raise landing gear (minimum 100 feet AGL)

   f. Raise flaps/slats at 140 KIAS or above, wings level and 300 feet AGL

   g. Communicate missed approach one stabilized in missed approach

   h. Accelerate to 200 KIAS if remaining in pattern or 250 KIAS is departing pattern

   i. Comply with controllers and published missed approach procedures

Instrument to Visual Scan

1. Incrementally shift to visual flight by initiating inside/outside scan

2. Maintain steady flight path

3. Continue to crosscheck flight instruments, increasing emphasis on altitude approaching DH or MDA

4. Use HUD as supplemental source of instrument indications during transition to visual scan

Deviations from Glidepath and Localizer Approach Course

1. Shown on ADI and HUD and HSI localizer course deviation shown provided CDI mode selected and only ILS steering selected

2. Avoid overcontrolling corrections

   a. Correction to glidepath are made by small power and/or attitude adjustments

   b. Corrections to localizer course deviations are made by heading changes of 5 degrees or less

3. Glideslope and localizer deviation corrections become smaller as the distance between the aircraft and field decrease, because of the decreasing width of the glideslope and localizer beam

ILS Approach with DME Incorporated

1. TACAN digital bearing and bearing pointer (TACAN steering selected) are not displayed

2. For localizer approaches timing from FAF or DME may be used to determine the missed approach point

Radar Vector to ILS/LOC Final Approach Course

1. Ensure FWD/AFT option is selected as appropriate

2. Select CDI mode and ILS steering

3. Monitor position with TACAN or VORTAC if available

4. Tune and identify the localizer and DME if provided

Back Course (BC) Localizer

1. BC LOC is shadow projection of localizer antenna therefore localizer deviation indications on CDI courseline are reversed

2. With back course set in CRS, the pilot must turn away from localizer steering needle on the ADI, HUD, and HSI

3. A BC LOC approach never includes a glideslope -- ignore all glideslope steering needle indications during a BC LOC approach

Flight Path Information Provided for an ILS Approach

1. Aircraft instrument indications

a. ADI display

i. Localize steering needle displays ILS localizer deviation

ii. Glideslope steering needle displays glidepath deviation

b. HSI display with ILS only steering selected the CDI courseline shows ILS localizer deviation

c. Inner

i. Indicates decision height point for Category II approach (100 ft RVR 1,200)

ii. Provides progress reference point for Category III approach (RVR 700) special authorization and equipment are required for Category II and IIIA ILS approaches

ILS Approach

1. Initial entry to localizer intercept

NOTE

The localizer should be set into CRS on the HSI prior to localizer intercept.

a. Tune and identify the ILS freq. Set inbound course in HSI prior to localizer intercept

b. Select MARKER and VOR on COMM Panel

NOTE

It is recommended that when flying an ILS approach that the LOC audio signal be monitored throughout the approach.

c. Transition to landing configuration

i. Radar vector - Rule-of-Thumb, when on base leg or when within 10 nm of the FAF and on an intercept heading to the FAF, transition to landing configuration and on-speed by 3-5 nm

ii. TACAN penetration - transition to landing configuration 5-7 nm prior to the FAF (speed brakes up) and on-speed by 3-5 nm

iii. VOR penetration/procedure turn:

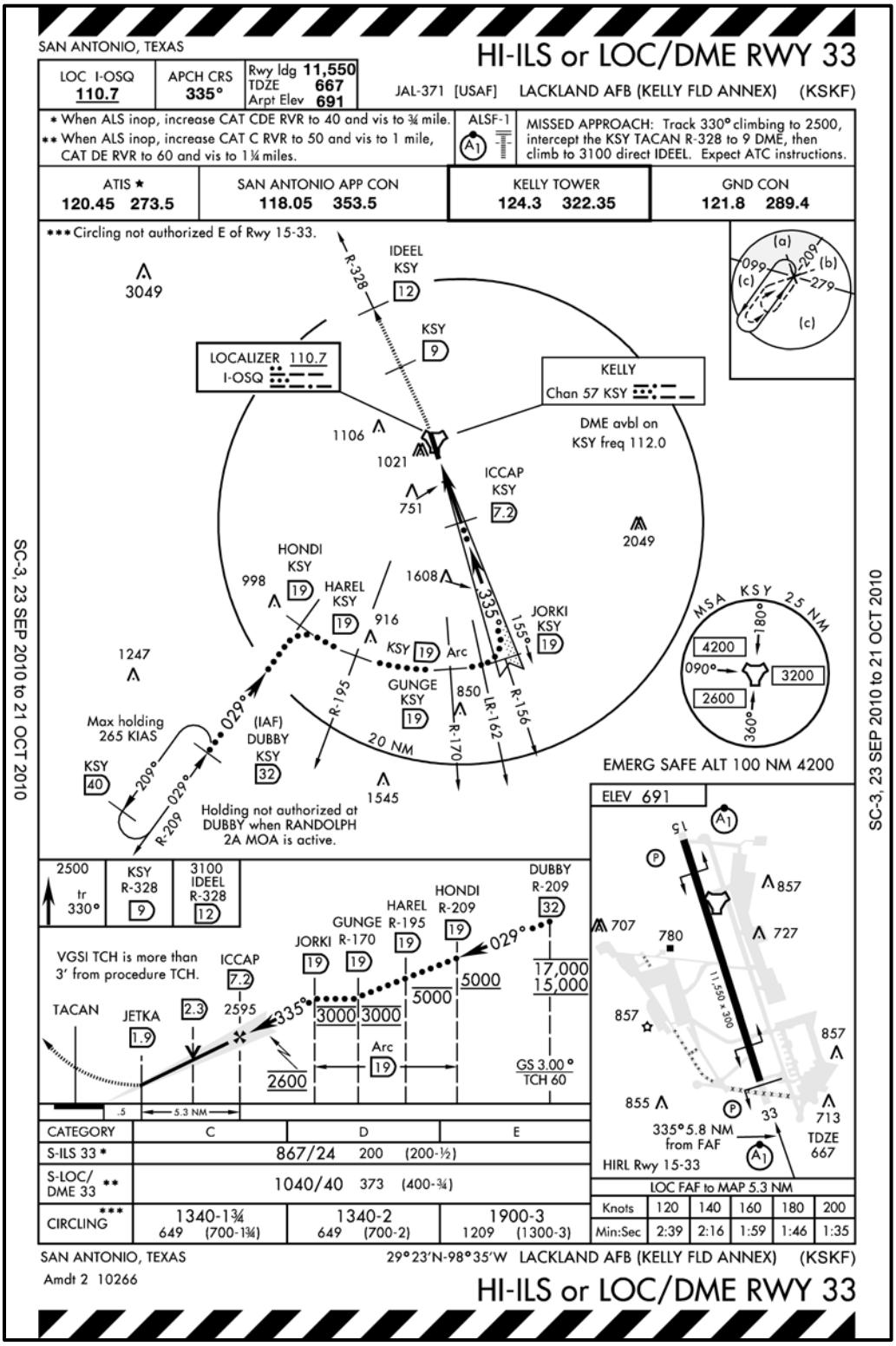


Figure 4-1 HI-ILS or LOC/DME RWY 33

(a). With a FAF - transition to landing configuration 5-7 nm prior to the FAF (speed brakes up) and on-speed by 3-5 nm

(b). Without a FAF - transition to landing configuration and on-speed when wings level inbound on course

2. Localizer/glidepath intercept to MAP

- Maintain localizer course

NOTE

The localizer is only 5 degrees wide vs 20 degrees for a TACAN or VOR signal. Heading corrections once on the localizer should be limited to +/- 5 degrees from WCH to maintain course. Once established inside the OM heading corrections should be initially limited to the number of degrees off course with consideration of the known WCH.

3. Glidepath intercept to MAP

a. Start clock at FAF if timing depicted

b. Maintain course and glidepath

c. Monitor barometric altimeter for decision height (DH)

COMMON ERROR: Fixating on azimuth and glideslope deviation bars, and thus dropping altitude out of scan and descending below minimums.

4. MFD advisories

a. The GLIDESLOPE advisory window appears on all four MFDs when the glideslope signal is determined invalid

b. The LOCALIZER advisory window appears on all four MFDs when the localizer signal is determined invalid

c. The ILS advisory window appears on all four MFD when both the localizer and glideslope signals are determined invalid

Missed Approach Procedures - criteria for initiating missed approach

1. MAP on non-precision or DH on precision reached without visual contact with runway

COMMON ERROR: Executing missed approach when MDA is reached, prior to MAP.

2. Loss of visual contact with runway environment after DH/ MAP

3. Determine that a safe landing is not possible

4. Directed by tower or without clearance to land. Instructed by ATC to execute a missed approach

VOR Approach

1. IAF to FAF

   a. Intercept/maintain course as published for approach

   b. Report departing IAF altitude if required

   c. Descend to and maintain published altitude

   d. Intercept and maintain published course to FAF

2. FAF to MAP

   a. At FAF

      i. Start clock

NOTE

Timing should have been determined prior to commencing the approach.

      ii. Intercept final approach course immediately after station passage

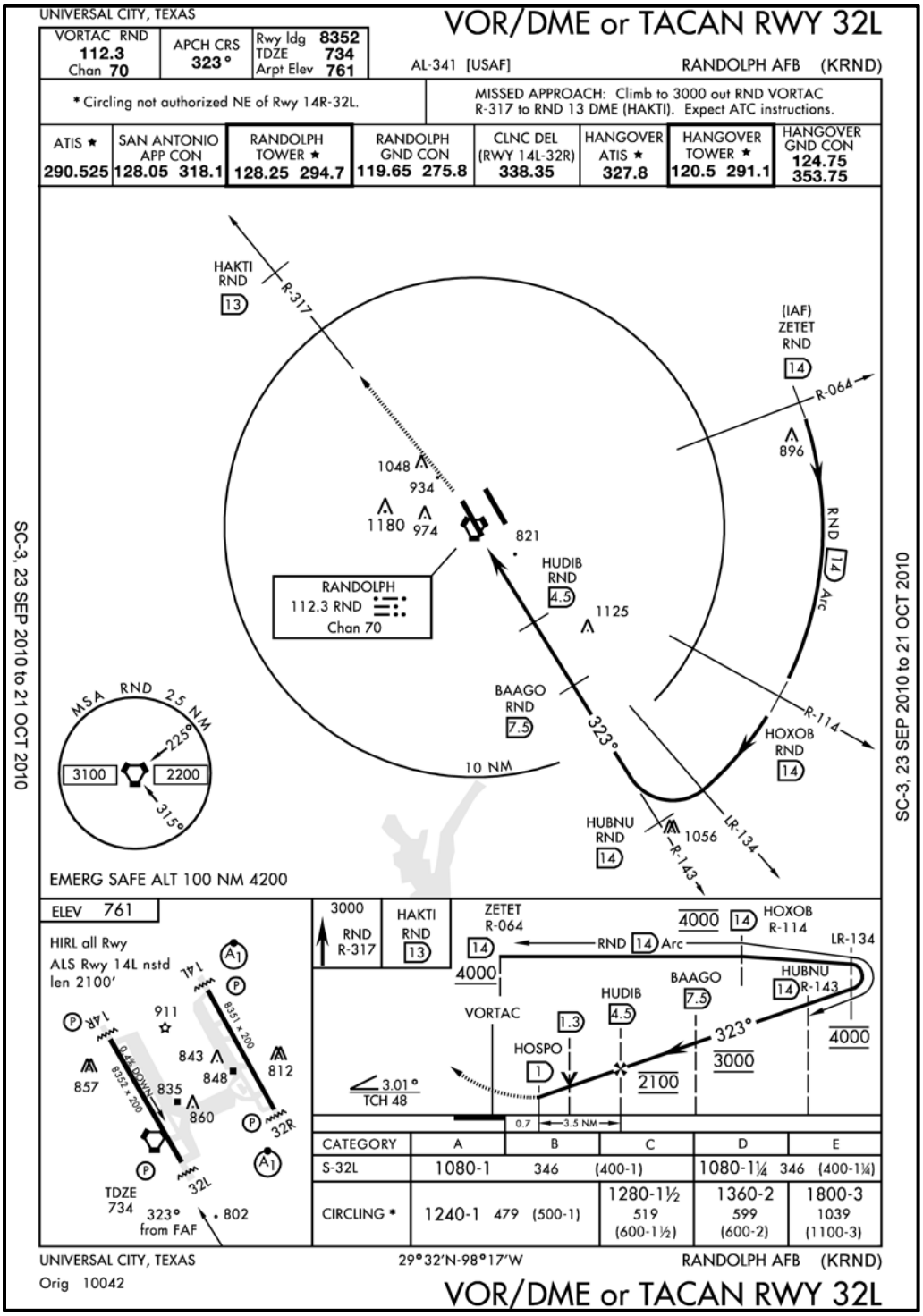


Figure 4-2 VOR/DME or TACAN RWY 32L

iii. Extend speed brakes and establish a descent rate to reach MDA before MAP

iv. Report FAF with gear (ATC)

v. Report landing checklist complete (ICS)

b. At MDA

i. Maintain approach course

ii. Monitor clock for MAP

NOTE

The timing from the FAF to the MAP is based on ground speed.

3. VOR approach without published FAF: IAF to MAP

a. IAF station passage outbound to wings level inbound on course

NOTE

When departing the IAF, use the same procedures as you would for VORs with published FAFs.

b. Wings level inbound to MAP

NOTE

Since this type of approach has no FAF, the procedures performed from the FAF inbound on an approach where there is a FAF are initiated and performed in the same sequence when the aircraft roles wings level inbound on course with exception of the timing inbound, which is excluded.

i. Roll out of penetration/procedure turn wings level on final approach course inbound

ii. Transition to landing configuration with speed brakes extended and establish an on-speed descent rate to reach MDA before MAP

iii. Report procedure turn inbound with gear (ATC) if required

iv. Report landing checklist complete (ICS)

Circling Approach

1. Visual maneuver

2. Used to align aircraft with runway other than depicted for straight-in instrument approach

3. Pilot must have specific clearance to circle to land

4. If you have any doubt whether aircraft can be safely maneuvered to landing, execute missed approach

NOTE

Missed approach procedures are those of the runway for which the approach was flown.

5. If you execute a missed approach while circling to land, turn to fly over the airport center, then fly the published missed approach

TACAN/VOR DME Approach

1. Setting Low Altitude Warning (LAW)

   a. Set LAW by selecting "boxing" LAW on HSI display

   b. Use increment/decrement push-button on HSI to set LAW to desired setting

   c. LAW changes in 10 foot increments, round up to nearest 10 foot increment for DH or MDA

   d. LAW also set using DEP by pressing LAW, entering desired altitude on DEP and pressing ENT

NOTE

When entering an MDA or DH that is not a multiple of 10, the number is rounded down. So since you don't want to go below a DH or MDA, round entries to the next higher multiple of ten before entering the number with the DEP.

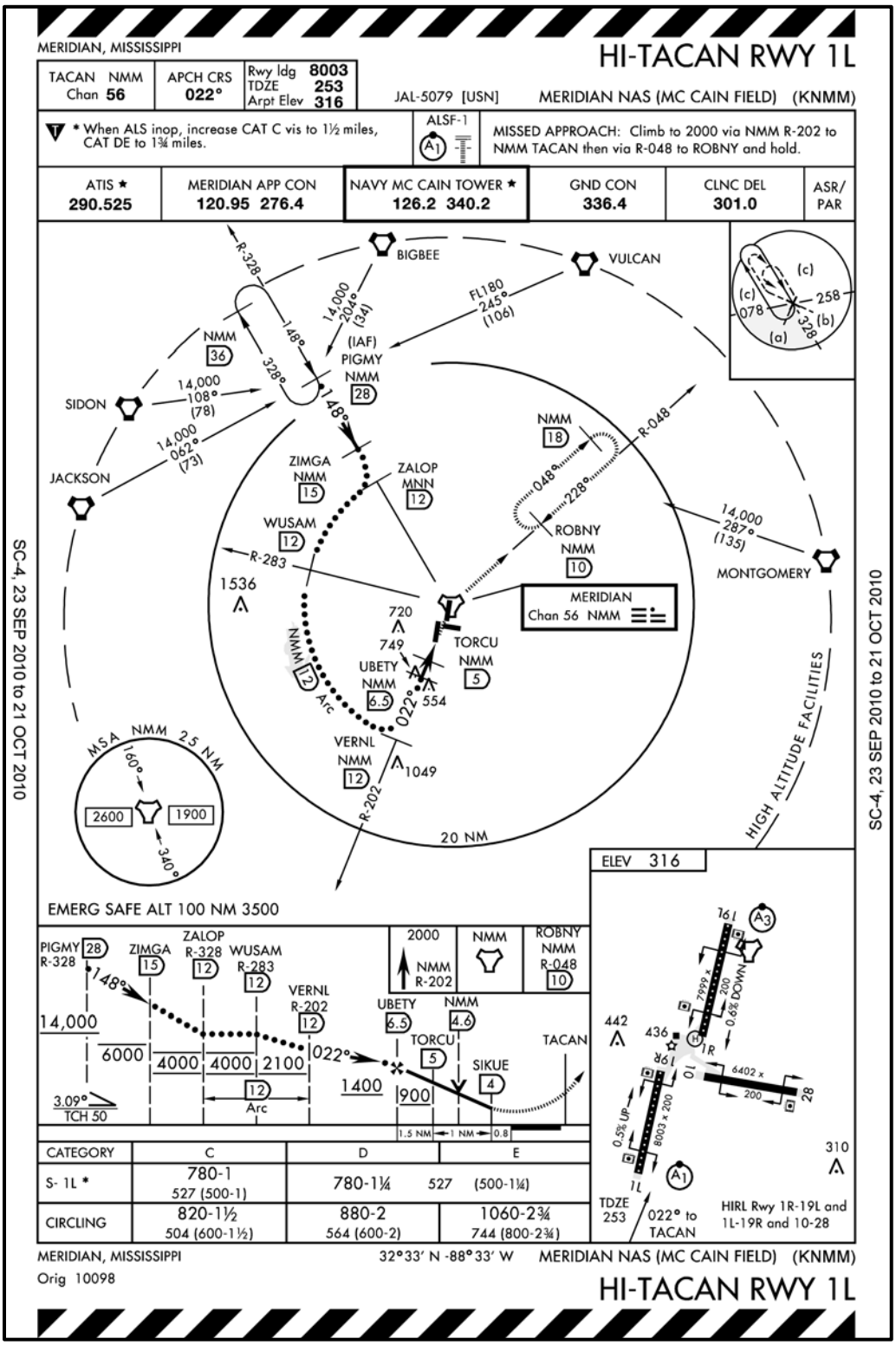


Figure 4-3 HI-TACAN RWY 1L

e. When the radar altitude is below the LAW setting

i. Flashing LAW advisory window is displayed on all MFDs

ii. LAW tone is generated

iii. Warning "W" flashed on HUD

iv. LAW advisory window and "W" on HUD removed after 3 seconds with the landing gear down

v. LAW advisory and tone is removed when REJ on MFD display is pressed

vi. LAW legend and number continue to flash until the:

(a). LAW is reset to altitude below aircraft radar altitude

(b). Aircraft lands

(c). Aircraft climbs to an altitude above the LAW value

2. Initial Approach Fix (IAF) to Final Approach Fix (FAF)

a. Intercept/maintain course as published for approach

b. Report departing IAF altitude, if required

c. Descend to and maintain published minimum altitude (adhere to all restrictions)

d. Intercept and maintain published course to FAF

3. FAF to Missed Approach Point (MAP)

a. At FAF

i. Start the clock (backup for DME)

ii. Extend speed brakes, begin descent to the MDA (adhere to intermediate altitude restrictions)

4. At MDA

a. Maintain altitude

b. Begin "inside/outside" scan

c. Make transition to visual approach if able

d. Incorporate HUD as you scan for runway environment

e. At MAP: Execute missed approach if runway environment not in sight or you determine that a safe landing cannot be made

PAR Approach

- Final approach

a. Verify gear down and full flaps/slats

b. Trim for hands off level flight

c. AOB should approximate the number of degrees to be turned, not to exceed 10 degrees AOA

d. Maintain assigned heading and on-speed AOA (verify against airspeed)

COMMON ERROR: Maintaining 150 KIAS instead of on- speed AOA.

e. At glidepath interception, extend speed brakes, adjust power, commence descent on glidepath, and complete landing checklist

NOTE

"Glideslope" is the descent angle assigned to an approach to a given runway for terrain or obstacle clearance and/or reception purposes. Normally the term is associated with the final descent angle of an ILS or PAR approach. "Glidepath" is defined as that portion of a precision approach where the glideslope intersects the localizer beacon of an ILS or FAC of a PAR.

ASR Approach

1. Pattern entry configuration

a. 200 KIAS, clean

b. Approximately 1,100 pph

c. Approximately 2-3 degrees nose-up attitude

d. Available NAVAIDs tuned, and final approach course set in CDI

2. Initial pattern: Downwind leg for lost comm procedure

   a. Maintain 200 KIAS, clean

   b. Maintain assigned altitude

3. Initial pattern: Base leg

   a. Maintain assigned base leg altitude: Normally 1,500 ft AGL at 200 KIAS

   b. When within 10 nm and 30 radials of FAC, transition to landing configuration

   c. Maintain 150 KIAS, speed brakes up and perform landing checklist to speed brakes

4. Final approach (within 10 nm and 30 degrees of heading to final approach course)

   a. AOB on final should approximate the number of degrees to be turned, not to exceed 10 degrees

   b. Verify gear down and full flaps/slats

   c. Maintain assigned heading

   d. Slow to on-speed AOA (verify against airspeed)

   e. At descent point - extend speed brakes, adjust power (if required), commence descent on-speed, and complete landing checklist

      COMMON ERRORS:

      1. Not descending to MDA with enough time to level off and stabilize prior to the MAP.

      2. Maintaining 150 KIAS instead of on-speed AOA.

405. SUMMARY

This lesson has focused on the following topics:

1. Approach communication procedures

2. TACAN/VOR DME approach procedures

3. VOR approach procedures

4. ASR approach procedures

5. PAR approach procedures

6. ILS information and approach procedures

7. Procedure for transition from instrument to visual scan

8. Circling approach procedures

9. Missed approach procedures

406. CONCLUSION

This lesson has covered the pertinent information, procedures, and communication rules for performing instrument approaches, missed approaches, and the transition from instrument to visual flight in the T-45C. You have completed a three leg cross-country flight scenario. You have studied a number of different instrument approaches, missed approaches, the transition from IMC to VMC, and circling to land. Be certain that you can identify the pertinent facts and recognize the commonalities and differences among these different types of approaches.

NOTES

CHAPTER FIVE
AIRWAYS NAVIGATION FLIGHT PROCEDURES

500. INTRODUCTION – N/A

COURSE/STAGE:

- T-45 Airways Navigation Flight Procedures

LESSON TITLE:

- Airways Navigation Flight Procedures

LESSON IDENTIFIER:

1. T-45 ANFP-01
2. T-45C ADV RIFP-05

LEARNING ENVIRONMENT:

- Classroom

ALLOTTED LESSON TIME:

1. T-45 ANFP-01 2.7 hr
2. T-45C ADV RIFP-05 3.0 hr

TRAINING AIDS:

- None

STUDY RESOURCES:

1. DOD FLIP IFR Supplement
2. OPNAVINST 3710.7
3. DOD FLIP high altitude approach plates
4. DOD FLIP low altitude approach plates
5. FLIP General Planning

LESSON PREPARATION:

- Read:

  a. Sections 420 and 428, NATOPS General Flight and Operating Instructions Manual, OPNAVINST 3710.7

  b. Chapter 25, NATOPS Instrument Flight Manual, NAVAIR 00-80T-112

  c. Instrument Flight Planning, Flight Procedures, Safety/Emergency Procedures, Instrument Flight FTI

REINFORCEMENT:

- Review the procedures for completing the Single-Engine Jet Flight Log and DD-175.

EXAMINATION:

- The objectives in this lesson will be tested in Airways Navigation 02X and RIFP-06X (T-45C ADV).

501. LESSON OBJECTIVES

1. Recall FLIPs required for flight planning
2. Recall items to be checked for destination airfield
3. Determine weather criteria for flight
4. Recall takeoff minimums as defined in OPNAVINST 3710.7
5. Determine alternate routes/airfields
6. Plan route of flight
7. Recall procedures for performing an enroute descent
8. Determine fuel requirements for route of flight
9. Prepare single-engine jet log
10. Recall procedures for completing DD-1 75
11. Recall instrument approach criteria outlined in OPNAVINST 3710.7
12. Recall procedures for modifying route of flight and destination

13. Recall procedures for lost communications situations

14. Recall procedures for mission cockpit management

15. Recall procedures for performing IFR to a contact approach

16. Recall procedures for performing visual approach

17. Recall procedures for performing a circling approach

18. Recall procedures for performing missed approach

19. Recall procedures for terminal communications

502. MOTIVATION

Prior to beginning any flight, you must know your fuel requirements and have a plan of action that will enable you to make accurate and rapid decisions in the event weather conditions change. Because flight planning is a part of every flight, you will use the material reviewed in this lesson extensively both during training and in the fleet.

As you know, a primary ingredient in a successful flight is thorough preflight planning. To ensure a safe and successful flight, you must understand the flight planning process along with the associated documents needed to manage a cross-country flight.

Filling out a flight plan correctly serves as a checklist, ensuring that you have a plan to follow based on aircraft performance, weather, NAVAIDs, and applicable USN/FAA regulations.

503. OVERVIEW

Stressing preflight preparation, this lesson reviews the related procedures, requirements, and criteria used to prepare for cross-country flight. Your thorough preparation will take most of the uncertainties out of your flight.

In this lesson we will be studying:

1. FLIP publications required to prepare a flight plan

2. Check-items for destination airfield

3. Weather minimums for instrument flight

4. Departure point minimums for takeoff

5. Selecting alternate routes/airfields

6. Planning route of flight

7. Fuel requirements for route of flight

8. Preparing Single-Engine Jet Flight log

9. Preparing DD Form 175, Military Flight Plan

10. Criteria determining type of approach

11. Additional Airways Navigation review topics

REFRESHER:

- Recall:

    a. OPNAVINST 3710.7 regulations from your T-34 training and T-45 FRR lessons

    b. Regulations and your meteorological data interpretation skills to solve flight planning problems

    c. Your experiences of flight planning during your earlier T-45 training

504. PRESENTATION

FLIPs Required for Flight Planning

1. DOD FLIP General Planning

    a. Index for aeronautical information

        i. Location of data contained in General Planning

        ii. Reference to other primary publications

    b. Definition of aeronautical terms

    c. Flight plans

    d. Pilot procedures

        i. Preflight

        ii. Departure

        iii. En route

iv. Arrival

v. Supplementary information

2. DOD FLIP high altitude charts

a. High altitude route structure

b. Primary NAVAIDs

c. Airport locations

d. Special use airspace

3. DOD FLIP IFR supplement

a. IFR airport/facility directory

b. Special notices/procedures required to support enroute and area charts

4. DOD FLIP Flight Information handbook

a. Emergency and lost communication procedures

b. Flight data and procedures

i. Traffic control

ii. Approach/runway lighting systems

iii. Position reporting

iv. Runway condition reading

c. Meteorological information

i. Telephone weather briefings

ii. Pilot-to-Metro Service (PMSV)

iii. FAA Weather Services

iv. Automatic Terminal Information Service (ATIS)

v. Pilot Weather Reports (PIREPs)

vi. Turbulence/icing types and intensity

d. Conversion tables

e. FLIP and NOTAM abbreviations

5. DOD FLIP Area Planning AP/1, North and South America, planning and procedural information

a. Route and area restrictions and flight hazards

b. FAA airspace classifications

c. Specific airport restrictions and cautions

d. Preferred IFR routes

6. DOD FLIP Area Planning AP/1, tabulated information on all special use airspace areas for North and South America

a. Prohibited

b. Restricted

c. Danger

d. Warning

e. Alert

f. Military operations

g. Parachute jumping

7. DOD FLIP high altitude (Terminal) Airport Diagrams, Instrument Approach procedures, Military Standard Instrument Departures, Radar Instrument Approach Minimums

a. Transition information from high altitude route structure

b. Instrument approach procedures for high performance aircraft

c. Military standard instrument departures (SIDs)

d. Airport sketches/diagrams

e. Instrument approach minimums

5-6 AIRWAYS NAVIGATION FLIGHT PROCEDURES

f. Minimum safe altitude for radius of 25 nm from approach NAVAID

g. Emergency safe altitude for radius of 100 nm from approach NAVAID

h. Airport communication frequencies

8. DOD FLIP low altitude approach plates: same as high altitude approach plates with two exceptions

a. No transition information from high altitude route structure

b. Instrument approach procedures are not for high performance aircraft

9. DOD FLIP area arrival charts: depict detailed facilities/routes for twelve high density terminal areas

10. DOD FLIP standard arrival routes (STARS): provide clues for filing to feeder fixes and other terminal routing information

Check Following Items for Destination Airfield

1. Hours of operation/landing restrictions (DOD FLIP IFR supplement and NOTAMs)

2. Length of runway (DOD FLIP IFR supplement and high altitude approach plates)

3. Types of approaches available and minimums (DOD FLIP high altitude approach plates)

4. Runway lighting (DOD FLIP IFR supplement flight information handbook and high altitude approach plates)

5. Field elevation (DOD FLIP IFR supplement and high altitude approach plates)

6. Obstructions (DOD FLIP IFR supplement and high altitude approach plates)

7. Communications/NAVAID frequencies (DOD FLIP IFR supplement and high altitude approach plates)

8. Availability of arresting gear and jet barrier (DOD FLIP IFR supplement and high altitude approach plates)

9. Availability of aircraft servicing (DOD FLIP IFR supplement)

10. Forecast weather and winds at ETA +/- 1 hour (terminal forecasts)

11. Status of runways, NAVAIDs, and emergency equipment (NOTAMs and DOD FLIP IFR supplement)

12. Airfield restrictions, hazards, and cautions (DOD FLIP AP/1)

13. Miscellaneous information provided by DOD FLIP IFR supplement

Weather Criteria

NOTE

IFR flight plans shall be filed and flown by Naval aviators whenever practicable regardless of weather as a means of reducing the potential for midair collisions.

1. All flight plans are based on the following:

   a. Weather at the actual point of departure at time of clearance

   b. Existing and forecast weather for entire route of flight

   c. Destination and alternate forecast WX for ETA +/-1 hour

NOTE

A DD-175-1 WX briefing form shall be completed for all flights to be conducted in IMC. The forecaster will complete the form for briefings conducted in person. It is the pilots responsibility to complete the form for telephonic or weathervision briefings.

DCA22101010SCTC18BKN5SW-3415G250CNLC8 X1/2SW12ZC50BKN3312G2204ZMVFRCLG.

DCA221010: DCA Forecast 22nd day of month – valid time 10Z-10Z.

10SCTC18BKN5SW—3415G25OCNLC8X1/2SW: Scattered clouds at 1000 feet. Ceiling 1800 feet broken. Visibility 5 miles. Light snow showers. Surface wind from 340 degrees at 15 knots. Gusts to 25 knots. Occasional ceiling 8 hundred feet sky totally Obscured. Visibility ½ mile in moderate snow showers.

12ZC50BKN3312G22: By 12Z becoming ceiling 5000 feet broken. Surface wind 330 degrees at 12 knots. Gusts to 22.

04MVFRCLG: Last 6 hours of FT after 04Z marginal VFR due to ceiling.

Figure 5-1 WX Briefing Data

2. The following are filing criteria rules for destination approach minimums

   a. Observe absolute minimums of 200 and 1/ 2 sm (2,400 RVR) for single-piloted aircraft

   b. Use minimums for instrument approach to probable runway based on forecast surface winds

   c. Use lowest minimums for any approach you are qualified and your aircraft is equipped to fly

3. In-flight weather sources

   a. ATIS

   b. FSS (frequency 255.4)

   c. ARTCC

   d. Approach control

e. PMSV - METRO (FIH or IFR ES)

4. Pilots are expected to obtain enroute and terminal weather updates, especially:

a. When forecast for enroute or destination is marginal

b. Before overflying the alternate airfield

c. Before descent is initiated (prior to hand-off to approach control)

d. When on a stopover flight plan

Takeoff Minimums

1. Special instrument rating

a. No takeoff ceiling or visibility limits apply

b. Takeoff dependent upon

i. Judgment of pilot

ii. Urgency of flight

2. Standard instrument rating minimums

a. Lowest non-precision minimums for runway in use but not lower than 300-1

b. If runway in use has precision approach, takeoff is permitted to precision minimums or 200-1/2 (2,400 RVR), whichever is higher

RVR (feet)	Visibility (statute miles)
1600	¼
2400	½
3200	5/8
4000	¾
4500	7/8
5000	1
6000	1-1/4

Figure 5-2 RVR to Ground Visibility Conversion Chart

Planning for Alternate

1. Apply weather minimum rules to destination

    a. Ceiling and visibility of 0-0 up to, but not including, published minimums: alternate must be 3,000-3 or better at ETA +/- 1 hour

    b. Published minimums up to but not including 3,000-3

        i. Non-precision: alternate must be published minimums plus 300-1

        ii. Precision: alternate must be published minimums plus 200-1/2

    c. 3,000-3 or better: no alternate required

NOTE

CNATRA requires that you always file for an alternate.

2. Select appropriate alternate

    a. Choose suitable alternate with required forecast weather minimums

    b. Check NOTAMs for compatible NAVAIDs

    c. Alternate airfield must have approach compatible with aircraft NAVAIDs and can be flown without use of two way communications if either of the following conditions exist:

        i. If destination airfield lacks approach that is compatible with aircraft NAVAIDs and cannot be flown without two way communication

        ii. If forecast weather is below 3,000 ft ceiling and 3 sm

DESTINATION WEATHER ETA plus and minus one (1) hour	ALTERNATE WEATHER ETA plus and minus one (1) hour		
0-0 up to but not including published minimums	3000-3 or better		
Published minimums up to but not including 3000-3 (single-piloted absolute minimums 200-1/2)	NON-PRECISION	PRECISION	
		ILS	PAR
	*Published minimums plus 300-1	*Published minimums plus 200-1/2	*Published minimums plus 200-1/2
3000-0 or better	No alternate required		
* In the case of single-piloted or other aircraft with only one operable UHF/VHF transceiver, radar approach minimums may not be used as the basis for selection of an alternate airfield.			

Figure 5-3 IFR Filing Criteria

d. Determine suitable approach to runway with consideration to crosswinds and T-45 requirements

e. An airfield may be selected as an alternate even though certain restrictions may preclude use of the same airfield as a destination

i. When another unrestricted airfield is not available as an alternate the following airfields may be used without obtaining permission:

(a). Official business only

(b). PPR

ii. Civilian airfields may be used as an alternate provided:

(a). A DOD flying unit is located on the aerodrome

(b). No military airfield or civilian airfield with a DOD unit is available

NOTE

Don’t forget to close your flight plan with flight service if you land at a civilian airfield.

Planning Route of Flight

1. Select destination and route of flight

2. Obtain initial weather briefing

   a. Determine route with acceptable enroute weather (consider winds, turbulence, icing, and thunderstorms)

   b. Determine altitude/flight level with most favorable winds

NOTE

Consider MEA's and hemispheric rotation

   c. Determine need for alternate

NOTE

Always file for an alternate.

   d. Determine suitable alternates

   e. Record forecast surface winds for destination and possible alternates

   f. Record required data for computing takeoff performance

      i. Departure base pressure altitude

      ii. Winds

      iii. Temperature

   g. Determine expected active runway

3. Reference required FLIP publications and NOTAMs

   a. Select suitable alternate(s)

   b. Review SID, if available

   c. Review approach charts for destination and alternate

Determining Fuel Requirements for Stages of Flight

1. NATOPS performance data, Section XI for nonstandard conditions

2. T-45 fuel planning data, above, for standard conditions during initial planning. (Data is not current NATOPS values and is to be used for training purposes only. DO NOT USE FOR FLIGHT.)

a. Optimum altitude and speed

b. Start, taxi, takeoff fuel

c. Fuel to climb

d. Enroute fuel from level off to destination IAF (time enroute multiplied by fuel consumption rate)

e. Penetration and approach fuel

NOTE

Consider altitude leaving and altitude descending to for enroute descent fuel computation.

f. Fuel from destination IAF to alternate IAF plus approach fuel

g. Reserve fuel (10% or 20 minutes at 10,000 ft at maximum endurance, whichever is greater)

FOR TRAINING PURPOSES ONLY
DO NOT USE FOR FLIGHT

STANDARD T-45 FUEL PLANNING DATA

Based on T-45A NATOPS flight manual, 15 JANUARY 1997.
Actual performance will vary with prevailing temperature, winds, drag index, and varying gross weight.

For initial planning only.

Total usable fuel (JP-8/JET A+) . . . . . 2,861 LB
Start/Taxi/Takeoff 200
Penetration 200
GCA 250
Reserve (20 min @ 10,000 ft MSL) 300
Low level (360 KGS, 12K GW = 6.6 LB/NM and 2,375 PPH/300 KGS = 5.0 LB/NM = 1,500 PPH)

JP-4 = 6.5 LB/Gal **JP-5 = 6.8 LB/Gal** **JP-8 = 6.7 LB/Gal ALSO JET A+**

Climb Out (13K GW, 250 KIAS to 10K, 300 KIAS to .75 IMN)

Altitude	KIAS	NM	Time	Fuel Used
5,000	250	04	0+01	60 lb
10,000	250	08	0+02	110
15,000	300	14	0+03	180
20,000	300	22	0+04	240
25,000	300	32	0+05	320
30,000	283/.75	44	0+07	380
35,000	253/.75	60	0+09	460
40,000	225/.75	91	0+13	570

Figure 5-4 Fuel Card

FOR TRAINING PURPOSES ONLY
DO NOT USE FOR FLIGHT

ENROUTE (Max range @ 12K GW)

ALTITUDE	#/NM	IMN	CAS	#/HR	TAS
5,000	5.21	.43	260	1460	280
10,000	4.72	.45	250	1345	285
15,000	4.08	.49	245	1245	305
20,000	3.69	.52	240	1180	320
25,000	3.46	.56	230	1160	335
30,000	3.24	.61	225	1165	360
35,000	2.90	.65	220	1090	375
40,000	2.84	.68	200	1110	390

DESCENT (12K GW idle w/spd brakes in @ max range)

ALTITUDE	KIAS	NM	TIME	FUEL USED
5,000	195	12	0+03	25 lbs
10,000	195	28	0+07	80
15,000	195	39	0+10	90
20,000	195	53	0+14	125
25,000	195	68	0+17	150
30,000	195	85	0+21	175
35,000	195	100	0+24	210
40,000	195	116	0+26	225

OPTIMUM ALTITUDE and SPEED

GROSS WEIGHT	IMN	ALT	#/NM
13,000 #	.68	36,800 ft	3.08
12,000 #	.68	38,400 ft	2.86
11,000 #	.68	39,600 ft	2.63

Figure 5-5 Fuel Card (Cont)

Preparing Single-engine Jet Flight Log

1. Discuss techniques for preparation of flight log

SINGLE-ENGINE JET FLIGHT LOG

DEP ELEV	CLNC DELIV	GND CONT	TOWER
317	301.0	336.4	340.2(L) 360.2(R)
ALT CORR	**TIME OFF**	**TAS**	**LBS PH**
		300	1078

CLEARANCE

DEPARTURE

DEST ELEV	APC CONT	TOWER	GND CONT
30	270.8/120.65	340.2/126.2	336.4/121.7

ATIS 267.6
METRO 359.6

Figure 5-6 Single-engine Jet Flight Log – Top Section

ROUTE / TO	IDENT / CHAN	CUS	DIST	ETE	ETA / ATA	LEG / FUEL	EFR 2904 / AFR	NOTES
Depart NMM	NMM / 56	START-TAXI-T/O				200	2704	
D ▸ ℄	MEI / 117	224	28	6		300	2404	MEI 117.0
D ▸ NPA 141010	NPA / 119	142	153	27		520	1884	
			178	33		1020		
								FRCST ALT

ALTERNATE	ROUTE	ALTITUDE	TIME	FUEL
VPS ELGIN AFB	D ▸	16000	0+09	1+15

ALT ELEV	APC CONT	TOWER	GND CONT
85	322.6/125.1	348.4/118.2	335.8/121.8

VPS ELGIN AFB	DWO / 02	112	45	9		180	1824	ATIS 373.5/134.625 METRO 342.5

Figure 5-7 Single-engine Jet Flight Log – Lower Front

2. Discuss use 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)	_____		

EMERGENCY "BINGO" TO ALTERNATE

	REQUIRED		APPROACH		RES		TOTAL
LAST CRUISING ALT	_____	+	_____	+	_____	=	_____
INITIAL APP ALT	_____	+	_____	+	_____	=	_____
EMER SAFE ALT	_____	+	_____	+	_____	=	_____

Figure 5-8 Single-engine Jet Flight Log – Top Section

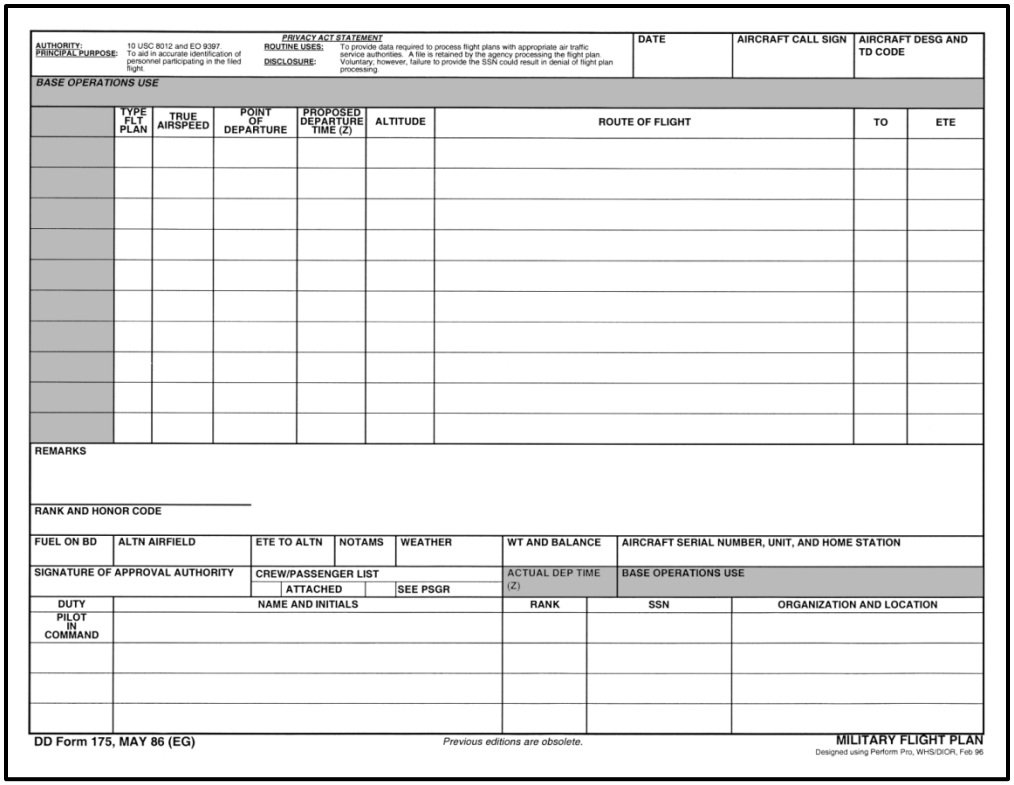
CHECK LIST	DESTINATION	ALTERNATE
RWY LENGTH	25/8000 x 200	30 12,000/300
LIGHTING	HIRL	A1 HIRL
FUEL / JASU / LOX	J5	J8
ILS	NONE	RW 30 110.3 270/24
LOC	NONE	RW 30 110.3 320/40
ASR	25L 460 1¼	30 520/40
PAR MINS	25L 200 ½	NONE
TAC MINS	25L 460 1¼	30 520/40
ARR GEAR	E 28 Both Ends	BAK 12 Both Ends
PUBS	✓	✓
NOTAMS	✓	✓
FUEL PACKET	✓	✓
FLASHLIGHT, WALLET, ETC.	✓	✓

EMER FIELDS	
MERIDIAN KEY FIELD	
ID	MEI
CH	117/117.0
PAGE NO.	96

Figure 5-9 Single-Engine Jet Flight Log – Top Section

Military Flight Plan: Completing DD Form 175

1. Review DOD FLIP General Planning for specific preparation steps



AUTHORITY: 10 USC 8012 and EO 9397
PRINCIPAL PURPOSE: To aid in accurate identification of personnel participating in the filed flight.
PRIVACY ACT STATEMENT
ROUTINE USES: To provide data required to process flight plans with appropriate air traffic service authorities. A file is retained by the agency processing the flight plan.
DISCLOSURE: Voluntary; however, failure to provide the SSN could result in denial of flight plan processing.

DATE	AIRCRAFT CALL SIGN	AIRCRAFT DESG AND TD CODE

BASE OPERATIONS USE

	TYPE FLT PLAN	TRUE AIRSPEED	POINT OF DEPARTURE	PROPOSED DEPARTURE TIME (Z)	ALTITUDE	ROUTE OF FLIGHT	TO	ETE

REMARKS

RANK AND HONOR CODE

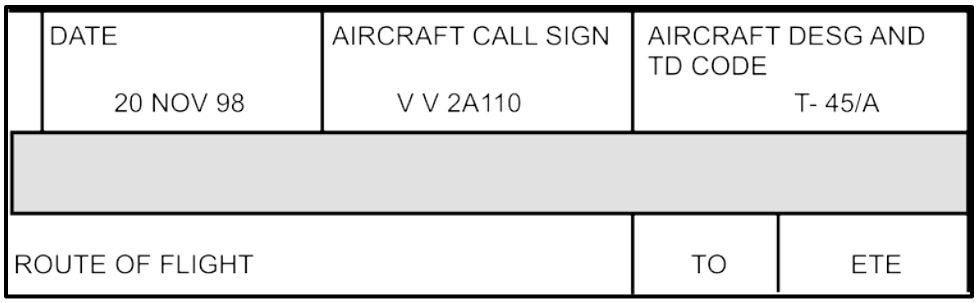
FUEL ON BD	ALTN AIRFIELD	ETE TO ALTN	NOTAMS	WEATHER	WT AND BALANCE	AIRCRAFT SERIAL NUMBER, UNIT, AND HOME STATION

SIGNATURE OF APPROVAL AUTHORITY | CREW/PASSENGER LIST ATTACHED SEE PSGR | ACTUAL DEP TIME (Z) | BASE OPERATIONS USE

DUTY	NAME AND INITIALS	RANK	SSN	ORGANIZATION AND LOCATION
PILOT IN COMMAND				

DD Form 175, MAY 86 (EG) Previous editions are obsolete. MILITARY FLIGHT PLAN
Designed using Perform Pro, WHS/DIOR, Feb 96

Figure 5-10 Flight Plan DD-175



DATE	AIRCRAFT CALL SIGN	AIRCRAFT DESG AND TD CODE
20 NOV 98	V V 2A110	T- 45/A

ROUTE OF FLIGHT	TO	ETE

Figure 5-11 DD-175 Section I

2. ANFP instructor will discuss techniques for preparation and use of DD Form 175 for different mission profiles

a. IFR point to point

b. Stopover

c. Terminal delay

NOTE

If there is a delay in takeoff, do not forget to revise your ETA. Pilots are required to file 30 minutes prior to expected departure time.

BASE OPERATIONS USE								
	TYPE FLT PLAN	TRUE AIRSPEED	POINT OF DEPARTURE	PROPOSED DEPARTURE TIME (Z)	ALTITUDE	ROUTE OF FLIGHT	TO	ETE
	I	300	NMM	1350	190	MEI NPA 141010	NPA	0+31

Figure 5-12 DD-175 Section II

REMARKS Request Radar Departure								
RANK AND HONOR CODE V5H								
FUEL ON BD	ALTN AIRFIELD	ETE TO ALTN	NOTAMS	WEATHER	WT AND BALANCE	AIRCRAFT SERIAL NUMBER, UNIT, AND HOME STATION		

Figure 5-13 DD-175 Section III

RANK AND HONOR CODE V5H						
FUEL ON BD 2+40	ALTN AIRFIELD VPS	ETE TO ALTN 0+09	NOTAMS √	WEATHER 4-129	WT AND BALANCE N/R	AIRCRAFT SERIAL NUMBER, UNIT, AND HOME STATION 165457/TW1/NMM
SIGNATURE OF APPROVAL AUTHORITY		CREW/PASSENGER LIST ATTACHED SEE PSGR MANIFEST			ACTUAL DEP TIME	BASE OPERATIONS USE
DUTY	NAME AND INITIALS				RANK	SSN	ORGANIZATION AND LOCATION
PILOT IN COMMAND							

Figure 5-14 DD-175 Section IV

SIGNATURE OF APPROVAL AUTHORITY	CREW/PASSENGER LIST ATTACHED SEE PSGR MANIFEST	ACTUAL DEP TIME	BASE OPERATIONS USE	
DUTY	NAME AND INITIALS	RANK	SSN	ORGANIZATION AND LOCATION
PILOT IN COMMAND	READY, R.U.	LTJG	450-44-443	VT23/NMM

Figure 5-15 DD-175 Section V

Criteria Determining Type of Approach

1. Navigational equipment on aircraft

2. Types of approaches available at destination

3. Weather: at or above published minimums

NOTE

Do not commence approach at destination if reported weather is below published minimums.

4. Absolute minimums for single-piloted aircraft executing a precision approach: 200 ft ceiling visibility 1/2 sm (2,400 RVR) or published minimums, whichever is greater

5. Published minimums

   a. Review published landing minimums for category C aircraft (T-45 is category C) to determine lowest MDA/DH approach

NOTE

T-45 in no-flap configuration is not a category C aircraft. The radius of turn may exceed circling cleared airspace.

   b. Determine if forecast weather conditions are above published minimums

Additional Airways Navigation Review Topics

1. Procedures for modifying route of flight and destination

   a. Use procedural steps found on the back of the IFR Supplement

   b. D.R.A.F.T. report

2. Bingo fuel computations

   a. Use appropriate drag index

   b. Climb schedule: 300 KIAS to .75 Mach

   c. Descent @ 180 KIAS

NOTE

A good rule of thumb to use is to multiply the altitude to lose by 3.

This will give you the approximate distance out to begin your descent.

3. Enroute descent

   a. Pilot or controller can initiate

   b. Pilot may refuse in lieu of published approach

   c. Fuel computations

   d. Controller must provide terminal WX if:

      i. Ceiling is below 1,000 ft (when higher than the highest circling minimum)

      ii. Visibility is <u>less</u> than <u>3 miles</u> (IFR)

4. Procedures for lost communications situations

   a. Squawk 7600

   b. Controller may attempt to reestablish contact by requesting that the pilot:

      i. Change squawk

      ii. Squawk ID

      iii. Squawk STBY

      iv. Make turns

5. Procedures for mission cockpit management

   - Stay ahead of the aircraft, plan ahead for the next NAV/COMM transition

      i. Set navigation radios for seamless transition to next course

      ii. Set communications for seamless change over to next controller without compromising primary comm

      iii. Keep crew member/IP informed/briefed of problems, plans, updates, and NAV/COMM setup

6. Procedures for performing IFR to a contact approach

   a. Pilot must request

b. Clear of clouds and minimum 1 sm visibility and can expect to continue under those conditions

c. Authorized instrument procedure to destination airport having a standard or special instrument approach procedure

d. Pilot responsible for obstruction clearance

e. ATC responsible for aircraft separation

7. Procedures for performing IFR to a visual approach

a. IFR procedure that is pilot requested but authorized and controlled by ATC

b. Clearance authorizes pilot to proceed visually and clear of clouds to the airport

c. Pilot must have the airport <u>or</u> the proceeding aircraft in sight

d. Reported WX, ceiling at or above 1,000 ft AGL and visibility 3 sm or greater

e. Separation

i. If pilot has airport in sight but cannot see the aircraft to be followed, ATC retains responsibility for separation and wake vortex separation responsibility

ii. If visually following a proceeding aircraft, acceptance of the visual approach clearance constitutes acceptance of pilot responsibility for maintaining safe interval and adequate wake turbulence separation

NOTE

Standard cloud clearance requirements are not applicable.

8. Procedures for performing a circling approach/ missed approach

a. Circling Approach

NOTE

Circling minimums are for the runway approach flown, not to the landing runway.

i. Published circling minimums provide obstacle clearance when pilots remain within the protected area

ii. Remain at or above circling minimums until the aircraft is in a position to descend to a landing on the intended runway using

(a). Normal rate of descent

(b). Normal maneuvers

iii. Basic rules

(a). Maneuver the shortest path to the base or downwind leg, as appropriate, considering existing WX conditions

NOTE

There is no restriction from passing over the airport or other runways.

(b). Circling maneuvers may be made while VFR or other flying is in progress at the airport

NOTE

Standard left turns or specific instruction from the controller for maneuvering must be considered when circling to land.

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

b. Missed approach

i. When landing cannot be accomplished

(a). Advise ATC

(b). At missed approach point (MAP) comply with published missed approach procedures or specific ATC instructions

NOTE

Obstacle clearance for missed approach is predicated on the missed approach being initiated at the MAP. No consideration for obstacle clearance is provided for initiating a missed approach procedure early. Always commence a missed approach procedure at the MAP at or above the MDA or DH.

ii. Visual reference is lost while circling to land

- Follow missed approach procedure specified for the approach conducted unless specific ATC instructions received

  - Make initial climbing turn toward the landing runway and continue the turn until established on the missed approach course

NOTE

Adherence to the procedure will assure that the aircraft will remain within the circling and missed approach obstruction clearance areas.

iii. Always conform to ATC radar vectors in lieu of the published missed approach procedure

9. Procedures for Terminal Communications

a. Keep transmissions short and concise

b. Clearance to land is provided only by the tower

NOTE

Landing clearance may be relayed by tower through any ATC facility.

10. 3710.7 instrument approach criteria

a. Alternate weather criteria

i. Non-precision approach, published minimums + 300-1 (non-radar)

ii. Precision approach available, published minimums + 200-1 (ILS but <u>not</u> PAR)

b. Takeoff weather criteria (standard instrument rating)

i. Non-precision approach, not less than 300-1

ii. Precision approach available (ILS or PAR for duty runway) not less than 200-1/2 or 2,400 ft RVR

c. An approach shall not be commenced if the reported weather is below published minimums for type of approach being conducted

i. If a turbojet enroute descent is to be executed, the approach is considered to be commenced when the aircraft descends below the highest initial penetration altitude established in high altitude instrument approach procedures for the destination airport

ii. Once an approach has been commenced, pilots may, at their discretion, continue the approach to approved landing minimums for type of approach

d. Absolute minimums for single-piloted aircraft executing a precision approach are 200 ft ceiling/height above touchdown (HAT), and visibility 1/2 sm/2,400 ft RVR, or published minimums, whichever is higher

505. SUMMARY

This lesson has focused on the following topics:

1. FLIP publications required to prepare a flight plan
2. Check-items for destination airfield
3. Weather minimums for instrument flight
4. Departure point minimums for takeoff
5. Selecting alternate routes/airfields
6. Planning route of flight
7. Fuel requirements for route of flight
8. Preparing Single-Engine Jet Flight log
9. Preparing DD Form 175, Military Flight Plan

506. CONCLUSION

As your flight planning experience continues to grow, you will become increasingly efficient in arranging the many details for your flight. Attending to the criteria for determining what type of approach to use to your destination airport or what departure point minimums apply to your takeoff is critical. The more carefully you examine these details, the better prepared you will be for the unexpected.

APPENDIX A
GLOSSARY

A100. INTRODUCTION – N/A

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