NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-821 (12-14)**

FLIGHT TRAINING INSTRUCTION

ADVANCED UMFO FAMILIARIZATION T–45C/VMTS

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Subj: FLIGHT TRAINING INSTRUCTION, ADVANCED UMFO FAMILIARIZATION, T-45C/VMTS

1. CNATRA P-821 (Rev. 12-14) PAT, "ADVANCED UMFO FAMILIARIZATION, T-45C/VMTS" is issued for information, standardization of instruction, and guidance for all flight instructors and student flight officers within the Naval Air Training Command.

2. This publication shall be used as an explanatory aid to the UMFO Curricula. 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 CNATRA P-821 (10-13) PAT is hereby cancelled and superseded.

M. B. TATSCH
By direction

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FLIGHT TRAINING INSTRUCTION

FOR

ADVANCED UMFO FAMILIARIZATION

T-45C/VMTS

P-821

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Page No.	Change No.	Page No.	Change No.
COVER	0	A-1 – A-3	0
LETTER	0	A-4 (blank)	0
iii – ix	0	B-1 – B-5	0
x (blank)	0	B-6 (blank)	0
1-1 – 1-89	0	C-1 – C-5	0
1-90 (blank)	0	C-6 (blank)	0
2-1 – 2-3	0		
2-4 (blank)	0		
3-1 – 3-35	0		
3-36 (blank)	0		
4-1 – 4-8	0		
5-1 – 5-7	0		
5-8 (blank)	0		
6-1 – 6-12	0		
7-1 – 7-6	0		
8-1 – 8-6	0		

INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE

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

INTERIM CHANGE NUMBER	REMARKS/PURPOSE	ENTERED BY	DATE

TABLE OF CONTENTS

TABLE OF FIGURES

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CHAPTER ONE
INSTRUMENT PROCEDURES

100. INTRODUCTION

The importance of a proficient basic instrument scan is paramount in military aviation. Day and night, all weather capability depends on instrument flight proficiency. Actual and simulated flight into Instrument Meteorological Conditions (IMC) will start with simulator (SIM) events and progress to Familiarization flight events. Later in the syllabus, formation flight procedures in IMC conditions will be introduced.

Familiarization Instrument events are an important part of the Naval Flight Officer's training. While completing Familiarization events in the simulator, the student will learn to perform all basic transitions from the instrument takeoff to the final approach phase. Familiarization events are intended to improve student knowledge and performance in the following areas:

1. ***CHECKLISTS***: Improve student skills in accurate and efficient completion of aircraft checklists.

2. ***SCAN***: Rapidly develop and improve student’s instrument scan.

3. ***AIRCRAFT KNOWLEDGE***: Increase student’s knowledge of the T-45C aircraft through operation of the aircraft’s systems.

4. ***COMMUNICATIONS***: Improve student’s radio communication skills by practice of local communication procedures.

5. ***COCKPIT RESOURCES***: Improve student’s cockpit organizational skills through management of cockpit equipment and controls and kneeboard documents.

6. ***CREW COORDINATION***: Improve integration of student tasks with pilot actions. Student will gain an appreciation of pilot responsibilities, tasks, and workload.

7. ***UNUSUAL ATTITUDES***: Develop student’s capability to recognize different types of unusual attitudes as well as provide verbal instructions for correct T-45C unusual attitude recoveries. These procedures are located in Chapter 5 of this instruction.

8. ***SIMULATED FLIGHT***: Enhance follow-on instruction by gaining an understanding of the characteristics, capabilities, and limitations of the T-45C Flight Simulator.

101. PHYSIOLOGY OF INSTRUMENT FLIGHT

During flight, sight is used to determine the aircraft's attitude in relation to the earth's surface. In visual flight conditions, the aircraft’s attitude is determined by reference to the earth's horizon and flight instruments. During instrument flight conditions, when the earth's horizon is not visible, the aircraft’s attitude must be determined by reference to the attitude indicator and other flight instruments.

Under instrument flight conditions, sight may disagree and conflict with other senses, and equilibrium may be lost. When this happens, aircrews are susceptible to spatial disorientation and vertigo. The degree varies with the individual, his proficiency, and the conditions that induced it. To recognize and successfully overcome the effects of false sensations that may cause spatial disorientation, it is important to understand the senses affecting a pilot's ability to remain oriented.

The ability to maintain equilibrium and orientation depends on various sensations, or signals, from three sources:

1. The motion-sensing (vestibular) organs of the inner ear

2. The postural senses of touch, pressure, and tension

3. The sense of sight

If one of these sensory sources is lost or impaired, the ability to maintain equilibrium and orientation is reduced. The need for adequate crew rest and proper hydration should never be overlooked; fatigue and dehydration will invariably induce sensory impairment.

Required periodic physiology training exposes the SNFO to the numerous spatial orientation influences essential in flight. A complete review of the sensations of instrument flight may also be found in the NATOPS Instrument Flight Manual.

Effective use of flight instruments to supplant the senses must be preceded by knowledge and confidence. Interpretation of the combined reports of various instruments is necessary. Attention must not be fixed on one instrument. The pilot must learn to scan the panel and gain an almost instantaneous picture of the situation. An SNFO must also learn to develop an efficient scan pattern, which provides the pilot with descriptive information and, when required, enables switching to directive communication should the pilot become disoriented to the point of degrading performance.

It must be recognized that instrument perception is slower than sensory perception. Tests show a visual interpretation of the actual horizon is one-fifth of a second faster than an interpretation using instruments. Recovery from a dive takes one and one-half seconds longer on instruments.

One must remember that in instrument flight, factors such as fatigue, boredom, and instrument fixation are more likely to occur. To counteract this, the crewmember may occasionally move about in the seat, shake his head, or change cockpit lighting.

102. AIRCRAFT INSTRUMENTATION

The aircraft flight instruments are the primary source of performance information in the cockpit. An understanding of their function and proper use is essential to flight safety in instrument conditions.

1. **Aircraft Flight Instruments.** Aircraft flight instruments are divided into three categories according to their specific function: control instruments, performance instruments, and position instruments. Except for engine instruments, all primary instrument flight information is presented on either the ADI display or the HSI display. The engine instruments are on the right side of the instrument panel, and the standby instruments, airspeed indicator, altitude display, attitude indicator, and Vertical Speed Indicator (VSI) are located on the left side of the instrument panel. The magnetic compass is located on the canopy bow. Refer to the Forward and Aft Cockpit foldout in the T-45C NATOPS for specific instrument location.

a. **Control Instruments.** The control instruments enable the proper combination of pitch, roll, yaw (attitude), and power control to achieve the desired aircraft performance. These instruments include the ADI display, RPM gauge, fuel flow gauge, and the slip indicator.

b. **Performance Instruments/Displays.** The performance instruments indicate how the aircraft is performing as a result of control changes. These instruments include the airspeed indicator, various heading indicators (magnetic compass, HSI display, and ADI display), vertical speed indicator, angle of attack indicator, clock, and turn needle. Although the HSI is primarily used as a position instrument, in some maneuvers it can be used as a cross-check on aircraft performance.

c. **Position Instruments.** The position instruments convey the aircraft's location in space and will determine what control changes are required to achieve the desired aircraft performance. These instruments include altitude and bearing pointers, TACAN and Waypoint data blocks, Planimetric or Course Deviation Indicator (CDI) course lines, and ILS azimuth and glideslope deviation bars. A course deviation situation steering arrow, azimuth deviation bars and glideslope deviation bars are also displayed on the HUD.

2. **Attitude Director Indicator (ADI) Display**. The ADI display is the primary control instrument. It replicates a conventional electromechanical ADI instrument. It provides the primary indication of the aircraft's attitude and consists of the horizon bar, bank pointer, pitch reference scale, and the attitude display. Whenever a deviation from a desired performance is indicated on one of the performance instruments, the correction should be made by referencing the ADI display.

In addition to attitude information, the ADI display (Figure 1-1) includes True airspeed, Angle of Attack (AOA), Mach, G, and peak G shown digitally on the left-hand side of the display. Indicated airspeed and barometric altitude, trend indicators, and a heading scale are shown across the top of the display.

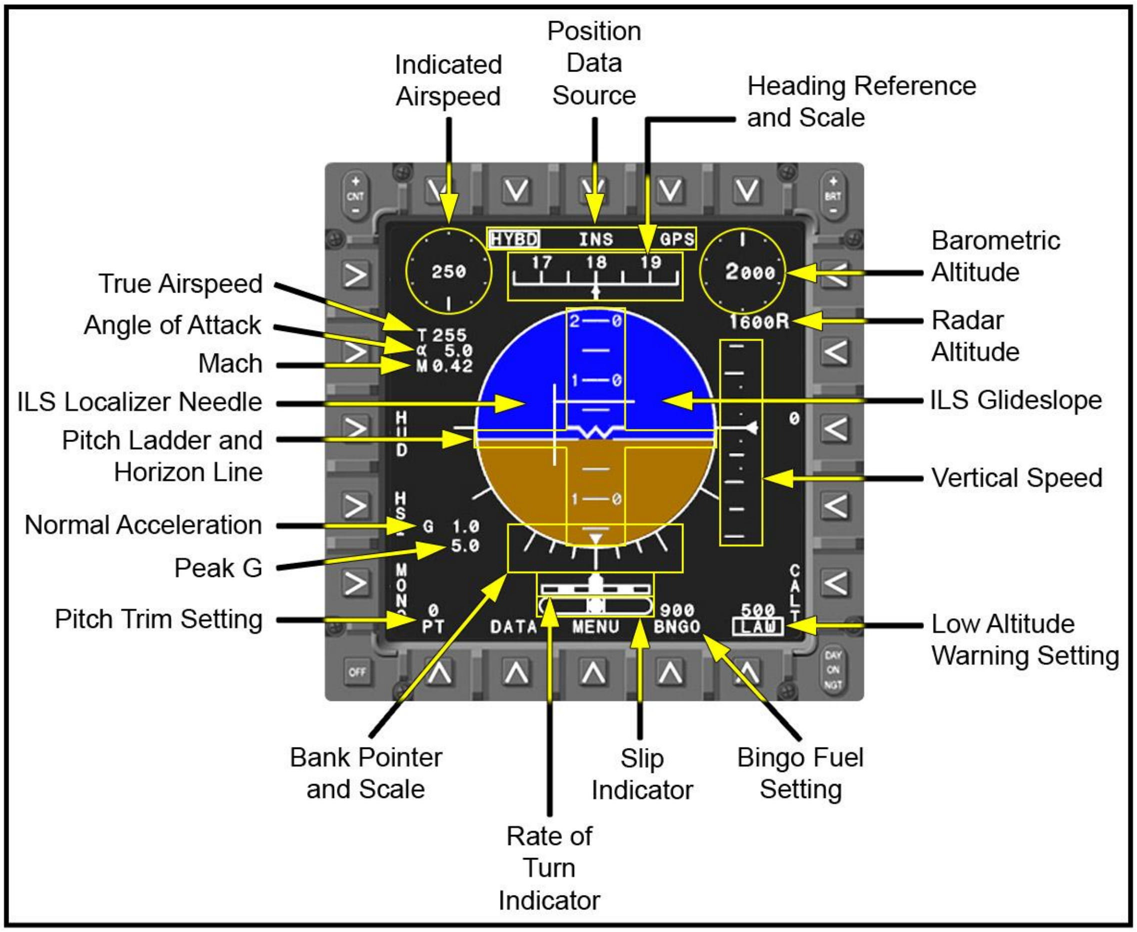


Figure 1-1 Attitude Director Indicator Display

The digital indicated airspeed has a resolution of one knot. The indicated airspeed trend indicator wiper blade rotates clockwise for increasing airspeeds and counterclockwise for decreasing airspeeds. The airspeed trend scale is graduated in 10-knot increments with multiples of 100 KTS at the 12 o'clock position.

The digital barometric altitude resolution is 20 feet. The barometric altitude trend indicator wiper blade rotates clockwise for increasing altitude and counterclockwise for decreasing altitude. The altitude trend scale is graduated in 100-foot increments with multiples of 1,000 feet at the 12 o'clock position.

The heading scale, with heading numbers and scale tick marks, scrolls left or right above a fixed caret. The command heading bug, a vertical line, is referenced to the heading scale. The command heading is referenced to the selected navigational aid unless ILS or no steering is selected. With ILS or no steering selected, the command heading bug location is determined by the heading value set on the HSI display heading option.

A digital radar altitude and a vertical velocity trend indicator are located on the right side of the display, below the barometric altitude. The vertical velocity scale limits are –2,000 ft./min and

1,500 ft./min. Dashes are located at –2,000, –1,000 and 1,000 ft./min. Tics are located at –750, –250, 250, and 750 ft./min. The digital vertical velocity resolution is 10 ft./min. The vertical velocity caret is open when vertical velocity exceeds –2,000 or +1,600 ft./min. The digital vertical velocity range is +/- 9,990 ft./min.

A turn and slip indicator is at the bottom of the display. The shaded reference areas to the left and right of the center marker represent a +/- 3 degree per second turn rate (standard-rate turn).

Bingo (BNGO) fuel, Low Altitude Warning (LAW), and command altitude (CALT) height settings are also on the ADI display.

The ADI display pitch can be adjusted +/- 5 degrees in relation to the waterline with the "PT" selection. With a valid ILS channel station selected and ILS steering selected, ILS needles are shown. The needles are referenced to the waterline. The localizer and glideslope needles range +/- 1/2 inch from the waterline. Full deflection represents +/- 2.5 degrees of azimuth deviation (with a 5-degree localizer signal) and +/- 0.7 degrees of glideslope deviation. The localizer or glideslope needle will flash when limited. The needles for an invalid input are removed, and a multi-function color display (MFCD) advisory window, "GLIDESLOPE" (Figure 1-2), "LOCALIZER," or "ILS" will flash on all MFCDs. The advisory window will remain on the MFCDs until either the REJ button is depressed or the failed data becomes valid again. The ADI display is normally placed on the left MFCD to facilitate cross-checking the standby instruments on the left side of the main instrument panel.

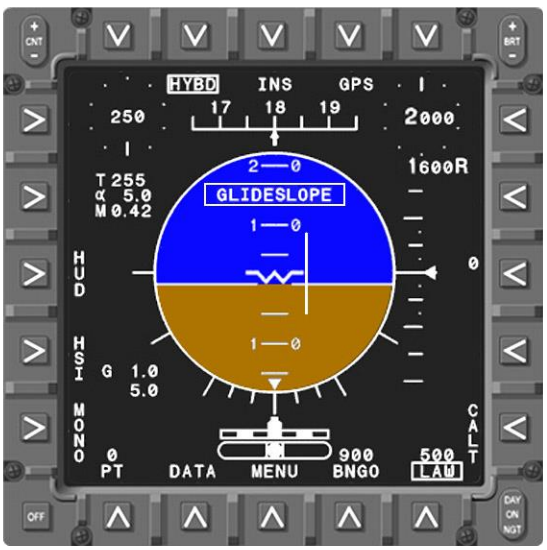


Figure 1-2 Failed ILS Glideslope

3. **Horizontal Situation Indicator (HSI) Display.** The HSI display performs the course deviation indication function of a conventional electromechanical instrument. With the capabilities of the Global Positioning/Inertial Navigation Assembly (GINA) and display electronic unit (DEU), additional display options and navigation information are available on the HSI display (Figure 1-3).

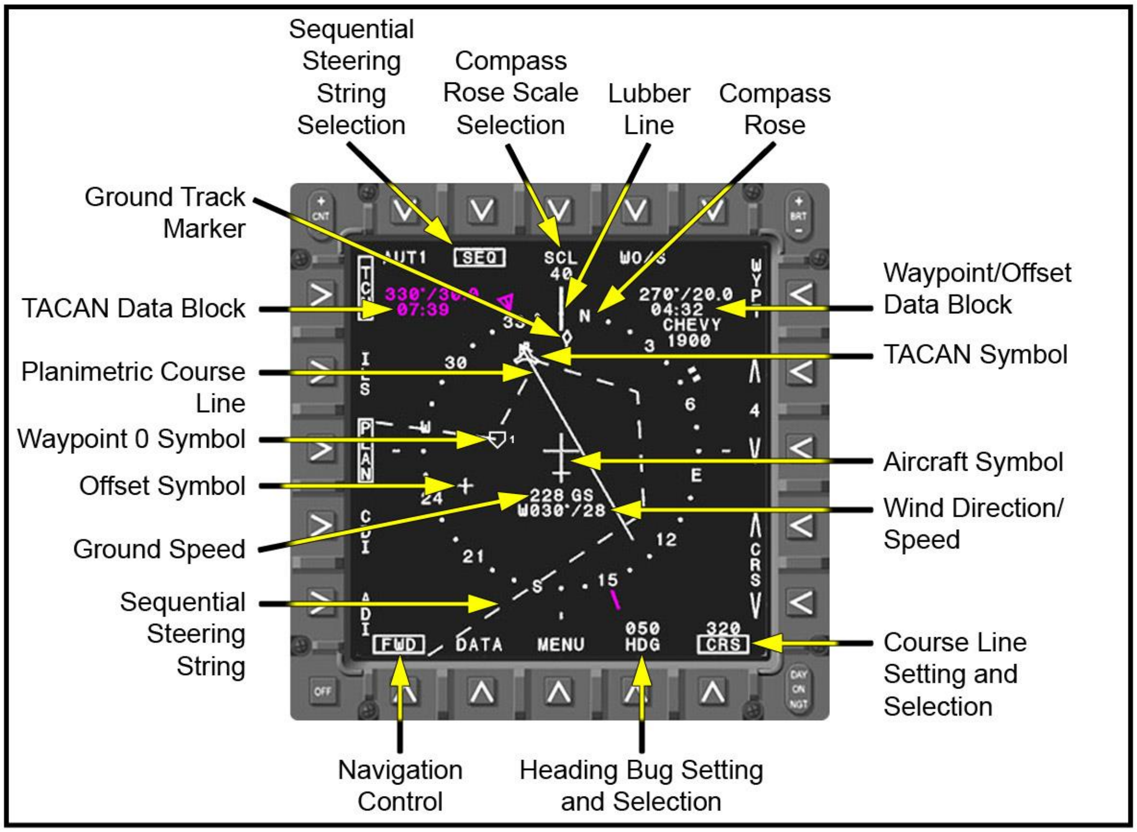


Figure 1-3 Horizontal Situation Display

The aircraft symbol is fixed in the center of the display, heading up. Ground speed and wind direction/speed are below the aircraft symbol. The compass rose rotates according to the aircraft's magnetic heading, referenced to a lubber line and the actual ground-track marker.

A command heading marker, referred to as a "heading bug," is a split rectangle along the periphery of the compass rose. The heading bug is positioned by selecting HDG on the HUD Data Entry Panel (DEP) (Figure 1-4) and entering the heading with the number keys. The heading bug is then moved to the selected heading and this commanded heading is displayed above the HDG pushbutton. The head and tail of the TACAN bearing pointer are located on the outer edge of the compass rose. The head and tail of the VOR, or waypoint bearing pointer, are located on the inner edge of the compass rose. Only the bearing pointer for the selected steering reference is displayed. In the Course Deviation Indicator (CDI) mode, the inner bar represents deviation from the selected course. If TACAN or VOR is the selected steering, each dot represents 5 degrees of course deviation. For waypoint or waypoint offset steering, the scale varies based on landing gear position. With the landing gear up, full scale deflection of the inner CDI bar represents a +/- 4.0 NM cross track deviation. With the landing gear down, a full scale deflection represents a +/- 0.3 NM cross track deviation. When ILS is the only steering selected, the CDI deviation scale is relative and must be interpreted by the pilot, depending on the width of the localizer course. If the localizer course is 5 degrees wide, a full scale deflection represents a 2.5 degree deviation. In addition to the typical CDI course line, a Planimetric (PLAN) course line can be selected. The Planimetric course line is only available for TACAN or waypoint steering. The Planimetric course line is drawn through the selected steering symbol (TACAN, waypoint, or waypoint offset). Course intercept angle and deviation are shown by the relationship of the Planimetric course line to the aircraft symbol. The course line is only shown when CRS is selected on the HSI display. The course is set with the increment and decrement arrows on the HSI display or by selecting CRS on the HUD data entry panel and entering the course with the number keys. The scale of the compass rose can be set to 10, 20, 40, 80, or 160 nautical miles. TACAN, TACAN offset, waypoint, and waypoint offset symbols are shown within the compass rose, relative to their bearing and distance from the aircraft symbol and the selected scale of the compass rose. Digital bearing, slant range distance, and time-to-go are provided for waypoints and valid TACAN stations. Expected fuel remaining at selected waypoint is also displayed below the waypoint information. Digital bearing is also shown for a valid VOR station. A sequential steering string of two or more waypoints can also be displayed as a dashed line on the HSI display. Navigation control selection is also made on the HSI display indicating either FWD or AFT.

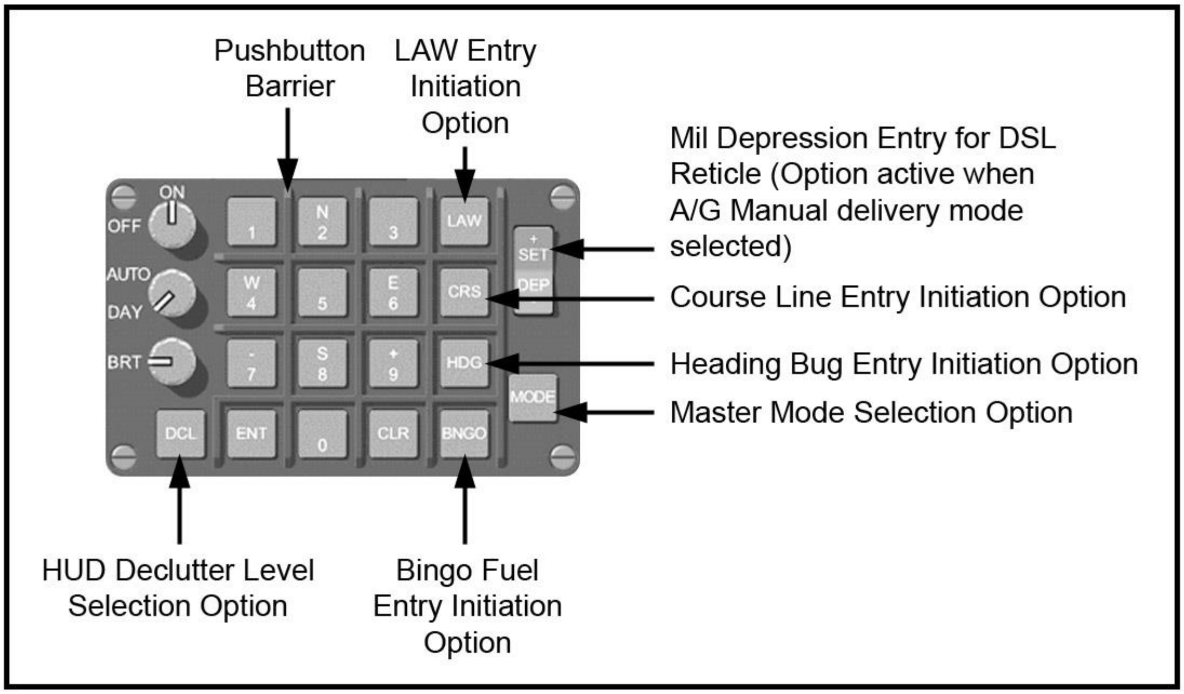


Figure 1-4 Data Entry Panel

4. **Fuel Flow and RPM Gauges**. These instruments each provide a reference to the proper control of the aircraft's engine. In many of the different maneuvers, a specified RPM or fuel flow can be set to ensure the proper thrust to complete the maneuver. In some cases, a range of settings can be used to allow for other possible variables. Fuel flow and RPM can also be monitored on the MFCD ENGINE page (Figure 1-5).

Figure 1-5 MFCD Engine Page

5. **Standby Flight Instruments.** The standby instruments include airspeed, altimeter, VSI, turn and slip indicator, and attitude indicator. These instruments are used as a cross-check of multi-function color display indications if there is a failure of the ADI display or a failure of one or both of the MFCDs. The standby performance instruments, airspeed, altimeter, and VSI all have lag. This factor must be accepted as an inherent characteristic of the instrument. When the attitude and power are smoothly controlled, the lag factor is negligible, and the indications displayed on the performance instruments will stabilize or change smoothly.

6. **Head-Up Display (HUD).** The head-up display (Figure 1-6) presents control, performance, and position information. The pitch ladder, AOA bracket, course deviation steering needle and dots, and ILS needles are referenced to the velocity vector. These symbols are referenced to the waterline of the aircraft if velocity vector information becomes invalid (velocity vector occulted). The pitch ladder attitude bars are in five-degree increments. Solid attitude bars represent a nose-up pitch, and dashed attitude bars represent a nose-down pitch. The attitude bars are angled toward the horizon at one half the pitch attitude. The tips of the attitude bars point toward the horizon. The bank scale is located at the bottom of the HUD and indicates 0, 5, 15, 30, and 45 degrees of bank. The bank pointer limits and flashes at 47.5 degrees and is occulted at bank angles greater than 90 degrees (the bank scale on the ADI display is different than the bank scale on the HUD). The currently selected steering mode on the HSI display is displayed on the lower right side of the instantaneous field-of-view.

The displayed steering mode acronyms are:

a. TCN – TACAN

b. W## – Waypoint (waypoint number)

c. O## – Waypoint offset (waypoint number)

d. VOR – VOR

e. ILS – ILS only

f. TILS – TACAN and ILS

g. WILS – Waypoint and ILS

h. OILS – Waypoint offset and ILS

The distance, time-to-go, and expected fuel remaining to the selected steering point are displayed when applicable. When TACAN, waypoint, or waypoint offset steering is selected and course line (CRS) is selected on the HSI display, a situation steering arrow and two reference dots are displayed. Orientation of the situation arrow indicates the difference between the aircraft's ground track and the selected course. The position of the arrow in relation to the two dots represents course deviation, commensurate with the CDI scaling on the HSI display. The reference dots are removed when deviation from the selected course is within one degree of TACAN steering. With waypoint or waypoint offset steering selected, the dots are removed when course deviation is less than 0.4 NM and gear up or 0.03 NM and gear down. When ILS needles are shown on the ADI display, they are also displayed on the HUD. The ILS needle scaling is commensurate with the scaling on the ADI display. The needles will flash when limited.

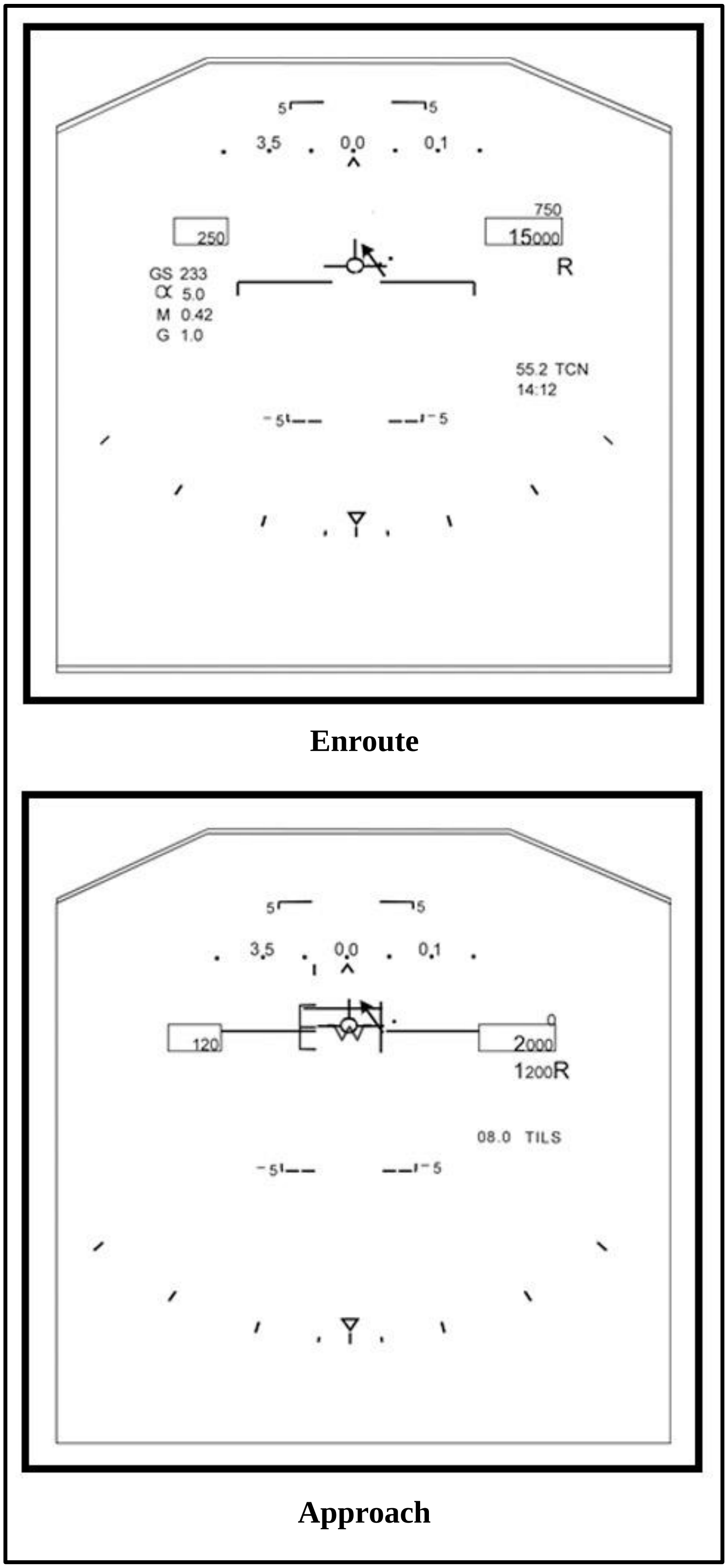


Figure 1-6 Head-Up Display (HUD)

7. **Instrument Scan.** During instrument flight, the pilot and SNFO must divide their attention between the control, performance, and position instrument displays. Proper division of attention and the sequence of checking the displays change throughout the various phases of flight. There is no one set order for scanning the instrument displays. The type of maneuver to be executed determines which instruments are of prime importance. The SNFO should become familiar with the factors to be considered when dividing his or her attention between instrument/displays. The SNFO should know the indications that will enable him to identify the correct and incorrect scan techniques. The best way to improve proficiency is through practice. Some common errors in instrument scanning include the following: having no scan pattern plan, omitting a display entirely from the scan, fixating on a single or a few display indications, or misusing a display indication.

– **Scan Technique.** A major factor influencing scan technique is the characteristic manner in which instruments respond to attitude and power changes. Because of signal filtering, raw data processing, and display time, there is an inherent lag in a digital display. The lag will not appreciably affect the tolerances within which the pilot controls the aircraft; however, at times, a slight unavoidable delay in knowing the results of attitude and/or power changes will occur.

  For every maneuver, the ADI display is the primary reference that should be scanned most frequently. The majority of your pilot’s time will be spent on the control of the aircraft attitude by referencing the ADI display, supported by the control instruments. The remainder of your pilot’s time will be spent confirming the desired performance and position by quickly scanning those displays.

8. **Ground Procedures.** Prior to taking off on an instrument flight, you must ensure that the instruments, displays, navigation equipment, radios, aircraft lighting, and the hood are in proper operational condition.

a. **Instrument Prior to Takeoff Checklist.** The instrument procedures for Prior to Takeoff checklist are located in NATOPS, Chapter 20.

b. **Low Altitude Warning (LAW).** Procedures for low altitude warning usage are outlined:

i. Takeoff – The LAW is set to 200 feet for climb-out.

ii. Enroute – The LAW is set at 5,000 feet (platform) when aircraft is above 5,000 feet AGL. Once the LAW tone sounds descending through 5000’ AGL, the LAW will be set to 1000’ AGL or 2000’ AGL if in mountainous terrain.

iii. Penetration – During penetrations, the LAW will be set to 5,000 feet (platform) so the LAW advisory will serve as a warning to break the rate of descent.

iv. Approach – LAW is set to Height Above Touchdown (HAT/HAA) for precision approaches and 10% below HAA (after crossing the final descent point on the approach) for non-precision approaches.

NOTE

Do not confuse HAT with HAA. HAT refers to Straight-in approach minimums (precision or non-precision). HAA refers to circling approach minimums.

v. VFR Pattern – At the initial, the LAW will be set to 380' AGL to correspond to the 45º position in the VFR landing pattern.

NOTE

The only time the LAW should sound is at Platform and passing through DH/DA / "45." At intermediate altitudes, the LAW should be reset so as not to sound passing through the previous altitude setting. SNFOs will report to IP any time the LAW setting is changed. In addition, any time the LAW sounds, the SNFO will report the reason as to why and the subsequent LAW setting. In addition, ***SNFOs will not utilize the REJ button to silence the LAW Warning***.

c. **Cockpit Lighting.** When preparing for a night flight, set the cockpit lighting as low as possible to safeguard your night vision and reduce glare on the canopy while still enabling you to see your instruments. You should use a white lens in your flashlight for a night preflight (to detect hydraulic fluid leaks). Once in the cockpit, put a diffuser lens over the flashlight to reduce its intensity.

103. GENERAL COMMUNICATION PROCEDURES

You may have heard the old adage covering flight priorities, "aviate, navigate, communicate." This means that first you take care of flying the aircraft, then you attend to keeping the airplane at the correct point in three-dimensional space, and finally, you worry about talking to others. There certainly is good sense in that set of priorities, but simply because communication is last on the list does not relegate it to insignificance.

When flying on an IFR flight plan, you will be in constant contact with various Air Traffic Control (ATC) facilities from before takeoff until after landing. To operate successfully within the traffic control system, you must be thoroughly familiar with the responsibilities and capabilities of these control facilities. Although you must comply with controller instructions, it is your responsibility to follow them intelligently, not blindly. Always be sure that you understand the controller's intentions, that he or she understands your needs, or request clarification.

General ATC procedures will be discussed later in this FTI, in chronological order with each phase of flight.

1. **Navigation and Communication Cockpit Management**

a. **Multiple NAVAID Management.** Use TACAN, VOR/ILS, and waypoints to navigate airways and maintain orientation at airfields. During the enroute portion, navigate primarily off the applicable TACAN or waypoint and set the other navigation resource(s) to the next station or waypoint ahead. During ILS vectors at the field, select TACAN and ILS steering. TACAN course deviation is displayed on the HSI display, and ILS steering is displayed on the ADI display. If required, change from TACAN to ILS DME frequency on the base leg. During the approach phase, consider selecting NAVAIDs such that one backs up another in case of failure. For example, if on a HI TACAN penetration approach and TACAN bearing fails, have ILS in VOR to fly ILS or localizer as backup.

b. **Two-Radio Management**. Managed effectively, two radios can add convenience; however, avoid the confusion of listening to two radios at once. Inform the other crewmember of any changes in audio selection.

Start by briefing the communication plan before the flight. When audio selection is changed, inform the other crewmember “selecting AUX.” Also, selecting AUX implies deselecting PRI unless otherwise briefed. Here is one sample scenario for calling METRO in flight:

ROKT 403 *“Center ROKT 403, request off frequency two mikes, monitor guard.”*

ATC *“ROKT 403, approved as requested, report back up Center frequency.”*

ROKT 403 *“ROKT 403, WILCO.”*

Select METRO frequency in radio 2, T/R&G and deselect radio 1 or turn volume low after informing crew on ICS. After completing transmission to METRO, inform crew, deselect radio 2, and reselect radio 1 (or turn up volume).

ROKT 403 *“Center, ROKT 403 back up (frequency #).”*

During approaches, consider putting tower frequency on #2 (deselect) until approach directs switch and crew is informed, “selecting #2.” After reporting missed approach to tower, deselect #2, inform crew, and select #1.

2. **IFR Voice Procedures.** Required voice reports and procedures vary depending on whether you are operating in a radar or non-radar environment.

a. **Reports Made At All Times (Radar and Non-Radar)**

i. When vacating any previously assigned altitude or flight level for a newly assigned altitude or flight level

ii When an altitude change will be made if operating on a clearance specifying "VFR ON TOP" (Below 18,000 ft MSL or above FL600)

iii When unable to descend or climb at a rate of at least 500 ft per minute

iv. When an approach has been missed (Include a request for specific action, i.e., to alternate airport, another approach, etc.)

v. Change in the average true airspeed (at cruising altitude) when it varies by 5 percent or 10 KTS (whichever is greater) from that filed in the flight plan

vi. Time and altitude arriving at a holding fix or point which to which you are cleared

vii. When leaving any holding fix or point

NOTE

The last two reports above may be omitted by pilots of aircraft involved in instrument training at military terminal area facilities when radar service is provided.

viii. Any loss of navigational capability such as VOR, TACAN, ADF, or INS; complete or partial loss of ILS capability; or impairment of air/ground communications capability. Reports should include aircraft (identification), (equipment affected), (degree to which the capability to operate under IFR in the ATC system is impaired), and (the nature/extent of assistance desired from ATC).

NOTE

Other equipment installed in an aircraft that may effectively impair safety and/or the ability to operate under IFR. If such equipment (e.g., airborne weather radar) malfunctions and in the pilots judgment either safety or IFR capabilities are affected, reports should be made.

ix. Any information relating to safety of flight

x. When encountering weather conditions that have not been forecast or hazardous conditions that have been forecast, you are expected to forward a report of such weather to ATC and, time permitting, to FSS or METRO.

NOTE

The ATC controlling agency should be informed anytime weather conditions on an IFR approach differ from the latest observation or anytime a wind shear or (microburst) is encountered on departure or approach.

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

xii. When unable to comply with an ATC clearance as given

b. **Reports Specific to Radar Environment**

When operating in a radar environment and no position is required, on initial contact, pilots should advise controllers of their altitudes preceded by the word “level,” “climbing,” or “descending” and provide the present vacating altitude, if applicable, and the final altitude. Also, when on other than published routes, pilots should include the present navigational position on initial contact with each air traffic controller.

NOTE

Pilots will comply with all specific ATC-requested reports during a given flight regardless of environment (radar or non-radar).

c. **Reports Specific to Non-Radar Environment**

When radar contact has not been established by initial handoff:

i. Initial contact ***not at a fix*** – Report will include “ATC (name), aircraft (identification), estimating (to the next identifiable published fix or reporting point and time), (descending, climbing, or maintaining altitude or flight level).”

ii. Initial contact ***at a fix*** – Report will consist of a courtesy call only “ATC (name), aircraft (identification), and (position).”

NOTE

If ATC states “Roger” and does not state “Go ahead,” then no additional information is required at this time. Another courtesy call shall be made once the aircraft has reached the next designated reporting point (solid triangles, low altitude structure). ***(There are no compulsory reporting points in the high altitude structure.)***

If ATC states "Go ahead," then a full position report is required.

iii. Position report includes (position), (time), (altitude), (next compulsory reporting point), (planned time to that point), and (next compulsory reporting point). (P.T.A.P.T.P.)

NOTE

If radar contact is established or has been reestablished once lost along the route, pilots should discontinue position reports over designated reporting points in the low altitude structure. Pilots should resume normal non-radar position reporting when ATC advises "Radar Contact Lost" or "Radar Service Terminated."

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

NOTE

OPNAVINST 3710.7 requires gear down report be made to the controlling agency by the final approach fix.

v. When a corrected ETA at any time becomes apparent that an estimate, as previously submitted, is in error in excess of three minutes

d. **Change of Flight Plan**

Three voice procedures are used when changing your flight plan. Each procedure addresses a different change to your flight plan and contains different content to be delivered to ATC in a specific sequence. The categories are:

i. Change of route or destination – 13 items

ii. Change from VFR to IFR only – 7 items

iii. Change of ETA by more than 30 minutes – 4 items

The specific items and sequence are found on the inside back cover of the IFR Supplement, which should be used when delivering an in-flight change of flight plan.

NOTE

Aircrew should request a frequency change for a change in flight plan from the ATC controlling agency. Normally, the change is given to an FSS facility; however, if the ATC controller handling you is not too busy, he will often copy the change.

104. INSTRUMENT FLIGHT PLANNING

Flight planning requires you to understand the planning process along with the associated documents needed to manage a cross-country flight. Before you can prepare a flight plan, you must gather accurate and complete weather and route information for your intended flight.

1. Facility Requirements

When planning a flight, be sure to take into account the facilities and equipment available at your destination and alternates. Those airports must have an adequate runway and the equipment required for aircraft servicing. Especially, you need to determine before departing for an unfamiliar field that (1) the runway is of adequate length and properly surfaced, (2) fuel is available at the proper grade IAW NATOPS, and (3) if you are going to a civilian field that has contract fuel, it will accept a government fuel card. Additionally, you should always determine if your destination is PPR (prior permission required).

2. Route and Altitude

You must give primary consideration to enroute weather and winds when planning a flight. You will normally want to use the most direct route at the most favorable altitude for your fuel requirements.

3. Alternate

You are required to plan for an alternate anytime your destination is forecast to be below 3,000 foot ceiling and 3 mile visibility during the period from one hour prior to and one hour after your ETA. If your destination is forecast to be below published minimums, then your alternate must be above 3,000-3. If your destination is between published minimums and 3,000-3, your alternate must be forecast to be 300-1 above published minimums for a non-precision approach or 200-1/2 above published minimums for a precision approach. Check alternate weather for the time you would arrive there and not for the ETA at your destination. Refer to Figure 1-7 for single pilot restrictions.

NOTE

CNATRA regulations require that you always plan an alternate.

<table>
<tr><td>DESTINATION WEATHER
ETA plus and minus one (1) hour</td><td colspan="3">ALTERNATE WEATHER
ETA plus and minus one (1) hour</td></tr>
<tr><td>0-0 up to but not including published minimums</td><td colspan="3">3000-3 or better</td></tr>
<tr><td rowspan="3">Published minimums up to but not including 3000-3 (single-piloted absolute minimums 200-1/2)</td><td rowspan="2">NON-PRECISION</td><td colspan="2">PRECISION</td></tr>
<tr><td>ILS</td><td>PAR</td></tr>
<tr><td>*Published minimums plus 300-1</td><td>Published minimums plus 200-1/2</td><td>*Published minimums plus 200-1/2</td></tr>
<tr><td>3000-3 or better</td><td colspan="3">No alternate required</td></tr>
<tr><td colspan="4">*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.</td></tr>
</table>

Figure 1-7 IFR Filing Criteria

4. **Filing Minimums**

When filing an IFR flight plan, base your weather requirement on the existing weather at your point of departure and the forecast weather at your destination and alternate from one hour before to one hour after your ETA. Figure 1-7 outlines the weather criteria to follow when selecting an alternate for an IFR flight.

The following are filing criteria for your destination:

a. Single-piloted aircraft (T-45C) absolute minimums are 200-1/2.

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

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

For single-piloted aircraft, you may not commence an instrument approach if the weather is below the minimums published for your planned approach unless you do not intend to land; however, if you have commenced the approach prior to the weather being reported below minimums, you have the option of continuing down to the published minimums for that approach.

5. **Fuel Requirements**

Fuel requirements are a chief concern in planning for a flight. In addition to having enough fuel for the route, you must also account for all the fuel you will use from engine start to the approach at your destination. On top of this, you will have to include the required amount of reserve fuel and the fuel you will need from destination to alternate (if required) under various circumstances, including a divert at enroute altitude, at the destination IAF altitude, or from a missed approach at the destination. You must be prepared for unusual occurrences such as unforecasted weather enroute.

6. **Takeoff Minimums.** Takeoff minimums are dependent on the pilot's instrument rating.

a. **Special Instrument Rating**

i. No takeoff ceiling or visibility limits apply.

ii. Takeoff dependent on judgment of pilot and urgency of flight.

b. **Standard Instrument Rating**

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

ii. If runway has a precision approach, takeoff is permitted to precision minimums or 200-1/2, whichever is higher.

Use the STANDARD T-45C FUEL PLANNING DATA chart (Figure 1-8) to determine your fuel requirements for a flight.

OPNAVINST 3710.7 and CNATRA cross-country instructions set policy for minimum fuel requirements. Local directives may impose further fuel requirements for your cross-country flights, and the situation may dictate that you need to plan for more reserve fuel than the minimum required in the event of higher winds, worse weather, increased distance to a suitable alternate, or other unusual circumstances.

STANDARD T-45C FUEL PLANNING DATA

Based on T-45C NATOPS flight manual. Actual performance will vary with nonstandard temperature, winds, and varying gross weights. For initial planning only.

Total usable fuel . . . . 2938 lbs
Start/Taxi/Takeoff 200
Penetration approach 250
GCA 250
Reserve (20 min @ 10,000 FT MSL) 300

LOW LEVEL

360 KGS, 12K GW = 6.6 lbs/NM and 2,375 PPH
300 KGS, 12K GW = 5.0 lbs/NM and 1500 PPH

JP-4 = 6.5 lbs/Gal **JP-5 = 6.8 lbs/Gal** **JP-8 = 6.7 lbs/Gal**

CLIMB OUT (Using climb schedule: 250 KIAS to 10K, 300 KIAS to intercept .72 IMN)

ALTITUDE	KIAS	NM	TIME	FUEL USED
5,000	250	04	0+01	60 lbs
10,000	250	10	0+02	120
15,000	300	20	0+04	190
20,000	300	28	0+06	260
25,000	292/.72	38	0+08	360
30,000	263/.72	53	0+10	440
35,000	235/.72	70	0+12	540
40,000	209/.72	80	0+16	600

ENROUTE

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

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 1-8 T-45C Fuel Card

105. FLIGHT PROCEDURES

This section of the FTI discusses Familiarization instrument flight procedures in sequence by phase of flight.

1. **Departure Phase.** The departure phase of instrument flight includes that portion of your flight occurring from takeoff to level off at your enroute altitude and requires specific communication and standard instrument departure procedures.

   a. **Departure Communication Procedures.** In your initial communication with clearance delivery, you should state your aircraft's identification, location on the airport, type of operation planned (VFR or IFR), point of first intended landing, and request (i.e., clearance on request). If no delay is expected, you should receive your clearance within 30 minutes of filing your flight plan.

   Your IFR clearance should contain the following information in order:

   i. Aircraft identification

   ii. Clearance limit

   iii. Departure instructions or SID

   iv. Route of flight

   v. Altitude

   vi. Special information, including departure frequency and IFF code

   You should not accept a clearance if it has a clearance limit short of your destination, an altitude not in the filed route structure, or an altitude at which sufficient fuel reserves would not be available, unless you receive an expected further clearance (EFC) time or expected higher (suitable) altitude, as appropriate.

   b. **Standard Instrument Departure (SID).** The standard instrument departure is designed to expedite traffic from airfields and provide a set transition from takeoff to the enroute structure, while ensuring adequate vertical and horizontal aircraft separation. The two types of SIDs are Pilot NAV (Figure 1-9) and Vector (Figure 1-10).

   Preflight and pre-takeoff preparation for a SID includes the following:

   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.

c. **Pilot NAV SID**

For a Pilot NAV SID, you will use a pre-published route that supplies headings, altitudes, and reporting points for the transition from takeoff to the enroute structure. ATC can issue amendments to initial clearance anytime action is necessary to avoid conflict between aircraft. When a SID is changed, confirm which part of the SID is still in effect. If ATC desires to reinstate a canceled SID, departure control must state which portion of the routing applies and restate altitude restrictions. The SID plate is divided into two sections, with a pictorial representation on top and a textual description of the departure procedures on the bottom (Figure 1-9).

When performing a Pilot NAV SID, you must comply with the instructions published on the SID plate. Normally, you will be assigned the SID as part of your clearance and receive no further departure instructions. The Pilot NAV SID has distinct advantages: it requires a minimum of controller time and sorts departing aircraft by initial route. On the other hand, the pre-published format of the Pilot NAV SID cannot adapt to changing weather or traffic conditions.

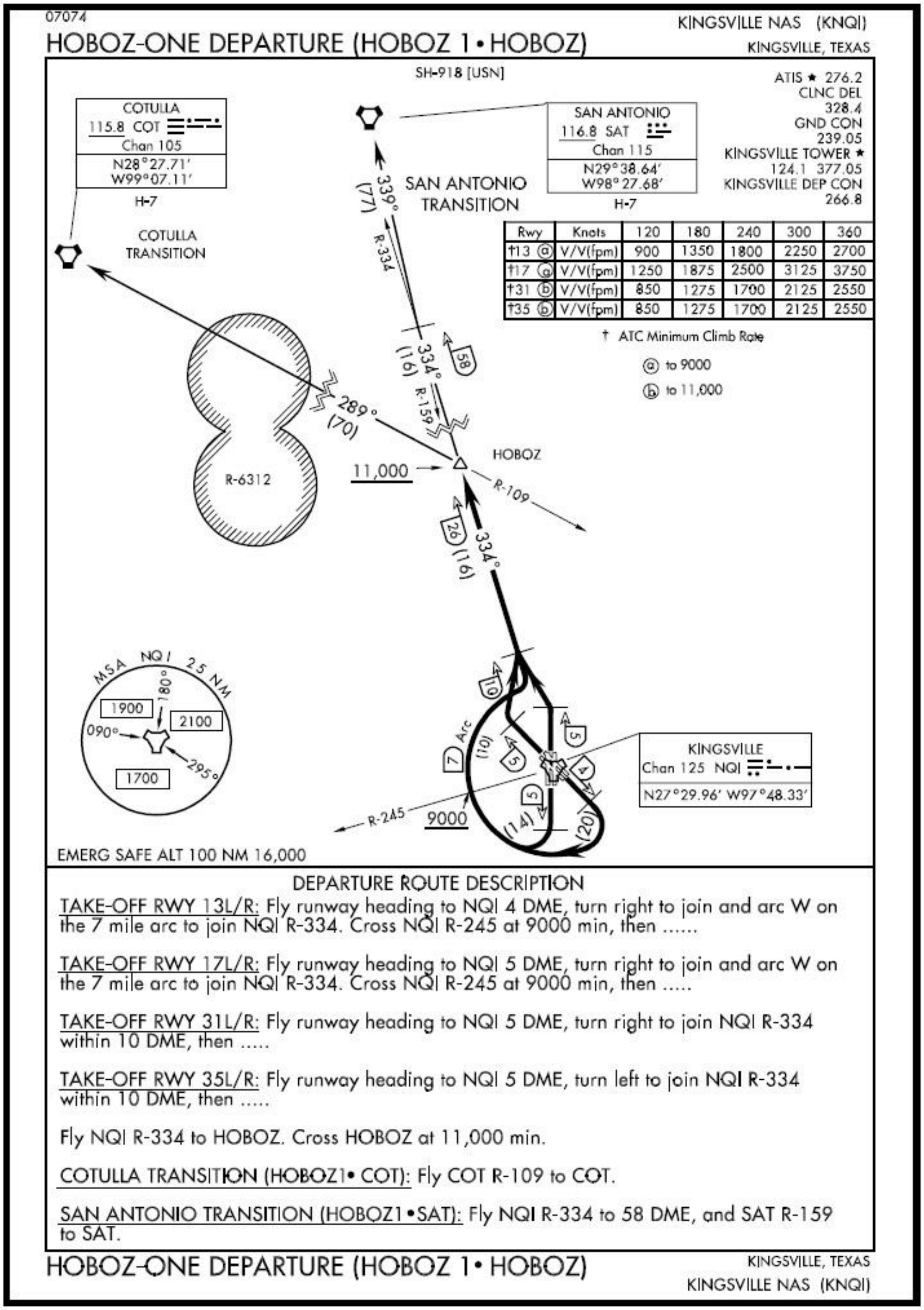


Figure 1-9 Pilot NAV SID

d. **Vector SID**

A Vector SID is more flexible than a Pilot NAV SID, but at the cost of being more labor-intensive for the controller. In this type of SID, you will be given radar vectors and altitudes by the controller, who will constantly monitor your position (Figure 1-10).

Because the Vector SID requires the active participation of the controller, the amount of radio traffic between you and the controller will be significant. You must acknowledge all radio calls; repeat all headings, altitudes, and altimeter settings; and promptly comply with any instructions.

While a Vector SID makes more demands on the controller than does a Pilot NAV SID, it also provides the controller more flexibility in dealing with changing weather or traffic conditions or with temporary restrictions. Consider the SID canceled if the aircraft is vectored or cleared off the SID (a specified heading), unless ATC adds "expect to resume the SID" or otherwise indicates the deviation is temporary.

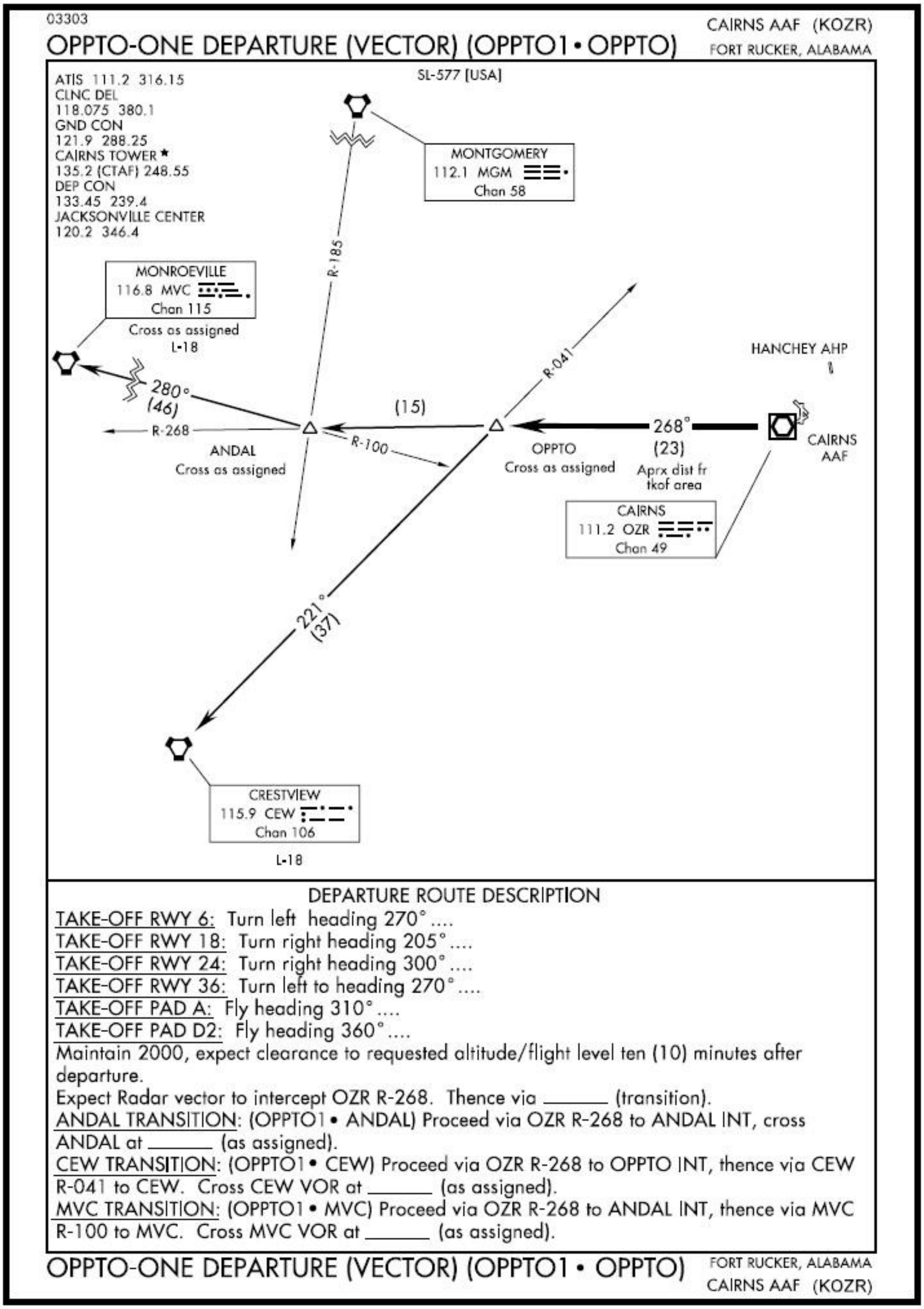


Figure 1-10 Vector SID

2. **Enroute Phase.** The enroute phase of flight includes all of your flight activities from the time you level off at enroute altitude until you initiate an approach at your destination.

a. **Enroute Cruise**. Level off at enroute altitude at "optimum cruise" IMN for cruise altitude. Use the fuel chart found in Figure 1-8 for cruise settings.

b. **Enroute Communication Procedures.** Enroute communications will begin when you switch from departure control to ARTCC (hereafter referred to as "Center"). The phrasing of your initial contact with Center should be in one of the following three formats:

i. When operating in a radar environment and no position reporting is required: "[name] Center, [aircraft identification] at/climbing to/descending to/passing [altitude] for altitude."

ii. When a position report is required: "[name] Center, [aircraft identification], [position], [altitude]."

iii When no position report is required, but you're not in radar contact: "[name] Center, [aircraft identification], estimating [reporting point] at [time] [altitude]."

When operating in a non-radar environment, you will provide position reports to Center at designated compulsory reporting points along your route of flight. The report is always preceded by a courtesy call that includes *"[name] Center, [aircraft identification], [position]."* If Center's reply is *"[Roger],"* then no further information is required or wanted from the pilot. If Center states "[*Go Ahead],"* then the full position report is given. The report includes the following information:

i. Identification

ii. Position

iii. Time

iv. Altitude/FL

v. Position – (Next reporting point)

vi. Time

vii. Position – (Name only of next succeeding reporting point)

When you are operating under an IFR clearance, you may not deviate from it unless you obtain an amended clearance or unless safety of flight considerations prohibits compliance.

When you are cleared to climb or descend at pilot's discretion, you may do so, leveling off at intermediate altitudes if desired, but you may not return to an altitude once you have vacated it.

Don't forget to report leaving altitude.

When cleared to a point short of your destination, you should ask for an expected further clearance (EFC) time if it is not given or offered. When cleared to a point not on your route of flight, you must receive expected further routing (EFR). You should normally receive further clearance at least five minutes prior to reaching your clearance limit.

Request an amendment to your clearance as early as possible to avoid delays. Refer to the format for filing a flight plan while airborne and requesting a change of routing on the back of the FLIP IFR Enroute Supplement or in the Flight Information Handbook.

To file a change to your flight plan enroute, five items must be communicated to ARTCC:

i. (D) destination

ii. (R) route

iii. (A) altitude

iv. (F) fuel

v. (T) time

You can recall these items by using the acronym D-R-A-F-T. This acronym may not be understood by ATC; it is only a memory aid for you to recall the items necessary in the request.

c. **Lost Communications**

When dealing with a communications failure, you are expected to use good judgment in whatever action you take. Do not be reluctant to take emergency action to maintain safety of flight.

If your aircraft has a usable transponder when two-way radio communications are lost, squawk mode 3, code 7600. Using this code will bring immediate controller attention to your problem. Continue to squawk this code while you still have radio problems or until directed by ATC to change your squawk. In addition to the squawk, make "in the blind" calls in case your transmitter is still operating.

If you lose communications enroute, first try to contact Center on the last assigned frequency, then on an appropriate frequency listed in the FLIP Enroute IFR Supplement. If you are unable to reestablish contact with Center, attempt to call the nearest FSS on 255.4 or 122.5, monitor the appropriate VOR frequency (as Center may issue instructions over this frequency), or as a last resort, transmit on guard.

If you have lost your transmitter but are still receiving, you can expect ATC to attempt to determine if you are receiving by requesting that you do one or more of the following: squawk IDENT on your IFF, change your IFF squawk, switch IFF squawk to standby, or request that you execute turns.

If you are in Visual Meteorological Conditions (VMC) when communications are lost, do not enter IFR conditions if it is possible to descend and land VFR at a suitable field.

If you are in Instrument Meteorological Conditions (IMC) or must reenter IMC when communications are lost, continue along your route and altitude in accordance with the following procedures in the priority order presented:

i. **Route:**

(a). Route assigned in the last ATC clearance

(b). If on a vector, direct to the point specified in the vector clearance

(c). In absence of assigned route, by the route given in an expected further routing (EFR)

(d). In absence of EFR or assigned route, by route filed in flight plan

ii. **Altitude (at the highest of the following):**

(a). Altitude or flight level last assigned

(b). Minimum enroute altitude/flight level for the segment being flown

(c). Altitude ATC says you may expect in a further clearance

As previously mentioned, if a climb is required, commence it as necessary to comply with the minimum altitude, as required.

If you lose communications while on a vector off your planned route with no expected further routing (EFR), return to your filed route. If at all possible, do not accept a clearance off your filed route without an EFR.

d. Proceeding Direct to a Station

There are two ways to fly to a NAVAID: by homing and by proceeding direct. The difference between the two is that in the presence of a crosswind, a homing aircraft will fly an arcing route (therefore not maintaining a given course) to the station instead of flying in a straight line (Figure 1-11).

To proceed direct to a station, first tune and identify the station and then turn the aircraft in the shortest direction to place the VOR or TACAN bearing pointer under the lubber line (heading index) at the top of the HSI display. (If you were to stop at this point and fly to the station, keeping the bearing pointer at the top of the HSI display, you would be homing.) Once the bearing pointer is centered at the top of the HSI display, use the course selection option on the HSI display and increment or decrement the course until the CDI or Planimetric course line is centered with the course line arrow pointing to the lubber line. Note the position of the ground track marker. Turn the aircraft to place the ground track marker under the lubber line and maintain a wind-corrected heading that will track the selected course to the station by crabbing, as necessary, to keep the course line centered.

A simpler method to determine wind corrected heading is to reference the ADI or HUD (repeater) and note the Command Heading Marker below the Heading Scale. To proceed direct, the Command Heading Marker should be aligned with the Heading Caret.

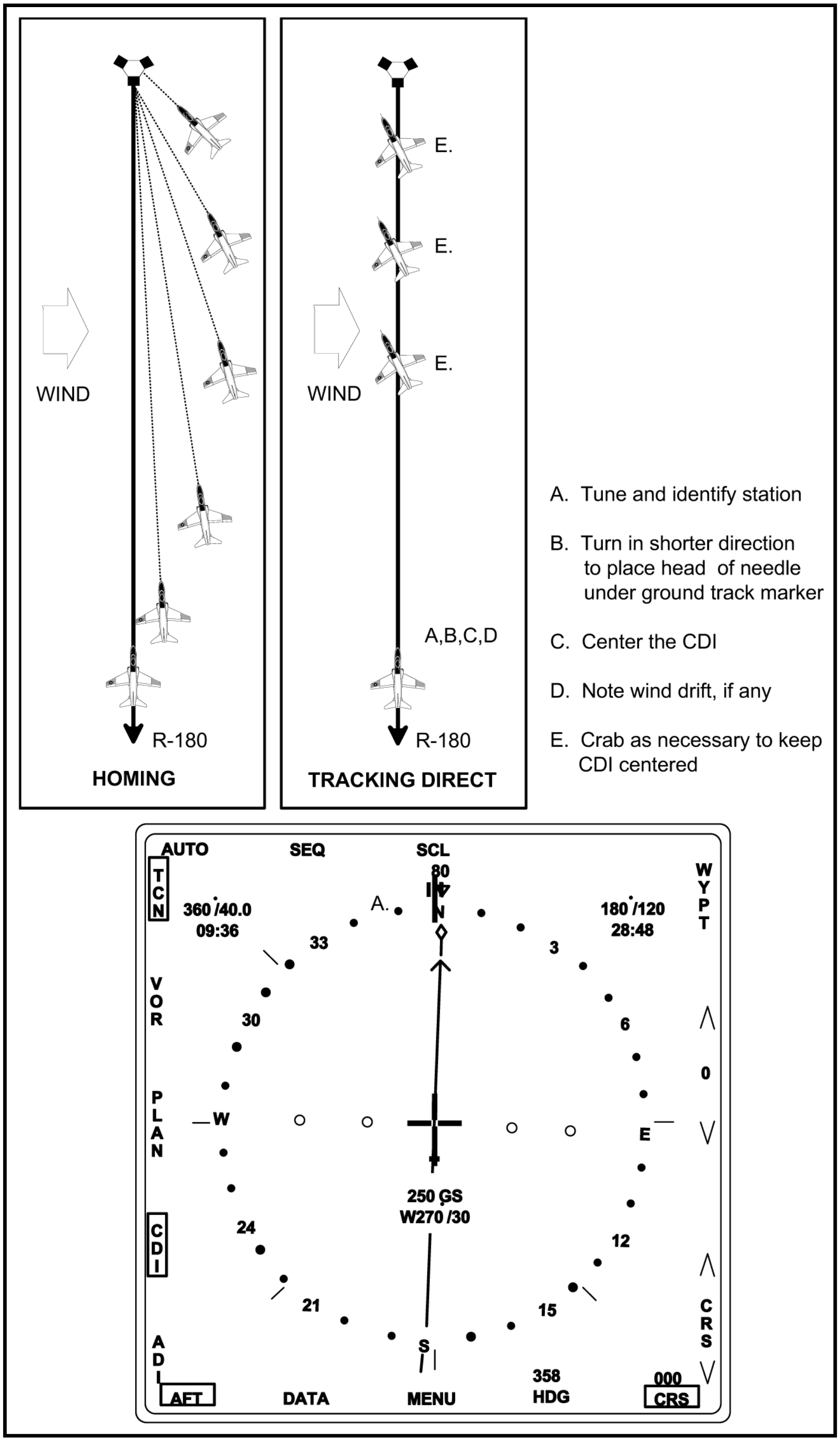


Figure 1-11 Proceeding Direct

i. **Indications of Station Passage**

When flying VOR or VOR/DME, station passage is indicated when the bearing pointer falls past the 90-degree reference benchmark on the periphery of the compass rose. TACAN station passage, due to increased size of the cone of confusion associated with TACAN stations, is noted when minimum DME is reached.

e. **Wind Drift Correction**

Determining wind-corrected heading (WCH) is the technique you will use to compensate for crosswinds when maintaining a course on a radial. To compensate for wind, use a WCH that stops drift from your course. The difference between WCH and desired course is called “crab angle” (Figure 1-12).

The difference between the lubber line and the ground track marker is your “crab angle.” To compensate for crosswinds using the ground track marker, first establish the aircraft on a radial tracking on course, course line centered, inbound or outbound from a station. Check the position of the ground track marker for an indication of drift. If the ground track marker indicates a drift, turn the aircraft to place the ground track marker under the bearing pointer. Maintain the heading under the lubber line. Continuously monitor the course line to ensure that you are maintaining the desired course. Adjust your heading to maintain a centered course line. The amount of crab angle required will vary with wind strength and direction and may change while the course is being tracked.

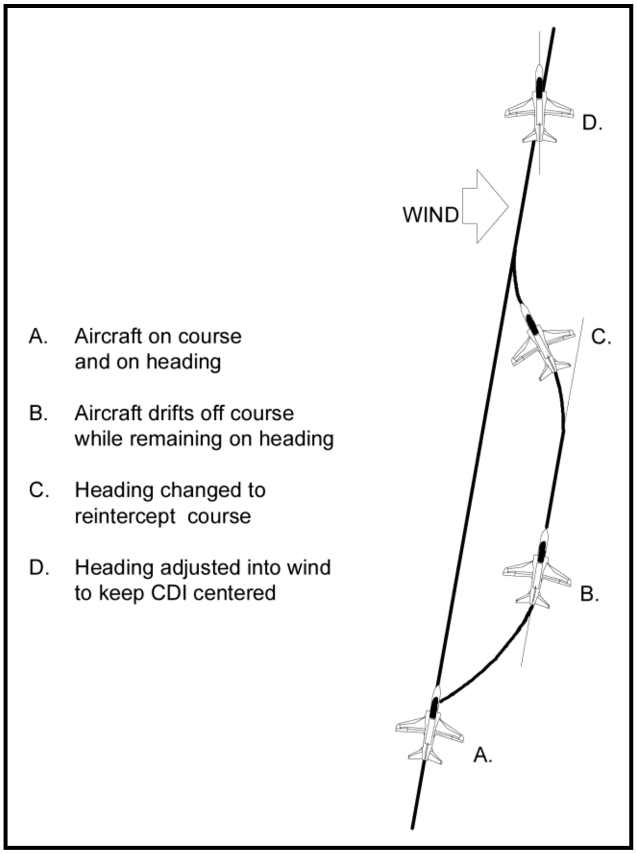


Figure 1-12 Wind Drift Correction

f. **Course Intercepts**

It is sometimes necessary to change positions or radials inbound to or outbound from a facility. Both inbound and outbound course intercepts are basically the same in that you must determine the angle of intercept to achieve the most expeditious intercept and on heading of the desired radial. The angle of intercept is the angle between the heading of your aircraft and the desired course; it is normally greater than the number of degrees you are from your desired course, but it must not exceed 90 degrees. At 90 degrees, the rate of interception is the maximum possible. Within these two limits, you can adjust your intercept angle to achieve the most desirable rate of interception.

Lead point for course intercepts is calculated as one percent of your ground speed for an intercept angle of 90 degrees. For intercept angles of less than 90 degrees, use an applicable ratio of this formula (e.g., a 45-degree intercept would require one-third as much lead as a 90-degree intercept). See Figures 1-13 and 1-14. You will calculate lead point either in radials or DME, depending on the maneuver you are performing.

The HSI display provides two indications that will assist you in determining lead point. First, the bearing pointer will give you the relative speed at which you are approaching the desired course. By observing the rate at which the bearing pointer approaches the desired course, you can determine when to initiate your turn. Second, the course line provides the relative speed at which you are approaching the desired course. The CDI course line starts to move once you are within 10 degrees of that course. When you are 60 NM from the station, the radials are 1 NM apart, and at 30 NM, they are 0.5 NM apart. Therefore, the CDI will move rapidly when you are close to a station and more slowly when the station is distant. Use the HSI display scale selection and relative position of the aircraft symbol to the Planimetric course line to judge the distance and intercept angle from the desired course.

i. **Inbound Intercepts**

To perform a course intercept inbound to a station, first tune and identify the station (if you have not already done so) and then dial in the desired inbound course in the course select window. The two most used procedures for accomplishing an inbound intercept are the 30-degree and the double angle off the bow methods. When determining which intercept is most appropriate, consideration should be given to the aircraft's distance to the NAVAID (if known). A double angle off the bow intercept could be as little as one or two degrees or as much as 45 degrees. The 30-degree method is always 30 degrees. Consideration for radial spread and closure rate, determined by the distance from the NAVAID, as well as wind should always be a factor in the selection and application of an inbound intercept.

(a). **30-Degree Method**

Once you have tuned the station and selected the desired course in the HSI display course select window, look from the desired course on the compass card to the head of the bearing pointer used and then to 30 degrees beyond. The heading located 30 degrees beyond the bearing pointer is the heading you will fly to the intercept. Turn the aircraft to this heading and maintain it until you reach the lead point and then complete the intercept (Figure 1-13). You must be sure to look ***from*** the desired course ***to*** the bearing pointer.

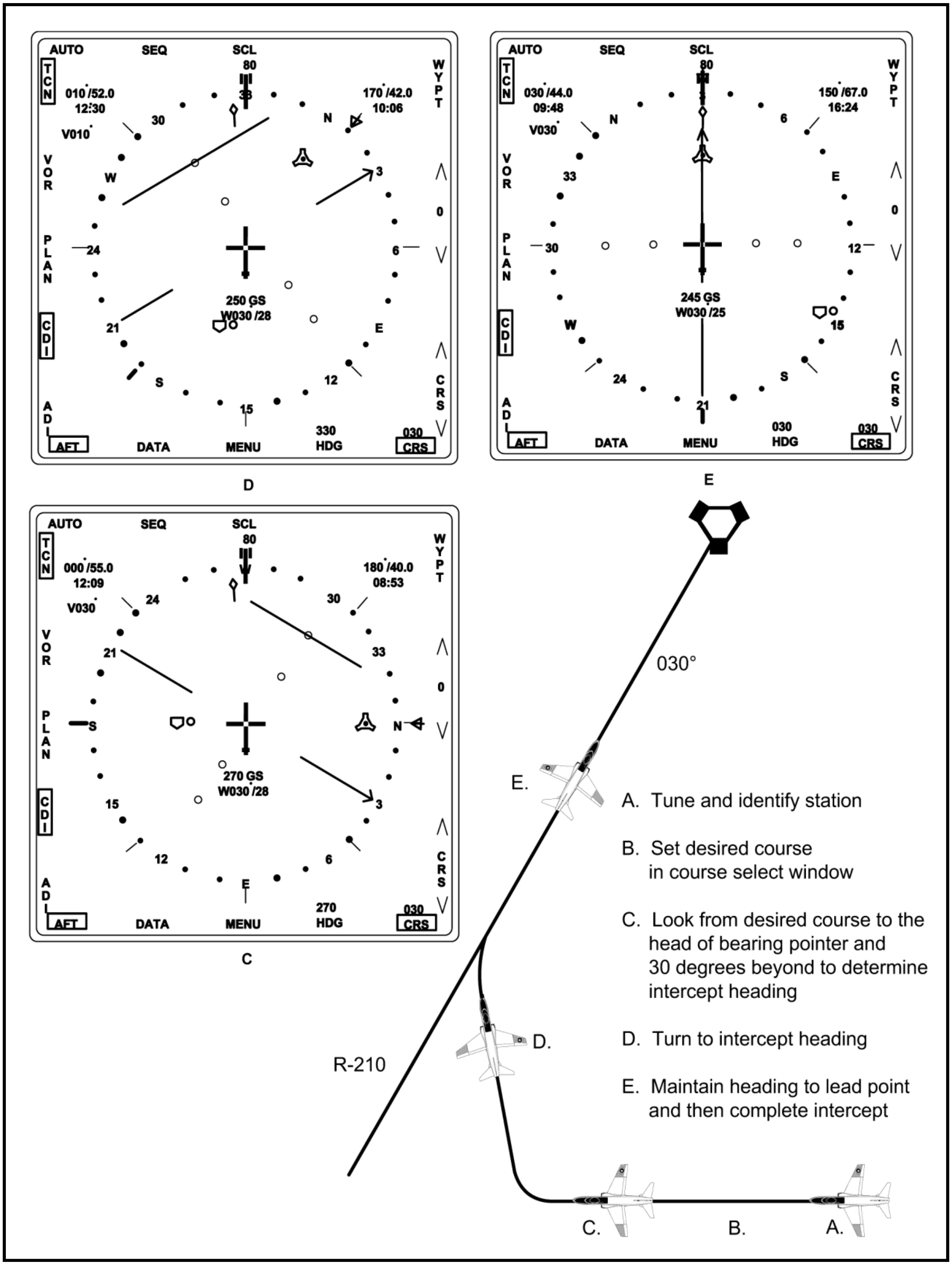


Figure 1-13 30-Degree Method

(b). **Double Angle off the Bow Method**

As with the 30-degree method, begin this intercept by tuning the station and setting the desired inbound course in the course select window. Now, look from the desired course on the compass card to the head of the bearing pointer used and an equal number of degrees beyond. The heading located an equal number of degrees beyond the head of the bearing pointer is the heading you will fly to the intercept (max 45 degrees). Turn the aircraft to this heading and maintain it until you reach the lead point and then complete the intercept (Figure 1-14). You must be sure look ***from*** the desired course ***to*** the head of the bearing pointer.

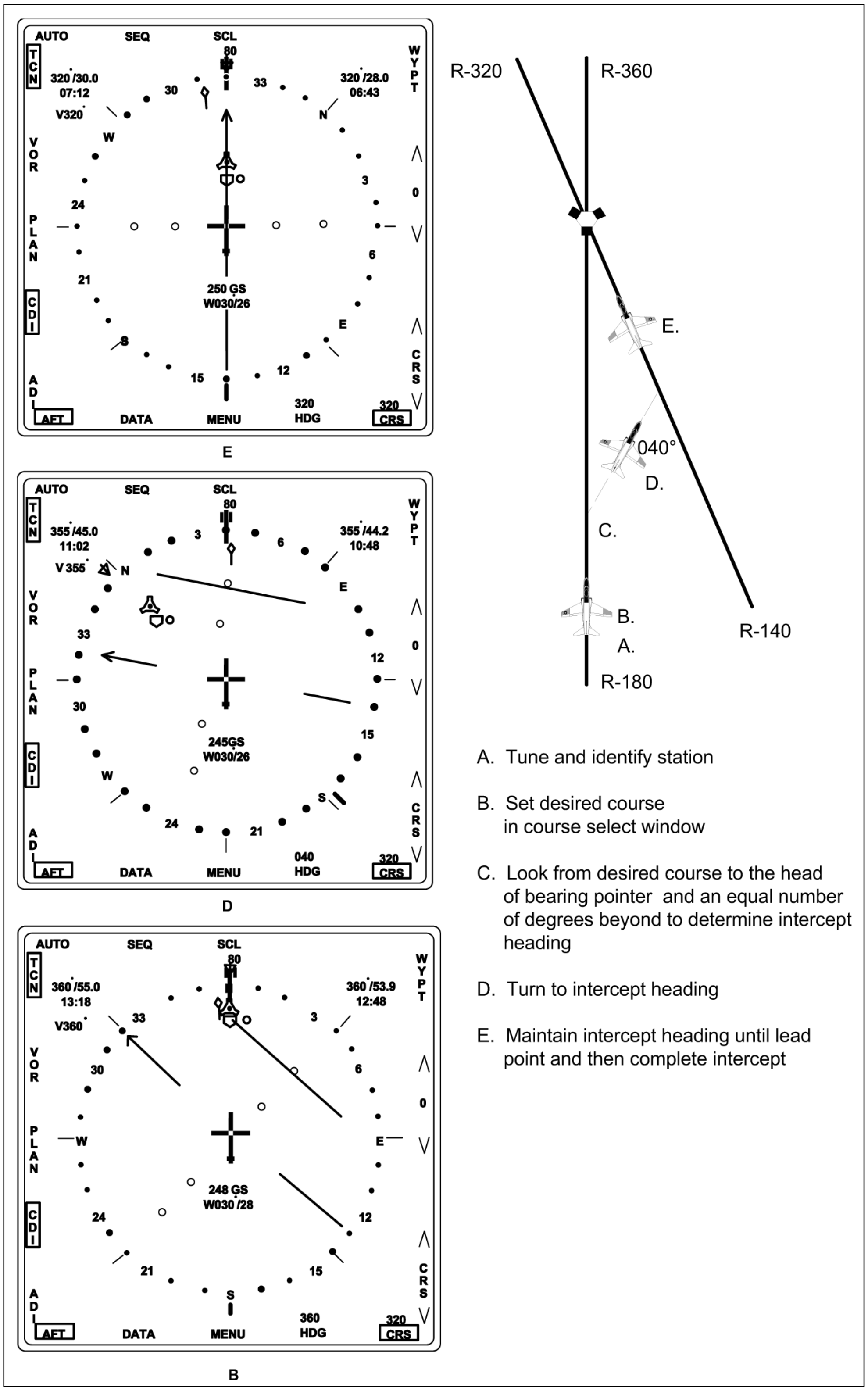


Figure 1-14 Double Angle-off Bow Method

ii. **Outbound Intercepts**

You can intercept a radial outbound from a station either when you fly directly to a station and then pick up an outbound radial immediately after passing the station or when you intercept an outbound radial at some distance from the station. The two outbound intercept procedures discussed here will address each of these situations.

(a). **Course Intercept Immediately After Station Passage**

First, tune and identify the station if you have not already done so. When station passage occurs, turn parallel to your desired course and then dial it in on the course select window. Now, look from the tail of the bearing pointer used to the desired course and an equal number of degrees beyond, but not more than 45 degrees, to determine the intercept heading. Turn to and maintain the intercept heading until you reach the lead point and then turn to intercept the desired course (Figure 1-15). You look ***from*** the tail of the bearing pointer ***to*** the desired course.

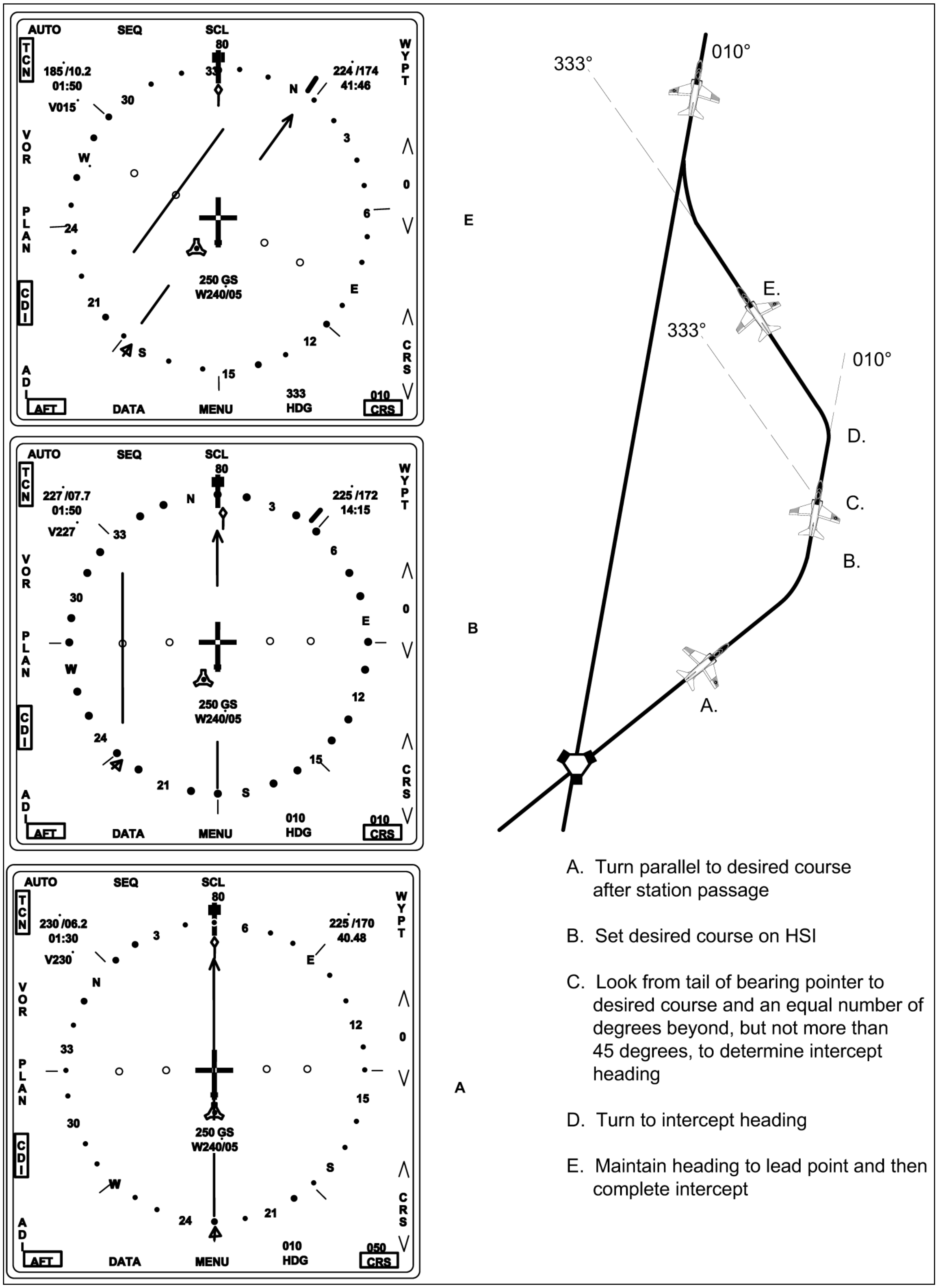


Figure 1-15 Course Intercept Immediately After Station Passage

(b). **45-Degree Method**

You will find this procedure useful when intercepting an outbound radial of a VOR or TACAN station that is some distance away. As with the other intercept procedures, you must first ensure that the station is properly tuned and identified and then set the desired course (radial) on the HSI display or DEP. To determine the intercept heading, look from the tail of the bearing pointer used to the desired course and 45 degrees beyond. Now, turn to and maintain the intercept heading until you reach the lead point (Figure 1-16).

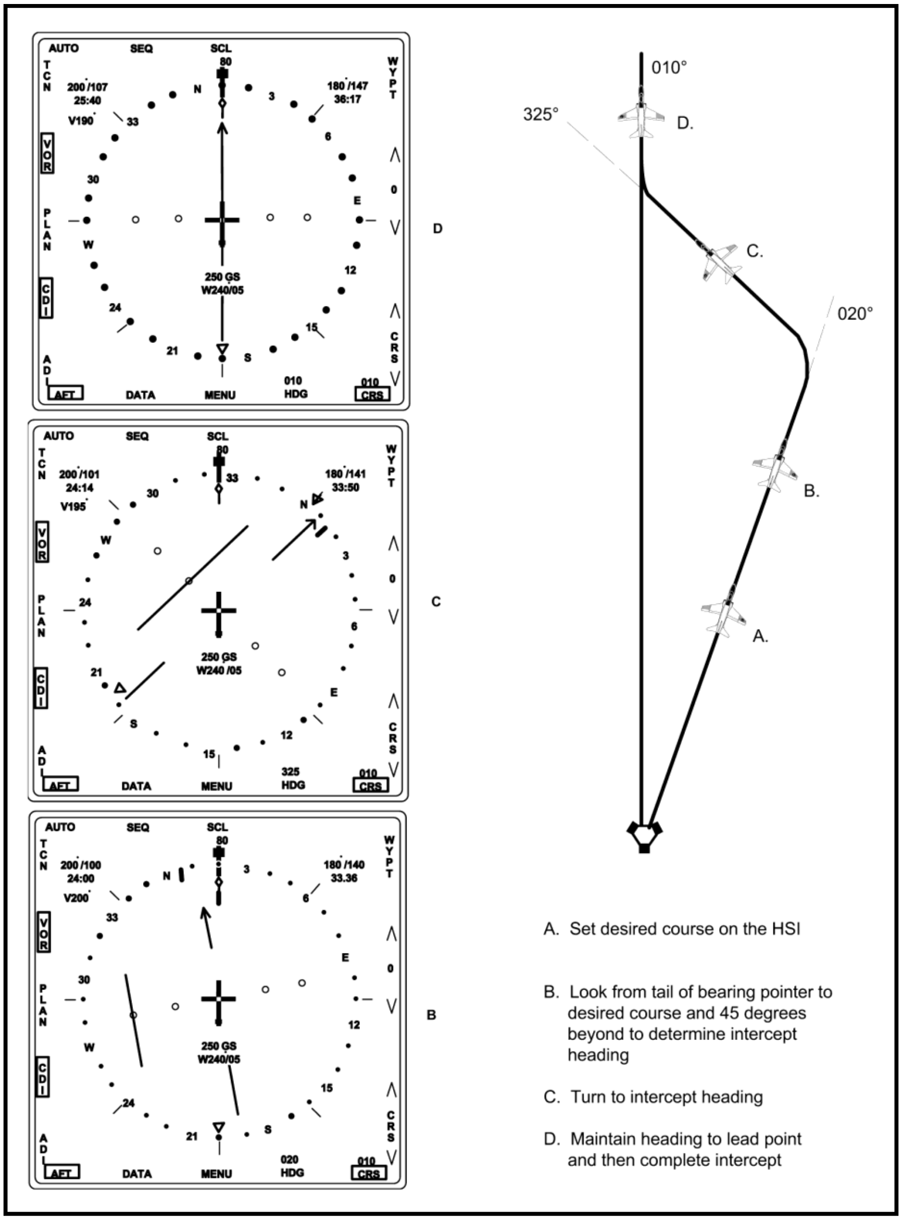


Figure 1-16 45-Degree Method (Outbound)

g. **TACAN and VOR/DME Procedures**

Adding range information to instrument navigation enables you to perform several other navigational procedures, including flying an arc around a station, proceeding point-to-point, or determining ground speed, if the ground speed indication on the HSI display does not display.

i. **Ground Speed Checks**

You must recall two facts to perform a TACAN ground speed check: first, your DME from the station must be greater than or equal to your altitude in thousands of feet (in order to limit the impact of slant range on your calculation); second, you must be flying either directly to or directly from a station in order to get an accurate ground speed check. If you are arcing or cutting across radials, your calculations will be inaccurate.

The GINA also calculates ground speed. But unlike the ground speed check that you do, the aircraft does not have to proceed directly to or from the station for the system to calculate a valid ground speed. The time-to-go in the TACAN data block is computed from slant range to the station and computed ground speed. Therefore, the time-to-go displayed in the TACAN data block is only valid if the DME from the station is greater than or equal to your altitude in thousands of feet. The time-to-go in the waypoint data block is not based on slant range, so it is always valid.

To perform a ground speed check, start your timing when the DME displays a whole number. After a predetermined time (in minutes), record the DME that has elapsed.

To calculate your ground speed, divide the distance (in nautical miles) by the elapsed time (usually one or two minutes) and then multiply the quotient by 60. The product of this calculation will be your ground speed in knots.

For example: 12 nm/2 min = 6 X 60 = 360 KTS

You can also time for a longer period of time to find the average miles per minute and then multiply by 60. This will increase the accuracy of your ground speed calculation.

For example: 12 NM in 3 minutes = 4 nm/min = 240 KTS

NOTE

ATC can also provide you with ground speed from radar.

ii. **Intercepting an Arc from a Radial**

The key to intercepting an arc precisely at the desired DME lies in performing an accurate lead point calculation (LPC) to determine the correct lead point DME to initiate the interception turn. For radial to arc intercepts, you will determine the lead point in miles (DME) instead of radials, which are used in arc-to-radial intercept calculations discussed later in this chapter.

The turn to intercept an arc from a radial will normally be at approximately 90 degrees (Figure 1-17). When intercepting an arc, you have to calculate the lead point at which you initiate the turn in order to intercept it at the correct distance. To determine the lead point, use one percent of your ground speed. For example, whether flying inbound or outbound at a ground speed of 250 KTS, your lead point will be 2.5 DME prior to the desired arc. When inbound to the arc, add the one percent to the arc DME, and when outbound, subtract one percent from the arc DME when calculating the lead point.

When you reach the lead point, initiate a one-half SRT turn in the proper direction and maintain it until the bearing pointer nears the 90-degree benchmark on the HSI display. You may have to modify your turn rate/AOB somewhat in order to arrive on the arc at the proper DME.

When intercepting an arc from a radial that is significantly more or less than a 90-degree turn, adjust the lead point by applying the following:

(a). For turns of approximately 45 degrees, use one-third of the distance calculated for a 90-degree turn.

(b). For turns of approximately 60 degrees, use two-thirds of the distance calculated for a 90-degree turn.

(c). Turns of 30 degrees or less require very little lead.

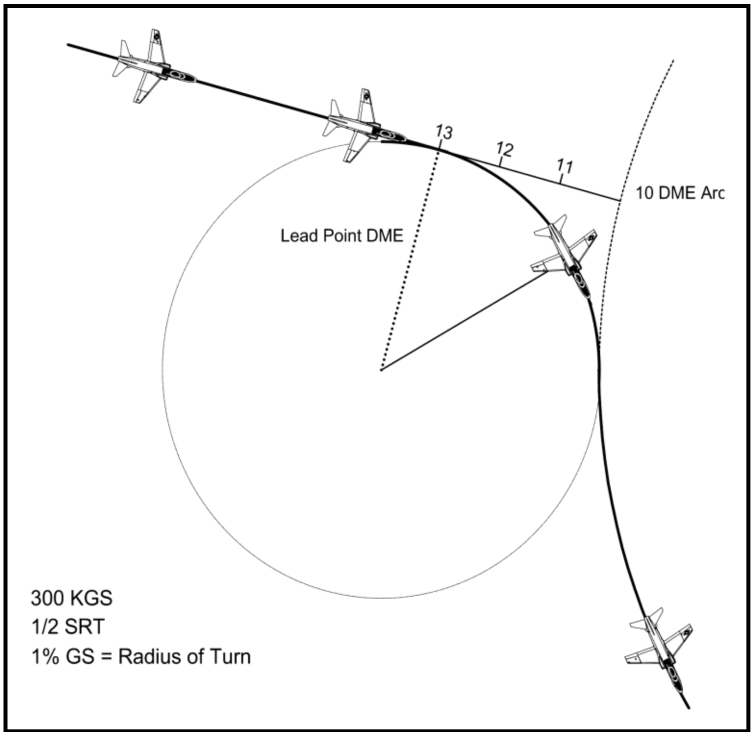


Figure 1-17 Radial-to-Arc Intercept

iii. **Maintaining an Arc Around a Station**

Two ways of maintaining an arc around a station are the chord method and the angle of bank method. Either procedure (or a combination of the two) will work at any distance from a station; however, the chord method is generally more practical when you are flying a distant arc (usually more than 12 DME from a station), while the angle of bank method usually works better when you are flying an arc close in (12 DME or less). The chord method consists of a series of short, straight legs, connected by turns. The angle of bank method is flown as a shallow turn with variable AOB to maintain a constant arc.

(a). **Chord Method**: To maintain an arc using the chord method, fly a series of short, straight legs connected by small turns that take you slightly inside and outside the actual arc (Figure 1-18). To maintain an arc using the chord method, first ensure that the station is tuned and identified; then, determine the direction of turn and calculate lead point. Initiate the turn at the lead point (when DME equals the radius of arc, plus your correction according to the rate of deviation minus the LPC) using a one-half SRT. Roll out from your interception as necessary, according to the rate of turn, when the bearing pointer correction is 5-10 degrees ahead of the 90-degree benchmark at the correct DME. Maintain your heading until the bearing pointer has moved to 5-10 degrees behind the 90-degree benchmark and then turn until the bearing pointer is once again positioned 5-10 degrees ahead of the 90-degree benchmark.

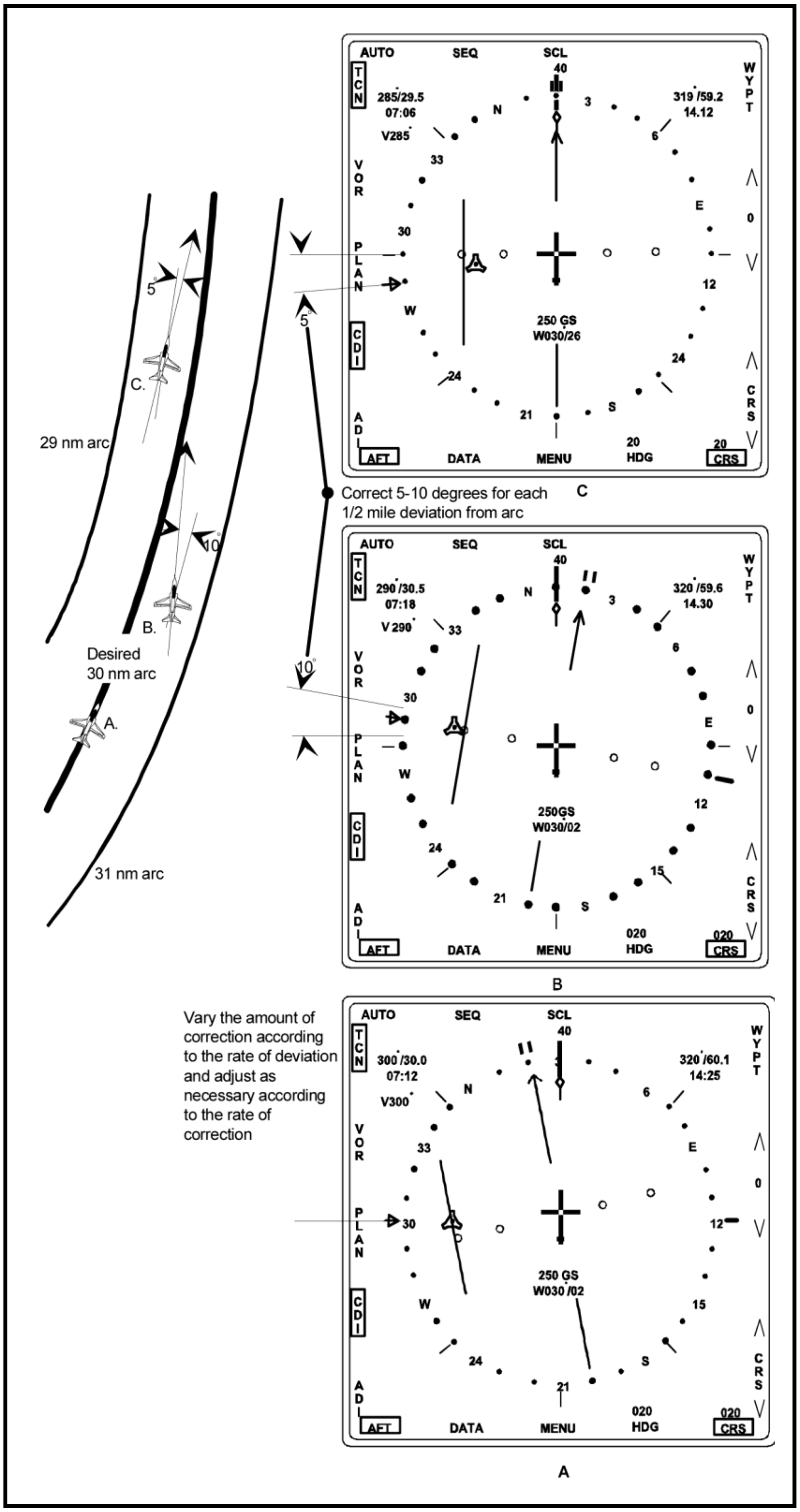


Figure 1-18 Maintaining an Arc (Chord Method)

Repeat this procedure as long as you are flying on the arc. The length of the legs will decrease as you fly arcs closer to a station until you reach a point where this method loses its advantage over the angle of bank method described below. If a crosswind makes holding your DME difficult, you may need to increase or decrease the number of degrees you place the bearing pointer ahead of the 90-degree benchmark or the number of degrees that you allow it to move behind the 90-degree benchmark to avoid having to make heading changes too frequently to maintain the arc.

(b). **Angle of Bank Method**: To maintain an arc using the angle of bank method, first ensure the station is tuned and identified. Next, determine the direction to turn and lead point. At the lead point, turn and position the bearing pointer on the 90-degree benchmark and keep it there by holding the aircraft in a shallow turn. The closer you are to a station, the greater your bank angle will be. The angle of bank method is normally used inside of 12 DME. Outside of 12 DME, the bank angle that is required to maintain an arc will probably be too small to hold accurately.

Adjustments to the position of the head of the bearing pointer, relative to the 90-degree benchmark, will have to be made to compensate for the position of the wind, relative to the aircraft, as it moves around the arc.

iv. **Intercepting a Radial from an Arc**

When intercepting a radial from an arc, you must determine which direction you have to turn to intercept and fly the radial in the correct direction (Figure 1-19). Since you will most often be performing an arc as part of an approach or departure procedure, you can obtain this information from the appropriate approach plate or SID. To turn from an arc to a radial, your main consideration is to determine the proper lead in radials. Radials diverge as you get further from a station and are 1 NM apart at 60 DME. Take this divergence into account when calculating your lead point for the turn.

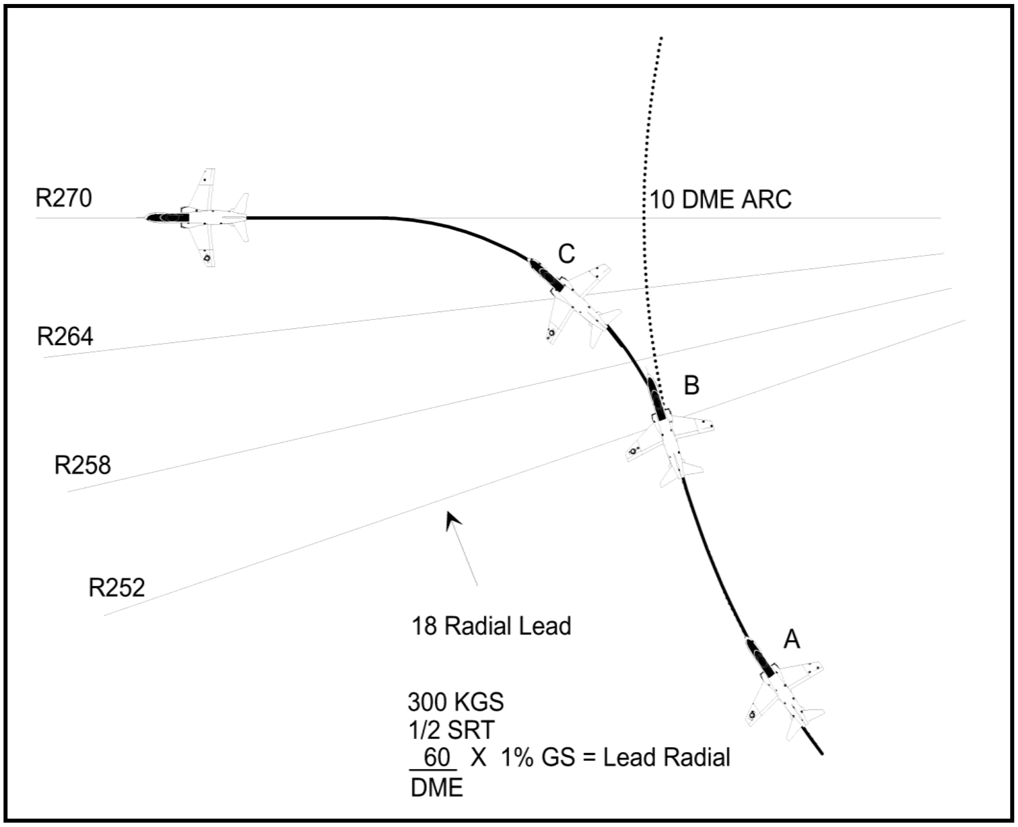


Figure 1-19 Arc-to-Radial Intercept (Method 1)

To calculate the lead point for intercepting a radial from an arc, first you must calculate or estimate the ground speed and then apply the following formula:

Divide the arc DME into 60, then multiply the quotient by 1 percent of the ground speed.

For example, if you are on a 15 DME arc at 250 KTS ground speed, your lead point will be 10 radials (60 divided by 15 equals 4; 1 percent of 250 is 2.5; and 2.5 multiplied by 4 equals 10).

When making your intercept turn, you can also use the movement of the bearing pointer and course line as a guide to determine when to initiate the turn. Use the HSI display scale and relative position of the Planimetric course line to initiate and execute the radial intercept. When you are flying close to the station, you must initiate the intercept turn before the CDI course line begins to move. Therefore, the turn must be initiated at the calculated lead point. Figure 1-20 depicts the HSI display indications during the intercept procedure.

To intercept a radial from an arc, first set the desired course on the HSI display. Next, determine your lead and then turn using a one-half SRT when you reach the lead point. Finally, vary your AOB in the turn with the movement of the course line so that it is centered when the turn is complete. Do not exceed 30 degrees AOB.

For radial intercepts from arcs less than 10 DME, a correction factor must be applied to the arc-to-radial formula to account for the turn to the radial being more or less than 90 degrees. In the case of a turn inbound, the turn will actually be more than 90 degrees, and the correction factor will be added to the standard 90-degree arc-to-radial formula. In the case of an outbound turn, the turn will actually be less than 90 degrees, and the correction factor will be subtracted from the standard 90-degree arc-to-radial formula.

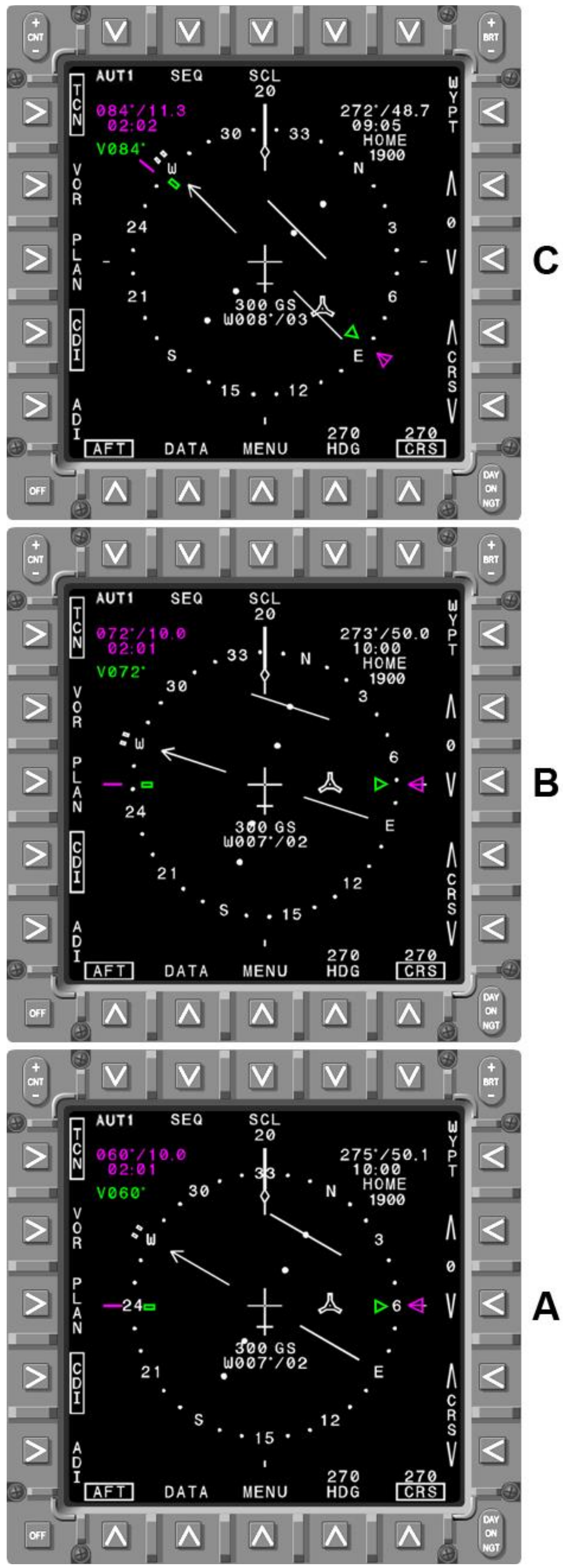


Figure 1-20 Arc-to-Radial Intercept (Method 2)

The correction factor is calculated as follows:

(a). ***Inbound turn*** correction factor = ([90 + Lead (radials)] / 90) x (Turn Radius)

(b). ***Outbound turn*** correction factor = ([90 - Lead (radials)] / 90) x (Turn Radius)

Examples:

An inbound turn of more than 90 degrees on a 10 DME arc at 250 KGS:

Correction Factor = ([90 + 15] / 90) x 2.5 = 2.9

Therefore, the correct lead for an inbound turn at 10 DME =

15 (lead for 90-degree turn at 10 DME) + 2.9 = 17.9 or approximately 18 radials

See Figure 1-21.

An outbound turn of less than 90 degrees on a 10 DME arc at 250 KGS:

Correction Factor = ([90 - 15] / 90) x 2.5 = 2.08

Therefore, the correct lead for an outbound turn at 10 DME =

15 (lead for 90-degree turn at 10 DME) – 2.1 = 12.9 or approximately 13 radials

See Figure 1-21.

ARC DME	90 DEGREE TURN	INBOUND TURN (>90 DEGREES)	OUTBOUND TURN (<90 DEGREES)
20	7.5	N/A	N/A
15	10	N/A	N/A
10	15	» 18	» 13
7	21	» 27	» 16
5	30	» 40	» 20

Figure 1-21 Approx. Lead Radials to Arc (250 KGS)

3. Point-to-Point Navigation

As you approach a terminal area, the controller may clear you either to a holding fix or to the IAF. When cleared direct to a fix, you will have to use radar vectors, traditional point-to-point navigation, or waypoint offset navigation to navigate to the fix.

a. Traditional (non-system) Point-to-Point Navigation

The following steps (Figure 1-22) are used to accomplish the point-to-point procedure:

i. First, tune and identify the appropriate TACAN or VOR/DME equipped station. The HSI display will function as a plotting board.

ii. Place the station at the center of the compass rose.

iii. Picture the fix with the greater distance on its radial at the edge of the HSI display compass rose. The HSI display scale and the scale you used for a point-to-point calculation do not have to be the same.

iv. Visualize the fix with the lesser distance (determined by the previous step), placed at a proportional distance from the center of the HSI display on its radial. The aircraft is placed on the tail side of the radial that the aircraft is on. The actual point on the radial is determined by which fix is greater. If the aircraft is farther away from the station than the point-to-point target fix, then the aircraft fix will be located where the tail of the bearing pointer crosses the compass card. If closer, then the aircraft is located at a proportional point along the tail of the bearing pointer.

v. Once the fixes are determined, connect them with an imaginary line or with the aid of a straight instrument such as a pencil.

vi. Move the line to the center of the HSI display, paralleling the original imaginary line and read the course to the target fix where the line intersects the outside edge of the compass rose.

vii. Turn the aircraft to the new course and apply a WCH, if known.

viii. Repeat the point-to-point procedure periodically enroute and make corrections to the target fix as needed.

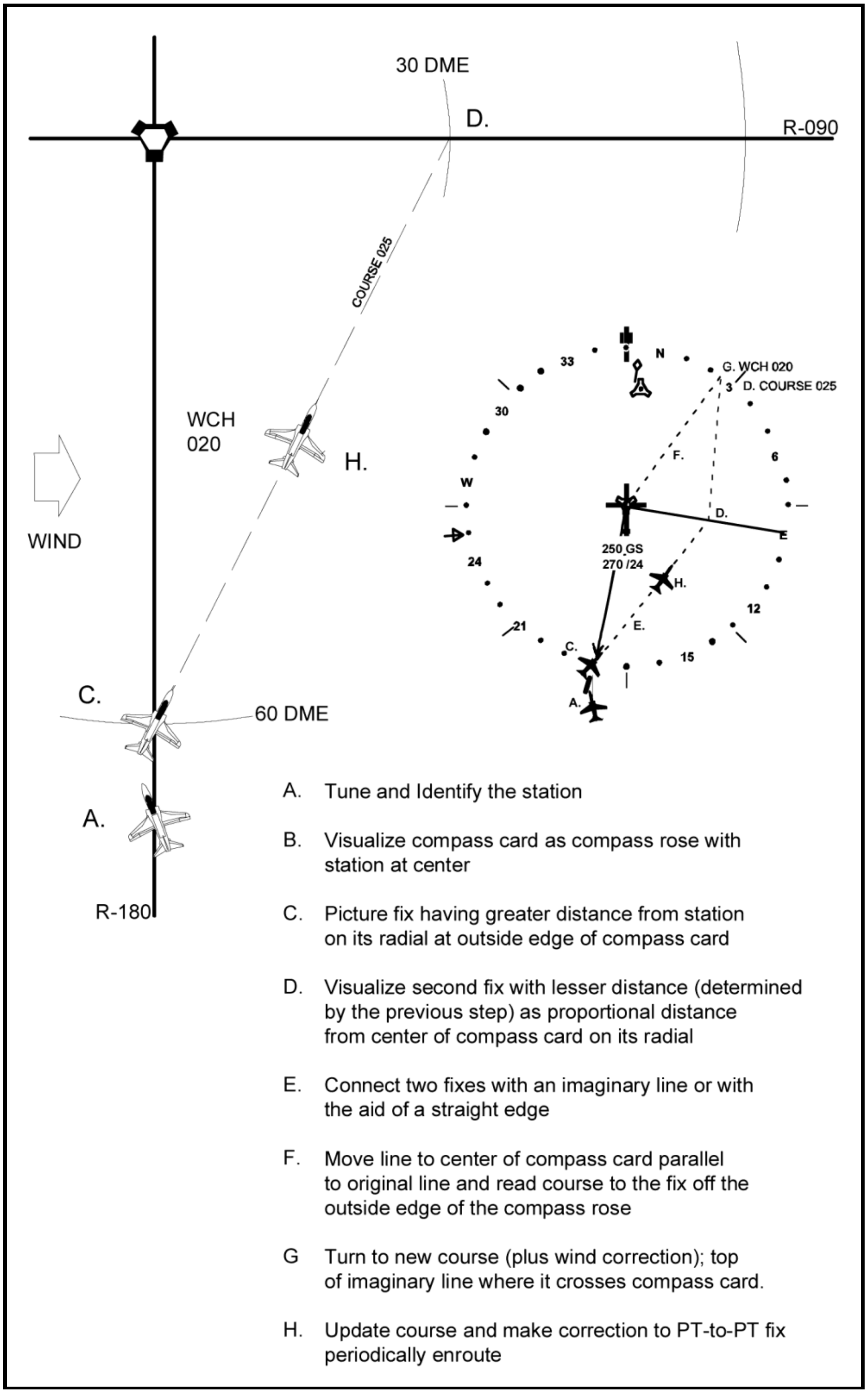


Figure 1-22 Point-to-Point Navigation

b. **Waypoint Offset Point-to-Point Navigation**

The following steps are used to set up steering to a waypoint offset. First, select a waypoint that represents the location of the appropriate navigational aid that defines the fix. If the waypoint is one of the active waypoints, select that waypoint number with the increment/decrement arrows on the HSI display.

Second, from the HSI, ADI, or MENU display, select DATA. On initial selection of DATA, the system defaults to the waypoint selection; on subsequent selections of DATA, the display returns to the last selected sublevel format, WYPT, ACFT, or GPS. If required, select WYPT (Figure 1-23).

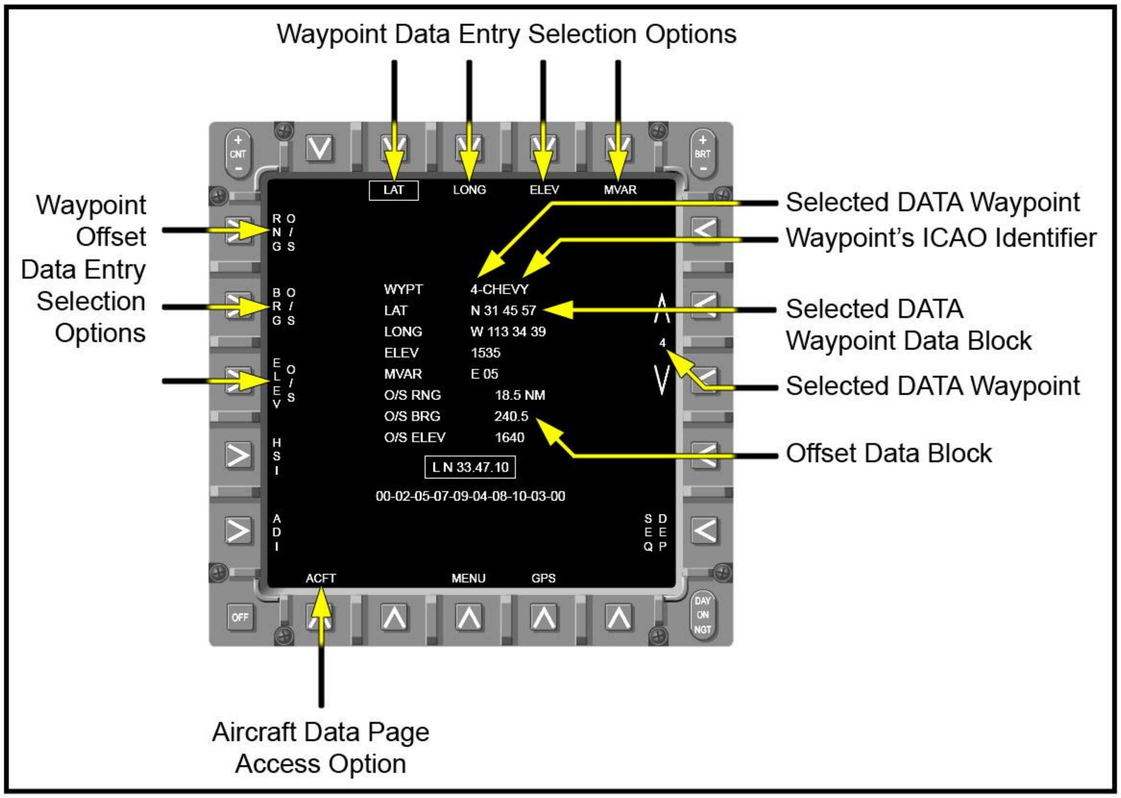


Figure 1-23 Waypoint Data Display

Third, enter the bearing and range of the fix for the waypoint that define the navigational aid. The offset entry options are located on the left bezel of the MFCD (Figure 1-24): range (RNG O/S), magnetic bearing (BRG O/S), and elevation (ELEV O/S). Offset data entry, using the DEP and scratchpad, is enabled when one of the O/S options is selected. No offset data is displayed if range is set at 0.0 nm. Range is limited to 0.0-99.9 NM in one-tenth-of-a-mile increments. Bearing is 000-359.9 degrees in one-tenth-of-a-degree increments (360 may be entered for 000). The decimal is not displayed on the scratchpad, but is automatically entered before the last digit after the data is entered into the system. The decimal is displayed in the offset data block. Elevation initializes to the associated waypoint elevation and is limited from -999 to 9,999 ft in one-foot increments. Do not change elevation; it is not used for waypoint offset steering. Changing the position of the waypoint after entering the offset data automatically sets the offset data for that waypoint to zero and blanks all offset data.

Fourth, select HSI and WO/S. The waypoint bearing pointer and waypoint data block provide steering information to the fix.

If there is no active waypoint for the navigational aid, this waypoint data must be transferred from the Mission Data Loader (MDL), if the navigational aid is one of the 200 waypoints in the MDL, or the latitude, longitude, and magnetic variation of the navigational aid can be manually entered.

To transfer data from the mission data load, select DATA from the HSI, ADI, or MENU and then select GPS to bring up the Global Positioning System Data Display (Figure 1-24).

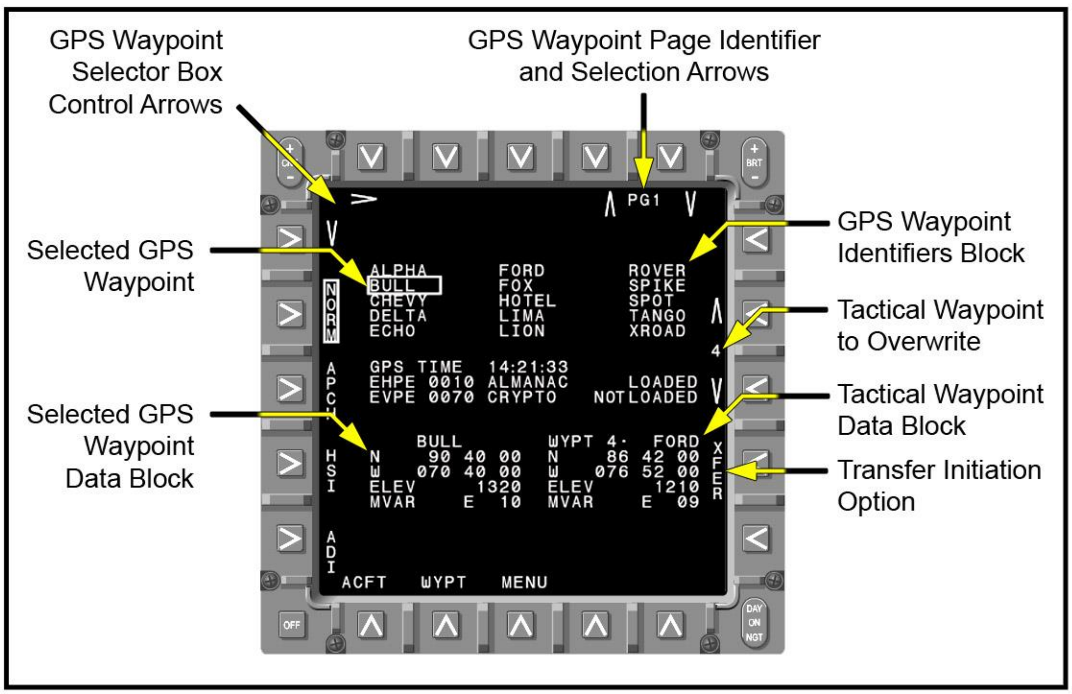


Figure 1-24 GPS Display

The first fifteen waypoints in the mission data load are displayed at the top of the screen in the GPS waypoint identifiers block. The desired page of the GPS waypoint identifiers is selected with the increment/decrement arrows in the upper right of the display. Individual GPS waypoint information is selected by locating the selector box around the desired GPS waypoint with the selector box control arrows in the upper left corner of the display. The selected GPS waypoint data is shown in the selected

GPS Waypoint Data Block. Using the increment/decrement arrows on the right side of the display, select the tactical waypoint that you want to overwrite; the tactical waypoint data is shown in the Tactical Waypoint Data Block. Press the pushbutton next to XFER to copy the waypoint data from the GPS mission data block into the Tactical Waypoint Data Block. Verification of a successful transfer of waypoint information is accomplished by comparing the two waypoint data blocks. They should be the same.

If the navigational aid is not one of the 200 waypoints in the MDL, you can manually enter the latitude, longitude, and magnetic variation for the navigational aid. To do this, select DATA from the HSI, ADI, or MENU and then select WYPT if required (Figure 1-24). Manual waypoint data entry starts by selecting the desired waypoint number with the increment/decrement arrows on the right of the display. When the desired waypoint is displayed, all parameters for that waypoint may then be changed by selecting data options at the top of the display: LAT (latitude), LONG (longitude), ELEV (elevation), or MVAR (magnetic variation).

Selecting a data option enables the scratchpad on the MFCD and HUD; other data options are blanked. New data is entered with the pushbuttons on the data entry panel (DEP). When the ENT pushbutton on the DEP is pressed, the scratchpad is removed, waypoint data is updated with the new value, the option is unboxed, and the other blanked options are redisplayed. (Waypoint elevation is only used for CCIP bombing computations; not for waypoint steering or time-to-go computations.)

Once the latitude, longitude, and magnetic variation of the navigational aid are entered as an active waypoint, the bearing and range of the fix can be entered as previously described.

4. **Arrival Phase**

This phase consists of those activities occurring in the transition from enroute flight to the approach phase and includes procedures for holding and performing enroute descents.

a. **Holding**

“Holding” refers to the maneuvering of an aircraft in relation to a navigational fix. Holding patterns are defined areas of airspace where aircraft could be required to hold enroute when awaiting clearance to commence an approach or after executing a missed approach. All aircraft given the same holding instructions must fly the same pattern, separated only by altitude. Holding is often required when weather conditions are poor in a terminal area and traffic congestion occurs.

Two basic holding categories are flown in the T-45C: VOR only and TACAN/VOR DME. The difference between the two is predicated on the use or availability of DME to identify the fixes and the limits of the holding pattern. There are also two different types of holding patterns, standard and nonstandard. Standard holding uses right turns in the pattern and nonstandard holding is flown using left turns in the pattern. Determination of which category and type of holding to be flown is dictated either by a depiction on a chart, the clearance the pilot receives from the controller, or equipment availability.

i. **TACAN/VOR DME Holding**

When you are instructed to hold in relation to a TACAN or VOR DME station, the radial, DME of the holding fix, and DME limits of the pattern will be published (as on an approach plate) or will be assigned to you by the controller (Figure 1-25).

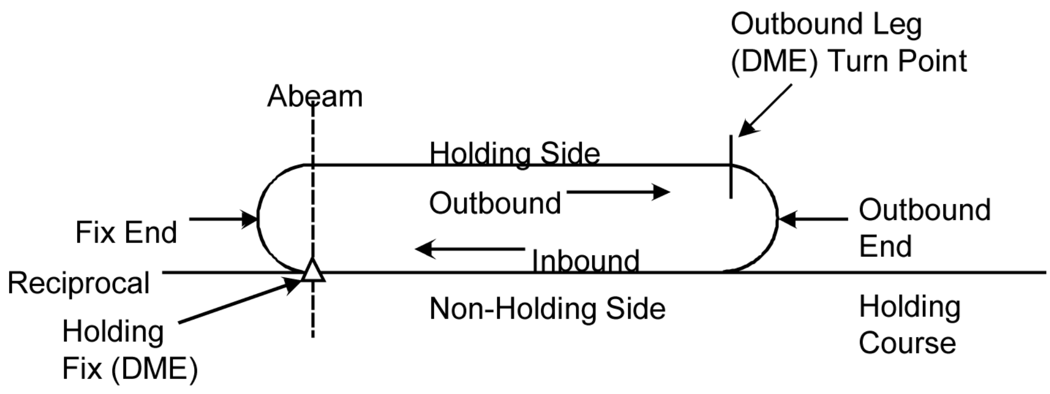


Figure 1-25 Standard Holding Pattern (TACAN)

A TACAN/VOR DME holding clearance will consist of the following instructions (if published holding instructions are not available):

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

(b). Radial and DME of the holding fix

(c). Outbound leg length or the outer limit of the pattern in nautical miles (applicable DME)

(d). Altitude

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

(f). Expected further clearance (EFC) time

ii. **VOR Holding**

The VOR holding clearance is essentially the same as that for TACAN/VOR DME except that VOR holding will not include leg lengths. Unlike DME-based patterns, VOR patterns are located over the station because there is no distance reference available to establish the holding fix (Figure 1-28). The difference between VOR holding and TACAN/VOR DME holding is that instead of measuring leg lengths with DME, you will have to time the legs. Leg times are 1-1/2 minutes above 14,000 ft MSL and one minute at 14,000 ft MSL and below. These times apply only to the initial outbound leg and all subsequent inbound legs. You may have to adjust your outbound time (due to head wind or tailwind components) to achieve the necessary inbound time. Outbound leg timing begins when you are abeam the fix or when you roll wings level out of the turn, whichever occurs last.

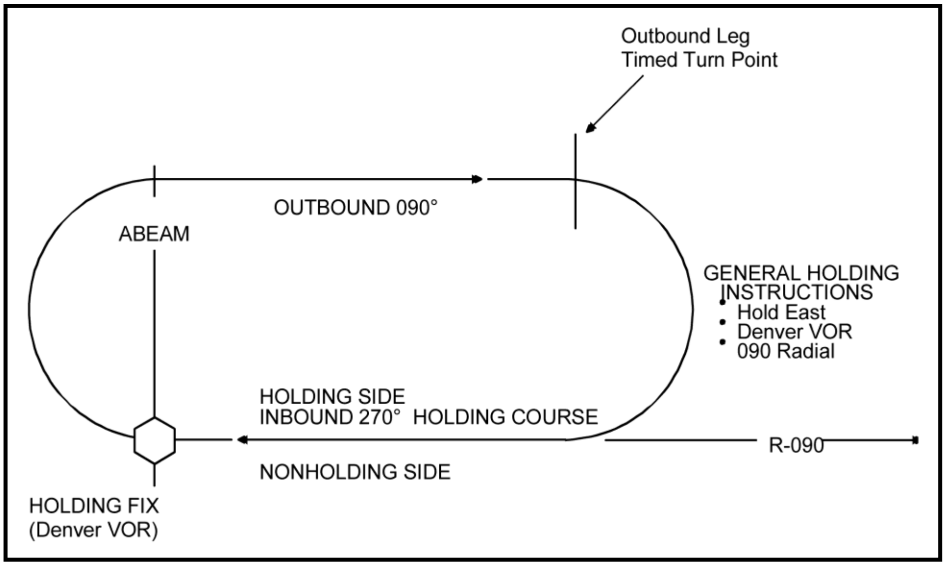


Figure 1-26 Non-DME Holding

iii. **General Holding Procedures**

The basic procedures for flying a holding pattern (Figure 1-28) are as follows. First, begin slowing to holding airspeed no sooner than three minutes from the holding fix. Next, from your holding clearance, or published holding procedure, determine the type of holding to be used. From your heading, determine the appropriate entry procedure. Upon arrival at the holding fix, note the time and initiate the entry procedure. If timing is used for the pattern vice DME, note the time wings level or abeam the holding fix, whichever occurs last on the entry procedure heading outbound and on subsequent outbound orbits. Set inbound holding course on the HSI display or the DEP. Turn inbound when the appropriate time outbound has elapsed for the holding altitude and begin timing inbound wings level. All turns in holding are made at three degrees per second (standard rate), but do not exceed 30 degrees AOB. Communicate entering holding, if required, once established in the pattern. On subsequent orbits, adjust heading and/or timing, as required, for winds to maintain a holding pattern track and time.

iv. **Communication Procedures for Holding**

For a normal holding pattern with a charted destination, the controller will not necessarily provide instructions unless they are requested by the aircrew or the controller deems it necessary. If the destination is not charted, the controller will provide fix, direction from fix, radial or bearing, leg length if DME, altitude if different than present assigned, and an EFC time or expected further routing (EFR). The controller will only indicate turn direction if holding is nonstandard by stating “Left Turns” in the clearance at the aircrew’s request or if the controller considers it necessary.

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; however, these reports may be omitted by pilots involved in instrument training at military facilities when radar service is being provided. If the holding fix is the clearance limit (EFC assigned and not cleared for approach), then the fix is a compulsory reporting point.

Example:

ROKT 401 *“ROKT 401, flight level two one zero, time one three five zero Zulu.”*

Once cleared for the approach, penetrate upon arrival at the IAF (you need not make a complete turn in holding). See “Penetration from Holding,” page 1-56.

v. **Holding Airspeeds**

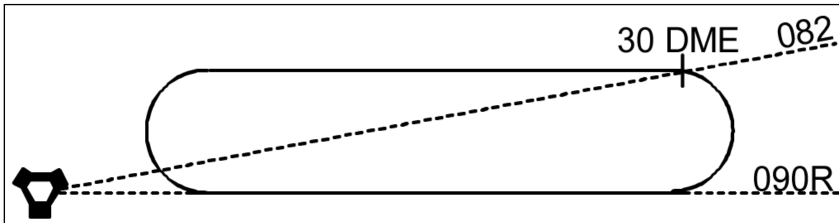
If you have been cleared to a holding fix or have not received further clearance while enroute, begin slowing to holding airspeed no sooner than three minutes prior to a holding fix. Since holding is a delaying or loitering maneuver until further clearance is received, it is flown at an airspeed approximating maximum endurance. Maximum holding airspeed for this aircraft, as published by the FAA, is 230 KTS. Maximum endurance airspeed in the T-45C is 14 units; for simplicity, procedural holding airspeed for the T-45C is 200 KIAS regardless of altitude, not to exceed 14 units AOA. If turbulence is encountered, hold at 250 KIAS per NATOPS and notify ATC. The T-45C NATOPS recommended turbulence penetration airspeed is 250 KIAS. When higher speeds are no longer necessary, return to normal holding airspeed and notify ATC.

vi. **Entry Procedures**

To enter holding, use one of three possible procedures, depending on your heading that is relative to the holding pattern when you arrive over the fix. (The discussions of entry procedures on the following pages assume a ***standard*** [right-hand] pattern; reverse the turns for a ***nonstandard*** [left-hand] pattern.) In each procedure, you cross the fix and turn outbound on the appropriate heading. At holding fixes that are not over NAVAIDs, an outbound offset should be determined prior to the entry (Figure 1-28). Turn inbound to intercept the holding course at the appropriate DME or time (Figures 1-27 and 1-28).

vii. **No Wind VOR/TACAN DME Entry Offset**

Prior to reaching the holding fix on a teardrop or direct entry, based on the T-45C turn radius for 180 degrees at holding airspeed, the pilot should calculate the approximate offset required so that, at the inbound turn point, an SRT or 30-degree AOB burn for 180 degrees will place the aircraft on the holding course inbound. The actual offset required will vary with wind, true airspeed, altitude, and turn radius. For 200 KIAS at 15,000 ft., the T-45C turn radius is approximately 2 nm, or 4 NM for 180 degrees of turn. See Figure 1-27.



NO WIND

Offset 8 radials according to table:

DME (At turn inbound)	RADIAL OFFSET (Approximate)
10	24
20	12
30	8
40	6

Figure 1-27 No-wind Holding Offset

The quickest and most accurate method of determining which type of entry to perform is to use the HSI display compass rose as a plotting board (Figure 1-28). For a standard holding pattern, locate the holding radial on the compass rose. If the holding radial is located within an area of 70 degrees to the right of the aircraft's heading at the holding fix, perform a teardrop entry. If the holding radial is located within an area of 110 degrees to the left of the aircraft's heading, perform a parallel entry. If the holding radial is located outside an area of 110 degrees to the left and 70 degrees to the right of the aircraft's heading, perform a direct entry. For a nonstandard pattern (left turns), reverse the 70 and 110-degree lines. Additionally, most approach plates include a holding entry diagram to aid you in determining which type of entry to perform.

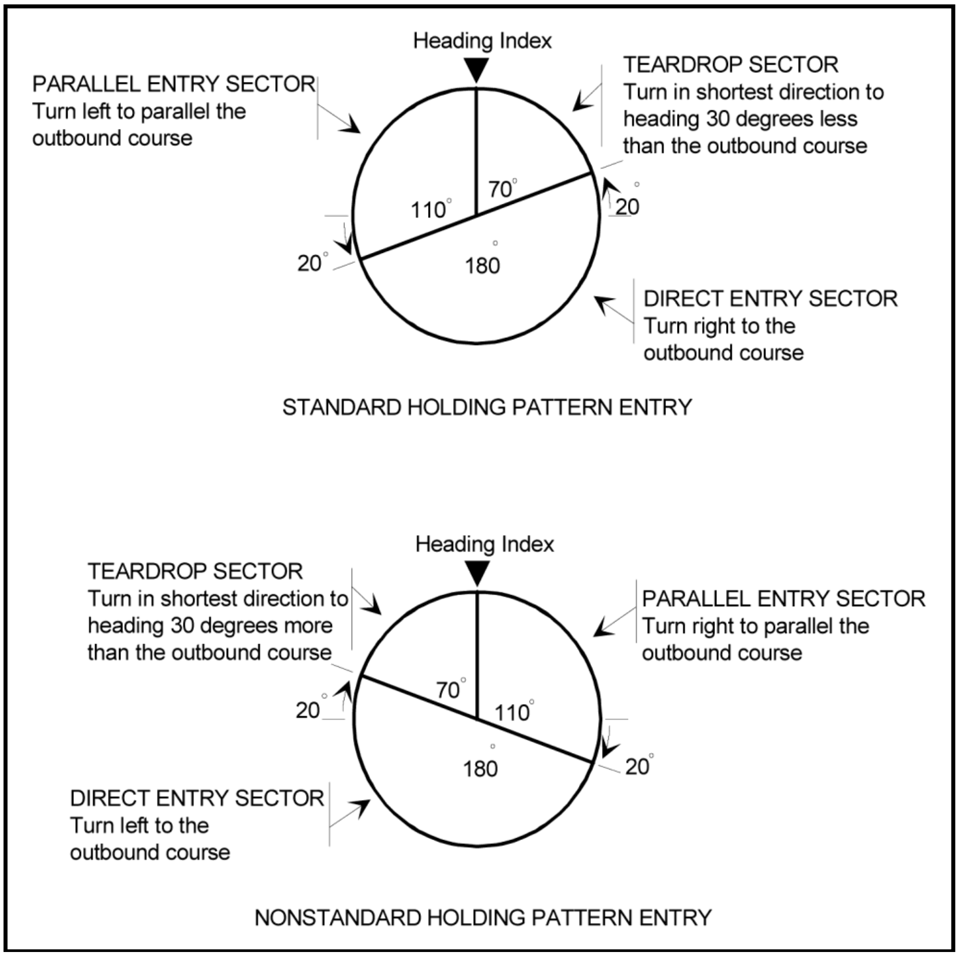


Figure 1-28 Holding Pattern Entry Sectors

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.

(a). **Parallel Entry Procedure.** When approaching the holding fix from anywhere in sector (A), the parallel entry procedure would be to turn to a heading to parallel the holding course/radial outbound on the non-holding side (Figure 1-29). Wings level (VOR only) time for a period of one or one and one-half minutes (depending on the altitude). At end of timing (VOR) or outbound DME (TACAN), turn in the direction of the holding pattern through more than 180 degrees and return to the holding fix or intercept the holding course inbound.

(b). **Teardrop Entry Procedure.** When approaching the holding fix from anywhere in sector (B), the teardrop entry procedure would be to fly to the fix, turn outbound with a heading change of 30 degrees more than the outbound holding course/radial for a nonstandard holding pattern or 30 degrees less than the outbound holding course/radial for a standard holding pattern to initiate the teardrop entry within the pattern (on the holding side). Wings level outbound (VOR only), time for a period of one or one and one-half minutes (depending on the altitude). Turn to parallel holding radial at desired offset. At end of timing (VOR) or pattern outbound DME (TACAN), turn in the direction of the holding pattern to intercept the inbound holding course or proceed directly back to the fix.

(c). **Direct Entry Procedure.** When approaching the holding fix from anywhere in sector (C), the direct entry procedure would be to fly directly to the fix and turn outbound to follow the holding pattern. Initial timing (VOR only) would begin wings level or abeam, whichever occurs last. Time for a period of one or one and one-half minutes (depending on the altitude). At end of timing (VOR) or pattern outbound DME (TACAN), turn in the direction of the holding pattern to intercept the inbound holding course or proceed directly back to the fix.

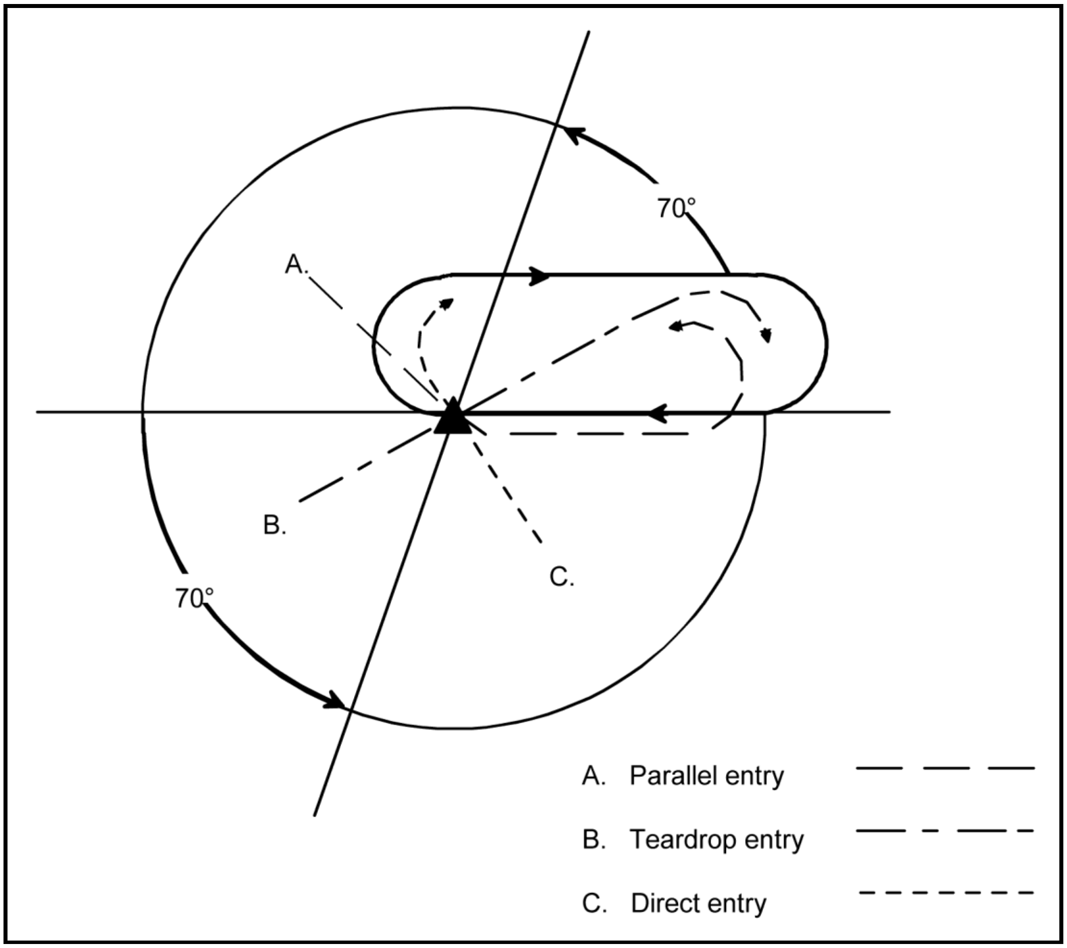


Figure 1-29 Holding Pattern Entry

viii. **Wind Drift Correction Techniques**

You may have to compensate for two different wind effects while flying a correct holding pattern: head winds or tailwinds, and crosswinds.

Head winds or tailwinds will only be a factor on non-DME patterns, for which you will have to adjust the outbound leg for a correct inbound time. Compensate for crosswinds in order to arrive at an outbound position from which a turn inbound will place the aircraft on the holding course. This is normally accomplished by using a larger drift correction (approximately two to three times) on the outbound leg. See Figure 1-30.

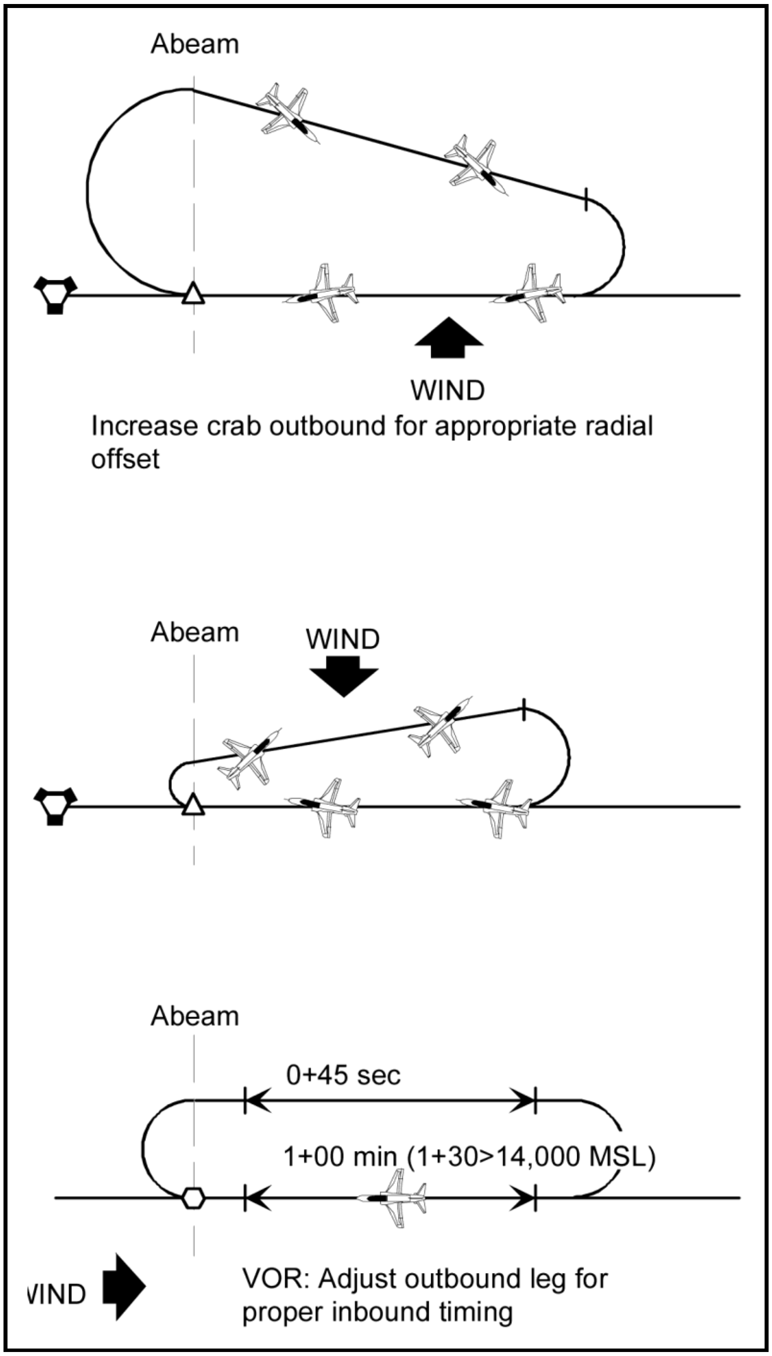


Figure 1-30 Holding Wind Correction

ix. **Lost Communication**

If communication is lost and the pilot has received EFC time, and the holding fix and Initial Approach Fix (IAF) are the same, then depart the fix at EFC time. If, however, the holding fix and IAF are not the same, depart the holding fix at EFC time and proceed to initial approach fix. When EFC has not been received, continue on assigned route and do not hold.

x. **Penetration from Holding**

Depending on the goal, choose an appropriate method to accelerate from holding airspeed to 250 KIAS (TACAN penetration airspeed):

(a). For fuel conservation, plan to intercept 250 KIAS as you descend out of altitude. At the fix, lower the nose and begin descent while accelerating to 250 KIAS. As airspeed approaches 250 KIAS, reduce power to IDLE and extend the speed brakes if necessary.

(b). For timing considerations (for example, CV approaches), accelerate to arrive at the IAF at 250 KIAS. Once cleared inbound and on course, perform a level speed change from 200 KIAS to 250 KIAS.

NOTE

To begin penetration, the aircraft must be established on initial approach course.

During approaches to airfields, retract boards when the profile allows and maintain 250 KIAS. During field approaches, call “Platform,” and your IP may retract the speed brakes if practical. Regardless, honor the minute-to-live rule.

b. **Enroute Descent**

Enroute descents are used to transition from an enroute altitude to the final portion of an instrument approach or visual approach in lieu of published penetrations. An enroute descent can also be flown to a GCA pickup. The routing on this descent may be via radar vectors or the NAVAIDs depicted on the high altitude charts.

You may request, or a controller may initiate, an enroute descent; however, the controller must advise you of his or her intention to provide this service, and you may refuse it in favor of a published instrument approach. Prior to issuing descent clearance below the highest published IAF for an airport, the controller must advise you of the type of approach to expect, current altimeter setting, and the current weather (if the ceiling is below 1,000 ft AGL or the highest published circling minimums, whichever is greater, or if visibility is less than three miles).

c. **Enroute Descent Planning**

i. **Cruise Descent**

Goal: Reduce time to destination by descending at an IAS that is higher than the max range airspeed. This type of descent is used when saving fuel is less important than time-to-destination.

Procedure: To calculate VSI, divide altitude to lose by the distance to go (in NM) then multiply by ground speed (in NM/min). For example, you are cruising at FL300 and Center clears you to "descend and maintain 15,000 ft in the next 50 miles." Substituting these numbers into our equation would look as follows:

(Altitude/Distance)*(Groundspeed) = (15000/50)*(5) = 1500 fpm rate of descent

Of course, the specific VSI depends on ground speed, but Figure 1-33 provides a rough approximation.

Fuel Flow (PPH)	Airspeed (KIAS)	VSI (fpm)	DME to lose 1K
500 (idle)	250	-2,500	2
500 (idle), BOARDS	250	-6,000	1
500 (idle)	Max Range	-1,500	3-4
700 (75%)	250	-2,000	2.5

Figure 1-31 T-45C Enroute Descent Table

From cruise power and IAS at altitude, lower the nose to accelerate (if necessary) to the desired descent airspeed (usually 250 KIAS), then reduce power (if necessary) to maintain the desired VSI. At altitude, you will need to reduce fuel flow by approximately 50 PPH for every –100 ft of VSI. You must request permission to perform directed descents at rates less than 500 fpm.

ii. **Max Range Descent**

The goal of a max range descent is to use less fuel while maximizing distance traveled. NATOPS lists the max range descent airspeed and descent point in the BINGO tables for various airspeeds and configurations. Max range descent AOA will be higher than the max range cruise AOA (triangle at 12–13 units). Center normally plans to descend you at your altitude plus ten, so you may need to ask for an earlier descent. For example, the letdown point for max range descent from FL350 is about 123 nm, but Center would not normally descend you until 45 nm. A rough approximation is to letdown three and one-half times altitude plus the desired DME from field level off.

iii. **Delayed Descent**

The goal of a delayed descent is to minimize downrange travel if your descent is delayed by ATC or weather. Use this strategy when you are forced to stay higher than desired. At altitude, maintain max endurance AOA ("box" at 14 units) until cleared lower, then lower the nose and accelerate to 250 KIAS, reduce power to idle, and use boards as necessary. The idle-with-boards configuration gives the maximum altitude loss for distance over the ground.

iv. **All Descents**

When descending through 5,000 ft AGL, call “platform” and comply with the “minute-to-live” rule.

v. **Standard Terminal Arrival Route (STAR)**

A STAR is a preplanned Instrument Flight Rule (IFR) air traffic control arrival procedure that is published for pilot use in graphical and/or textual form. STARs provide transition from the enroute structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area. Its purpose is to simplify clearance delivery procedures.

Until the military fully distributes STAR publications, STARs will be issued to military pilots only when requested in the flight plan or verbally by the pilot. Still, some of the “preferred” routes in the A/P-1A contain STARs. Use of STARs requires pilot possession of at least the approved textual description. As with any ATC clearance or portion thereof, it is the responsibility of each pilot to accept or refuse an issued STAR. Pilots should notify ATC if they do not wish to use a STAR by placing “NO STAR” in the remarks section of the flight plan or by the less desirable method of orally stating the same to ATC. This option may result in terminal delays and holding.

5. **Approach Phase**

Instrument approaches enable you to transition from IMC to a visual landing while providing terrain clearance and separation from air traffic. As part of the FLIP series Terminal Procedures, instrument approach procedure charts are divided into two categories, high altitude (Figure 1-32) and low altitude.

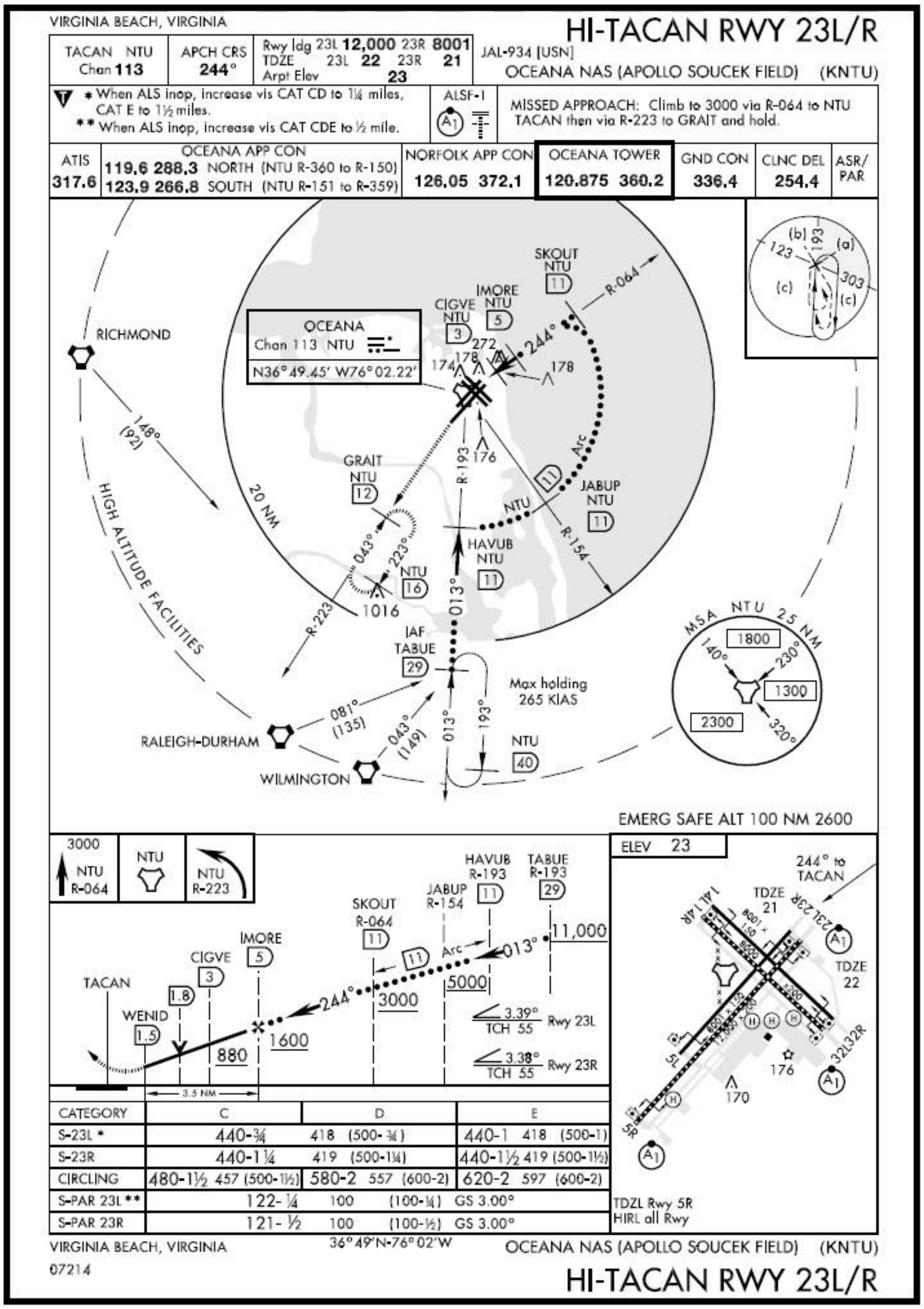


Figure 1-32 Instrument Approach Plate

Consider the following factors as you select an instrument approach:

1. Altitude structure flown (high or low)

2. Navigational equipment aboard aircraft

3. Types of approaches available at your destination

4. Published approach, pilot, and aircraft minimums

5. Weather

In preparing to execute an instrument approach, you should thoroughly familiarize yourself with the following information:

1. Minimum and emergency safe altitudes

2. Initial approach altitude

3. Penetration and final inbound course

4. Altitude restrictions

5. Approach weather minimums

6. Approach minimums (minimum descent altitude (MDA) and/or decision height (DH/DA)

7. Field elevation plus any special notes on terrain or obstacles

8. Missed approach procedures

9. Communications procedures

In addition to approach procedures, instrument approach charts also provide a diagram of the airport (Figure 1-33) showing runway lengths, taxiways, obstructions, arresting gear and barrier locations, approach lighting configuration, buildings and structures, and ground tract from FAF to runway.

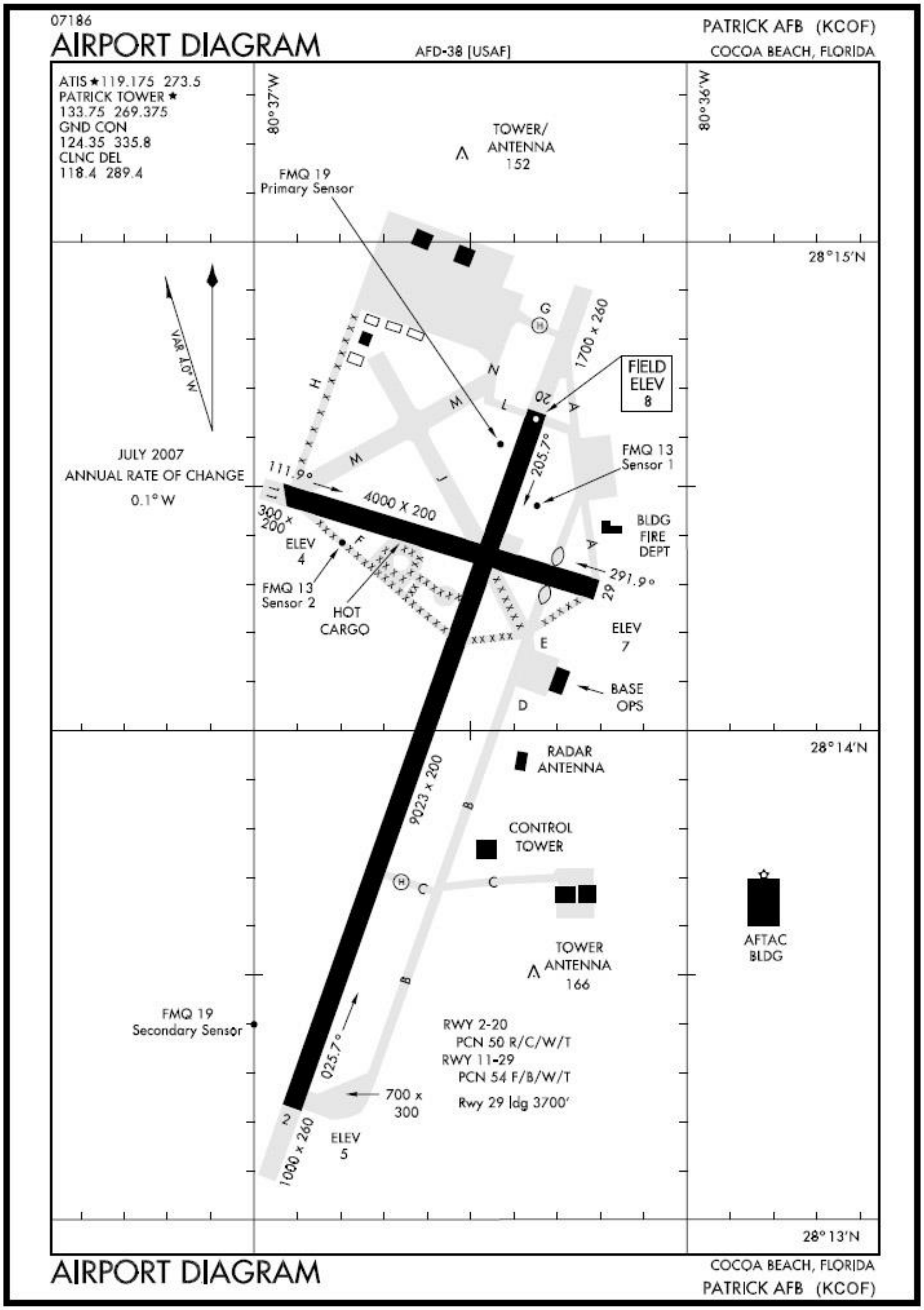


Figure 1-33 Airfield Diagram

Before commencing an instrument approach, you must know which approach procedure is in use and complete the "WARP" checklist: confirm the ***W***eather, ***A***ltimeter setting, ***R***unway in use, and perform ***P***enetration checks.

After determining which approach you desire to fly, request clearance to commence the approach. Clearance for an approach does not constitute clearance to land or give you priority over VFR traffic in the landing pattern; only the control tower may grant you clearance to land; however, the approach control facility (a radar controller) can relay landing clearance to you.

NOTE

Selection of an approach other than the one identified by approach control as the approach in use may cause a delay in clearance. If not equipped for the approach in use, relay that information to the controller on initial contact with approach control.

You may not commence an instrument approach if weather is below minimums unless (1) you are dual-piloted or (2) you are performing a practice approach and do not intend to land, however, if the approach was above minimums when commenced, you may continue to the published minimums regardless of changes in the weather. An approach is considered to commence from an enroute descent when leaving the highest published IAF altitude. For penetration approaches, the approach commences when leaving the IAF. Before commencing an instrument approach, complete the penetration checklist, as follows:

Canopy defog and cockpit temperature:	AS REQUIRED
MASTER ARM switch:	SAFE
CONTROL AUG switch:	ALL
Weather/field conditions:	CHECKED
NAVAIDS:	TUNED/IDENTIFIED
Steering option:	AS REQUIRED
Positional data source:	AS REQUIRED
Wet compass, ADI display, HSI display:	ALIGNED
Standby attitude indicator	ERECT
Standby Barometric Altimeter:	SET AS REQUIRED
LAW:	SET
Fuel:	CHECKED/EST FUEL ON DECK
Approach clearance time:	NOTE AND PLAN HOLDING

a. **Approach Communication Procedures**

In your initial communication with approach control, use the P-A-R format by providing your ***P***osition (if required), your ***A***ltitude and ATIS letter (information Alpha), and ***R***equest an approach. Most often you will be requesting a specific approach (e.g., High TACAN runway 13). In addition, you may also request current weather information, the altimeter setting, and the duty runway (WAR), if ATIS is not available. A prudent SNFO 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. In response to your request, approach control will provide clearance, duty runway, surface wind, ceiling and visibility, current altimeter setting, and missed approach instructions. Whenever the controller gives you instructions containing headings, altitudes, or an altimeter setting, you are required to read that information back.

b. **Ground-Controlled Approach (GCA)**

There are two basic types of ground-controlled approaches: the precision radar approach (PAR) and the surveillance radar approach (ASR). A PAR provides you with the precise course, glidepath, and range information and is classified as a precision approach. An ASR (commonly referred to as a surveillance approach) provides lower resolution course and range information only (no glideslope) and is classified as a non-precision approach.

NOTE

Glideslope is defined as the descent angle assigned to an approach to a given runway for obstacle clearance and/or signal reception. Glidepath is defined as the portion of a precision approach that intercepts the azimuth of an ILS approach or the FAC of a PAR approach.

Both the PAR and ASR approaches are divided into two segments: initial pattern and final approach. Refer to (Figure 1-34) for an illustration of the GCA pattern.

During the initial pattern of an ASR or PAR approach, you will be guided by surveillance radar. This segment includes all maneuvering up to the point at which your aircraft is inbound on the final approach course and at approximately 8 NM from touchdown. During the transition to final, the GCA controller will direct your headings and altitudes. All controller instructions to initiate turns and descents should be complied with immediately. In the pattern, maintain standard rate turns not to exceed 30 degrees AOB.

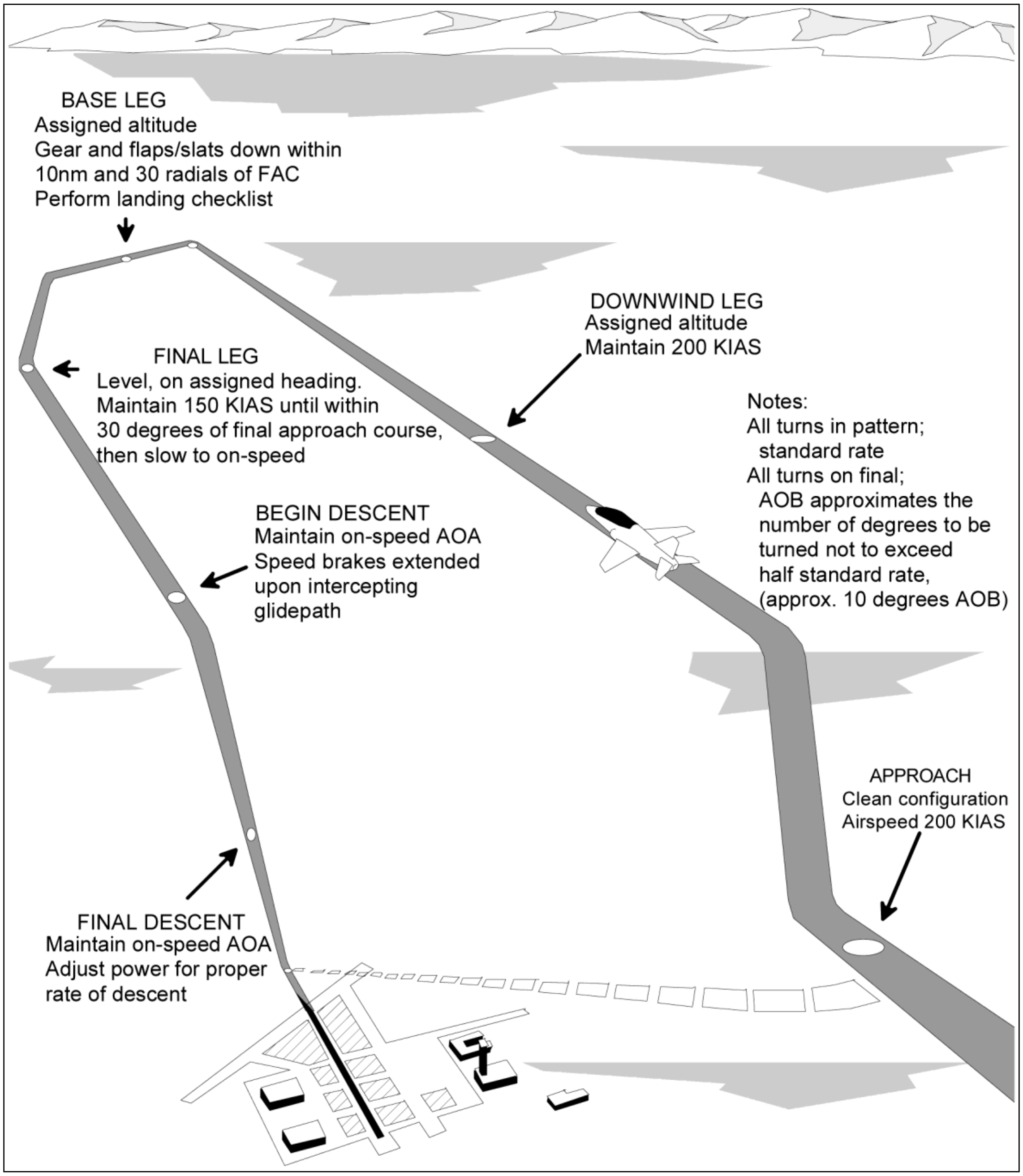


Figure 1-34 GCA Pattern

Radar approach minimums can be found in the FLIP instrument approach procedure publications, both on the approach plates and in the radar approach minimums section (Figure 1-35). Although some published approach minimums are lower than 200-1/2, you are limited to absolute minimums of 200-1/2 when single-piloted.

RADAR INSTRUMENT APPROACH MINIMUMS

OCEANA NAS (KNTU)

RADMINS

OCEANA NAS (KNTU), (APOLLO SOUCEK FIELD) VA (07214 USN) **ELEV 23**

RADAR - (E) 124.825 310.8 328.4 346.4 348.75 352.1 363.1 ▼

	RWY	GS/TCH/RPI	CAT	DH/ MDA-VIS	HAT/ HAA	CEIL-VIS
PAR ⑥	5R ①	3.0°/36/682	ABCDE	**120**-¼	100	(100-¼)
	23L ①	3.0°/42/798	ABCDE	**122**-¼	100	(100-¼)
	32L ①	3.0°/41/785	ABCDE	**123**-¼	100	(100-¼)
	5L	3.0°/40/752	ABCDE	**121**-½	100	(100-½)
	23R	3.0°/44/842	ABCDE	**121**-½	100	(100-½)
	14R	3.0°/38/720	ABCDE	**122**-½	100	(100-½)
PAR	14R		ABCDE	**300**-1¼	278	(300-1¼)
W/O GS ⑦	32L ④		ABCDE	**360**-¾	337	(400-¾)
	5R ②		ABCD	**420**-¾	400	(400-¾)
			E	**420**-1	400	(400-1)
	5L		ABCD	**420**-1¼	399	(400-1¼)
			E	**420**-1½	399	(400-1½)
	23L ③		ABC	**460**-¾	438	(500-¾)
			DE	**460**-1	438	(500-1)
	23R		ABC	**460**-1¼	439	(500-1¼)
			DE	**460**-1½	439	(500-1½)
PAR	14L		AB	**320**-1	300	(300-1)
SIDESTEP ⑦			C	**320**-1½	300	(300-1½)
			DE	**320**-2	300	(300-2)
	32R		AB	**360**-1¼	339	(400-1¼)
			C	**360**-1½	339	(400-1½)
			DE	**360**-2	339	(400-2)
	5L		ABC	**420**-1½	399	(400-1½)
			DE	**420**-2	399	(400-2)
	23L		ABC	**460**-1½	438	(500-1½)
			DE	**460**-2	438	(500-2)
	23R		ABC	**460**-1½	439	(500-1½)
			DE	**460**-2	439	(500-2)
PAR W/O GS	14L		AB	**320**-1¼	300	(300-1¼)
SIDESTEP ⑦			C	**320**-1½	300	(300-1½)
			DE	**320**-2	300	(300-2)
	32R		AB	**360**-1¼	339	(400-1¼)
			C	**360**-1½	339	(400-1½)
			DE	**360**-2	339	(400-2)
	5L		AB	**420**-1¼	399	(400-1¼)
			C	**420**-1½	399	(400-1½)
			DE	**420**-2	399	(400-2)
	23L		AB	**460**-1¼	438	(500-1¼)
			C	**460**-1½	438	(500-1½)
			DE	**460**-2	438	(500-2)
	23R		AB	**460**-1¼	439	(500-1¼)
			C	**460**-1½	439	(500-1½)
			DE	**460**-2	439	(500-2)

(Continued on next page)

RADAR INSTRUMENT APPROACH MINIMUMS

1

Figure 1-35 RADAR Instrument Approach Minimums

i. **GCA Communication Procedures**

During a GCA, your position in the pattern and on final will be directed by a controller who will continuously feed you course and heading information and, in the case of a PAR approach, glidepath information on final.

In the pattern, you are required to acknowledge all radio calls and read back all headings, altitudes, and altimeter settings. According to FAR 7110.65, the controller is required to give missed approach instructions, weather conditions (if less than VFR), altimeter, and lost comm instructions (if likely to encounter IMC).

In the pattern, the controller must communicate with you at least once a minute, and you are required to acknowledge the controller's calls. If you hear no transmissions for more than 60 seconds, attempt to contact the controller. If you are unable to reestablish contact, then comply with the lost communication instructions. While you are flying the pattern, the controller will furnish the following information:

(a). Type of approach to expect (precision or surveillance)

(b). Duty runway

(c). Location of the missed approach point (MAP) (surveillance only)

(d). Advisory to perform landing check (USN/USMC controllers only)

(e). Missed approach and lost communication instructions

Additionally, the controller will give you position information and heading changes, as necessary, to keep you on course.

As you commence your final approach, the final controller will perform a radio check: "This is the Sherman final controller. How do you hear?" You should respond with "loud and clear, three down and locked" (or position of gear). The controller may also tell you that you need not acknowledge further transmissions. On final approach, the controller is required to make contact with you at least every five seconds on a PAR or 15 seconds on an ASR. If you lose contact with the controller for the respective amount of time for the approach being flown, attempt to contact the controller and, if not successful, execute the lost communication instructions.

ii. **GCA Pattern**

The entry configuration for the GCA pattern is as follows:

(a). Airspeed: 200 KIAS

(b). Gear: Up

(c). Speed brakes: In

(d). Flaps/slats: Up

(e). NAVAIDS: Tuned

Normally, you will fly the first leg of the pattern (the downwind leg) straight and level at 200 KIAS and pattern altitude. At the end of the downwind leg, the controller will direct a turn to base leg. At the end of the base leg, the controller will direct a turn to either a dogleg or the final approach course. Once established on the downwind leg or on a dogleg to the FAC, unless directed by ATC, stay clean and at 200 KIAS until you are within 10 NM and 30 radials of the final approach course. When within those parameters, verbalize to your IP "slow to gear speed," wait for three green gear lights, and complete the landing checklist (speed brakes retracted).

NOTE

USN/USMC controllers will state "perform landing checks" on the base leg; this is only a reminder and does not direct the pilot to dirty up. If the controller says "slow to approach speed," the controller is directing this for sequencing and the aircrew must comply or state that they are unable.

NOTE

GCAs can be flown at full, one-half, and no-flap configurations.

Because the remaining PAR and ASR final approach procedures differ considerably, they will be discussed separately below.

iii. **PAR Final Approach**

At the beginning of a PAR final approach, you will be straight and level, on-speed, and normally at approximately 1,500 ft AGL. Verify gear down, flaps at half or full. When the controller informs you that you are "on glidepath," direct the IP to extend the speed brakes and adjust power as required to establish a descent. Report "speed brakes full, landing checklist complete" on the ICS.

The rate of descent will vary for different glideslope angles and ground speeds. The inside back cover of the approach plates contains a chart that will provide you with the rate of descent for a given glideslope and ground speed. Your IP will adjust power to maintain your rate of descent and keep the aircraft on-speed. When making heading corrections, keep the amount of bank angle small

(5–10 degrees) so that you do not end up chasing the heading. If you get off heading, do not try to correct to course, return to your last assigned heading.

As you near the decision height, begin an "inside/outside" scan to visually acquire the runway environment. If you do not have the runway environment in sight when you reach the DH/DA, direct the IP to execute a missed approach (make the mandatory missed approach call).

iv. **ASR Final Approach**

On the ASR final approach, the controller cannot furnish glideslope information. It will be up to you to establish and maintain the correct rate of descent. The controller will identify the missed approach point (MAP) in nautical miles from the end of the runway and will direct the descent by stating "begin descent." On SNFO request, the controller will provide recommended altitudes each mile on final. Recommended altitudes decrease 300 ft per mile (approximates a three-degree glideslope). In order to smoothly level at MDA prior to the MAP, your altitudes should be slightly lower than those recommended. Depending on your ground speed, a descent rate of 500–700 fpm will allow you to descend to the MDA prior to reaching the MAP. Upon reaching the MAP, if you do not have the runway in sight or are otherwise unable to perform a safe landing, direct the IP to execute the missed approach as instructed.

c. **Radio Instrument Approaches**

Radio instrument approaches, unlike GCAs, employ onboard navigational equipment as a guide and can be flown, if necessary, without communication with the ground. In the T-45C, you will fly these approaches—VOR, TACAN, localizer, and ILS—in accordance with the published instructions found on high or low altitude approach plates.

Plan ahead by reviewing the procedures for the chosen approach before arriving at the IAF; stay ahead of the aircraft during the approach. Use all available NAVAIDs during the approach as backups in the event of equipment malfunction. If, for example, you are flying an ILS approach at a field that also has a TACAN, you should also tune the TACAN and select both TCN and ILS steering. TACAN course information is shown on the HSI display, and ILS information is shown on the ADI and HSI.

i. **VOR Penetration Approach**

VOR navigational aids supply only bearing information to the VOR station you have tuned. Instrument approaches flown to these facilities usually rely on direct over flight of the station during the approach (Figure 1-36).

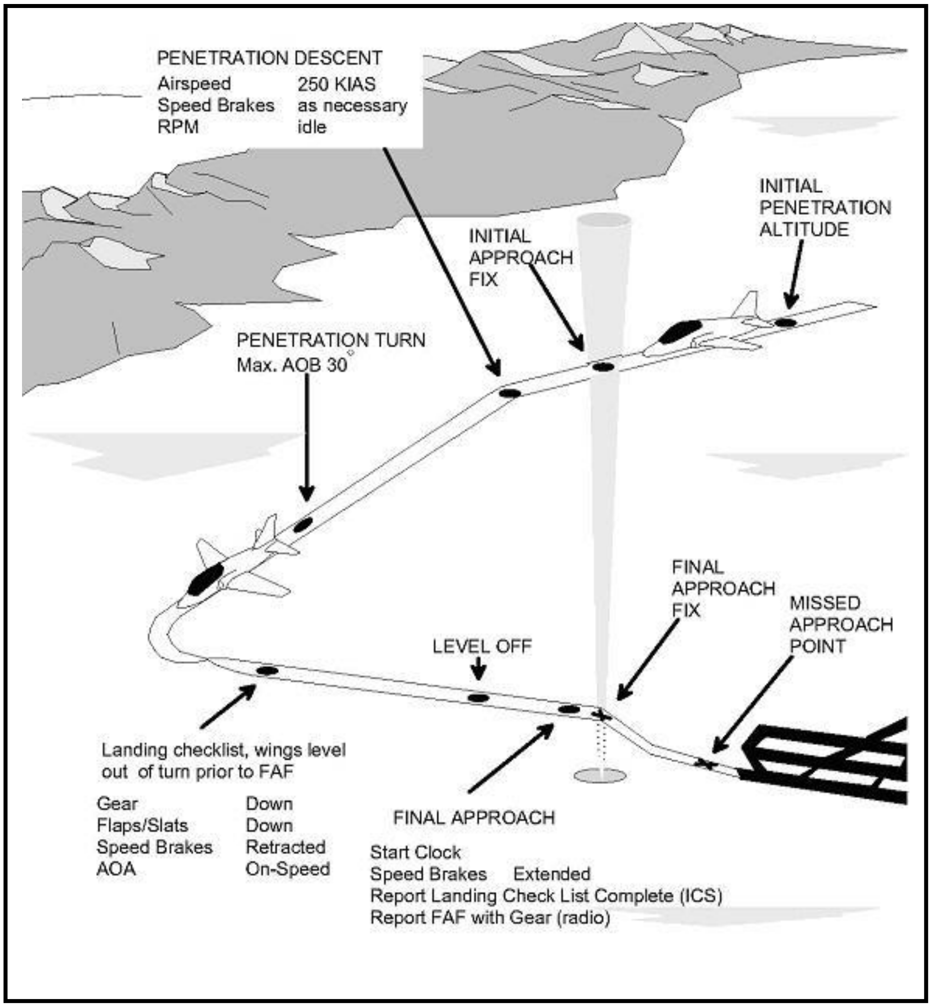


Figure 1-36 Non-DME Penetration

The VOR penetration approach is generally a procedure turn (i.e., 90/270, teardrop). Before beginning the approach, set the final approach course on the HSI display. The HSI must be in the CDI mode in order for VOR information to be displayed. Begin the approach when you pass over the station on the altitude and heading prescribed by the approach plate.

At one half your initial altitude or at reaching the published penetration turn altitude, initiate the penetration turn (do not exceed 30 degrees AOB) to intercept the final approach course.

NOTE

Do not exceed the “minute-to-live” rule in the penetration descent.

At this point, the approach procedure can vary depending on whether the NAVAID is located at the field or not.

If the approach has an FAF (station located away from the field), station passage is normally the FAF, and timing will determine the MAP. After completing the penetration turn, transition to the landing configuration and check speed brakes retracted prior to reaching the FAF. At station passage, start timing to the MAP, basing your timing on ground speed and the FAF to MAP table on the approach plate under the sketch. Extend speed brakes, reduce power if necessary, and transition to descend on-speed to MDA. (Do not exceed 1,000 fpm.) Report FAF with gear to ATC and landing checklist complete on the ICS. Continue to a landing if you visually acquire the runway up to the MAP and you are in a position to land or maneuver to land safely. If you do not have the runway environment in sight when at the MAP (i.e., time expires), execute a missed approach.

If the approach does not have an FAF (station located at the field), transition to the landing configuration (on-speed and speed brakes extended) as soon as you are wings level inbound to the station. Descend to the published MDA using the procedures in the paragraph above and start looking for the runway. Station passage is usually the missed approach point (MAP) for this type of approach.

If executing a low altitude TACAN and VOR approach that requires the aircraft to stay within 10 NM of the IAF/field, maintain 200 KIAS during the procedure turn and penetration.

ii. **TACAN Approach**

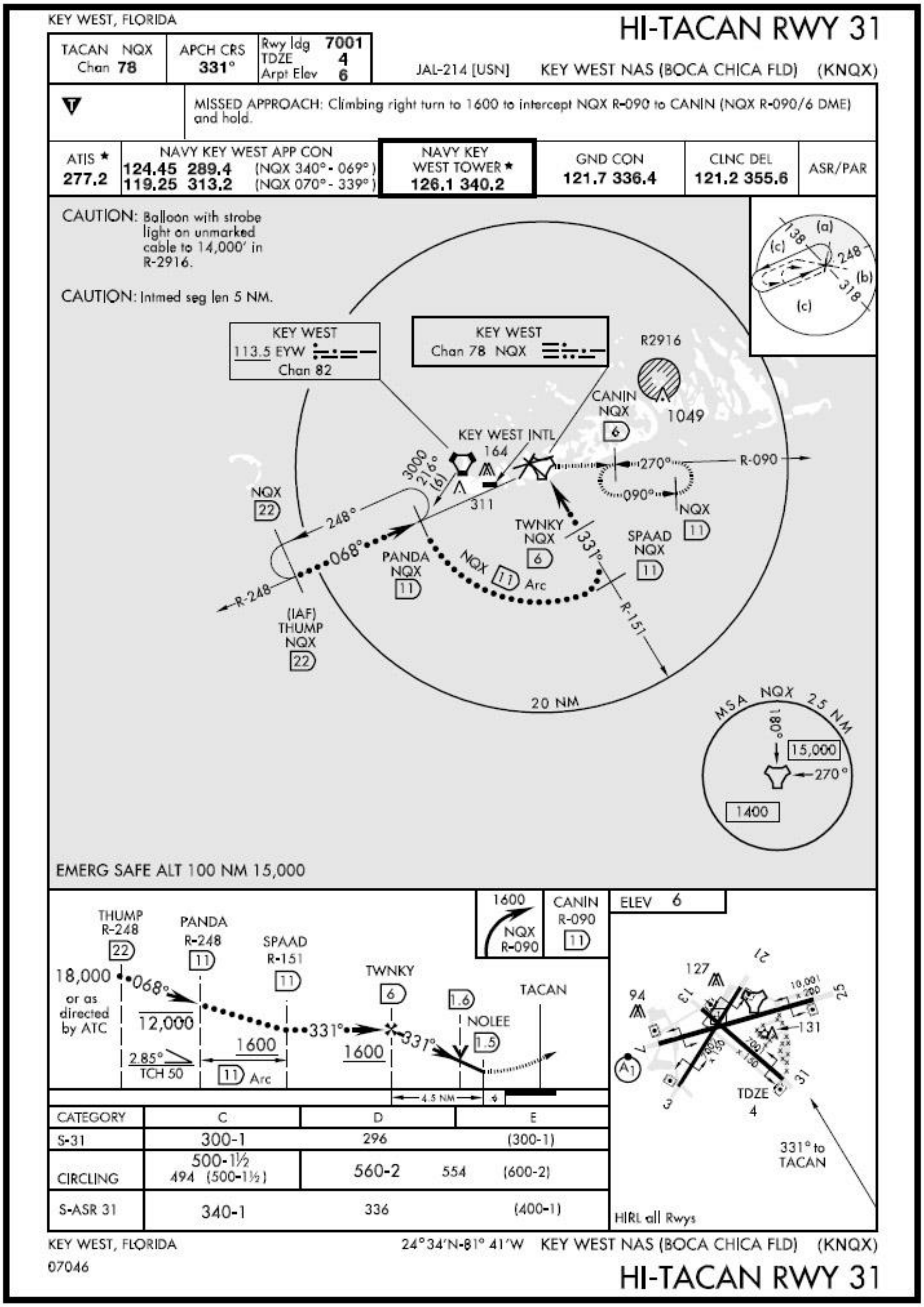
TACAN (and VOR/DME) navigational equipment supplies both range and distance information, making arcing approaches possible. Because range information is available, you can determine the fixes (IAF, FAF, and MAP) defined by DME (Figure 1-37).

The course line may be used for tracking all radials on the approach (e.g., initial inbound radial and final approach course).

When executing a TACAN/VOR DME approach and before reaching the IAF, set the final approach course on the HSI display and select the CDI mode. At the IAF, intercept and maintain the approach course as published. Direct the IP to lower the nose and accelerate to 250 KIAS. Report departing the IAF if requested. Start penetration turn 2.5 NM DME from the arc. At 5–7 NM prior to the FAF, direct the IP to “slow to gear speed.” Configure the aircraft for landing 3–5 NM prior to the FAF and perform landing checklist (speed brakes retracted). Conform to all course, altitude, and DME instructions on the approach plate. Lead level off from penetration by 1,000 ft if VSI pegged at 6,000 fpm.

At the FAF, start the clock, direct the IP to extend speed brakes, report landing checklist complete on the ICS, and make gear down call to ATC. Descend to the MDA and start looking for the runway while monitoring your DME for the MAP. Plan your descent to be in level flight at the MDA prior to reaching the MAP. From the FAF, maintain precise course, speed, and rate of descent control. Do not exceed 1,000 fpm. Keep heading changes small so you do not chase the final approach course on the HSI display or the course situation steering arrow on the HUD.

When you reach the MAP, if you do not have the runway environment in sight or determine that a safe landing is not possible, direct the IP to execute a missed approach.



CATEGORY	C	D	E
S-31	300-1	296	(300-1)
CIRCLING	500-1½ 494 (500-1½)	560-2 554	(600-2)
S-ASR 31	340-1	336	(400-1)

Figure 1-37 TACAN Approach

iii. **ILS Approach**

Glideslope and localizer needles are displayed on the ADI display and HUD, and localizer deviation is displayed on the HSI when an ILS frequency is selected on the VOR control panel and ILS is the only selected steering. TACAN or WYPT can be selected in conjunction with ILS steering. In this case, TACAN or waypoint course deviation is shown on the HSI, and ILS deviation is shown on the ADI. The HUD displays either the TACAN or the waypoint steering arrow and the ILS needles (Figure 1-38).

The ILS approach is a precision approach in which you are provided precise glideslope, azimuth (course), and range information. The ILS (Figure 1-39) is composed of three elements: the localizer transmitter, the glideslope transmitter, and marker beacons. As with any approach, you should back up the ILS approach with any other available NAVAIDs.

The localizer transmitter provides azimuth information to the HSI display course line (ILS selected as the only steering selection), azimuth deviation bar on the ADI display, and the HUD for maintaining alignment with the approach course.

The localizer signal has a maximum range of 18 NM from the station, if you are within 10 degrees either side of the course centerline.

The glideslope transmitter provides glideslope information to the glideslope deviation bar on the ADI display and HUD. Glideslope transmitters have a normal range of approximately 10 nm, if you are on or near the localizer course; however, at some locations, the glideslope has been certified for an extended service volume that exceeds 10 nm.

When over flown, the three marker beacons (outer, middle, and inner) provide a distance (range) reference by sounding an aural tone and illuminating one of three marker beacon lights on the instrument panel. Although there are a maximum of three marker beacons, most ILS approaches do not have all three, and some do not use them at all. If beacons are not present, cross-radial fixes, DME, or radar is required. The outer beacon usually marks the FAF and will often indicate the point of glidepath intercept. The middle marker denotes the vicinity of the DH/DA for category I approaches (the T-45C is equipped for Category I) and progress points for categories II and III. You will cross the middle marker approximately half a mile from the runway, at 200 ft AGL (this may vary depending on local terrain and minimums). The inner marker denotes the DH/DA for category II approaches and is a progress point for category III approaches. You will usually cross the inner marker at 100 ft AGL. Fly the portion of the approach prior to intercepting the localizer using VOR or TACAN (depending on the published procedure; Figure 1-40). If you are using VOR prior to localizer intercept, ensure that you have tuned and identified the ILS frequency. Upon selection of an ILS frequency, the VOR steering selection will automatically change to ILS steering. Set the ILS final approach course on the HSI display course selection so that the ILS azimuth deviation is correctly shown on the CDI. If you are using TACAN prior to localizer intercept, select TACAN and ILS steering. TACAN course information is shown on the HSI display, DME is shown on the HSI display and the HUD, and ILS information is shown on the ADI display and the HUD (Figure 1-40). Select MKR and VOR on the comm control panel to monitor the audio signals of the localizer signal and when passing the marker beacons.

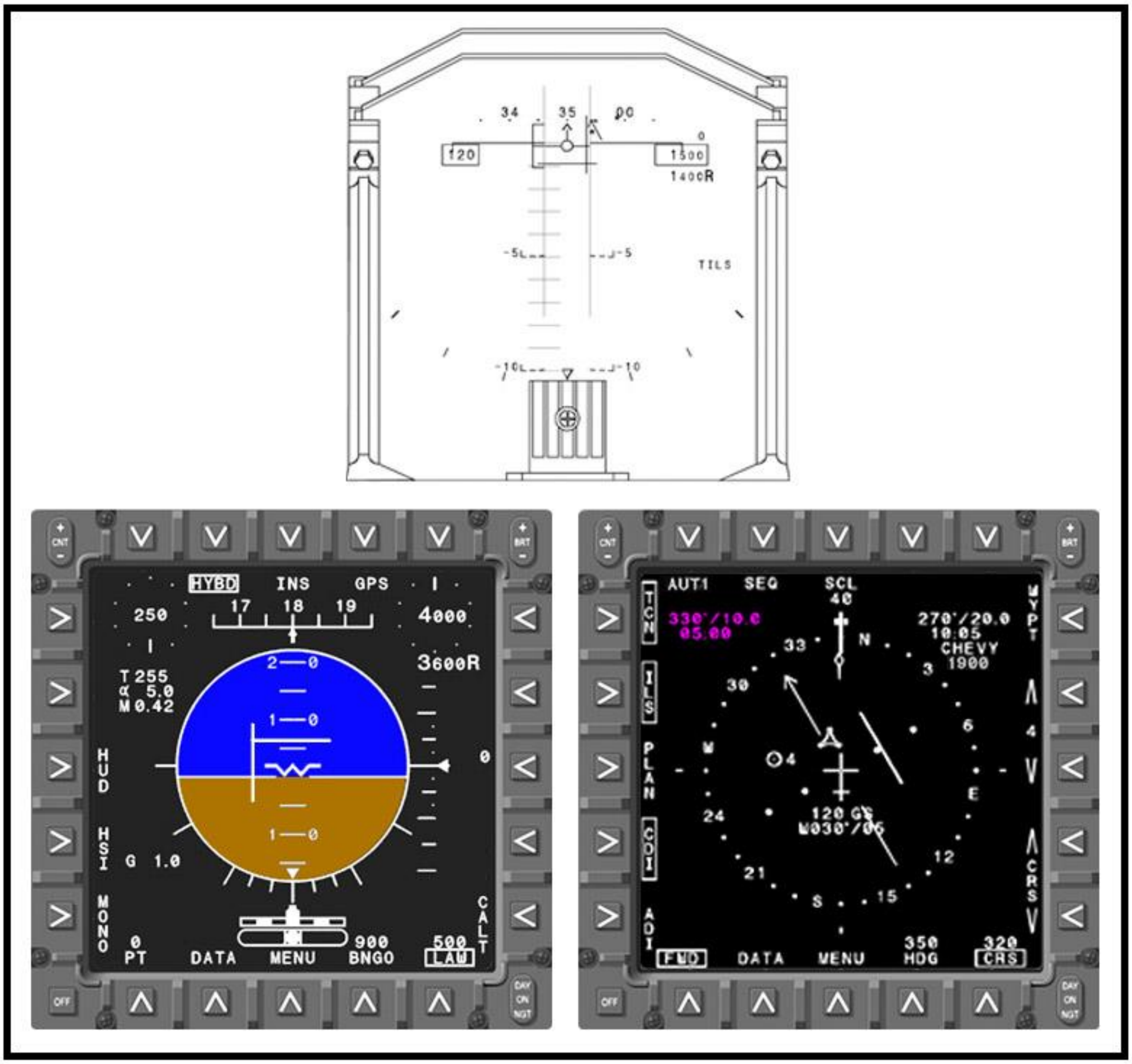


Figure 1-38 ILS Displays

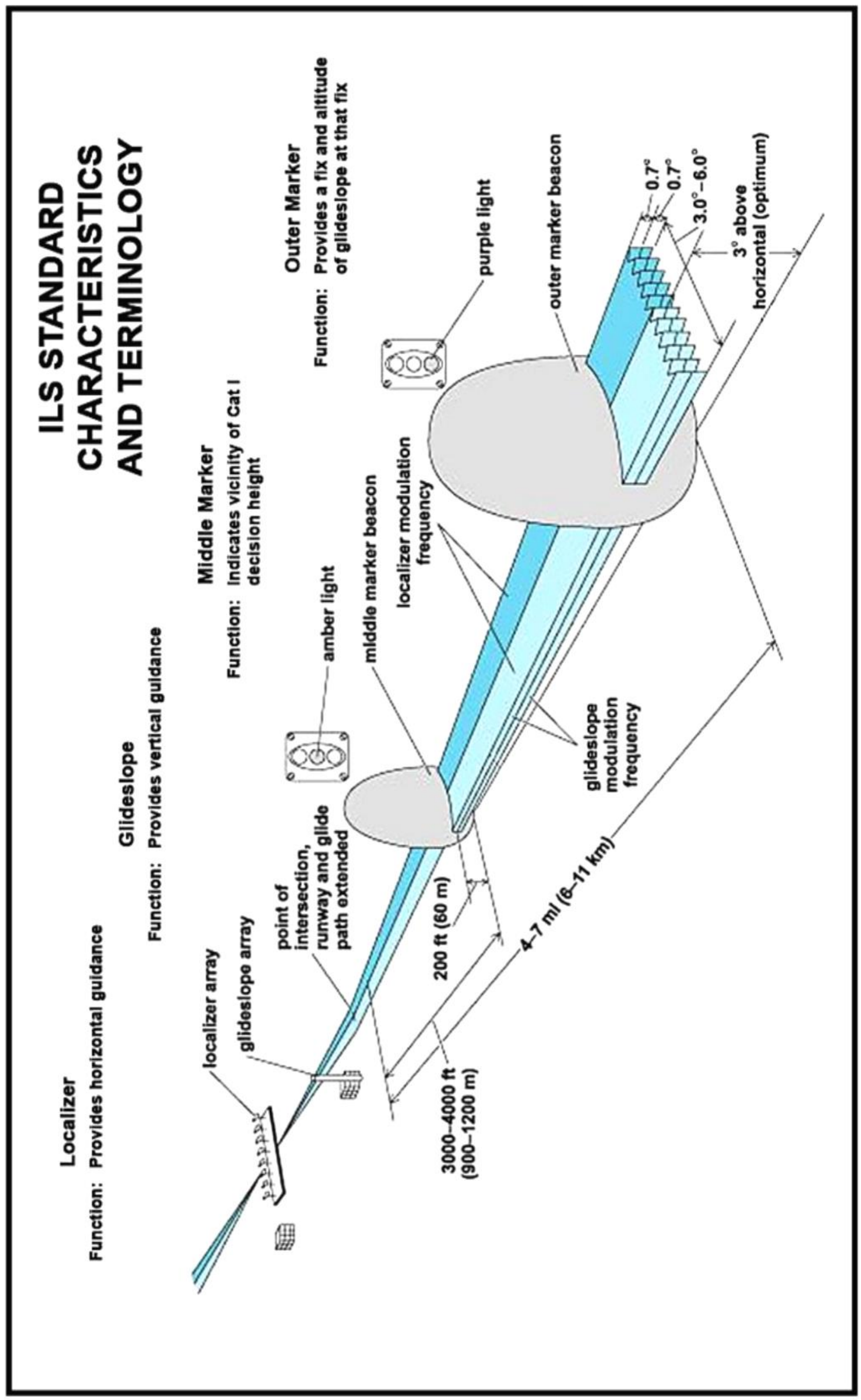


Figure 1-39 ILS Components

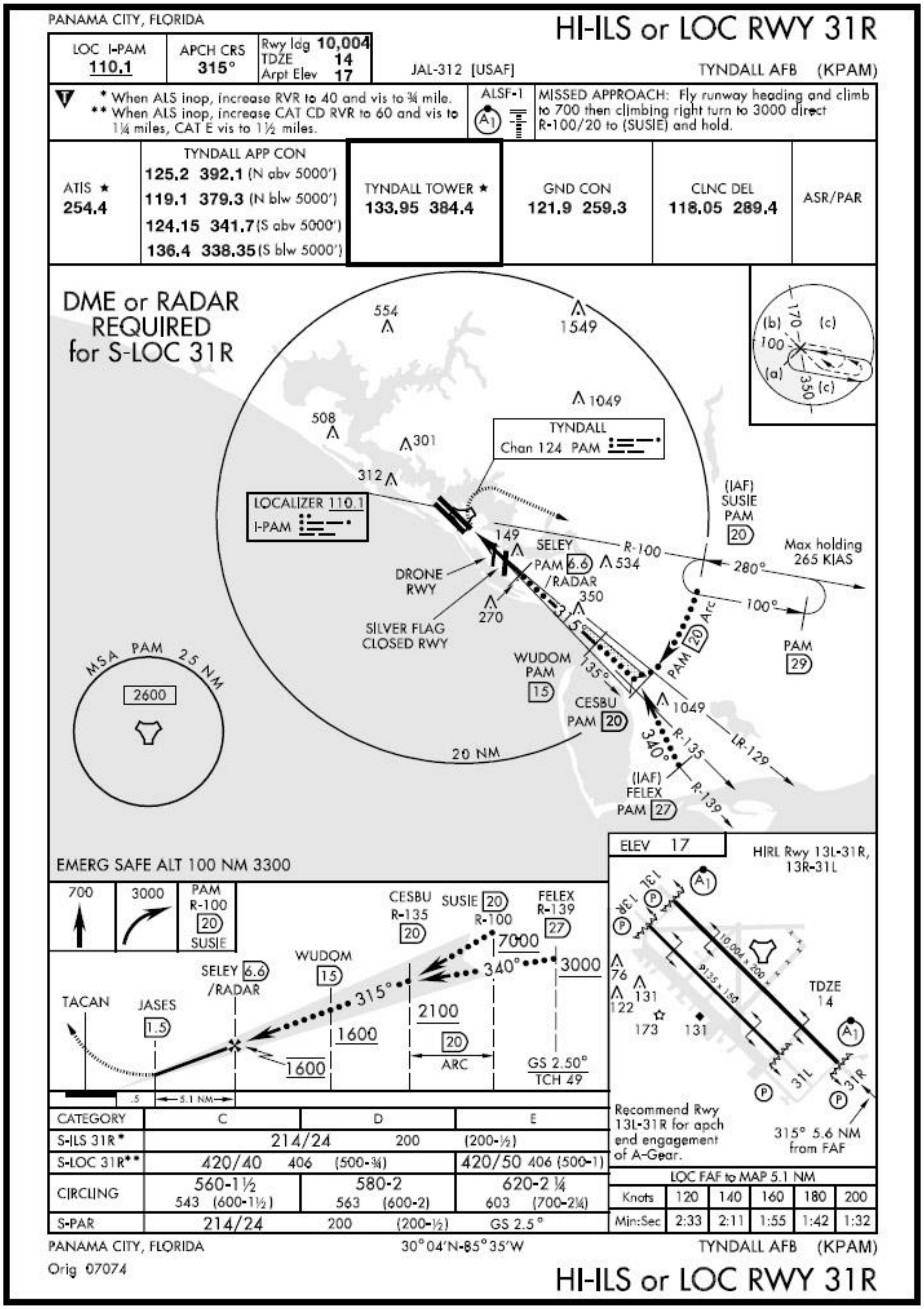


Figure 1-40 ILS Approach

If the penetration is performed on VOR, transition to landing configuration and on-speed, immediately after completing the penetration turn with the speed brakes retracted (if used in the transition). If the penetration is performed on TACAN or VOR DME, direct the IP to "slow to gear speed" 5-7 DME prior to the FAF. Speed brakes should be retracted if used before the FAF.

NOTE

Transition to the landing configuration and on-speed for an ILS approach with DME is performed using the same procedures as TACAN or VOR DME.

– **Radar Vector to ILS Final**

Since a vector to an ILS final is a controlled, non-formalized procedure to a precision approach, aircrew should use logic and common sense when determining an appropriate time to transition from 250 KIAS to the landing configuration and 150 KIAS and then to on-speed. As a rule of thumb, it is appropriate to initiate the transition to the landing configuration anytime the aircraft is established on a base leg or within 10 NM of the FAF and on an intercept heading to the FAC, within 10 NM. It is important not to transition late.

By the time you intercept the glidepath, you should be flying on-speed with the landing checklist completed (speed brakes retracted).

Immediately prior to glidepath intercept, as indicated by the glideslope deviation bar on the ADI display or HUD, verify on-speed with airspeed. As the glideslope deviation bar intercepts the glidepath, extend the speed brakes and adjust pitch and power as required to maintain on-speed and stay on glidepath. Maintain course by making corrections using heading changes no greater than +/- 5 degrees from the WCH. At the FAF, start the clock and report FAF with gear, if necessary, to the ATC and landing checklist complete on the ICS. Descend to the DH/DA. When approaching the DH/DA, start looking for the runway while monitoring your range indications, marker beacons, and/or DME. Although you normally refer only to the barometric altimeter (using the current altimeter setting) to determine the DH/DA, use radar altimeter as a backup, but be aware of extreme terrain features that could make the radar altimeter a dangerous alternative.

The elapsed time clock is started when passing the FAF in case the glideslope signal information is lost during the approach. If this happens, you can (depending on minimums) continue flying the localizer only, using time to determine the MAP.

If, upon reaching the DH/DA on an ILS approach or the MDA on a localizer approach, you do not have the runway environment in sight or you determine that you cannot make a safe landing, execute a missed approach.

iv. **Localizer Approach**

The localizer approach uses the ILS equipment, minus glideslope signal generation equipment. You may have to perform this approach because of equipment failures in your aircraft, on the ground, or because the runway lacks a glideslope transmitter. The localizer approach is non-precision with minimums higher than a full ILS approach to the same runway (Figure 1-41). The MAP is determined by timing from the FAF, by DME, or by radar. As in the ASR, plan your descent so that you are leveled off and on speed prior to the MAP.

CATEGORY	C	D	E
S-ILS 31R *	214/24 200 (200-½)		
S-LOC 31R**	420/40 406 (500-¾)		420/50 406 (500-1)
CIRCLING	560-1½ 543 (600-1½)	580-2 563 (600-2)	620-2 ¼ 603 (700-2¼)

Figure 1-41 ILS Minimums

v. **Back Course Localizer Approach (BC LOC)**

The back course localizer is established along the centerline of a runway in the opposite direction to the front course.

Caution should be taken when flying a back course LOC approach because of reverse sensing when the back course is selected in the HSI display. To center the CDI, it will be necessary to steer the aircraft in the direction opposite the CDI deflection. An alternate procedure is to set the front course into the HSI display. This will induce a normal sensing display in the HSI display. Again, caution should be taken because the azimuth deviation bar in the ADI display will continue to display reverse sensing.

Whichever procedure is used, a higher level of concentration is required from the SNFO to maintain orientation and fly the approach correctly.

vi. **No-Gyro Compass Approach**

A no-gyro approach is ASR/PAR performed when you lose primary heading information. During this approach, the controller will transmit your turns using “turn right/turn left” and “stop turn.”

vii. **BINGO Profile**

The BINGO profile for the T-45C is defined in NATOPS. During simulator flights, you may be asked to perform this maneuver. Refer to the NATOPS for all BINGO procedures.

viii. **Simulated Minimum Fuel Approaches**

On vectors for ILS or in the GCA box, remain in the clean configuration until 30 seconds before glidepath intercept. Direct the IP to “slow to gear speed.”

ix. **Simulated Minimum Fuel GCA**

When a minimum fuel GCA is requested, ATC will give normal GCA box pattern vectors (intercept glidepath at approximately six miles from the end of the runway) and expect 200 KIAS until final. ATC should also provide a 30-second gear warning. The call “perform landing checks” is a required USN/USMC advisory call on the base leg and does not mean to dirty up or reduce airspeed.

x. **Simulated Minimum Fuel ILS**

Request vectors to ILS final and advise the ATC that you will maintain 200 KIAS until glidepath intercept. The glideslope needle starting to move down serves as a 30-second glidepath warning.

xi. **Simulated Emergency Fuel GCA**

This GCA is designed to get you from altitude to the deck without any undue delay and is actually a practice procedure for dealing with emergency fuel situations. The controller will vector you direct to final approach with a continuous turn from downwind to final, providing a glidepath intercept much closer to the runway than a normal GCA. The controller will vector you to intercept a final at approximately four miles from the end of the runway at 800 ft AGL. The controller may ask how much fuel you have remaining in minutes and will attempt to get you on the deck prior to simulated fuel exhaustion. Request a 30-second prior to glidepath intercept call from the controller. You will remain in a clean configuration until the 30-second call is heard. Then direct the IP to “slow to gear speed.”

xii. **Simulated Emergency Oil/Precautionary Instrument Approach**

The emergency oil instrument approach is a precautionary approach (PA) (see NATOPS), that is modified for actual instrument conditions or nighttime. On a day visual meteorological conditions PA, the “aimpoint” is short of the runway on a 10-degree (approximately) glideslope; however, the emergency oil approach “aimpoint” is the touchdown point for the PAR or ILS. Also, the glideslope is more shallow, so the transition to half and full flaps is delayed to ensure that airspeed does not bleed too rapidly.

The emergency oil/precautionary instrument approach, like the emergency fuel instrument approach, will get you on the deck without any delays. It sets the power at an appropriate setting for an impending engine failure.

When given the simulated emergency and conducting an emergency oil precautionary instrument approach, set the power to 85-87 percent RPM (see NATOPS). 87 percent should be used with extreme flying conditions, i.e., high elevation or a hot summer day. If given outside the GCA box pattern, monitor and control airspeed with speed brakes, as necessary, to expedite landing without causing an unduly difficult transition to gear speed and glidepath. In the GCA box, use the speed brakes to maintain 200 KIAS. When given the “up and on glidepath” call (approximately 6 NM from touchdown) on a PAR or as the needles center on the ILS, direct the IP to “slow to gear speed.” The IP will lower gear and set flaps to half while lowering the nose to maintain the glidepath at 175 KIAS.

If during an actual emergency, the landing environment is not in sight at decision height or a safe landing cannot be completed, direct the IP to execute a waveoff as follows: retract the speed brakes, raise the gear, and slowly position the nose to a climb attitude. When above 300 ft AGL and indicating a positive rate of climb, raise the flaps (140 KIAS minimum). ***Do not*** reset power. Use speed brakes as necessary to maintain 200 KIAS in the GCA box pattern.

d. **Visual Maneuvers**

Once you reach the MAP or are cleared by ATC for a visual approach, you will complete your approach and landing VFR. Non-precision approaches that have a visual descent point (VDP) require you to remain at the MDA until the visual descent point is passed.

i. **Contact Approach**

The contact approach is an IFR procedure that you can request when you are operating on an IFR flight plan in VMC conditions. To request a contact approach, you must be clear of the clouds with at least 1 SM of visibility and have an unobstructed view of the ground. During a contact approach, you may deviate from the published approach procedure and proceed to landing via visual references. You may not perform a contact approach to an airport that lacks an authorized instrument approach procedure or conduct an approach to one airport and then, when "in the clear," discontinue that approach and proceed to another airport. The pilot must specifically request it and obtain clearance from approach control. During a contact approach, you are still operating under IFR, and ATC will provide separation from other aircraft; however, you are responsible for your own obstruction clearance. Radar service, if you are receiving it, will be terminated when you are told to contact the tower.

ii. **Visual Approach**

During a visual approach, an aircraft on an IFR flight plan operating in VMC conditions and having received an Air Traffic Control authorization may deviate from the prescribed instrument approach procedures and proceed to the destination airport by maintaining VFR conditions. ATC may initiate a visual approach, but you are never required to accept it.

Certain conditions must be met before you can fly a visual approach: (1) the field or a preceding aircraft must be in sight, (2) the ceiling must be at least 1,000 ft AGL, and (3) there must be at least 3 SM of visibility.

iii. **Circling Approach**

The circling approach is used to align aircraft with the proper runway at the end of an instrument approach. The runway is often not the same one to which the instrument approach was flown. The minimums for a circling approach differ from the others published for a given runway. Circling minimums are higher than other instrument minimums and require you to remain VMC beneath the clouds while maneuvering to land.

Once you have elected to conduct a circling approach and have obtained clearance, descend to the circling minimums and visually acquire the runway. The applicable minimums are those published for the ***approach flown (not necessarily for the landing runway)***.

Once you descend to the MDA, determine if visibility is sufficient to safely complete the landing. If it is, choose the landing pattern (Figure 1-42) that is best suited to your situation or use the one directed by the controller. Stay at the MDA until you are in a position to execute a normal landing. Ideally, this is the point at which you would intercept the normal glideslope to the runway. If weather permits, fly the circling maneuver at the normal VFR pattern altitude. Be sure to check the approach plate for any obstacles in the vicinity of the airport.

If you cannot safely complete the landing, execute a missed approach utilizing the applicable missed approach procedures for the approach flown (not necessarily for the landing runway).

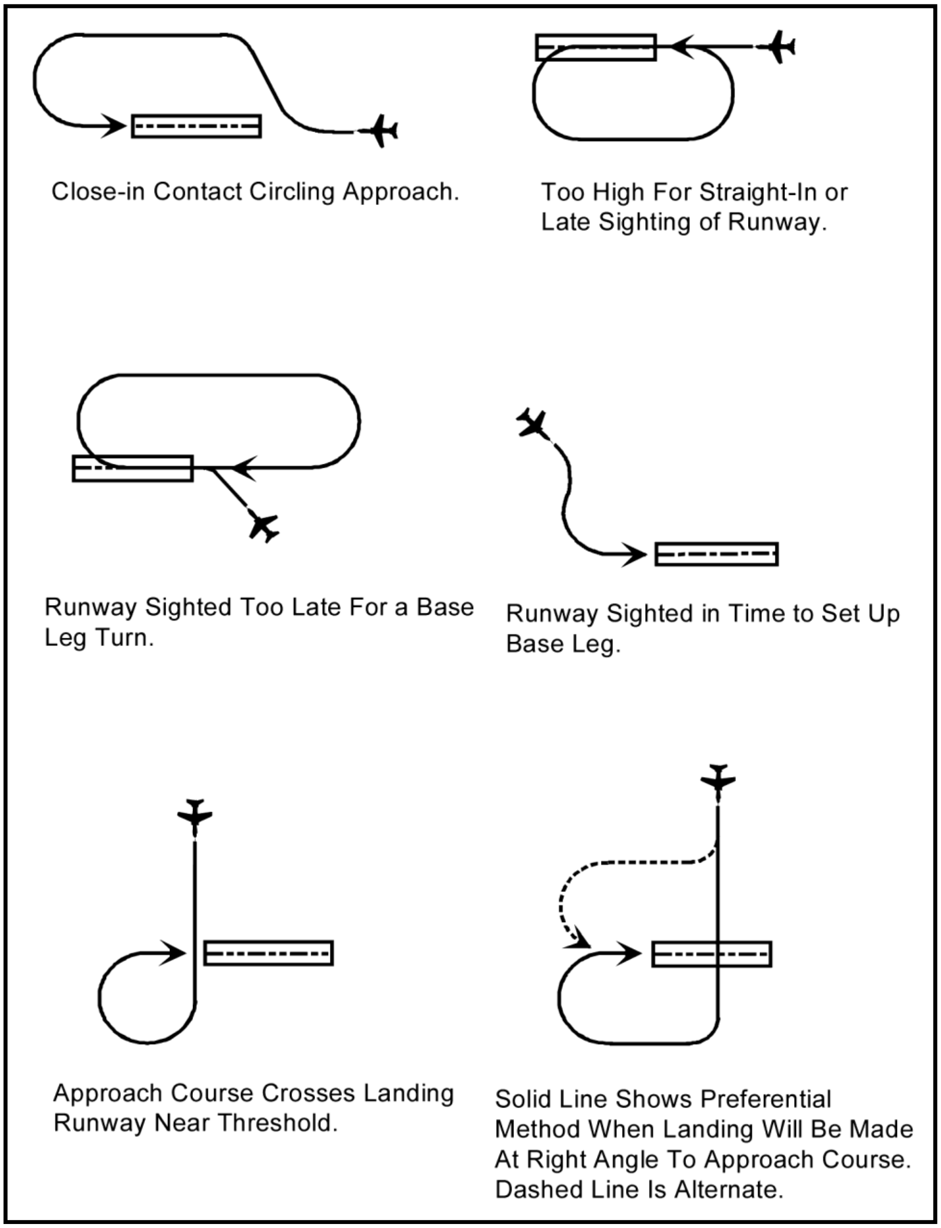


Figure 1-42 Circling Approach Options

iv. **Flap Setting**

Due to the number of approaches required in a given instrument training sortie and the transit times to practice airfields, practice approaches are normally performed with half flaps; however, approach configuration for full stop landings should be full flaps.

e. **Missed Approach**

You will execute a missed approach anytime you reach the MAP or DH/DA on an approach and you do not have the runway environment in sight, you lose sight of the runway when circling, a safe landing is not possible, or when instructed by your controller to do so. If you execute a missed approach while circling to land, direct the IP to turn to fly over the airport center, then fly the published missed approach.

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CHAPTER TWO
EMERGENCY PROCEDURES

200. INTRODUCTION

Simulator instruction during the Familiarization stage of training is intended to improve student knowledge and performance in the following areas:

1. CHECKLISTS: Accurate and efficient completion of aircraft checklists

2. SCAN: Instrument scan

3. AIRCRAFT KNOWLEDGE: Knowledge of the T-45C aircraft through normal operation of aircraft systems and the detection and correct execution of procedures for aircraft emergencies

4. COMMUNICATIONS: Radio communications

5. COCKPIT RESOURCES: Cockpit organizational skills: management of cockpit equipment and controls, kneeboard documents, and the NATOPS POCKET CHECKLIST (NPCL)

6. CREW COORDINATION: Development of an understanding and method for handling emergency procedures in a multi-crew aircraft

Proficiency in the above areas includes both normal and emergency procedures. Each emergency procedure (EP) is unique, and SNFOs are required to be well versed in all EPs, to include verbatim recall of all immediate action items.

201. EMERGENCY PROCEDURE STEPS DEFINED

1. **Immediate Action Items**: The NATOPS POCKET CHECKLIST states that "All EP steps with asterisks (*) within this section are immediate action items. These steps are required knowledge for all aircrew without reference to the NATOPS POCKET CHECKLIST." These items are also known as "bold-face" procedures.

2. **Deferred Action Items:** EP steps without asterisks are deferred action items. Students are expected to expeditiously locate, read aloud, and execute all deferred action items by reference to the NATOPS POCKET CHECKLIST.

NOTE

The BINGO profile does not include fuel that may be required for an instrument approach.

202. EXECUTION OF EMERGENCY PROCEDURES

1. Emergency procedures requiring only Immediate Action Items

The student will:

a. Identify the emergency by announcing the title (ABNORMAL START).

b. Simultaneously recite and verify IP execution of the Immediate Action Items.

c. State the NPCL page number and the title of the emergency procedures.

d. Read aloud and confirm completion of all immediate actions.

e. Read aloud all notes, cautions, and warnings.

f. Report when checklist is complete (i.e., "Abnormal Start Checklist Complete").

2. Emergency procedures requiring Immediate Action Items and Deferred Action Items

The student will:

a. Identify the emergency by announcing the title (CANOPY CAUTION LIGHT IN FLIGHT).

b. Simultaneously recite and verify IP execution of the Immediate Action Items.

c. State the NPCL page number of the emergency procedure.

d. Read aloud and confirm completion of all immediate actions.

e. Read aloud and execute the Deferred Action Items.

f. Read aloud all notes, cautions, and warnings.

g. Report when checklist is complete (i.e., "Canopy Caution Light in Flight Checklist Complete").

3. Emergency procedures requiring only Deferred Action Items:

The student will:

a. Identify the emergency by announcing the title (CABIN ALT Warning Light).

b. State the NPCL page number and title of the emergency procedure.

c. Read aloud and verify IP execution of the Deferred Action Items.

d. Read aloud all notes, cautions, and warnings.

e. Report when checklist is complete (i.e., "Oil Press Warning Light Checklist Complete").

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CHAPTER THREE
FAMILIARIZATION FLIGHT PROCEDURES

300. INTRODUCTION

The T-45C Familiarization flights are designed to transition the student from the simulator block to the T-45C aircraft. The T-45C is a modern Navy jet trainer. Its performance and handling characteristics serve as an excellent transition to the tactical jets in the fleet. While the T-6 provided a solid knowledge base regarding advanced aircraft systems, the aircraft is significantly slower than jet aircraft. SNFOs may find themselves rushed when operating at the higher speeds characteristic of jet aircraft. Thorough preparation and solid procedural knowledge are the best tools to mitigate this perceived time compression. You will find yourself adapting as experience is gained.

301. FLIGHT PLANNING/SORTIE COMPOSITION

FAMs may be flown as single events locally, as out-and-ins, or completed in series during extended cross country events. If the flight schedule does not delineate a local stereo route, the SNFO should coordinate with the assigned IP the evening prior to the scheduled event. Flight data (e.g., climb airspeeds, fuel data, etc.) may be found in NATOPS as well as in the "T-45C In-flight Guide" and JMPS.

The composition of a Familiarization flight resembles a T-45C Familiarization simulator event. Each event should include at least one instrument approach (PAR, ASR, TACAN, or ILS). Additionally, unusual attitudes (VMC), stalls and aerobatics, precautionary approaches (PA's), VFR arrival procedures, and the VFR landing pattern will be emphasized during the Familiarization flight syllabus.

302. COMMUNICATIONS

Excellent ICS and UHF radio communications are the hallmark of a professional Naval Flight Officer. Effective comms are essential to the efficient employment of tactical aircraft in a dynamic environment. For these reasons, radio comms are a high priority throughout the entire Familiarization Flight block. The radio skills previously learned in the Training Command will be built upon throughout the syllabus.

Checklists will be challenge and reply if indicated in the T-45C In-flight Guide. Care shall always be made to avoid stepping on external UHF transmissions while using the ICS.

303. BRIEF/DEBRIEF

All students and observers shall be in the briefing room with all appropriate briefing materials no later than 5 minutes prior to the scheduled brief time. Unless coordinated otherwise, the IP will meet the student in the VT-86 briefing spaces at the scheduled brief time.

1. **Briefing Board**

A briefing board will be completed to include the following:

a. Type flight (i.e., FAM4101)

b. Aircraft call sign (i.e., ROKT 403)

c. Instructor and student names

d. Brief, T/O, and land times

e. Route of flight (i.e., Stereo Route or DD-175). Students will utilize JMPS for route depictions /mission overviews instead of hand drawn depictions. JMPS depictions will be taped to the briefing board IAW the briefing board examples in the Briefing Guide.

f. Fuel Planning Data

g. Takeoff and Landing Data (TOLD). Takeoff and Landing Data (TOLD) is temperature specific. These numbers will be computed from the appropriate charts found in the NATOPS Pocket Checklist (PCL) and NATOPS. The student will make calculations based on actual forecasted temperatures and winds.

h. Communication plan (local channels may be used)

i. Weather

j. NOTAMS

k. VT-86 questions of the day. In addition to reciting boldface items, SNFOs will generate a scenario, using worst case fuel and weather, and describe in detail how to recover the aircraft (type of approach, configuration, etc.).

Additionally, the student will have the following available for the brief:

a. A copy of the Master Curriculum Guide (MCG) opened to the syllabus block for event discuss items, In-Flight Guide (IFG), VT-86 T-45C Briefing Guide, and FTI.

b. T-45C model

c. Aviation Training Jacket (ATJ)

d. Briefing cards (one for each leg for the IP and SNFO)

e. A completed DD-175 for the route of flight, if required

f. Students will obtain a (–1) weather brief (FSS weather brief if conducting ops at civilian field) prior to briefing and include the VOID TIME on the briefing board IAW the briefing board examples in the Briefing Guide.

g. A completed jet card and a copy for the instructor

h. At a minimum, the student is responsible for the following:

   i. Familiarity with T-45 flight procedures and checklists, as outlined in this FTI

   ii. The emergency, instrument, safety, and tactics questions of the day

   iii. Verbatim knowledge of all boldface items in the T-45 Emergency Procedures

   iv. Aircraft systems knowledge and limitations

   v. The Unusual Attitude Recovery Procedures (VMC and IMC)

   vi. The Course Rules for the local operating area to include local MOA procedures

   vii. Information applicable to T-45 procedures in the VT-86 SOP

i. Ensure flight gear is ready and appropriate pubs are available, including:

   i. PCL

   ii. T-45C In-flight Guide

   iii. Approach Plates and High/Low Altitude Charts

   iv. IFR Supplement

   v. Flight Information Handbook

2. **Fuel Planning**

One of the primary considerations for any jet aircraft mission is fuel planning. Because of the higher fuel burn rates associated with jet aircraft, mission block times are most often driven by fuel. Therefore, to maximize mission effectiveness (i.e., training), SNFOs are required to have a thorough working knowledge of fuel planning procedures and terms.

a. **Mission Completion Fuel (MCF)**: This is the fuel required to complete planned mission (route of flight, low-level or tactical maneuvering) and return to planned destination via standard routing (including approaches for training or weather) to arrive with:

i. VMC: SOP minimum fuel (500 lbs.) on deck or fuel to proceed to alternate and arrive above SOP emergency fuel (400 lbs.), whichever is higher

ii. IMC: Divert Fuel

b. **Joker**: Pre-briefed fuel state that allows for one more tactical run/set, or 1 minute at MRT (whichever is higher), prior to reaching Bingo fuel.

c. **Bingo**: This is the fuel required to fly from the farthest point of a working area or route to your planned destination using standard routing to arrive with:

i. VMC: SOP minimum fuel (500 lbs.) on deck or fuel to proceed to alternate and arrive above SOP emergency fuel (400 lbs.), whichever is higher

ii. IMC: Divert Fuel

d. **Divert**: Fuel required to fly direct to the planned alternate and shoot an approach (if required, based on weather) to land above SOP emergency fuel (400 lbs.) on deck.

e. **Emergency Divert**: This is the emergency fuel required to fly a Bingo profile from present position and to the nearest suitable divert with the published NATOPS reserve fuel (300 lbs.).

Other considerations should be taken into account for additional fuel that may be necessary for contingencies such as weather, single usable runways, etc.

NOTE

Depending on the type of flight, weather, etc., some fuel definitions may not be applicable. For example, on a BFM flight MCF would not apply but Joker and Bingo would. Conversely, on a Cross Country flight, Joker and Bingo would not apply but MCF and Divert fuel would.

f. **BINGO Caution Setting:** For the tactical/mission portion of the flight, the Joker fuel setting will be set in the BINGO Caution Setting. If Joker fuel is reached it will be communicated and the BINGO Caution will be reset to BINGO fuel. Upon completion of the tactical/mission conduct, the Divert fuel setting will be set in the BINGO Caution Setting for RTB. Mission Completion Fuel settings will be calculated during mission planning and will be referenced during the appropriate stages of the flight but will not be set in the BINGO Caution Setting. In addition, ***SNFOs will not utilize the REJ button to silence the BINGO Caution***.

3. **Brief**

Students will be prepared to brief all administrative portions of all syllabus flights. The brief for the first flight in each block will be at the discretion of the Instructor Pilot. Students should be prepared to discuss all Conduct of Flight specifics on each of these initial flights. For all other flights in a block following the first flight, the student shall be prepared to brief the entire flight conduct. Students may utilize the briefing guide during the brief to enhance briefing effectiveness.

The Briefing Guide is meant to be an aid to briefing. The published briefing flow shall be used to standardize the delivery order of information during all T-45C briefs. Specific information given during briefs is at the discretion of the briefer and may include more, or less, than is provided in this Briefing Guide.

While the Admin portion of a brief should typically only take about 10 to 15 minutes, in the Familiarization stage, the entire flight is Administrative in nature. SNFOs should take the time in the Familiarization brief to "Chair Fly" the event one more time, talking through each procedure that they are to accomplish during the flight. For the Mission Conduct portion of the brief, the route of flight and approaches for that flight should be briefed in depth just as one might brief a low-level route. Charts and Approach plates should be available for the brief with the SNFO briefing the particulars of the route/approach in the sequence it is expected to occur airborne.

4. **Debrief**

The debrief is where most of the learning occurs during a training event. To ensure that all of the learning points are addressed, the fleet uses a standard format when conducting debriefs. In VT-86, the following format will be utilized for ***all*** debriefs:

a. **Safety-of-Flight/Training Rule Violations**: It is important to address any safety issues immediately in order to "clear the air" right off the bat and enable the focused attention on addressing the flight's learning points.

b. **Questions from the Brief**: The debriefer should identify anything that was unclear or not addressed in the brief.

c. **Admin**: Conduct TO and FROM the tactical portion (low level entry/exit point or operating area) of the flight. Since everyone in the event knows what occurred during the flight, this debrief should only address deviations from the briefed conduct or standard execution. In other words, debrief what went wrong or differently than briefed. A common mistake is for aircrew to reconstruct the entire Admin portion of the flight during this stage of debrief; however, keep in mind that in the Familiarization stage of training, typically the entire flight is administrative in nature and may be covered more in-depth.

d. **TAC Admin**: Tactical Admin generally involves those areas that revolve around the facilitation of the tactical conduct of the hop: G-warm, fencing in/out, setup parameters, area management, fuel management, knock-it-off flow, etc. (these items will be discussed in subsequent chapters). Like Admin, it should only be a discussion of those items that were not standard or as briefed, instead of a rehash of the entire TAC Admin portion of the flight.

e. **Mission Conduct**: Portion of the event defined by the learning and mission objectives, thus requiring debriefing in great detail in order to extract the learning points. A common mistake is for aircrew to dive right into the Mission Conduct portion of the debrief before covering the four previous items.

f. **Training Objectives**: After covering the pertinent learning points in the Mission Conduct portion of the debrief, a final review of the Mission/Training Objectives generally tells aircrew if they accomplished the intended training. Often utilized in a "Goods/Others" format, the review of Training Objectives provides a "grade sheet" on how well a particular flight was executed.

304. FAMILIARIZATION FLIGHT CONDUCT

NOTE

The "flight conduct" sections of this FTI serve to provide the student with a standard flow of events and tasking during a typical syllabus flight. While this section may appear "canned" or "scripted," it must be emphasized that flights rarely evolve exactly as planned. Flexibility will be the one constant in your military flying career. Treat these sections as a guideline and always be prepared to flex to the basic priorities (aviate, navigate, communicate, then checklists) as required.

305. PREFLIGHT

All aircrew, students and IPs, are responsible for conducting a thorough preflight of the aircraft and their respective cockpit seat in accordance with NATOPS. An aircraft and seat preflight will be demonstrated prior to each SNFO's first flight. The IP for your first flight will oversee the preflight and ensure proper strapping into the aircraft. On all subsequent flights, the student and IP perform individual preflight. A thorough ramp FOD check will be conducted prior to entering the cockpit. Prior to engine start, the student will be strapped in with gloves on, sleeves and visor down, seat and MDC handle pins removed and stowed in the map case, and the Prestart Checklist completed.

306. PRESTART CHECKS

The student completes the Prestart Checks.

IP places battery switch on.

IP (ICS): *"ICS check."*

SNFO (ICS): *"Loud and clear, switches set, FCS Norm (Fuel Control Switch), Eject select FWD-Both."*

Student will report actual switch positions. The student must ensure the anti-skid switch is on, engine switch is on, and the fuel control switch (FCS) MUST be in Normal or a hot start may occur during engine start.

IP (ICS): *"Lights and tones."*

The student will then test his/her lights in the aft cockpit by pressing the lights test switch and the AOA indexer lights test push button to ensure no burnt out lights and proper brightness of the AOA indexer. After releasing light test switches, listen for four good tones (Warning, Caution, Wheels Up Warning, and Weapons Release). If the SNFO is still testing his lights while the IP initiates the tone test only three tones will be audible. If this happens do not report a successful tone test.

SNFO (ICS): *"Good lights and tones rear."*

IP (ICS): *"Good lights and tones front."*

307. GTS START/POSTSTART

1. **GTS Start**

IP signals PC to start the GTS.

IP (ICS): *"Fuel 3.0, GTS."*

During the start sequence, the student monitors the caution/advisory panel to ensure a GTS light displays within 20 seconds. The IP will then engage the engine start switch, and you will both monitor the engine instruments and look for a ready light within 15 seconds. At 15 to 20 percent RPM, the IP will move the throttle to idle, and you will monitor the start. If you note an abnormal start, call it out and the IP will perform the appropriate procedures.

2. **Post Start**

With a good start and a thumbs up signal from the plane captain (PC), student reports:

SNFO (ICS): *"Thumbs up from PC."*

The student will then turn on his/her MFCDs, Radios (ensuring squelch is on), TACAN, and VOR. He/she will select AFT on the right MFCD and AFT on the COMM 1 and COMM 2 transfer switches, while ensuring that both COMM switches are set in the UP position on the COMM control panel. The student will then tune ATIS in COMM1 (hereafter referred to as "PRI") and Base in COMM 2 (hereafter referred to as "AUX").

After receiving ATIS, the student will switch the PRI radio to clearance delivery.

As the student obtains ATIS, the IP will signal to the PC to run the engine up to 70% and initiate the run-up in order to reset HYD 2. The SNFO should be looking for the HYD caution light to extinguish and all HYD gauges to read 3,000 psi. The IP will then select TEST on the fuel control switch and both crew members shall note the resultant drop in RPM (6% Max) and illumination of M FUEL advisory light. Once tested, the fuel control switch will be placed back to Normal and the IP will pull the power back to idle ensuring that the M FUEL advisory light goes out. Bleed valve closure should occur and shall be verified by checking that the ground IDLE RPM settles at 55% +/- 2%.

After completion of these checks, the student will check the MENU/BIT/MAINT page on the MFCD to check for any exceedances or overflows and report actual indications:

SNFO (ICS): *"No exceedances or overflows."*

The student will then check the MENU/DATA/ACFT page to verify that the GPS is tracking four satellites and the QUAL alignment counter is counting down or is complete (indicated by a QUAL of 0.59).

SNFO (ICS): *"GPS 4 SATs, alignment countdown/complete."*

NOTE

If alignment is not counting down be prepared to enter the aircraft's current position into waypoint zero per NATOPS procedure.

Now the student will contact clearance delivery, receive the clearance and read it back to them in its entirety.

SNFO (PRI): *"Clearance, ROKT 403, NPA-802 on request, ready to copy."*

After reading back the clearance, the SNFO will switch PRI to GROUND frequency.

As the IP goes through the trim checks and Control AUG IBIT, the SNFO will accomplish the following tasks per the TRAWING 6 standardized checklist bold items:

a. LAW set to 200 ft.

b. Bingo set as briefed

c. BIT display – Check

d. RADALT – BIT

SNFO (ICS): *"Good tone back."*

IP (ICS): *"Good tone front."*

e. Waypoints – set **(*Do not overwrite waypoint zero*)**

f. NAV source – HYBD (If both the GPS and INS functions of the GINA are working properly, the NAV source defaults to HYBD.)

Once the system is set and/or the Control AUG IBIT is complete (noted by the C AUG caution light – OUT after 120 sec), the student will report:

SNFO (ICS): *"Ready for PC checks."*

308. PLANE CAPTAIN CHECKS/FINAL CHECKS

The IP will signal the PC to initiate PC checks:

1. Full throw of flight controls (ensure feet are clear of the rudders)

2. Lower the flaps (full down)

3. Extend the speed brakes

4. Lower the tailhook

5. Lower the launch bar (per Plane Captain signal)

Once these three (four) items are extended, both crewmembers will place hands out of the cockpit. While the crew is "hands out," the PC will check the appropriate control surfaces, tailhook, and launch bar.

NOTE

It is acceptable to input information via the DEP and MFCD's while PC checks are taking place; however, you must still ensure that your arms/elbows DO NOT come down below the canopy rail and you must maintain situational awareness (SA) on the PC's position during the check. This will avoid any confusion from the PC regarding your clearance from any control surface switches/controls and prevent inadvertent actuation.

Once complete with the external checks, the PC will signal the pilot to retract the speed brakes, raise the tailhook and launch bar, and place flaps to HALF. The final step of the PC checks is a brake check. It is at this time, during the brake check in which the PC is not in the vicinity of any moving surfaces, that the SNFO will report, "Ready for final checks."

SNFO (ICS): *"Ready for final checks"*

When the brake check is complete the PC will hand off control to a final checker. The final checker, like the PC, will look to the aircrew for a hands-up signal. Like the PC checks, the student may input data via the DEP and MFCD only, keeping arms/elbows above the rail. This is an ideal time to review the Instrument Checklist since most of the items can be checked visually (Needle/ball movement cannot be determined until taxiing to check L/R turns and the TACAN may or may not be received at this point).

Once final checks are complete, the IP will lower the canopy, the last step before taxi. A verbal confirmation from the rear cockpit crewmember that he or she is "clear" is required before the pilot in the front cockpit initiates any movement of the canopy, either open or closed.

The canopy shall be closed upon completion of final checks and prior to any aircraft taxi movement in the line.

IP (ICS): *"Canopy"*

SNFO (ICS): *"Clear"*

NOTE

Weather dependent, the IP may elect to close the canopy at an earlier time in the checklist.

309. TAXI PROCEDURES

When the IP starts to taxi, the student will call "outbound" to Base then request taxi clearance from ground:

SNFO (AUX): *"Base, ROKT 403 outbound, side 620"*

SNFO (PRI): *"Ground, ROKT 403, taxi with Delta."*

GROUND (PRI): *"ROKT 403, taxi to RWY 7R via Foxtrot–Delta–Alpha, altimeter 3002."*

SNFO (PRI): *"ROKT 403, taxi RWY 7R via Foxtrot–Delta–Alpha, 3002."*

The SNFO will then give the taxi instructions on the ICS:

SNFO (ICS): *"Make a left on Foxtrot, a right on Delta, a left on Alpha, and taxi to the hold short for 7R."*

SNFO (ICS): *"Squawk 1020, altimeter 2995, showing 20 ft in STBY altimeter/ 40 ft in MFCD."*

IP (ICS): *"Squawking 1020, altimeter 2995, showing 20 ft in STBY altimeter / 30 ft in MFCD."* (Maximum altimeter deviation is 75 ft between cockpits and from field elevation.)

SNFO (ICS): "*Departure brief: At 1 DME turn right 150 climb and maintain 3,000 feet."*

After verifying the turn needle and ball are working during taxi ***(both L and R turns)*** and all other items on the Instrument Checklist are operating properly (i.e., TACAN), the SNFO will report the Instrument Checks complete:

SNFO (ICS): *"Instrument Checks complete."*

Once all these checklists are completed, the student will initiate the Takeoff Checklist by challenging the IP on each item in the checklist. The IP will "reply" to each student "challenge." If the student notes NO disparity, he will proceed to the next item. Always remember to CHALLENGE, REPLY, and VERIFY.

STUDENT (Challenge)	**IP (Reply)**
"Control AUG."	*"All, light out."*
"Anti-skid."	*"On, light on."*
"Flaps/Slats."	*"Half, slats out."*
"Trim."	*"0, 0, 2–3 nose up."*
"Canopy."	*"Closed, locked, light out, arrows aligned."*
"Harness – I'm attached 8 points, pins removed, select in Fwd/Both, ready to arm in back."	*"I'm attached 8 points, pins removed, ready to arm in front."*
"Armed in back."	*"Armed in front."*
"Takeoff checks complete."	

Before calling takeoff checks complete, SNFOs should make it a habit to always double check ***all*** indications and instruments (in addition to the checklist items, such as hydraulic gauges and battery voltage indicator) by doing a complete sweep of the cockpit. This will ensure the aircraft is "completely" ready for takeoff.

310. TAKEOFF PROCEDURES

Approaching the hold short area (normally after crossing the last taxiway or 1000' prior), the SNFO will switch the PRI radio to Tower and call for T/O when both crews are ready.

SNFO (PRI): *"Tower, ROKT 403, takeoff."*

TOWER (PRI): *"ROKT 403, winds 040 at 10, cleared for takeoff runway 7R, change to departure."*

SNFO (PRI): *"ROKT 403, cleared for takeoff 7R, switching departure."*

The groove will be cleared during this time, and the IFF/strobes moved to their appropriate position for takeoff. PRI will be switched to appropriate departure frequency/preset.

SNFO (ICS): *"Groove clear, check strobes on, squawk normal, pitot heat on, landing light on, FCS norm, Hot Mike/staying Cold Mike (as briefed).*

IP (ICS): *"Pitot heat, strobes, landing light, squawking normal, FCS norm"*

Once the aircraft is positioned on the runway centerline and cleared for takeoff, the IP will run the power up to MRT. At military power, the student will verify all instruments are operating within limits and all warning and caution lights are extinguished.

SNFO (ICS): *"No warnings or cautions, good engine instruments. Ready. Line speed—94."*

During T/O roll, the student will monitor airspeed, engine instruments, warning and caution lights, and the flap and trim indicators and check the 1,000-foot line speed.

SNFO (ICS): *"Good line speed."*

After rotation, the IP will initiate the raising of the gear and flaps without any student input. It is the student's responsibility, though, to ensure that both the gear and flaps are safely retracted prior to 200 KIAS and report it.

***SNFO** (ICS):* *"Aircraft clean at 190 KIAS"*
(Report airspeed at which the gear and flaps indicated up.)

IP (ICS): *"Good gear handle"*
(After checking handle is up and locked.)

Once the aircraft is verified clean, the student will contact departure.

SNFO (PRI): *"Departure, ROKT 403, airborne, passing 800 for 3,000."*

DEPARTURE: *"ROKT 403, Pensacola Departure, radar contact."*

311. DEPARTURE/ENROUTE/NAVIGATION PROCEDURES

The student is responsible for all navigation and UHF communication throughout the flight. Additionally, the student is encouraged to be aggressive and drive the conduct of the flight as though he or she were the assigned MC.

1. **Checklists**

All Climbout Checklists should be completed within 500 ft of the prescribed altitude (i.e., 9,500 to 10,500 ft for 10,000-foot Checklist). Realize this is a guideline. If more pressing demands require the student's attention, it is important to recall the general hierarchy of priorities: Aviate, Navigate, Communicate, and then Checklists.

a. **5K' (AGL)**

Reset LAW to 5,000

b. **10K'**

Complete all items on the 10,000-foot Checklist, but only report the following:

SNFO (ICS): *"10K checks complete LAW set at 5,000, Cabin Altitude at 7,000."*

c. **18K'**

Climbing through 18,000 ft, the altimeter is set to 2992.

SNFO (ICS): *"Altimeter 2992 in back."*

IP (ICS): *"Roger, 2992 in front."*

Descending through 18,000 ft, set the altimeter to the local setting.

SNFO (ICS): *"Altimeter 3004 in back."*

IP (ICS): *"Roger, 3004 in front."*

2. **Departure**

Ensure navigation system is set up for the assigned departure to include (as applicable):

a. Navigation station/waypoint selected

b. Course or CDI selected for departure radial intercept

c. Heading bug set to assigned heading

d. First assigned altitude loaded into CALT on ADI

Direct IP to turn/climb/level off the aircraft at the appropriate time.

3. **Enroute/Navigation Procedures**

Perform the following Enroute/Navigation tasks when applicable:

a. Navigation station/waypoint selected.

b. Scale set to maximize SA, large enough to include the point of navigation.

c. Waypoint verified using defined navigation source and radial if navigating via Waypoint.

d. Alternate NAV source or GEOREF used to locate nearest divert, compute destination fuel or prepare for next NAV point (includes manually entering in nearest divert Waypoint if not in the system load and no associated TACAN/VOR).

e. Course Line and CDI used to maintain most direct track over ground and/or JET or VICTOR Route.

f. CALT used to hold assigned altitude.

g. Heading Bug used to direct wind corrected or assigned heading.

h. Update nearest divert when applicable to include location using clock codes:

Example:

SNFO (ICS): *"Nearest divert is now Trent Lott, One O'clock, 15 miles, GEOREF number 5."*

i. Be assertive/directive and take ownership of navigation at all times.

j. Utilize Offsets and Offset steering when able for IAF or PTP navigation.

312. CRUISE

1. Cruise Checks

Cruise checks will be conducted throughout the flight as time permits. Cruise checks should be reported approximately every 10-15 minutes. The student will report all four items in accordance with the T-45C student in-flight guide on the first Cruise Check. During subsequent Cruise Checks, complete all items and only report the fuel status, its relation to Estimated Fuel Remaining (EFR) and Mission Completion Fuel (MCF), and aircraft position (divert info as required).

SNFO (ICS): *"Fuel - 2.0. 100 below EFR and 300 above MCF. Nearest divert Mobile Regional at our 10 o'clock / 15 miles."*

2. Low Altitude Warning (LAW) Usage

Students will set the Low Altitude Warning to 5,000' any time the aircraft is above 5,000' (i.e., platform). Below platform (once the LAW tone has sounded), step it down to an intermediate altitude, using 1000' AGL, or 2000' AGL in mountainous terrain, for terrain avoidance.

a. Approaches

On precision approaches, once the aircraft is past the final descent point on the approach (glideslope intercept), the student will set the LAW ***to the HAT/HAA*** at the missed approach point.

On non-precision approaches, students will step down the LAW using the 10% rule of thumb when able, and set the LAW ***to 10% below HAT/HAA*** after crossing the final descent point on the approach.

b. VFR Pattern

For the overhead, LAW will be set to 380 (to alert pilot to confirm a ball on the lens at the 45) inside the initial. If course rules apply, the LAW will be set to 380 once past the entry point of the appropriate course rules (X-Ray, Pickens Gate, etc.).

NOTE

The only time the LAW should sound is at Platform and passing through HAT/HAA / "45." SNFOs will report to IP any time the LAW setting is changed. In addition, any time the LAW sounds off, the SNFO will report the reason why and the subsequent updated LAW setting. In addition, ***SNFOs will not utilize the REJ button to silence the LAW Warning***.

313. SUA ENTRY/EXIT PROCEDURES

During Familiarization flights, unusual attitudes will be practiced and evaluated in at least one of the flights as fuel, time and airspace permits. During local round robins or out-and-ins, the students shall plan to enter the Gator South MOA to the max extent possible. If weather precludes the MOA, the W155A serves as a viable alternative to execute any necessary requirements. It is up to the students to properly and proactively plan any area contingencies and execute them accordingly.

1. PNSS MOA

The PNSS MOA is the primary choice during Familiarization events due to its proximity to the field which allows for better route and fuel planning. The confines and procedures for MOA use are detailed in the Pensacola South MOA Procedures Letter of Agreement. The discussion that follows is a brief overview and does not relieve any student from thoroughly familiarizing themselves with all pertinent procedures. The operational limits of the PNSS and associated ATCAA are 10,500 feet MSL to 23,000 feet MSL. Working altitudes are 10,500 to 16,500 for the low blocks and 17,000 to 23,000 for the high blocks. IFR clearances are automatically canceled upon entering the PNSS, and operations within the PNSS shall be conducted VFR. Aircrews are responsible to advise ATC in the event VFR cannot be maintained.

Aircraft operating within the PNSS MOA shall use the local altimeter setting. When the local altimeter setting is below 29.92, 22,000 feet MSL shall be the highest useable working altitude within the MOA.

The PNSS MOA is sub-divided into 12 high blocks and 11 low blocks as depicted in Figure 3-1.

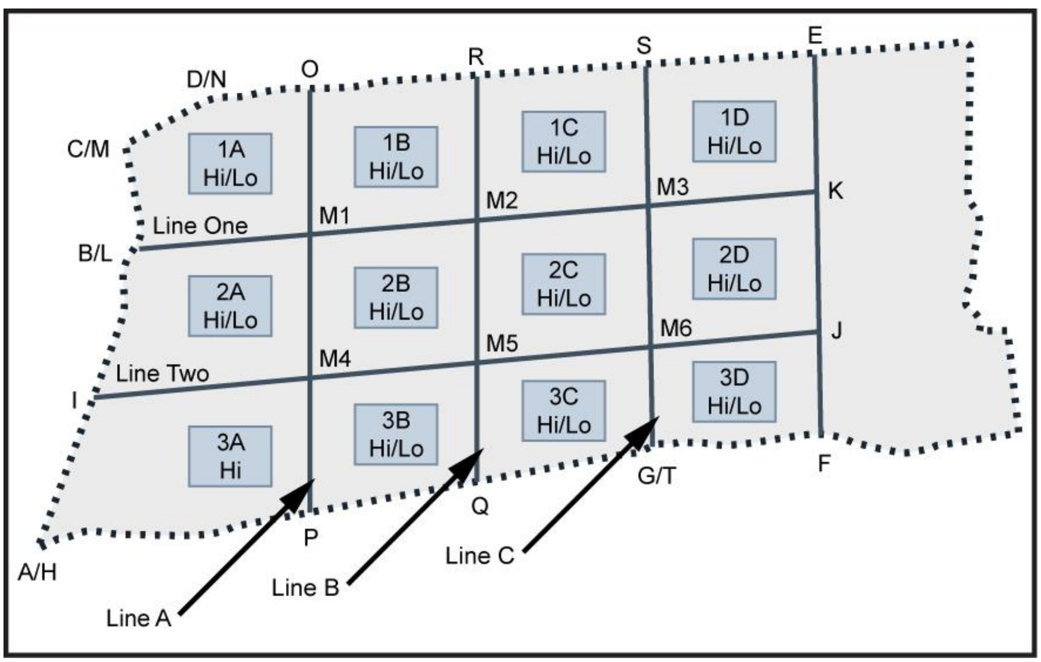

Figure 3-1 PNSS MOA

Familiarization operations require the use of two adjacent blocks, both high and low. If the flight is airborne and an area is not previously scheduled, areas can be requested through Pensacola Approach.

SNFO (PRI): *"Approach, ROKT 403, request two adjacent blocks high and low in the Pensacola MOA."*

Because the T-45 is not GPS capable, vectors will be required to enter the area unless assigned a border area. Other instructions cannot be accepted and vectors must be requested.
Once in the MOA, all aircraft will monitor UHF 360.725 (BTN 18) for MOA traffic. Students are responsible for area management while in the PNSS MOA.

When ready to exit the MOA utilize Aviate, Navigate, Communicate, Checklist mindset:

a. **Aviate** - direct pilot to descend to 11,000 feet or 1000 feet above an under-cast.

b. **Navigate** – direct a heading to navigate towards the southern boundary or an orbit so as to expedite RTB without exiting the area before cleared.

c. **Communicate** - Obtain ATIS and contact Approach Control with intentions.

SNFO (PRI): *"Approach, ROKT 403 complete in Block 2C, information [ATIS current letter code, request."*

ATC (PRI): *"ROKT 403, say your request."*

SNFO (PRI): *"ROKT 403, request ILS 7L followed by Course Rules."*

TRACON will issue a standard clearance to depart via radar vectors with assigned altitude.

d. **Checklist** – Complete Penetration Checklist, provide Field and Approach Brief, ***not to interfere with a-c above!***

2. **W155-A**

To enter the W155 area, students shall ensure that the working area is scheduled for the expected entry time, exit time, and filed accordingly. Like all other tasks, the students will be responsible for all navigation and UHF communication to and from the operating area. Once ready to proceed and enter the area, the student will request direct to the desired entry point (ROZIE, STAAR, or BEARD). Once headed toward the area, ATC will direct the flight to contact SEABREEZE (the controlling agency for W155). The student should proactively request a frequency change if it has not been received by 20 DME to minimize any delay. W-155-A is depicted in Figure 3-2.

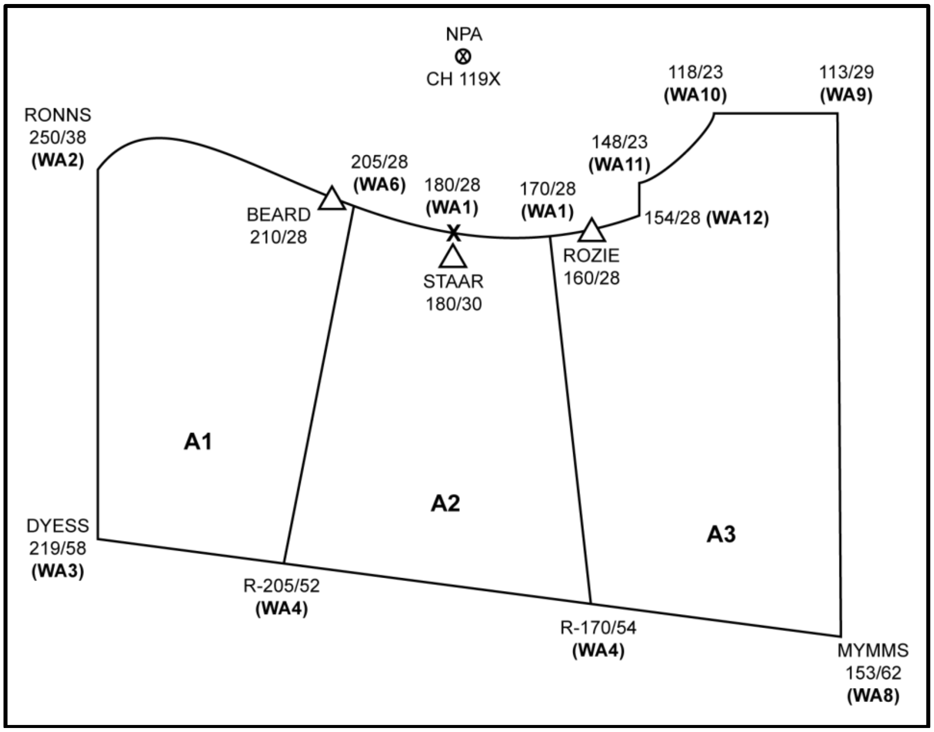

Figure 3-2 W155-A

All communication should be performed on PRI (unless otherwise required):

DEPARTURE: *"ROKT 403, contact SEABREEZE on 353.775."*

SNFO: *"ROKT 403, switching 353.775"*

On initial contact with SEABREEZE, the student will request one or more of the W155-A operating areas as scheduled and as de-conflicted with other flights with concurrent times:

SNFO: *"SEABREEZE, ROKT 403, one four thousand, request W155-Alpha's 1, 2, and(or) 3."*

SEABREEZE: *"ROKT 403, proceed direct ROZIE, expect Alpha 1, 2, & 3."*

If unable to comply with the request (i.e., the requested areas are occupied), SEABREEZE will assign the available working area/s. Since more than one flight can be scheduled into the W155 areas simultaneously, all students are responsible for area and COMM de-confliction prior to the brief. This will enable expeditious coordination with SEABREEZE for entry and exit out of the area.

Upon receiving clearance to a working area, the student will navigate to the applicable entry point for the assigned area. If SEABREEZE delays the clearance, or is slow in providing it, the SNFO is expected to be proactive and assertive to expedite the coordination without undue delay.

SEABREEZE: *"ROKT 403, upon reaching ROZIE, you are cleared operational W155-A3, maintain block seven thousand to flight level four zero zero."*

SNFO: *"ROKT 403, at ROZIE, cleared in W155-A3, seven thousand to flight level four zero zero."*

As the flight approaches the entry point, SEABREEZE will assign a discrete frequency:

SEABREEZE: *"ROKT 403, SEABREEZE, switch to discrete frequency on 275.6."*

SNFO: *"ROKT 403, switching 275.6."*

SNFO: *"SEABREEZE, ROKT 403 checking in on 275.6."*

Once SEABREEZE checks the aircraft in on the discrete frequency and verifies you are established in the area, it will terminate IFR control.

SEABREEZE: *"ROKT 403, loud and clear, radar services terminated, maintain VFR, contact me 10 minutes prior to RTB on my primary."*

SNFO: *"ROKT 403, Wilco."*

3. **W-155A 10 Minute Prior RTB Call**

Approximately 10 minutes prior to RTB, the SNFO will switch AUX to get ATIS for the intended destination and determine what type of recovery will be available. Once obtained, SNFO will switch PRI to SEABREEZE's primary frequency to notify the 10 minute prior with recovery intentions (Course Rules, GCA, etc…).

SNFO: *"SEABREEZE, ROKT 403, RTB ten minutes, course rules."*

SEABREEZE: *"ROKT 403, Roger, Sherman Field landing RWY 7, weather is VFR, altimeter 3002."*

SNFO: *"ROKT 403, 3002."*

4. **W-155A RTB**

Like the GATOR MOA, area management is the responsibility of the SNFO. When ready to exit, students will switch PRI to SEABREEZE's primary frequency and notify the intent to RTB. SEABREEZE will acknowledge and provide further direction for your exit, having already coordinated with ATC for your IFR clearance based on your 10 min prior request. If the student anticipates to arrive at the exit point before further clearance is received, the student will direct his pilot to orbit or navigate within the confines of the assigned area until SEABREEZE is able to coordinate the hand off to Pensacola Approach.

SNFO: *"SEABREEZE, ROKT 403, RTB."*

SEABREEZE: *"ROKT 403, roger, squawk 0627 and IDENT."*

SNFO: *"ROKT 403, squawking 0627 with the flash."*

SEABREEZE: *"ROKT 403, radar contact 5NM SE of ROZIE, descend and maintain 7000 feet, proceed direct ROZIE then NPA."*

SNFO: *"ROKT 403, passing 9,000 for 7,000, direct ROZIE, NPA."*

The student will direct the IP to descend to 7000 feet (the W155A exit altitude), and will provide an initial heading towards the applicable exit point (BEARD, STAAR, or ROZIE for Area 1, 2, and 3, respectively). The switch to Pensacola Approach should follow shortly thereafter for the remainder of the event as briefed.

SEABREEZE: *"ROKT 403, SEABREEZE, contact Pensacola Approach on 270.8."*

SNFO: *"ROKT 403 switching 270.8."*

SNFO: *"Pensacola Approach, ROKT 403, 7000, RTB, Course Rules."*

314. PREDESCENT

During climbs and descents, good crew coordination dictates that the student will make "1,000 ft prior" (to level off) calls on the ICS as appropriate. At 5,000 ft AGL, an ICS "Platform," call will be made. It is important to note that the "Platform" call is made at 5,000ft AGL, not MSL. When operating at areas other than sea level elevations the call will be made at something greater than 5,000 ft. Do not wait for the LAW tone to sound off to make the call. Once Platform has been reached the instructor should comply with the "minute-to-live rule" and shallow his rate of descent to approximately 2000 fpm. The "minute-to-live rule" dictates that the aircraft's negative VSI will not exceed the aircrafts AGL altitude once below 5,000ft.

Prior to commencing an approach, the student will initiate the Penetration Checklist. Every item on this checklist needs to be reported. The checklist should be initiated after obtaining ATIS. If ATIS or WX information not available or out of range, the student can initiate the penetration checks but will NOT call complete until WX information is gathered or not able to be obtained. When stating the fuel, it is necessary to estimate the fuel you will have on deck, not just the aircraft's current fuel state. All comms are made on ICS.

SNFO: *"Defog/Cockpit Temp."* (Challenge)

IP: *"Set."* (Reply)

SNFO: *"Master Arm."* (Challenge)

IP: *"Safe."* (Reply)

SNFO: *"Control Aug."* (Challenge)

IP: *"All."* (Reply)

SNFO: *"STBY Attitude/Altimeter – Erect and Set"*

IP: *"Erect and Set in front"*

SNFO: *"Weather is VFR, altimeter 2992, overhead to runway 7."*

SNFO: *"TACAN set NPA-119X, VOR/ILS – 109.3, Course 069"*

SNFO: *"LAW set 5,000' until Platform"*

SNFO: *"MFCD's/HUD set as required, NAV mode set"*

SNFO: *"Fuel - 1.5. Estimated fuel on deck – 1.2"*

The remaining three items (Hold, Approach, Field Briefs) in the Penetration Checklist are at the IP's discretion. For example, the student will ask the IP if he or she requires an approach brief. Good crew coordination dictates that the student is prepared to provide a hold, approach, and field brief, regardless of the field and type of approach selected. A holding brief is only applicable if holding is expected.

315. APPROACH/LANDING

1. Visual Overhead

Weather permitting, the visual overhead (break) is the recovery of choice for most flights, thus, it is important that students become very familiar with local operating procedures and course rules.

Approaching the initial for the runway in use (i.e., X-ray for RWY 7), the student will report the airfield in sight to the Approach Controller.

SNFO (PRI): *"Pensacola Approach, ROKT 403, field in sight."*

APPROACH (PRI): *"Roger ROKT 403, contact Tower."*

SNFO (PRI): *"ROKT 403, switching Tower."*

SNFO (PRI): *"Tower, ROKT 403, two miles south of X-ray for the break."*

TOWER (PRI): *"Roger ROKT 403, report numbers runway 7R."*

SNFO (PRI): *"ROKT 403, WILCO."*

When approaching or overhead the numbers:

SNFO (PRI): "*Tower, ROKT 403, numbers (or approaching numbers)."*

TOWER (PRI): *"ROKT 403, Right break approved (at the numbers – L/R break approved)."*

NOTE

There is no need to report the numbers if clearance to break has already been received.

The IP will break appropriately to slow the aircraft down below 200 KIAS. The IP should lower the gear and flaps automatically when airspeed below 200 KIAS is confirmed. The student shall verify that this occurs and challenge the IP over the ICS if the configuration change is not initiated promptly (for example below 195 KIAS). The student will then initiate the Landing Checklist only after visually confirming the gear is down-and-locked on the landing gear indicator and challenging the IP with a "GEAR" call on ICS.

2. **Landing Checklist**

The landing checklist will be performed for all landings and approaches. It is always initiated by the student and must be completed every time the aircraft does an approach and/or each time the aircraft goes around the landing pattern.

STUDENT	IP
"Gear."	*"Gear, three down-and-locked."*
	"Flaps full/half/up."
	"Hook up/down."
	"Harness locked."
	"Speed brakes out/in."
	"Anti-skid on/off."
	"Fuel – X.X."
"On Speed - ____knots."	

The IP will confirm the On-Speed calculated by the SNFO. If IP determines that SNFO calculated on-speed is incorrect, IP will announce the correct on-speed over the ICS: "On-Speed is 116." After confirming all items are set as required, SNFO will report checklist complete over ICS.

SNFO (ICS): *"Landing Checklist complete."*

The student will state intentions to Tower at the abeam position.

SNFO (PRI): *"Tower, ROKT 403, abeam, three down-and-locked, full stop."*

TOWER (PRI): *"ROKT 403, Sherman Tower, winds 060 at 8 knots, RWY 7R, cleared to land."*

SNFO (PRI): *"ROKT 403, cleared to land, 7R."*

With clearance to land or touch-n-go, the student will visually re-confirm the aircraft's landing configuration and report full clearance to land/option on ICS.

SNFO (ICS): *"Gear down, Landing checklist complete, cleared to land/touch-n-go on RWY…"*

Often, the landing gear has not yet been lowered when the abeam call is made. If this is the case, no reference to the landing gear occurs during this transmission. A separate UHF transmission is required once the gear is lowered and the Landing Checklist is completed.

SNFO (PRI): *"Tower, ROKT 403, three down-and-locked."*

TOWER (PRI): *"ROKT 403, Roger."*

NOTE

Do not interrupt the Landing Checklist to make the three down-and-locked transmissions.

During the approach turn, students shall monitor the approach and be able to recall and discuss all observed parameters with regard to altitude, position, and on-speed. Refer to Chapter 7 of the NATOPS manual for field landing pattern. Reference altitudes in the NATOPS manual are pertinent to every field, except for the break altitude which is dependent on local field procedures. LAW for the pattern should be set at 380'. This setting approximates the 45 degree position in the pattern. Unless intending to depart the pattern, this setting should be set at the initial and kept through the VFR pattern.

If a touch and go is requested in the VFR pattern, on climb out, the student will request clearance to turn downwind from Tower.

SNFO (PRI): *"Tower, ROKT 403, downwind."*

TOWER (PRI): *"ROKT 403, right downwind approved."*

NOTE

A separate Landing Checklist is required for every approach and/or landing.

During rollout, after a full stop landing, the student will report airspeeds and boards to the IP on the ICS. These calls occur every 1,000 ft until the aircraft has slowed to less than 60 KIAS or the IP acknowledges control of the aircraft. A “good brakes” call by the IP also negates the requirement for boards/airspeed calls.

SNFO (ICS): *“6 board, 80 knots; 5 Board 60 knots”* etc.

316. LANDINGS

You and your IP will practice waveoffs, touch and go, and full-stop landings in two configurations, full flap/slat and no flap/slat or speed brakes. You will also perform full flap/slat roll and go landings. The roll and go is performed to demonstrate engine acceleration characteristics and the distance required to take off after a go-around is initiated from an attempted full-stop landing.

Waveoff

A waveoff is mandatory when it’s directed by the Control Tower, the LSO, or the wheels watch/RDO. When a waveoff is directed, your IP should act immediately. Do not hesitate, execute waveoff procedures and acknowledge the waveoff on the radio. Any questions can be answered when you are safe on deck. Additionally, you may execute a waveoff any time that you believe a safe landing cannot be made. If you recognize an unsafe condition use good CRM, be assertive:

For example, you see a T-6 crossing the hold short towards the landing area while on short final to land:

SNFO (ICS): *“Waveoff! Waveoff! Waveoff!”*

Reasons

You may be told to wave off for several reasons. The RDO may give you a waveoff for an unsafe pattern, most often due to an excessive overshooting start. You may also be waved off for a poor pattern—for example, being too long in the groove. Tower may give you a waveoff if runway conditions make a landing unsafe. In any case, you will receive the waveoff signal over the radio or by the waveoff lights on the Fresnel lens.

Procedures

To perform a waveoff, simultaneously advance the power to MRT, retract the speed brakes, and maintain optimum AOA. Level the wings if necessary and verify a positive rate of climb. After a climb is established and you are above 300 ft AGL, turn to parallel the runway and conform to pattern airspeeds and altitudes. Inform the Tower that you are waving off.

Touch And Go—Full Flap/Slat and No Flap/Slat

Touch and go landings are practiced to improve your landing skills through a serial repetition that enables you to review the previous pattern while you're in the next, identifying pattern errors and adjusting on subsequent passes. This process is conducive to self-critique and analysis; through repetition, you are developing your ability to arrive consistently at a good start.

Procedures

To perform a touch and go, make a normal landing approach for your configuration to the runway centerline or the carrier box. If you are correcting for a crosswind, take out the crab with rudder while simultaneously applying aileron to maintain wings level, just prior to touchdown. Neutralize the rudder prior to nose wheel touchdown. At touchdown, simultaneously advance the power to MRT, retract the speed brakes, and rotate the aircraft to takeoff attitude.

Verify a positive rate of climb and maintain 130 KIAS for full flaps/slats or 170 KIAS for no flaps/slats. Turn downwind when cleared by the Tower and at or above 300 ft AGL and 130 KIAS for ***full flaps/slats*** or 500 ft AGL and 170 KIAS for ***no flaps/slats***. Establish the proper interval by turning downwind when the aircraft immediately ahead of you is:

1. 30 degrees forward of your wing after executing the break and is established on the downwind leg in a clean configuration.

2. 10 degrees forward of your wing and is established on the downwind leg in a dirty configuration.

NOTE

> Make the necessary adjustments for differences in pattern speed and configurations, if known (e.g., no flaps, dissimilar aircraft).

Continue climbing to pattern altitude (if you're not already level at pattern altitude) and maintain pattern airspeed. Vary your AOB as necessary to establish the appropriate abeam distance.

On the downwind leg, extend your speed brakes and adjust the nose attitude and the power as necessary to maintain pattern altitude and optimum AOA. Perform the landing checklist only when you're established with wings level downwind and complete it prior to reaching the abeam position. Remember to crab into the wind as necessary to maintain proper abeam distance.

Roll and Go—Full Flap/Slat

A Roll and Go is a maneuver aircrew practice in order to simulate a scenario that would require a go around. Performing this maneuver allows aircrew to become familiar with the aircraft response and it also gives aircrew the confidence to perform a go around in a non-standard situation.

To execute a Roll and Go, perform a normal full flap/slat landing approach and touchdown on the runway centerline. Upon touchdown, ***maintain back pressure on the throttle until GROUND IDLE is achieved***, and allow the aircraft to decelerate to 100 KIAS or until 4,000 ft of runway remain, whichever comes first. Maintain directional control with nose wheel steering. If you are correcting for a crosswind, take out the crab with rudder while simultaneously applying aileron to maintain wings level, just prior to touchdown. Immediately upon touchdown smoothly apply aileron into the wind as required to hold wings level, maintain longitudinal stick at approach position or slightly forward, and neutralize the rudder prior to nose wheel touchdown.

CAUTION

> Do not continue the roll beyond the 4,000 ft remaining marker on the runway.

Upon reaching either 100 KIAS or the 4,000 ft remaining marker, whichever comes first, direct IP to advance the power to MRT and retract the speed brakes. Once the aircraft is accelerating and 5-10 KIAS prior to the predicted takeoff speed, IP will rotate the aircraft to the takeoff attitude and allow the aircraft to fly off the runway. Anticipate a lag from the time you go to MRT to when you actually feel the aircraft begin to accelerate. Monitor your engine instruments as the engine accelerates. Remember, with MRT set at 100 KIAS, you only have to accelerate about 5-10 KIAS to reach liftoff speed, so shortly after the engine reaches MRT, you will be at your takeoff speed ***(within 1,500 to 2,000 ft under normal conditions)***. Turn downwind when the proper interval has been established at or above 300 ft AGL and when cleared by the tower.

Roll and Go—No Flap/Slat

Perform a normal no flap/slat landing approach and touchdown on the runway centerline. Upon touchdown, reduce the power to IDLE and allow the aircraft to decelerate to 140 KIAS or until 6,000 ft of runway remain, whichever comes first. Maintain directional control with the nose wheel steering, if required. If you are correcting for a crosswind, take out crab with rudder while simultaneously applying aileron into the wind to hold wings level, just prior to touchdown.

Immediately on touchdown, smoothly apply aileron into the wind to hold wings level, maintain longitudinal stick at approach position or slightly forward, and neutralize the rudder prior to nosewheel touchdown.

CAUTION

> Do not continue the roll beyond the 6,000 ft remaining marker on the runway.

Upon reaching either 140 KIAS or the 6,000 ft remaining marker, whichever comes first, direct IP to advance power to MRT. Once the aircraft is accelerating and 5-10 KIAS prior to the predicted takeoff speed, IP will rotate the aircraft to the takeoff attitude and allow the aircraft to fly off the runway. Anticipate a lag from the time you go to MRT to when you actually feel the aircraft begin to accelerate. Monitor your engine instruments as the engine accelerates. Remember, with MRT set at 140 KIAS, you only have to feel acceleration since you are above rotation speed, so shortly after the engine reaches MRT you will be at your takeoff speed. Turn downwind when the proper interval has been established at or above 300 ft AGL and when cleared by the tower. If turning downwind for a full flap/slat landing, lower flaps and slats at or above 300 ft AGL and slow to 130 KIAS prior to turning downwind.

Normal Field Landing Procedures

To perform a full-stop landing, fly a normal landing approach to touchdown on the runway centerline. Upon touchdown, maintain back pressure on throttle until ground idle is achieved. Apply smooth, steady braking below 100 KIAS, increasing brake pressure as speed decreases. Do not pump the brakes. During roll-out, less aileron may be required to maintain wings level.

Maintain initial directional control with nose wheel steering and begin normal braking at no more than 100 KIAS. Upon reaching taxi speed, clear the duty runway (high gain nose wheel steering may be engaged). Be sure to comply with local course rules/SOP for clearing the runway. Do not change configuration until clear of runway. Full aileron into the wind is required to taxi with a crosswind of greater than 20 knots.

After clearing the duty runway, perform the post-landing check list. Switch to Ground Control to request taxi clearance. Once you have received taxi clearance, taxi to the line. Call base on radio to advise of aircraft condition as you enter the line area.

NOTES

1. Braking or a combination of braking and NWS inputs may result in PIO. If PIO about the runway centerline occurs, discontinue braking and use low gain NWS to accomplish a straight track down the runway. Once a straight track is accomplished, resume normal braking. Slight pumping of the brakes prior to normal brake application may preclude PIO.

2. It has been determined through testing that the "T-45 has an unstable critical speed for ground handling above 57 knots. Although the aircraft is shown stable at touchdown speeds, the aircraft rapidly loses directional stability as it slows. Below 40 knots stability increases."

CAUTION

Improper braking and NWS technique may result in exaggerated PIO. The sensitive directional control characteristics of the T-45 during landing rollout will require the IP to make frequent, coordinated brake/NWS inputs to safely perform full stop landings. Not using these techniques or excessive or exaggerated NWS inputs may result in the airplane departing the runway at high speeds.

Night Landing at a Field without a Fresnel Lens

Night landings at a field with no Fresnel lens are usually preceded by an instrument approach, so review the circle-to-land procedures as outlined in the Instrument FTI. Many civilian fields provide visual glideslope indicators in the form of the Visual Approach Slope Indicator (VASI) or the Precision Approach Path Indicator (PAPI).

VASI—VASI is a system of lights that provides visual descent guidance to the runway installed on either or both sides of the approach end of the runway. At night, these lights can be seen from as far as 20 miles or more. VASI provides safe obstruction clearance within plus or minus 10 degrees of the extended runway centerline up to 4 miles from the runway threshold. VASI systems consist of two light units or bars, near and far, with some having three bars, near, middle, and far. VASI operates on the principle of color differentiation between red and white. Each light unit projects a beam of light having a white segment in the upper part of the beam and a red segment in the lower part. A two-bar VASI provides a visual glidepath normally set at 3 degrees. A three-bar VASI provides two glidepaths, the lower using the near and middle bars set at 3 degrees, with the middle and far bars providing a glidepath normally 1/4 degree higher used for high cockpit aircraft to provide sufficient threshold crossing height. The light units are arranged so the pilot will see the combination of lights shown in Figure 3-3.

PAPI—PAPI uses light units arranged in a single row of two or four light units installed on the left side of the approach end of the runway. Pilots may see this system from 20 miles at night. Glidepath indications are shown in Figure 3-3.

Techniques

When transitioning from instruments to the runway environment, note the VSI required to stay on the VASI or PAPI glidepath. Maintain on-speed and make corrections from above or below the indicated glidepath in the same manner as flying with the Fresnel lens, noting that once on glidepath, it is much wider and VSI must be kept in your scan all the way to touchdown.

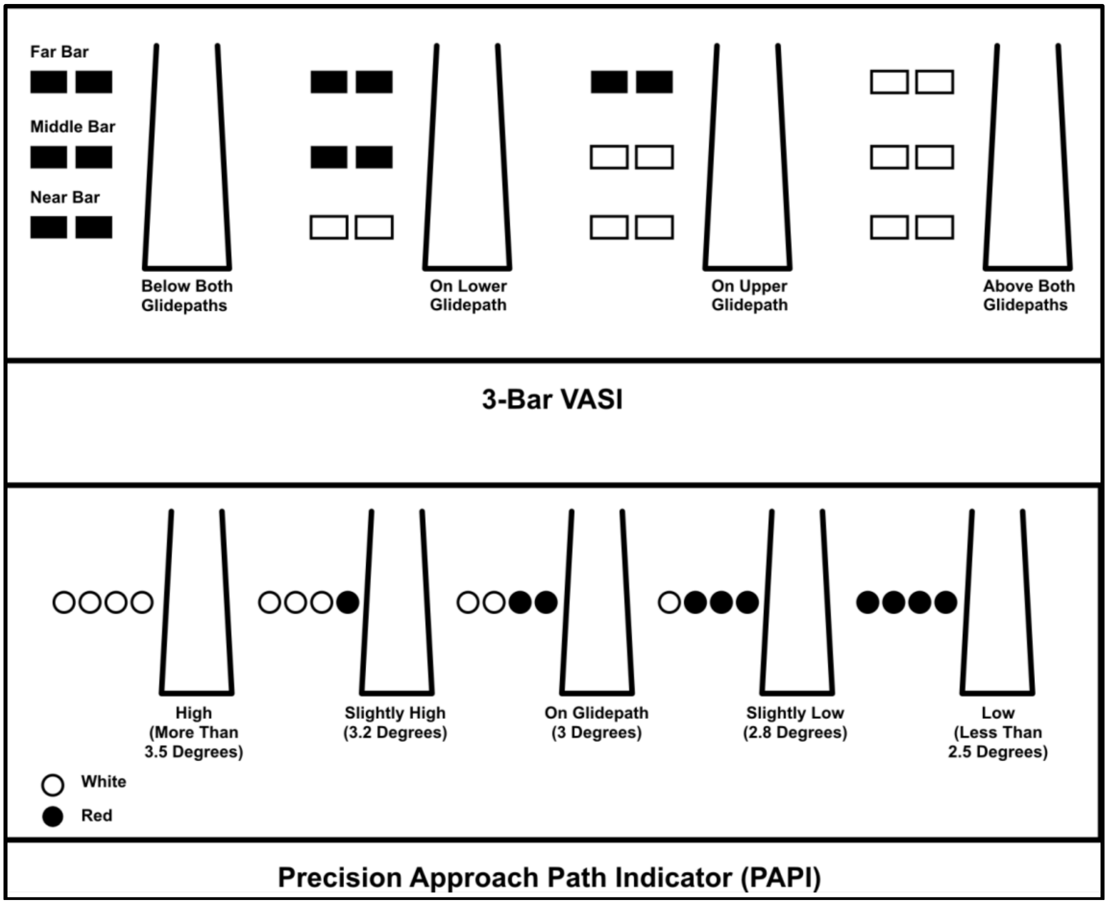

Figure 3-3 VASI (Three-bar) and PAPI

Landing at a Field with No Landing Aid

On approaching centerline, put the intended point of landing at approximately 3 degrees below the horizon (the HUD shows this as 3/5ths between the horizon line and the dashed negative 5-degree mark) and start your descent using VSI as your primary glidepath indicator. Hold a 500 to 700 fpm rate of descent, depending on headwind, on-speed. If going below glidepath, indicated by the point of landing moving away or rising above the 3-degree glideslope, make the proper power correction to decrease your rate of descent until the landing point is again 3 degrees down, then increase your rate of descent, realizing that the VSI must be less than the first attempt at maintaining glidepath. Going above glidepath is indicated by the landing point sliding below the 3-degree glideslope, or seeming to move closer. Make the power correction to increase VSI back down to glidepath, then reset the power to a relatively greater rate of descent than you started with. Maintain VSI and proper corrections all the way to touchdown.

Transition from Half Flaps to Full Flaps

Listen to ATIS before you start your approach and decide if it will be flown at half flaps or full flaps, based on fuel remaining and lowest reported broken or overcast layer. Transition to full flaps should be made at approximately 500-feet AGL or Height Above Touchdown, below the lowest layer of clouds if possible. Before the flaps are moved, note the rate of descent on the VSI, then select full flaps. The jet will want to balloon, so hold enough forward stick to maintain VSI. On-speed will now be slower than at half flaps, so you will now show fast on the AOA gauge. As you are holding forward stick, reduce power to slow the aircraft to the full flap on-speed. The forward pressure required to maintain VSI will decrease as the aircraft slows, and then pass through the half flap setting until you will need a little back-stick pressure to hold the full flap on-speed setting. Retrim the aircraft for on-speed.

Uncontrolled Airport and UNICOM Voice Procedures

Aircraft operating on an IFR flight plan, landing at a field without an operating Control Tower, will be advised to change to the airport advisory frequency when direct communications with ATC are no longer required. Towers and Centers do not have nontower airport traffic and runway-in-use information, so if the information has not been obtained through ATIS or otherwise, you should make a quick change to the airport advisory frequency when authorized. Be alert and look for other aircraft around the airfield, and exchange traffic information when approaching or departing the uncontrolled airfield. This is critical, as some aircraft, such as cropdusters, may not have comm capability, while others may not communicate their presence or intentions. These transmissions will be made on a common frequency identified for the purpose of airport advisories known as CTAF, or common traffic advisory frequency. The CTAF may be a UNICOM, MULTICOM, FSS, or tower frequency and is identified in appropriate aeronautical publications.

When approaching a field with an FSS or UNICOM, establish comm about 10 miles out, state your aircraft type, call sign, location relative to the airfield, intentions to land or overfly, and request wind information and runway in use. Each report is preceded with the airfield ID, such as, “College Station FSS. . .,” or “College Station UNICOM, ROKT 411, T-45, 10 miles south at 5,000 ft for landing, request airport advisory.” Report on downwind, base leg, final, and when clear of the runway to the area traffic: “College Station traffic, ROKT 411 downwind for runway 13.” If there is no Tower, FSS, or UNICOM station at the airfield, use MULTICOM frequency 122.9 for self-announcement of position and intentions. For practice approaches, report final approach fix inbound or established on final approach segment on being released by ATC, as well as missed approach or completion of approach. Departing aircraft should always be alert for arrival aircraft coming from the opposite direction and make calls for taxiing, taking the runway, and leaving the 10-mile radius of the airfield.

Crosswind Landing Technique

Immediately on touchdown, smoothly apply aileron into the wind as required to hold wings level, maintain longitudinal stick at approach position or slightly forward, and neutralize the rudder prior to nose wheel touchdown. During roll-out, less aileron may be required to maintain wings level.

Landing with Blown Main Tire(s)

Although the chances of a blown main tire while operating at an airfield are remote, consideration must be given to your reaction to this emergency and the handling characteristics of the aircraft during landing and roll-out. If a blown main tire is experienced, you can expect to receive an LSO talk down to a fly-in short field arrested landing. The target touchdown point is on centerline within 50 feet of the arresting gear. On touchdown, the aircraft will begin an immediate and rapid yaw or swerve to the side of the blown tire that could establish approximately 3 degrees AOB opposite the direction of yaw. The pilot should anticipate this and be prepared to apply the proper corrective control inputs (rudder pedal deflection opposite the swerve) and execute a go-around. The technique for go-around is the same as for normal touch and go or bolter with the additional and simultaneous application of rudder pedal to counter the swerve (up to 180 lbs of force). The prompt, but smooth application of aft stick (up to full aft stick) will reduce time on deck. This technique maintains the proper pitch attitude for arresting wire engagement and also prepares the aircraft for an immediate fly-away should the hook not engage the arresting wire. If an arrested landing is not possible, you must consider the effect of crosswind in determining the best runway to attempt a landing. A crosswind component of more than 5 knots from the bad tire side is highly undesirable. It is recommended to accept a quartering-tailwind from the good tire side rather than landing with more than 5 knots from the blown tire side. Land on the good tire side of the runway and simultaneously retard power and counter the swerve with rudder pedal input. Do not use high-gain nose wheel steering. Applying full forward stick can increase low-gain NWS effectiveness. Judicious application of brakes below 100 KIAS can help increase directional control (care must be taken to avoid blowing the remaining tire since anti-skid is off). If directional control of the aircraft is lost and high-speed departure of the runway is imminent, ejection should not be delayed. Pilot proficiency and ability to counter the swerve should be considered prior to attempting a roll-out landing. A gear-up landing or a controlled ejection may be required. If both main tires are blown, an arrested landing shall be used to recover the aircraft. For more clarification, consult the T-45 NATOPS.

NOTE

> In the event a field arrestment has been performed due to a brake failure, NWS failure, or a blown tire, aircrew shall not attempt to taxi clear of the runway. Aircrew should inform the tower that a tow is necessary and request coordination from their appropriate base.

Go Around

Every time a full-stop landing is performed, aircrew should crosscheck their deceleration with the distance remaining boards on the runway. If line speeds are not being met at any of the "gates," then a go around should be executed. For example, the aircraft should be at 60 knots or less at the 3 board, but indicated airspeed is 70 knots, the aircrew should execute a go around (see Roll and Go section above for expected aircraft performance).

CAUTION

Based on airspeed and/or runway length, high speed braking may be needed at greater than 100 knots in order to meet line speeds (e.g., landing at 119 knots close to the 5 board on a 6,000 foot runway). If that is the case, apply the same braking techniques described in the Normal Field Landing Procedures section below. Low speed braking techniques remain the same.

Additionally, a go around is prescribed in the Brake Failure and the Loss of Directional Control procedures, as well as in various other cases not mentioned in NATOPS/PCL;
e.g., controllability issues during roll out and failure to trap in a field-trap scenario. The decision to execute a go round for any unsafe condition must not be delayed. Once the decision to go around is made, initiate the go around according to NATOPS procedure. The prompt, but smooth application of aft stick (up to full aft stick without exceeding 24 units AOA) will reduce time on deck. Directional control and indicated airspeed are the critical factors the pilot should consider in determining whether to go around or stay on the runway. If directional control of the aircraft is lost, and high speed departure of the runway is imminent, ejection should not be delayed.

Scenario 1: Assuming no other malfunctions, weather VMC on a standard day, and fuel at 600lbs. On landing roll, you are passing the 3,000 ft remaining marker with 70 knots ground speed, what would you do? Go around or continue with the landing roll and check your groundspeed passing the 2,000 ft remaining marker?

Answer: Again, assuming no other issues, in this case, a go around would be prescribed.

Stall speeds with approach power and gross weight of 11,500 lbs are:

Half flaps 99 KIAS
Full flaps 94 KIAS

NOTES

1. Stall speeds at MRT will be 6-8 knots lower.

2. Liftoff will be prolonged under hot, humid, and/or high altitude conditions.

Scenario 2: You are on a cross country and are landing on a 6,000 foot runway. Upon landing, you notice that the brakes feel "mushy" but you still feel deceleration. At the 5 board, you see 105 knots. At the 4 board, you see 86 knots, and at the 3 board, you see 52 knots. What would you do? Assume a standard day with no other aircraft malfunctions.

Answer: Pilot discretion should be exercised in this scenario. Continuing with normal braking techniques as described in the Normal Field Landing Procedures is viable, but one can also argue that if you suspect a failure in the brake system, a go around should be executed.

Scenario 3: You launch from a 6,000 foot runway. Immediately after takeoff, you lose your radios and decide to immediately turn downwind to recover. On touchdown, your ground speed is 125 knots and you are just prior to the 5 board. At the 4 board, you see 90 knots. At the 3 board, you see 59 knots. What should you do?

Answer: If you are in a high speed braking situation, you may not have your line speeds by the 5 board. Pilot discretion should be used to determine if adequate deceleration exists. Check line speeds again at the 4 and 3 board. If your line speeds are met, continue with the full stop.

317. APPROACH PROCEDURES

1. HSI Usage on Instrument Approaches

For ILS approaches, the student will remain in Planimetric mode until intercepting final approach course (no later than 10 DME) then switch to CDI and deselect the previous steering source.

For non-precision approaches, the student has the option to switch to CDI mode when the aircraft is within 30 radials of the final approach course (no later than within 10 radials) and no later than 10 DME.

2. Precision Approaches

On any instrument approach, it is the student's responsibility to inform the IP when it is appropriate to transition to the landing configuration. On a precision or surveillance approach (PAR/ASR) or ILS, this occurs when the aircraft is within 5-7 NM of the FAF or 10 NM of the field and 30° from runway heading when there is no defined FAF.

SNFO (ICS): *"Slow to gear speed."*

The IP will ensure the gear and flaps are lowered as the aircraft decelerates through 200 KIAS (SNFO will back-up the IP). The student will initiate the Landing Checklist after three down-and-locked is observed on the landing gear indicator.

On a radar approach (PAR or ASR), the speed brakes will remain retracted until the aircraft begins its final descent. During an ILS, the speed brakes will remain retracted until glideslope intercept. The student will proceed through the entire Landing Checklist, but will not call the checklist complete until the speed brakes are extended and flaps are set as intended for landing. Once final descent is commenced, the speed brakes will be extended and, at this point, the Landing Checklist may be completed:

SNFO (ICS): *"Speed brakes."*

IP (ICS): *"Out."*

SNFO will report checklist complete whether he/she has clearance to land or touch-n-go, since clearance to land/option is separate from the internal landing checklist.

SNFO (ICS): *"Landing Checklist complete"*

When clearance to either land or execute the option has been received, the SNFO will verbalize the full Clearance to Land/Option report which re-confirms the landing checklist is complete for landing.

SNFO (ICS): *"Gear down, Landing checklist complete, cleared to land/touch-n-go on runway…"*

3. **TACAN Approaches**

On a TACAN approach, transition to the landing configuration will be initiated when the aircraft is within 5–7 NM from the FAF. As with a radar approach, the speed brakes may remain retracted until the aircraft begins its final descent at the FAF. Therefore, the student will treat the Landing Checklist in a manner similar to a GCA.

318. POST LANDING

Once clear of all active runways and prior to accomplishing any other task, the student will initiate the disarming of the ejection seats.

SNFO (ICS): *"Ready to safe in the back."*

IP (ICS): *"Safe in the front."*

SNFO (ICS): *"Safe in the back."*

IP (ICS): *"Cleared to unstrap."*

After the seats have been confirmed safe by both aircrew the student may call Ground:

SNFO (PRI): *"Ground, ROKT 403, clear of the duty, taxi to my line."*

GROUND (PRI): *"ROKT 403, taxi to your line."*

Additionally, once clear of the runway, the student and IP will check for any exceedances or overflows (on MFCD – MENU/ BIT / MANT) and complete the Post-Landing Checklist:

SNFO (ICS): *"No exceedances or overflows"*

SNFO (ICS): *"Check pitot heat, strobes, squawk, landing light, speed brakes, flaps, and trim."*

While no further communication is required regarding the Post-Landing Checklist, it is the student's responsibility to ensure the IP complies with all items in this checklist. The student, meanwhile, will complete his/her portion of the checklist. When completed and verified the student will report it complete.

SNFO (ICS): *"Post Landing checks complete."*

After exiting the taxiway into the CTW-6 line area, the student will call Base and report on deck, event complete or incomplete with estimated flight time and Aircraft status with side number.

SNFO (AUX): *"Base, ROKT 403, safe on deck."*

BASE (AUX): *"Roger 403."*

Before engine shutdown, SNFO will secure all pertinent items in the rear cockpit (NAVAIDs, MFCD's, DEP, radios, etc…) and report clear for opening of the canopy after shutdown.

SNFO (ICS): *"All my equipment is off, I'm clear of the canopy after shutdown."*

After the IP shuts down the engine and a thumbs-up is signaled from the PC, the student will ensure the ejection seat is properly pinned and exit the aircraft. Always ensure there is no loose gear or FOD left in the aircraft. Ejection seat etiquette forbids stepping on an ejection seat while getting in or out of an aircraft.

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CHAPTER FOUR
STALLS

400. INTRODUCTION

This phase of your training introduces the procedures for entering and directing recovering from several stall conditions, including the Break Turn Stall/Recovery, the Power Off Stall/Recovery, the Landing Attitude Stall/Recovery, the Approach Turn Stall/Recovery, and the Accelerated Stall/Recovery. This section also states the required weather and altitude minimums and discusses the pre-stall and aerobatic checklist.

You and your IP will perform stalls to familiarize yourself with the T-45's flight characteristics as you approach and enter a stalled condition. Your ability to recognize and direct your IP to recover from an impending stall is a critical component of your skills as a qualified Naval Flight Officer.

401. PRE-STALL ACTIVITIES

Weather/Altitude Minimums

Weather and altitude minimums for performing stalls are as follows:

1. Daylight

2. VMC/visible horizon

3. Recovery from maneuvers must be complete (return to straight and level flight) without descending below 10,000 ft AGL

Pre-stall and Aerobatics Checklist

Complete the pre-stall and aerobatic checklist prior to attempting any type of stall or aerobatic maneuver to ensure that you are prepared for the maneuver and that you are clear of other aircraft. To perform the checklist:

1. Secure the cockpit of foreign objects

2. Secure the map case

3. Check your fuel state

4. Clear the area

402. STALLS AND RECOVERIES

Break Turn Stall/Recovery

The Break Turn Stall and Recovery demonstrates stall characteristics and the proper recovery techniques to employ in the event that your pilot pulls too hard and stalls the aircraft during the break. In the Break Turn Stall, the stall speed increases dramatically because of the increase in the load factor imposed by the high-g break turn.

Complete the pre-stall and aerobatic checklist. At 300 KIAS, roll into a 70- to 80-degree AOB level turn, reduce the power to idle, and extend the speed brakes. Maintain altitude and continue to apply back stick pressure. At approximately 220 KIAS, smoothly increase back stick pressure until a stall occurs. Don't trim into the stall. The stall should occur within 180 degrees of turn. In addition to the rudder shaker, stall characteristics may include a wing drop, pitching oscillation, and some yaw with buffeting at full back stick. To recover from the stall, simultaneously decrease back stick pressure, advance the power to MRT, retract the speed brakes, and roll wings level. The maneuver is complete when the wings are level and the aircraft is in a level flight attitude at 150 KIAS.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver

   SNFO (ICS): *"Set 300 knots, heading XXX, setting up for the Break Turn Stall."*

   IP (ICS): when initial conditions are met: "R*eady"*

   SNFO (ICS): *"Ready, clear L/R."*

   IP (ICS): *"Clear L/R, breaking L/R"*

3. Recognize stall condition and direct recovery

   SNFO (ICS): *"MRT, boards in, level your wings, (altitude, airspeed)"*

   IP (ICS): IP will decrease back stick pressure at recovery initiation: *"Recovering"*

   SNFO (ICS): Upon reaching maneuver completion parameters: *"(altitude, airspeed), maneuver complete."*

Power Off Stall/Recovery

The Power Off Stall and Recovery demonstrates stall characteristics and proper recovery techniques to employ when the aircraft stalls in the clean configuration at low thrust. This stall could occur as you attempt to stretch a glide.

Review the pre-stall and aerobatic checklist. Reduce power to IDLE, slowing the aircraft to 180 KIAS. Speed brakes may be used, but retract them once established at 180 KIAS. Maintain 180 KIAS wings level in a descent. Trim the aircraft for hands-off flight in a 180-KIAS descent, note the rate of descent, and then stop trimming.

Without adding power, slowly increase back stick to level off, as though you are attempting to stretch the glide. Allow the aircraft to decelerate while increasing back stick to maintain altitude. Continue slowing down through rudder shaker. As you approach the stall, buffeting increases and some yaw may develop. At the stall, buffeting is pronounced and you will get a wing drop-off.

To recover, expeditiously lower the nose to slightly below the 180 KIAS descent attitude and allow the airspeed to increase. As you approach 180 KIAS, note the rate of descent, and then adjust the nose attitude to maintain a 180 KIAS descent without reentering the rudder shaker. The maneuver is completed when the aircraft is wings level in a 180 KIAS idle descent.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver:

   SNFO (ICS): *"Throttle idle, slow to 180 knot glide, setting up for the Power off Stall."*

   IP (ICS): when initial conditions are met: *"Ready"*

   SNFO (ICS): *"Ready, show (ADI attitude) degrees nose low, level off."*

3. Recognize stall condition and direct recovery:

   SNFO (ICS): *"Lower the nose, set (below the 180 glide attitude) degrees"*

   IP (ICS): *"Recovering"* (IP will intercept 180 KIAS glide attitude)

   SNFO (ICS): Upon reaching maneuver completion parameters: *"(altitude, airspeed), maneuver complete."*

Landing Attitude Maneuver

The Landing Attitude Maneuver demonstrates the recovery techniques to employ in the event of an inadvertent entry into rudder shaker in the landing configuration—most likely to occur after you dirty up for a landing but fail to add enough power to maintain optimum AOA. The goal is to fly the aircraft out of rudder shaker while maintaining attitude.

Review the pre-stall and aerobatic checklist. Dirty up, slow to on-speed, and complete the landing checklist, cross-checking AOA with computed "on-speed" condition for aircraft gross weight.

To perform the Landing Attitude Maneuver, maintain wings level, reduce the power to idle, maintain altitude, and allow the aircraft to decelerate until activation of the rudder shaker. Don't trim into the stall. To recover, advance the power to MRT, retract the speed brakes, and maintain the nose attitude. Fly out of the rudder shaker condition. When the rudder shaker stops, adjust the nose attitude to establish a climb without reentering the rudder shaker. The maneuver is complete when the aircraft has a positive rate of climb indicated on both the MFD altitude and the VSI.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver:

   SNFO (ICS): *"landing configuration, on-speed, setting up for the Landing Attitude Maneuver."*

3. Complete landing checklist and AOA crosscheck procedures

   IP (ICS): *"Ready."*

   SNFO (ICS): *"Ready, throttle idle, maintain altitude."*

4. Recognize pre-stall condition (rudder shakers) and direct recovery:

   SNFO (ICS): *"MRT, boards in, maintain attitude, (altitude, airspeed)"*

   IP (ICS): *"Recovering"*

   SNFO (ICS): Upon reaching maneuver completion parameters: *"(altitude, airspeed), maneuver complete."*

Landing Attitude Stall/Recovery

The Landing Attitude Stall and Recovery demonstrates the proper techniques to employ if airframe buffet occurs while you are wings level in the landing configuration. Airframe pre-stall buffeting increases until the stall, so it serves as your warning that a stall is about to occur. This stall could result if the rudder shaker is inoperative or ignored.

Review the pre-stall and aerobatic checklist. Maintain on-speed AOA in the landing configuration with the speed brakes extended. Maintain wings level, reduce the power to idle, and increase the nose attitude to maintain altitude. As the aircraft decelerates, disregard the rudder shaker and the onset of buffet. Don't trim as the aircraft decelerates.

At the first indication of stall, normally associated with wing drop-off but no later than 30 units, simultaneously reduce nose attitude, advance the power to MRT, and retract the speed brakes. The pilot must ease AOA below 24 units to break the stall, then carefully reset to 24 units for the recovery. Maintain 24 units AOA which precludes reentering airframe buffeting while minimizing the loss of altitude. The maneuver is complete when the aircraft has a positive rate of climb indicated on both the altimeter and the VSI.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver:

   SNFO (ICS): *"landing configuration, on-speed, setting up for the Landing Attitude Stall."*

3. Complete landing checklist and AOA crosscheck procedures

   IP (ICS): *"Ready."*

   SNFO (ICS): *"Ready, throttle idle, maintain altitude."*

4. Recognize stall condition and direct recovery:

   SNFO (ICS): *"MRT, boards in, 24 units, (altitude, airspeed)"*

   IP (ICS): ***IP WILL REDUCE ATTITUDE AT RECOVERY INITIATION TO PREVENT ENGINE STALL***: *"Recovering"*

   SNFO (ICS): Upon reaching maneuver completion parameters: *"(altitude, airspeed), maneuver complete."*

Approach Turn Stall/Recovery

The Approach Turn Stall and Recovery demonstrates the proper techniques to employ if airframe buffet occurs while you are in a turn during the landing approach.

Prior to the maneuver, review the pre-stall and aerobatic checklist, and the landing checklist. Decelerate to and maintain on-speed AOA. To perform the maneuver, roll into a 25-degree AOB level turn, reduce the power to idle, maintain altitude with the nose, and allow the aircraft to decelerate to stall. Recover at the first indication of stall, normally associated with wing drop-off but no later than 30 units, by simultaneously decreasing back stick pressure, rolling wings level, advancing the power to MRT, retracting the speed brakes, and flying out of the buffet by readjusting the nose attitude to achieve 24 units AOA and to minimize loss of altitude. The pilot must ease AOA below 24 units to break the stall, then carefully reset to 24 units for the recovery. The maneuver is complete when the aircraft is on-speed with wings level and with a positive rate of climb indicated on both the altimeter (T-45A) or MFD altitude (T-45C) and the VSI.

NOTE

> Engine compressor stall is an aerodynamic breaking of airflow through the compressor section. Factors that can increase the likelihood of compressor stall: FOD, high aircraft AOA at low airspeed, severe maneuvering, rapid engine acceleration from low power settings, high power settings, unusual flight attitude, flight through jetwash, hot gas ingestion, incorrect engine rigging, and ice formation on inlet ducts. T-45 NATOPS 11.8.1 states that crewmembers should be aware that many conditions cited above are encountered during a recovery from an Approach Turn Stall.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver:

   SNFO (ICS): *"landing configuration, on-speed, setting up for the Approach Turn Stall."*

3. Complete landing checklist and AOA crosscheck procedures

   IP (ICS): *"Ready, clear L/R."*

   SNFO (ICS): *"Ready, clear L/R, turn L/R, throttle idle, maintain altitude."* (IP will set 25 deg AOB)

4. Recognize stall condition and direct recovery:

SNFO (ICS): *"Wings level, MRT, boards in, 24 units, (altitude, airspeed)"*

IP (ICS): ***IP WILL REDUCE ATTITUDE AT RECOVERY INITIATION TO PREVENT ENGINE STALL***: *"Recovering"*

SNFO (ICS): Upon reaching maneuver completion parameters: *"(altitude, airspeed), maneuver complete."*

Accelerated Stall/Recovery

The Accelerated Stall and Recovery demonstrates the characteristics of and recovery techniques for a high-speed stall. It illustrates that excessive AOA, regardless of the cause, will result in a stall; in this stall, however, higher G forces cause the stall to occur at a higher airspeed.

Review the pre-stall and aerobatic checklist. Once established at 280 KIAS, set an RPM to maintain airspeed. Roll into a 70- to 80-degree AOB turn and apply back stick pressure through the onset of buffet and into a stall. Because the stall buffet is very clear, it provides good warning of the stall. Stall characteristics may include a wing drop, pitch oscillations, or the control stick's reaching the full aft position.

NOTE

The aircraft should stall within the first 90 degrees of the turn.

To recover, simultaneously release back stick pressure, advance the power to MRT, and roll wings level. The maneuver is complete when the wings are level and the aircraft is in a level flight attitude. Recovery is immediate when back stick pressure is relaxed.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver

    SNFO (ICS): *"Set 280 knots, heading XXX, setting up for the Accelerated Stall."*

    IP (ICS): when initial conditions are met: "R*eady"*

    SNFO (ICS): *"Ready, clear L/R."*

    IP (ICS): *"Clear L/R, turning L/R"*

3. Recognize stall condition and direct recovery

    SNFO (ICS): *"MRT, boards in, level your wings, (altitude, airspeed)"*

IP (ICS): IP will release back stick pressure at recovery initiation: *"Recovering"*

SNFO (ICS): Upon reaching maneuver completion parameters: *"(altitude, airspeed), maneuver complete."*

Stall Series

After you become proficient performing the stalls individually, they will be combined into a Stall Series. Perform the pre-stall and aerobatic checklist prior to the Stall Series and review it between each stall. The particular situation will dictate the order in which the stalls are performed, but normally they are executed in the following order:

1. Break Turn Stall

2. Power Off Stall

3. Landing Attitude Maneuver

4. Landing Attitude Stall

5. Approach Turn Stall

NOTE

The Accelerated Stall is not part of the "Stall Series" and may be completed anytime during the flight.

CHAPTER FIVE
UNUSUAL ATTITUDES/RECOVERIES

500. INTRODUCTION

Unusual Attitudes combine extreme attitudes with rapid increases or decreases in airspeed and require correct identification and proper recovery techniques. Unusual Attitude Recoveries are taught to boost your confidence in your ability to maneuver the T-45 throughout its flight envelope and to establish habit patterns that you will call on in later tactical stages.

Because your goals when recovering from Unusual Attitudes are to prevent the aircraft from departing controlled flight and to avoid overstressing the airframe, your ability to identify the situation rapidly is critical. You must be able to determine your aircraft's attitude in relation to the horizon and its energy state (airspeed) because these factors dictate what recovery procedures to perform.

501. ENTRY

Complete the pre-stall and aerobatic checklist. The instructor will take control of the aircraft, direct you to close your eyes, and will then maneuver the aircraft into a nose-high or nose-low attitude. The instructor will also position the throttle anywhere between MRT and IDLE and may even extend the speed brakes. When the instructor says, "You've got the controls." open your eyes, analyze the situation, and execute the proper recovery procedures.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Recognize unusual attitude and direct recovery over the ICS

3. Verbalize altitude and airspeed during the recovery

502. NOSE-HIGH UNUSUAL ATTITUDES (VMC)

1. **Concerns**

Your primary concern when recovering from a Nose-High Unusual Attitude is to maintain the AOA between 5 and 10 units. At slow speeds, very slight back stick pressure will cause a rapid increase in the AOA. Additionally, uncoordinated aileron and rudder inputs at slow speeds can introduce enough adverse yaw and increased AOA on the rising wing to cause a departure from controlled flight.

2. **Causes**

An unintentional Nose-High Unusual Attitude is typically caused by an improperly executed overhead aerobatic or tactical stage maneuver.

3. **Recovery**

When given control of the aircraft, simultaneously neutralize the flight controls (i.e., ailerons, stabilator, and rudder) and analyze the situation by scanning the appropriate instruments (i.e., ADI, AOA, airspeed, and altimeter). To recover from a nose-high condition, advance the power to MRT and retract the speed brakes to minimize loss of airspeed.

If airspeed is 150 KIAS or greater, smoothly roll inverted to nearest horizon, apply positive G to bring the nose back to the horizon, don't exceed 17 units AOA. After the nose passes through the horizon, G may be reduced slightly but positive G should be maintained. At 150 KIAS, roll upright and return to level flight.

If upright and airspeed is less than 150 KIAS, maintain neutral aileron and rudder and push the nose over to maintain an AOA indication of between 5 and 10 units (you will be between 0 and 1g). Hold this AOA until the nose falls through the horizon and the aircraft accelerates to 150 KIAS. Then roll wings level and return to level flight. If inverted, maintain neutral aileron and rudder and let the nose drop through the horizon while continuing to maintain no more than 17 units of AOA until the aircraft accelerates to 150 KIAS.

Level the wings in the shorter direction, raise the nose to the horizon, and adjust the power for straight and level flight. Do not exceed optimum AOA. During recovery at low speeds, you must be careful not to stall the aircraft.

4. **Voice Procedures:**

a. Upright < 150 KIAS

i. *"Throttle – MRT; speed brakes – IN"*

ii. *"Maintain 5–10 Units"*

iii. Once nose falls through the horizon AND airspeed is above 150 knots…

iv. *"Roll right/left"* (to nearest horizon)

v. *"Stop roll"*

vi. *"Pull not to exceed limits"*

vii. The maneuver is complete when the aircraft is wings level with level/positive VSI.

b. Upright > 150 KIAS and/or Inverted

i. *"Throttle – MRT; speed brakes – IN"*

ii. *"Slight Pull"*

iii. Once nose falls through the horizon AND airspeed is above 150 knots…

iv. *"Roll right/left"* (to nearest horizon)

v. *"Stop roll"*

vi. *"Pull not to exceed limits"*

vii. The maneuver is complete when the aircraft is wings level with level/positive VSI. *"Maneuver complete"*

503. NOSE-LOW UNUSUAL ATTITUDES (VMC)

1. **Concerns**

During recovery at high speeds, be careful not to overstress the aircraft—avoid rolling pullouts. Altitude loss is also a factor, so you should be familiar with the dive recovery charts in the NATOPS flight manual.

2. **Causes**

Inadvertent Nose-Low Unusual Attitudes are typically caused by improperly executed overhead aerobatic or tactical stage maneuvers.

3. **Recovery**

When given control of the aircraft, simultaneously neutralize the flight controls and analyze the situation by scanning the appropriate instruments (i.e., ADI, AOA, airspeed, altimeter).

To recover from a nose-low condition with your airspeed above 150 KIAS, reduce the power to IDLE to control airspeed and to minimize the loss of altitude. If the airspeed is rapidly increasing, extend the speed brakes as necessary. Level the wings (if inverted, roll upright in the shorter direction) and then raise the nose to the horizon without exceeding G limits or 17 units of AOA. When back in a level flight attitude, retract the speed brakes and advance the power for level flight.

4. **Voice Procedures:**

a. *"Throttle – Idle"*

b. *"Speed Brakes – OUT"*

c. *"Roll right/left"*

d. *"Stop Roll"*

e. *"Pull not to exceed limits"*

f. *"Power up, Speed Brakes – IN"*

g. The maneuver is complete when the aircraft is wings level with level/positive VSI.

"Maneuver complete."

504. UNUSUAL ATTITUDES (IMC)

General procedures:

Controls: Neutralize

Attitude: Analyze and evaluate to determine best recovery

Airspeed: Limit in dives

Bank: Eliminate when nose-low; hold constant when nose-high

1. Nose-High Recovery (IMC)

The difference between IMC and VMC UA's is with the Nose-High Recovery (IMC). When IMC, we will ***not*** intentionally roll the aircraft inverted to recover if airspeed is above 150 KIAS.

Your primary concern when recovering from a nose-high unusual attitude is to maintain the AOA between 5 and 10 units. At slow speeds, very slight back stick pressure will cause a rapid increase in the AOA. Additionally, uncoordinated aileron and rudder inputs at slow speeds can introduce enough adverse yaw and increased AOA on the rising wing to cause a departure from controlled flight.

When given control of the aircraft, simultaneously neutralize the flight controls and analyze the situation by scanning the appropriate instruments (i.e., ADI display, AOA, airspeed, and altitude trend indicators). To recover from a nose-high condition, advance power to MRT and retract the speed brakes to minimize loss of airspeed.

If upright, maintain neutral aileron and rudder and smoothly push the nose over to maintain AOA between 5 and 10 units (you will be between 0 and 1 g). Hold this AOA until the nose falls through the horizon and the aircraft accelerates to 150 KIAS. Then roll wings level and return to level flight.

If inverted, maintain neutral aileron and rudder and pull the nose through the horizon maintaining optimum AOA. When the aircraft accelerates to 150 KIAS, level the wings in the shortest direction, pull the nose to the horizon, and adjust power for straight-and-level flight. Do not exceed optimum AOA. During recovery at low speeds, you must be careful not to stall the aircraft.

Nose-high upright recovery:

Controls: Neutralize
Attitude: Analyze and evaluate
Throttle: MRT
Speed brakes: Retract
AOA: Apply stick pressure to obtain 5-10 units AOA
Nose: Lower to slightly below horizon
Airspeed: Minimum of 150 KIAS
Wings: Level in shortest direction
Nose: Pull to horizon - optimum AOA
Throttle: Adjust for level flight

Nose-high inverted recovery:

Controls: Neutralize
Attitude: Analyze and evaluate
Throttle: MRT
Speed brakes: Retract
AOA: Apply back stick to obtain optimum AOA
Nose: Pull through horizon
Airspeed: Minimum of 150 KIAS
Wings: Level in shortest direction
Nose: Pull to horizon - optimum AOA
Throttle: Adjust for level flight

2. **Nose-LOW Recovery**

Same as NOSE-LOW RECOVERY (VMC)

505. VERTICAL RECOVERY

It is during an improperly flown overhead maneuver or in the ACM environment that you are most likely to find yourself extremely nose-high and rapidly running out of airspeed. Unlike the nose-low and nose-high recoveries where the instructor places you into an unusual attitude, for the Vertical Recovery you will fly the aircraft into an attitude that will require you to perform the recovery.

Entry

Complete the pre-stall and aerobatic checklist prior to performing this maneuver. Begin the maneuver at 280 KIAS. Execute a wings level 4-g pullup to a 60-degree, nose-high climb attitude.

Recovery

At 180 KIAS, advance the power to MRT and ensure that the speed brakes are retracted. Push the nose over and maintain 5 to 10 units of AOA (between 0 and 1 g). Allow the nose to fall below the horizon and let the aircraft accelerate to 150 KIAS. If necessary, at 150 KIAS, roll in the shorter direction to wings level before raising the nose smoothly to the horizon. Do not exceed optimum AOA (17 units). Adjust the power for straight and level flight.

If the aircraft recovery is not initiated by 120 KIAS or the airspeed bleeds off below 85 KIAS, perform a zero airspeed recovery:

1. Reduce the power to IDLE.

2. Neutralize the flight controls.

3. Allow the aircraft to fall through the horizon until you achieve a nose-low attitude.

4. Hold the nose-low attitude and increase the power as necessary to increase airspeed to 150 KIAS.

5. Roll wings level in the shorter direction and then smoothly raise the nose to the horizon without exceeding G limits or optimum AOA (17 units).

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist.

2. Direct initial start conditions for the maneuver:

SNFO (ICS): *"280 KIAS, setting up for the Vertical Recovery."*

IP (ICS): *"Ready."*

SNFO (ICS): *"Ready, 4 G's to 60 degrees nose up."* (IP will pull 4 G's to 60 deg nose up)

3. At 180 KIAS direct recovery:

SNFO (ICS): *"MRT, boards in, push 5-10 units AOA, (altitude, airspeed)."*

4. When nose is below the horizon and airspeed > 150 KIAS:

SNFO (ICS): *"Roll L/R (if required), pull not to exceed limits."*

5. The maneuver is complete when the aircraft is wings level with level/positive VSI.

SNFO (ICS): *"Maneuver complete."*

506. COMPRESSOR STALL DURING VERTICAL RECOVERY

Before or during any Vertical or Nose-High Unusual Attitude Recovery, a compressor stall might occur.

Causes

A compressor stall may occur when the aircraft is at high AOA and low airspeeds with high power settings, during unusual flight attitudes that interrupt airflow through the compressor, or because of abrupt throttle movements at high altitudes and low airspeeds.

Indications

A compressor stall may be indicated by a "pop" or "bang" followed by a "buzzing" sound and vibration. These indications are accompanied by a rapid drop in RPM and a sudden increase in EGT. Refer to NATOPS for emergency procedures for clearing an engine/compressor stall.

Clearing an Engine Stall

Refer to NATOPS for emergency procedures for clearing an engine/compressor stall.

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CHAPTER SIX
AEROBATICS

600. INTRODUCTION

You perform aerobatics to learn the standard aerobatic maneuvers while improving your basic air-work recognition, increasing your confidence, and developing critical crew coordination skills during dynamic flight.

Aerobatic flight also familiarizes you with the unusual attitudes that are possible in the aircraft. By directing the proper recovery methods, your confidence in both the aircraft and in your abilities will increase. Aerobatic training is essential to your development as a tactical Naval Flight Officer.

You must know, understand, and observe all restrictions pertaining to aerobatics and be thoroughly familiar with the capabilities and limitations of the T-45 aircraft (refer to NATOPS, Chapter 4).

Aerobatic maneuvers must be initiated from an altitude that will enable you and your IP to complete the maneuver and return to straight and level flight without descending below 10,000 ft AGL (or 11,000 ft MSL if working in the PNSS MOA). You will use visual cues outside the cockpit along with an efficient instrument scan of altitude, AOA and airspeed to execute aerobatics in the FAM stage. All bank angles, pitch attitudes, and power settings are considered to be approximate. You will also refer to the ADI during each maneuver, but only as a backup to your primary visual references.

The following paragraphs provide detailed procedures that your IP will use to accurately fly the aircraft through each aerobatic maneuver. SNFO crew coordination responsibilities are included in each section. The SNFO will be graded on his/her general knowledge of maneuver procedures and the effective execution of crew coordination tasks associated with each maneuver.

601. GENERAL AEROBATIC PROCEDURES

Upon entry into a maneuver:

1. Note aircraft airspeed, altitude, and heading parameters.

2. IP will attempt to exit the maneuver with similar parameters.

3. Use inside/outside scan technique and effective ICS crew coordination comms.

4. Zero G for greater than 30 seconds is prohibited.

602. BASIC MANEUVERS

Aileron Roll

A constant-rate 360-degree roll about the aircraft's longitudinal axis, the Aileron Roll is practiced to develop your abilities to maintain lineup with a reference line and to retain spatial orientation while flying through the inverted position (Figure 6-1).

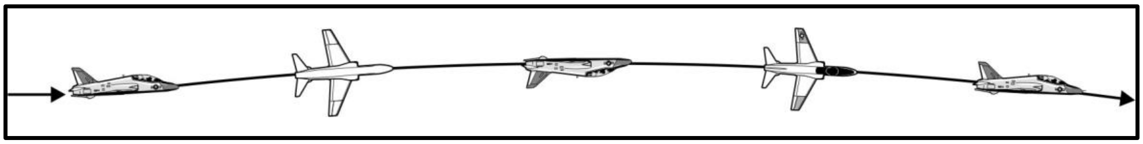

Figure 6-1 Aileron Roll

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Aileron Roll. Begin the maneuver at 300 KIAS, on altitude, with the power set to approximately 89% rpm, and aligned on a prominent terrain feature or section line. Raise the nose smoothly to 10 degrees above the horizon and then stop the nose movement. Apply aileron to produce a smooth, constant, and moderate rate of roll through 360 degrees. Excess back stick pressure will result in the nose scooping out more than 10 degrees below the horizon. Complete the maneuver with the nose on the horizon on the original heading and altitude.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver

   SNFO (ICS): *"Set 300 knots, heading XXX, 89%, setting up for the Aileron Roll."*

   IP (ICS): when initial conditions are met: "R*eady."*

   SNFO (ICS): *"Ready, clear L/R."*

   IP (ICS): *"Clear L/R, rolling L/R."*

3. Upon reaching maneuver completion parameters:

   SNFO (ICS): *"(altitude, airspeed), maneuver complete."*

Wingover

The Wingover is a 180-degree reversal of the direction of flight through the vertical as well as the horizontal plane. Perform it by combining a smooth climbing turn for 90 degrees and a smooth descending turn for 90 degrees, recovering at approximately the same airspeed and altitude at which you began the maneuver, but on the opposite heading.

The Wingover develops your ability to control the aircraft smoothly in balanced flight through constantly changing attitudes and airspeeds. Perform the maneuver in either direction in a series of two (in opposite directions) so that the series is completed on the same heading at which the first wingover was started (Figure 6-2).

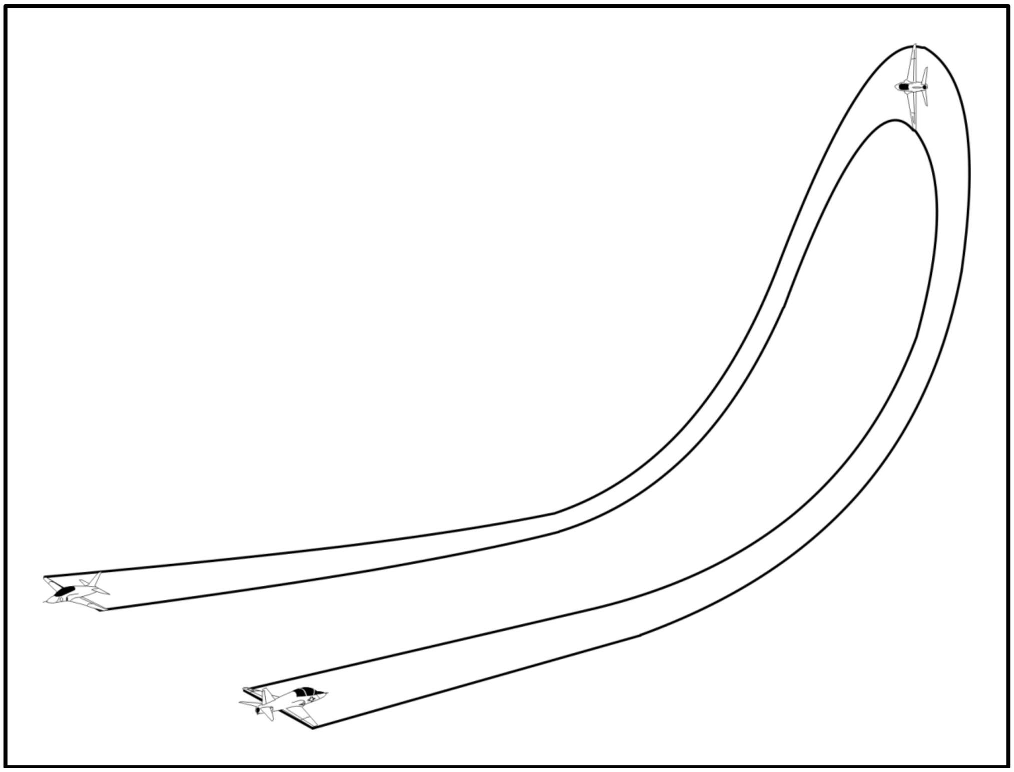

Figure 6-2 Wingover

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Wingover. Begin the maneuver at 300 KIAS, on altitude, with the power set to approximately 89% rpm, and aligned on a prominent terrain feature or section line. Select a reference point on the horizon that is approximately 90 degrees off the current aircraft heading. Raise the nose smoothly, keeping the wings level, to approximately 20 degrees noseup attitude. As the nose continues up, initiate a slow roll in the direction of the reference point. The nose should describe an arc above the horizon, reaching a maximum pitch of 45 degrees at approximately 45 degrees of heading change and 45 degrees AOB. As the AOB continues to increase, start the nose smoothly downward toward the horizon.

After 90 degrees of heading change, the nose passes through the horizon on the referenced point, with 90 degrees AOB and an airspeed of approximately 150-170 KIAS. Reverse the roll and begin to decrease the AOB as the nose falls through the horizon. The nose should describe a similar arc below the horizon, reaching a maximum pitch of 45 degrees nosedown, at approximately 135 degrees of heading change and 45 degrees AOB.

Roll out of the maneuver at a constant rate, increasing back stick pressure to control airspeed and altitude. Upon completion of the maneuver, you should be in straight and level flight at 300 KIAS, 180 degrees from the original heading, and at approximately the same altitude as at the beginning of the maneuver.

Now immediately raise the nose to continue the maneuver in the opposite direction. Your aircraft should be on its original heading upon completion of the second Wingover.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver

   SNFO (ICS): *"Set 300 knots, heading XXX, 89%, setting up for the Wingover."*

   IP (ICS): when initial conditions are met: "R*eady"*

   SNFO (ICS): *"Ready, clear L/R."*

   IP (ICS): *"Clear L/R, coming L/R"*

3. Upon reaching 90 degrees of turn (top), 180 degrees of turn (bottom):

   SNFO (ICS): *"(altitude, airspeed)."*

4. When maneuver complete:

   SNFO (ICS): *"(altitude, airspeed), maneuver complete."*

Techniques

When the Wingover is introduced, visualize the aircraft's path. Pay close attention to the relation of the aircraft to the horizon as you see it from the cockpit. Once you are able to visualize this relation, the Wingover is merely a matter of flying the aircraft through the pattern. As the aircraft's speed changes throughout the maneuver, you will have to adjust the amount of control deflection to maintain a constant rate of pitch and roll. As your bank angle increases, it is difficult to keep the nose coming up without drastically increasing your turn rate. If you are not getting 45 degrees nose up, you may be rolling too fast during the initial part of the maneuver.

Barrel Roll

In the Barrel Roll, you roll the aircraft 360 degrees about an imaginary point on the horizon that bears 45 degrees from the original heading of the aircraft. You practice it to further develop your confidence, coordination, and sense of feel while flying the aircraft through varying attitudes and airspeeds. The Barrel Roll also develops your ability to remain oriented while flying the aircraft in balanced flight through the inverted position (Figure 6-3).

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Barrel Roll. Begin the maneuver at 350 KIAS, on altitude, with the power set to approximately 92% rpm, and lined up on a prominent terrain feature or section line. Select reference points that are at 45 degrees and 90 degrees off the current aircraft heading. Smoothly bring the nose to approximately 20 degrees nose-high attitude while maintaining wings level. Passing 20 degrees noseup, initiate a smooth roll towards the 90-degree reference point while describing an arc around an imaginary 45-degree reference point. The nose will be at its highest when the aircraft is in 90 degrees AOB passing through 45 degrees of the turn.

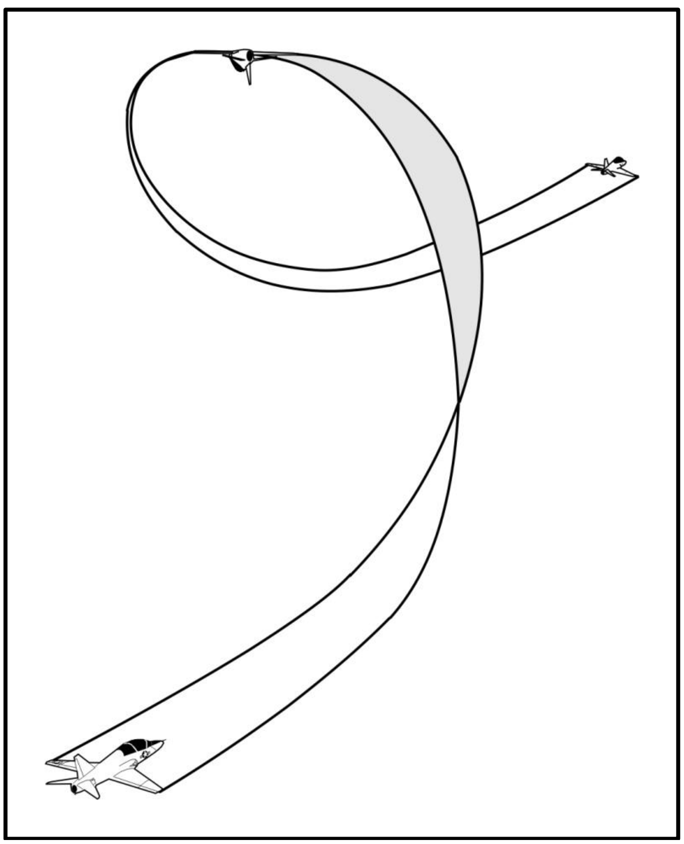

Figure 6-3 Barrel Roll

Continue at a constant rate of roll so that the aircraft is inverted wings level and 90 degrees off the original heading as the nose passes down through the horizon. Verify that your airspeed over the top is approximately 170-190 KIAS. Continue the roll so that the nose passes through the 45-degree nosedown position below the imaginary 45-degree reference point with a 90-degree AOB. Maintain constant nose movement and roll to exit the barrel roll at 350 KIAS at entry altitude and on entry heading.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver

   SNFO (ICS): *"Set 350 knots, heading XXX, 92%, setting up for the Barrel Roll."*

   IP (ICS): when initial conditions are met: "R*eady"*

   SNFO (ICS): *"Ready, clear L/R."*

   IP (ICS): *"Clear L/R, coming L/R"*

3. Upon reaching 90 degrees of turn (top):

   SNFO (ICS): *"(altitude, airspeed)."*

4. When maneuver complete:

   SNFO (ICS): *"(altitude, airspeed), maneuver complete."*

Techniques

As in the Wingover, you will have to adjust your control inputs to maintain a constant rate of roll and pitch as the airspeed changes during the maneuver. You will also have to visualize your lift vector location (at the top of the aircraft) so that you can use it to achieve the maneuver parameters. If you are not achieving 90 degrees of heading change as you roll inverted, you didn't maintain enough back stick when you were between 60 and 90 degrees AOB.

603. OVERHEAD MANEUVERS

NOTE

All overhead maneuvers require approximately 7,000 ft of altitude to complete.

For the execution of all vertical maneuvers to include the Squirrel Cage utilize the crew coordination procedures listed below.

SNFO Responsibilities:

1. Complete pre-stall and aerobatic checklist

2. Direct initial start conditions for the maneuver

   SNFO (ICS): *"Set XXX knots, heading XXX, XX%, setting up for the (maneuver)."*

   IP (ICS): when initial conditions are met: "R*eady"*

   SNFO (ICS): *"Ready, (altitude, airspeed)"*

3. Upon reaching top of vertical maneuver:

   SNFO (ICS): *"(altitude, airspeed)."*

4. When maneuvering nose low towards 90 degrees provide steady cadence of altitude and airspeed using outside and inside visual/instrument scan:

   SNFO (ICS): *"(altitude, airspeed)….(altitude, airspeed)"*

5. When maneuvering from 90 degrees nose low to the bottom of the maneuver provide steady cadence of altitude to the "deck" (11K MSL in PNSS MOA, 10K MSL in W-155A or as briefed) and airspeed. For example, in the PNSS MOA at 15K ft and 90 degrees nose low on the backside of a loop:

   SNFO (ICS): *"4 to the deck, 200…3 to the deck 280…2 to the deck 330…1 to the deck 360"*

6. At the bottom of the vertical maneuver (if follow on maneuvers remain, as with squirrel cage):

   SNFO (ICS): *"(altitude, airspeed)."*

7. When maneuver complete:

   SNFO (ICS): *"(altitude, airspeed), maneuver complete."*

Loop

Because the Loop is a 360-degree turn in the vertical plane, the stabilator is your basic flight control for the Loop. Employ ailerons and rudder for coordination and directional control (Figure 6-4).

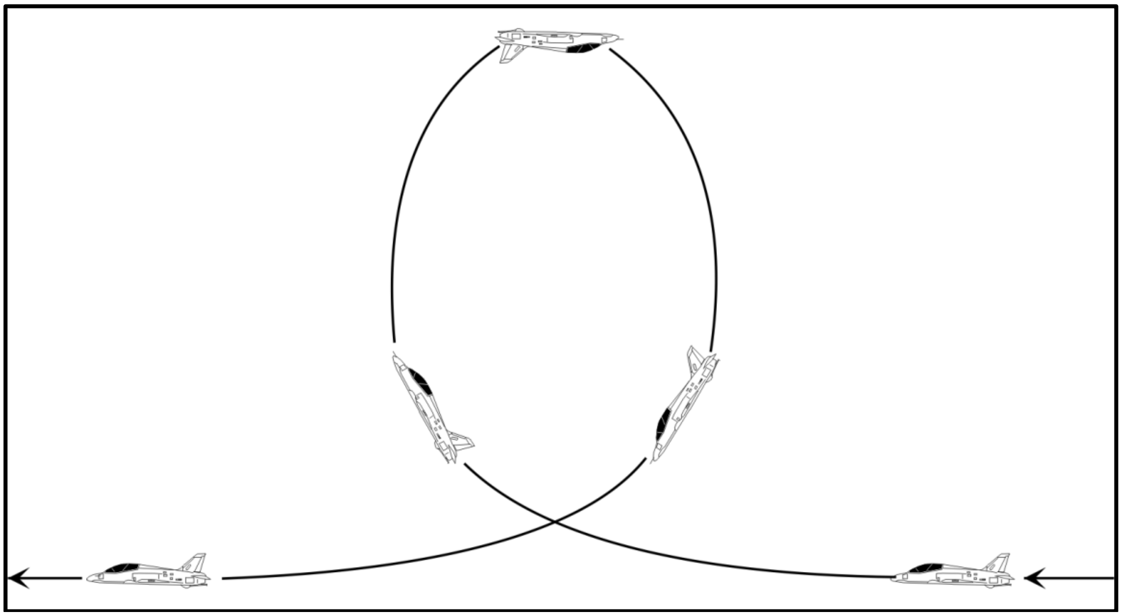

Figure 6-4 Loop

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the loop. Begin the maneuver at 380 KIAS, on altitude, and lined up on a prominent terrain feature or section line. Advance the power to approximately 96% rpm and expeditiously initiate a smooth 4-g wings level pullup to achieve 4 G in approximately 2 seconds. Increase back stick pressure to maintain 4 G as airspeed decreases. Maintain wings level with reference to the horizon. After the horizon disappears under the nose, maintain wings level by scanning the section lines on both sides of the aircraft. Continue to maintain the 4-g pull until reaching optimum AOA (17 units), then maintain optimum AOA over the top. As you approach the inverted position, look out over the top of the canopy to pick up on the section line for heading information and the horizon for wings level.

Verify that wings are level, that airspeed is about 150 KIAS, and that the aircraft is flying at optimum AOA going over the top. Bring the nose through the horizon, keeping the wings level, maintaining optimum AOA, and staying aligned on the referenced terrain feature. Continue to maintain optimum AOA until re-intercepting 4 G. Complete the loop at 380 KIAS, at initial altitude, and lined up on the referenced terrain feature.

Techniques

Going slow over the top results from failing to maintain the 4-g pull and optimum AOA during the first half of the Loop. Because of your decreasing airspeed in the climb, you must continuously increase back stick pressure to maintain the 4 G or optimum AOA. Not being aligned with the section line going over the top of the loop results from not maintaining a wings level pullup. Maintain your wing attitude in relation to the section lines throughout the Loop and immediately correct for any wing drop.

Half Cuban Eight

Initiated and ended at the same altitude, the Half Cuban Eight is a reversal of direction in the vertical plane and can be used as a standard weapons delivery maneuver. Enter the maneuver as you would a Loop, but, instead of completing the Loop, roll the aircraft to wings level when you are 45 degrees nose down, inverted. Continue the 45-degree nosedown descent to the original altitude but on the opposite heading (Figure 6-5).

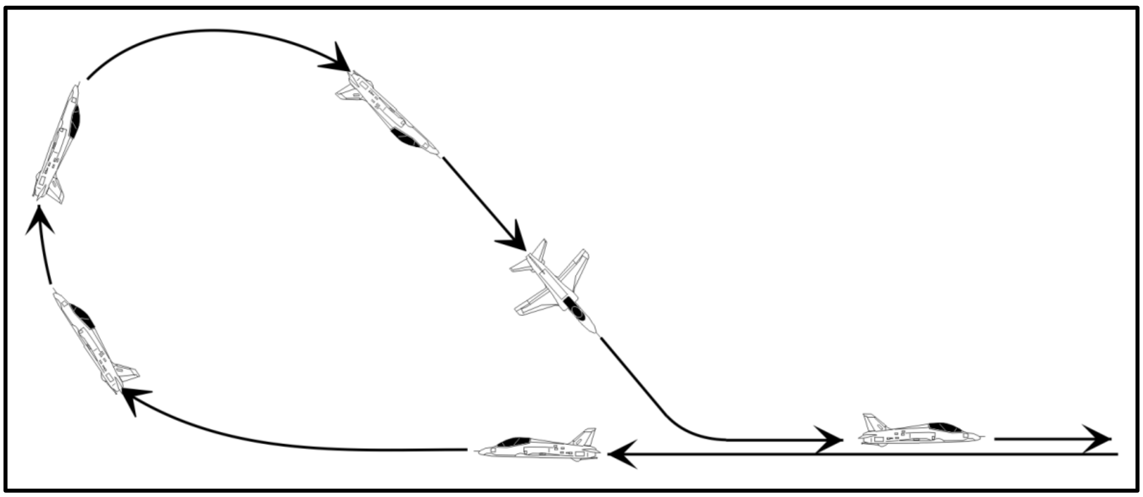

Figure 6-5 Half Cuban Eight

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Half Cuban Eight. Begin the maneuver at 380 KIAS, on altitude, and lined up on a prominent terrain feature or section line. Advance the power to approximately 96% rpm and expeditiously initiate a smooth wings level pullup to 4 G's. Increase back stick pressure to maintain the 4-g pull as airspeed decreases. To maintain wings level attitude during the first half of the maneuver, scan the section line on both sides of your aircraft after the horizon disappears under the nose.

Continue to maintain the 4-g pull until reaching the optimum AOA (17 units) and maintain optimum AOA over the top. Going over the top, verify that your wings are level, that airspeed is 150 KIAS, and that your aircraft is at optimum AOA.

Bring the nose through the horizon while still inverted with wings level and aligned on the referenced terrain feature. Stop the nose movement at 45 degrees nosedown and roll upright, maintaining wings level. Forty-five degrees nosedown is achieved when it feels like your feet are on the horizon. Continue in a 45-degree dive and accelerate to recover at entry airspeed. Use a 4-g pull to the horizon during recovery. The maneuver is complete when you are on entry altitude at 380 KIAS and going in the opposite direction. Be sure to stop the nose at 45 degrees nosedown with forward stick pressure prior to rolling wings level.

Immelmann

The Immelmann combines the first half of a Loop with a 180-degree roll to wings level at the top of the Loop (Figure 6-6).

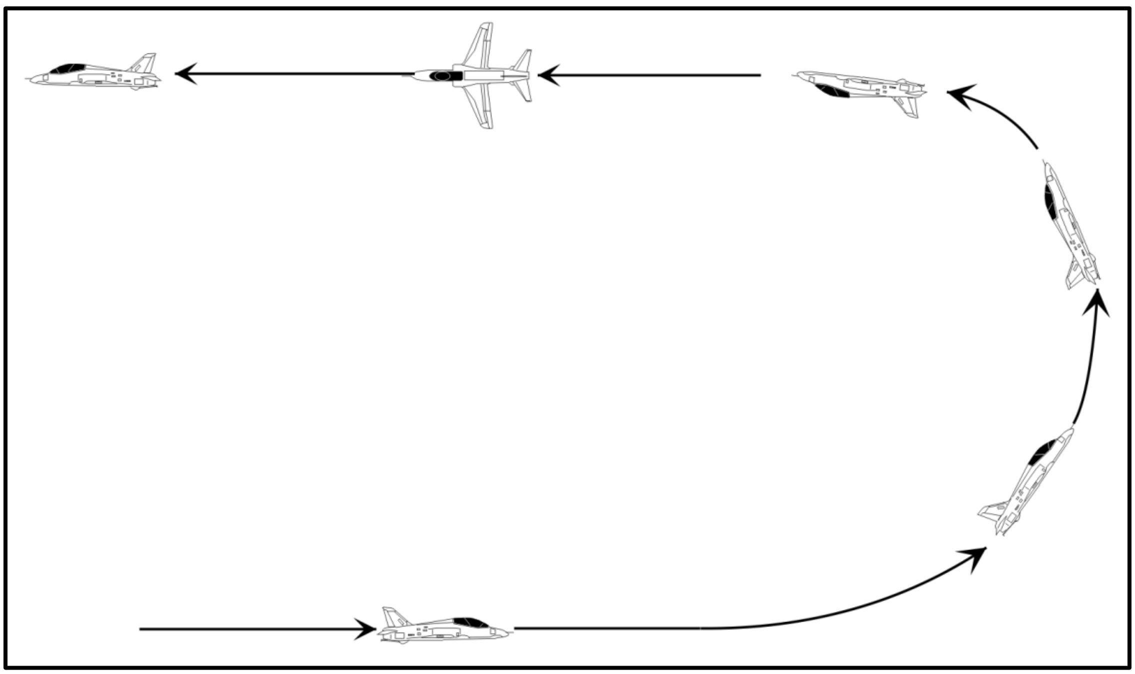

Figure 6-6 Immelmann

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Immelmann. Begin the maneuver at 380 KIAS, on altitude, and lined up on a prominent terrain feature or section line. Advance the power to approximately 96% rpm and expeditiously initiate a smooth 4-g wings level pullup. Increase back stick pressure to maintain 4-g pull as airspeed decreases. To maintain wings level attitude during the first half of the maneuver, scan the horizon on both sides of the aircraft after the horizon disappears under the nose.

Continue to maintain the 4-g pull until reaching the optimum AOA (17 units) and maintain optimum AOA until the nose is 10 degrees above the horizon inverted. Ten degrees above the horizon is achieved when the canopy bow is on the horizon. Gently stop the nose movement at

10 degrees above the horizon by releasing back stick pressure and then roll upright, using coordinated aileron and rudder. The aircraft will feel mushy because of the slow airspeed (about 150-170 KIAS). The maneuver is complete when you are in wings level flight at 180 KIAS going in the opposite direction.

Techniques

You will need to increase back stick pressure as you approach wings level upright so that you don't lose altitude. The nose will feel heavy because you are trimmed for 380 KIAS.

NOTE

Rudder is important for coordinated rolls.

Split-S

The Split-S is the reverse of the Immelmann. Enter the maneuver from level flight, raise the nose 10-15 degrees above the horizon, roll inverted, and pull the aircraft through a 180-degree vertical turn. You will lose as much as 6,000 ft of altitude while performing the Split-S (Figure 6-7).

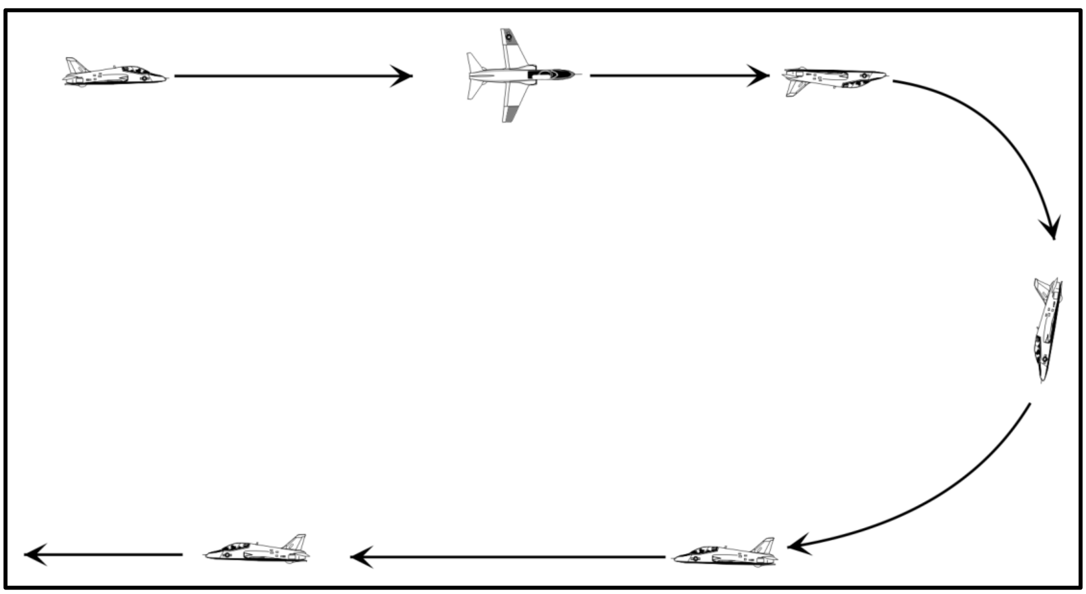

Figure 6-7 Split-S

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Split-S. Begin the maneuver at 180 KIAS, on altitude, and lined up on a prominent terrain feature or section line. Pull the nose up to 10 to 15 degrees above the horizon, reduce the power to IDLE, and roll inverted, using ailerons and rudder. Gently but expeditiously pull to optimum AOA. Maintain optimum AOA as your airspeed increases and maintain wings level and your lineup on the referenced terrain feature throughout this maneuver. Maintain optimum AOA (17 units) until intercepting 4 G and hold 4 G for the remainder of the maneuver. The maneuver is complete when you are in level flight going in the opposite direction.

Techniques

To minimize loss of altitude, it is very important that you immediately pull and maintain optimum AOA after rolling inverted until reaching 4 G and then hold 4 G until wings level. Beginning the pull before getting inverted will result in not staying on the section line. Delaying the pull to optimum AOA will greatly increase your altitude loss.

Squirrel Cage

The Squirrel Cage consists of a coordinated series of overhead maneuvers flown in the specific sequence of the Loop, Half Cuban Eight, Immelmann, and Split-S without pausing between each maneuver. Caution must be taken throughout this series to stay above 10,000 ft AGL (Figure 6-8).

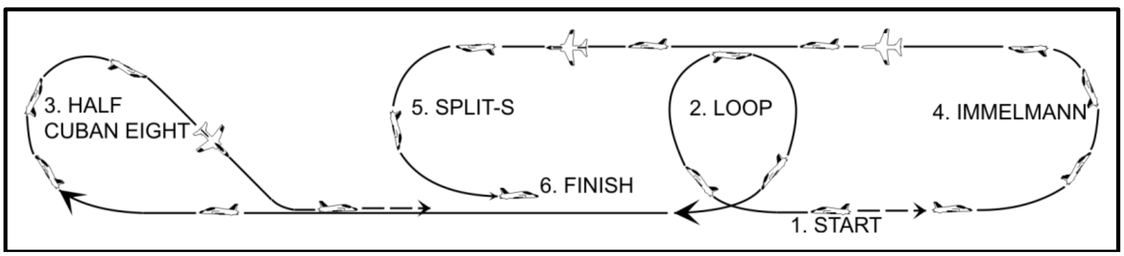

Figure 6-8 Squirrel Cage

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Squirrel Cage. Begin the maneuver at 380 KIAS, on altitude, and lined up on a prominent terrain feature or section line. Start with a Loop at approximately 12,000 ft AGL. As you're descending through the backside of the Loop, allow the aircraft to accelerate to 380 KIAS and then from a level attitude begin a Half Cuban Eight. As you exit the Half Cuban Eight, increase your speed to 380 KIAS and, from a level attitude, execute an Immelmann. Finally, reduce the power to IDLE and execute a Split-S.

Techniques

Pay particular attention to airspeed and altitude during the Squirrel Cage and, because of the duration of this maneuver, maintain an especially good lookout doctrine.

CHAPTER SEVEN
NIGHT OPERATIONS

700. INTRODUCTION

Some of your Familiarization events may be flown at night. Night flying, like night driving, requires increased care and attention to your surroundings as well as your instruments.

701. HUMAN FACTORS OF NIGHT FLYING

1. Night Vision

An object must be illuminated by some light source before it can be perceived by the human eye. Fortunately even the darkest of nights will have some light that will enable you to see objects with some degree of clarity. The extent to which you will be able to see depends upon the degree to which your eyes can adapt to the darkness and the intensity of existing sources of light, such as the moon, stars, and lights on the ground.

a. **Factors Affecting Night Vision.** The following factors affect your ability to interpret what you see at night:

i. Few lighted landmarks

ii. Limited depth perception

iii. Oxygen level in blood

iv. Fatigue

v. Anxiety

vi. Autokinesis

vii. Cockpit light intensity

b. **Night Vision Techniques**

Once your eyes are effectively adapted for night vision, take care to maintain that adaption until you have completed the flight. Avoid looking directly at brightly lighted areas because even momentary exposure will adversely affect your night vision. During the flight, keep the cockpit and instrument lights at a low intensity that permits you to see the instrument indications clearly but avoids canopy glare. Also, be sure to use the red lens with your flashlight.

Even when your eyes are completely adapted for night conditions, you will see objects as indistinct shapes in varying shades of grey. You won't be able to see an unlighted object if you look directly at it; however, if you shift your eyes to slightly above or below an object, you may then be able to detect it.

c. **Oxygen**

While proper oxygen flow is essential to good vision, especially at night, it cannot improve your night vision beyond your normal limits; however, it does help to sustain night vision by supplying the blood stream with required amounts of oxygen that may have been depleted by smoking or fatigue. Additionally, as altitude increases, the reduced oxygen in the ambient air has a noticeable effect on night vision. Therefore, be sure to use oxygen from takeoff to landing.

d. **Vertigo**

Night flying combines all of the elements likely to cause vertigo: poor visibility, fatigue, anxiety, and hypoxia. In a common vertigo experience, you feel as though you are in a turn, but upon checking your instruments, you see that you are flying straight and level.

Another sensation of vertigo fits the pattern known medically as the Coriolis phenomenon. This tends to occur when you look down to adjust some controls (Radio, Squawk, etc.) that are slightly behind and to one side of you. If the aircraft rolls slightly to one side, when you straighten up and look ahead you will experience vertigo. These impressions are increased during letdown or when you are performing penetration turns, so whenever possible, set up the cockpit prior to beginning such maneuvers.

Lighting can also play a role in vertigo. When you suddenly go from an area of good light reference to an area with few or no external light references, you may be subject to the effects of vertigo. This can occur when you suddenly lose sight of airfield lights after takeoff or in the break. Many cases of vertigo involve confusion of ground lights and stars, an illusory sense of lights in motion, errors in locating lights, and misjudging the position of clouds. Haze and adverse lighting conditions obscuring the horizon can also cause vertigo.

The experience of vertigo can vary greatly in duration and intensity, lasting only a few seconds in minor instances or over an hour in extreme situations. Although vertigo may continue after straight and level flight has been established, eventually it will disappear, and it can always be countered.

The most important and reliable method of safely countering vertigo is to discipline yourself to have full confidence in your flight instruments. Trusting your instruments is always the answer if you experience vertigo while in flight. Believe what you see on your instruments, not what you feel.

702. GROUND OPERATIONS

1. Exterior Preflight Inspection

Night aircraft preflight procedures are identical to those used during the day. Since hydraulic fluid is red, use a flashlight with a clear (white) lens during your preflight so you can see hydraulic fluid leaks. Turn on the battery and all exterior lights and then check that all exterior lights work. Figure 7-1 depicts the location of the T-45's exterior lights.

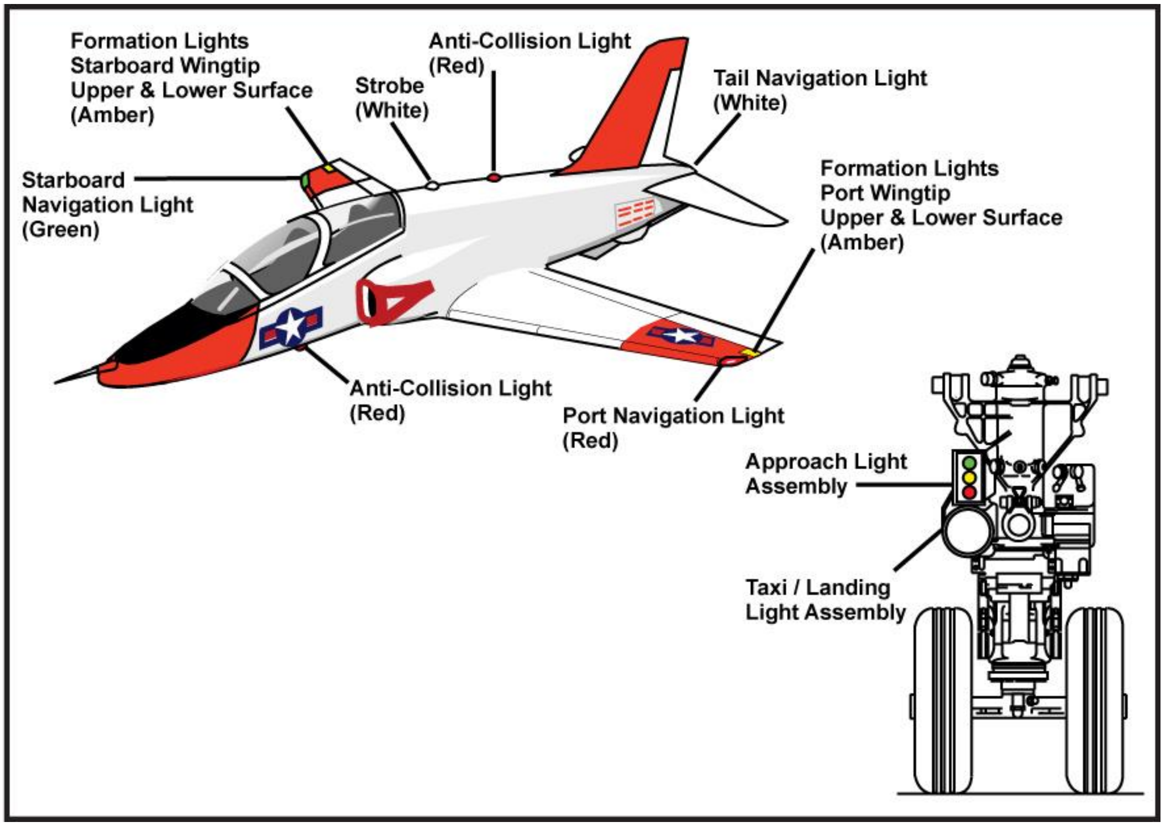

Figure 7-1 T-45C Exterior Lighting

2. Interior Preflight Inspection

Set the exterior and formation lights to BRIGHT and STEADY, the anti-collision light ON, and the strobe lights OFF. Set the interior lights to ON. After turning the battery on, adjust interior light intensity to a level where the instruments lights are dim but adequately illuminate instrument indications.

3. Field Lighting

You must fully understand the function of the various airfield lights including the rotating beacon and the blue, white, green, amber, and red lights, or you will jeopardize your safety and the safety of others (Figure 7-2).

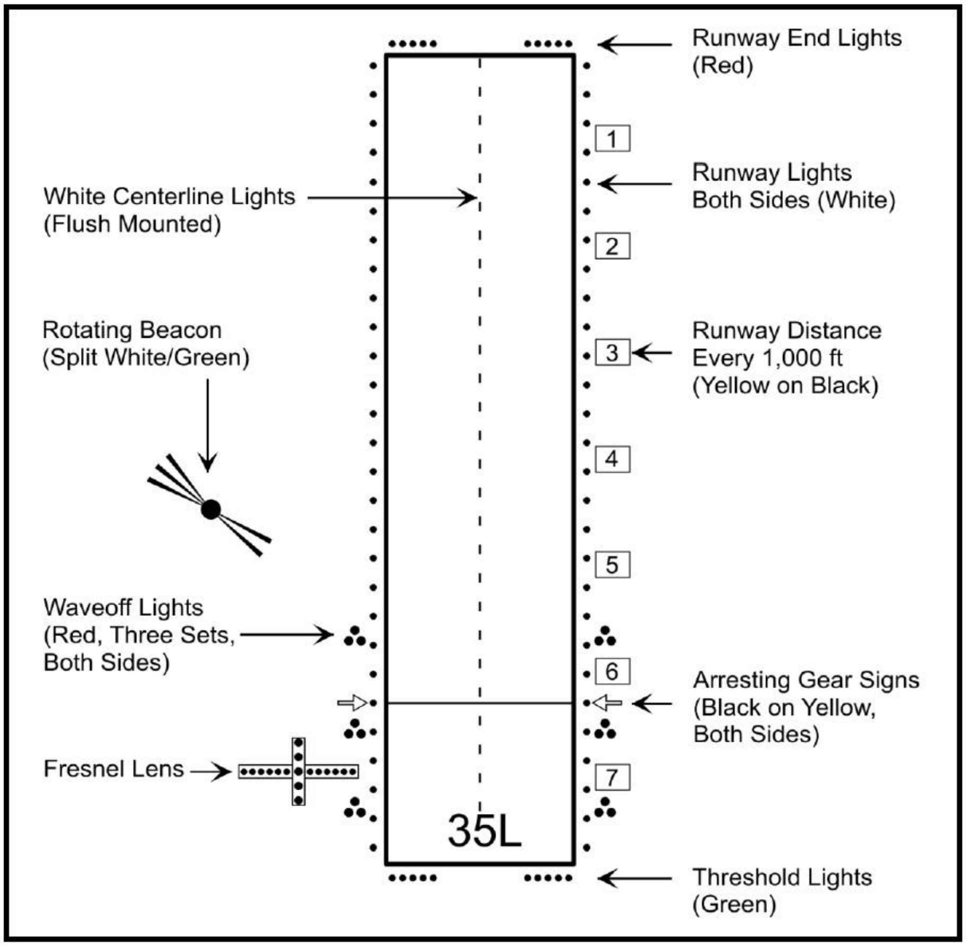

Figure 7-2 Generic Airfield Lighting

The rotating beacon, normally situated near the control tower, marks the airfield. It operates from sunset to sunrise and during periods when the field is in IFR conditions. All rotating beacons (military and civilian) are green and white; however, the military beacon uses a split white beam while the civilian beacon uses a single white beam.

Blue lights mark the sides of the taxiway and the edges of the mat areas. Additionally, in pairs, they mark all taxiway entrances and exits. Green lights mark the taxiway centerline as well as the runway threshold.

White lights define a variety of airfield features. They mark both sides of the active runway and, when they're installed, the runway centerline. White lights that flash twice per second mark the threshold. Additionally, white lights illuminate arresting gear arrows, wind tees/socks, and runway distance remaining (in thousands of feet) markers. Runway approach lighting is also white, and depending on the configuration, there may also be sequencing strobe lights.

Amber lights identify temporary ramp obstructions, such as construction work. Mobile ground support equipment may also be called out by flashing amber lights.

7-4 NIGHT OPERATIONS

Red lights typically identify areas requiring caution. They can be used to mark obstructions and equipment on taxiways as well as the top of obstructions in and around the airport. They are also used for the waveoff lights and to mark the end of the runway.

4. **Field Equipment**

There are three basic types of wind direction indicators:

a. Wind tee

b. Wind sock

c. Tetrahedron

The wind tee and wind sock are illuminated and free-swinging. The triangular tetrahedron is marked by red lights on its port side and green lights on its starboard side and down the center.

The location of the arresting gear is identified by internally lit arrows.

5. **Taxi Procedures**

Night taxi procedures are the same as day procedures, with the exception of the darker environment. For that reason, use the taxi/landing light during taxi whenever required and taxi more slowly at night than you would during the day and always on the centerline.

6. **Ground Personnel Signals**

Daytime and nighttime hand signals differ slightly. First, because taxi directors use lighted wands instead of their hands and arms, some signals have been modified to accommodate the wands. Refer to the NATOPS manual for a description of each nighttime hand signal.

703. TAKEOFF AND DEPARTURE PROCEDURES

1. **Pre-Takeoff**

Be prepared to readjust the intensity of your interior lights so that you will have maximum outside visibility without glare on the canopy and minimum eye strain when reading your instruments.

2. **Takeoff**

Night takeoff procedures are identical to those for the day except that your pilot will rotate and perform initial climb-out referencing instruments. As you continue your climb, begin an inside-outside scan. Look outside for traffic and aircraft attitude and inside to monitor engine instruments and to cross-check the flight instruments.

704. ARRIVAL AND FIELD ENTRY PROCEDURES

Night arrival and field entry procedures are similar to those performed during the day except that poor depth perception and the visual effects of field lighting require extra caution. Additionally, airspeed and AOB in the break at night may be limited by squadron SOP.

705. LANDING PROCEDURES

Night landing procedures are nearly identical to those performed during the day; however, the lack of distinct external visual references in combination with lighting could lead to a sensation of vertigo.

Because your field of view is limited at night, your sense of speed during the full-stop landing roll-out is not as acute. Use the runway remaining markers to determine how far down the runway you are and use the relative motion of the runway lights to judge your speed.

706. NO RADIO (NORDO) PROCEDURES

Of course, you normally use the radio as the primary method of communicating at night; however, in a NORDO situation, you have to know and follow the NORDO recovery procedures listed in the course rules.

If you are NORDO, set your IFF to 7600 and set your exterior lights to BRIGHT and FLASHING. Proceed directly to your home field and execute the NORDO recovery procedures. Make all normal radio transmissions in the blind on the appropriate frequencies.

When you enter the overhead pattern, pick up your own interval for the break. Ensure that you complete the landing checklist, turning on the landing/taxi light. As you roll into the groove, look for a steady green light from the tower to indicate clearance to land. If you don’t see the green light, wave off and go around for another approach. Remember to perform the landing checklist again. On the second approach, look for the green light again. If you don’t see it this time, land the aircraft unless you get the waveoff lights.

If you have another problem in addition to being NORDO, another aircraft may join on you. In this situation, pass the appropriate HEFOE signal to the other aircraft. To pass the HEFOE signal at night, hold the flashlight close to the top of the canopy, point it toward the other aircraft, and signal for the affected system:

1. Hydraulic system: one dash

2. Electrical system: two dashes

3. Fuel system: three dashes

4. Oxygen system: four dashes

5. Engine: five dashes

CHAPTER EIGHT
PRECAUTIONARY APPROACHES

800. INTRODUCTION

Precautionary approaches are practiced to simulate situations when loss of oil pressure or other engine malfunctions make it undesirable to reduce RPM; they keep you in the ejection envelope until you are in a position to land, even if the engine fails.

The following paragraphs provide detailed procedures that your IP will use to accurately fly the aircraft through the Precautionary Approach (PA) profile. SNFO crew coordination responsibilities are included at the beginning and apply to each type of PA. The SNFO will be graded on his/her general knowledge of PA procedures and the effective execution of associated crew coordination tasks.

801. PRECAUTIONARY APPROACHES

Precautionary approaches (PAs) are designed to keep the aircrew within a safe ejection envelope until a safe landing can be made and are typically flown when the aircraft has experienced some type of engine malfunction. Because these simulate approaches with some type of engine malfunction, don't move the throttle once it is set at 80% RPM until you are on final and then go to IDLE to begin the flare.

CAUTION

> After landing from a practice PA, don't rotate to takeoff attitude until you achieve flying speed and the power is at 100% RPM. For a real PA the throttle must be pulled to ground idle after the approach idle stop is released on touchdown.

SNFO Responsibilities:

1. Complete associated simulated Emergency Procedure crew coordination tasks.

2. Direct navigation towards intended point of landing and set up aircraft navigation system with runway waypoint and course line. Adjust to 5 nm scale prior approaching High Key (HK).

3. Coordinate Practice PA (PPA) with ATC.

4. Provide PA brief to IP to include: position, altitude (MSL), airspeed, RPM, configuration for first checkpoint (HK for Overhead PA, Low Key (LK) for Pattern PA).

Example (Parallel Entry):

SNFO (ICS): *"High Key, directly overhead 25L landing point, 5000 feet, 200 knots, 80% N2."*

5. Upon reaching first checkpoint (HK/LK), assess altitude deviation high/low, airspeed fast/slow and provide brief of next checkpoint in the format: position, altitude, airspeed, and configuration.

Example (Parallel Entry):

SNFO (ICS): *"High Key, 200 feet high, 10 knots slow, Low Key 3000 feet, 175 knots, 1.5 abeam"*

6. Complete landing checklist procedures and report LK with landing request.

SNFO (PRI): *"ROKT 403, Low Key, three down and locked, touch and go."*

7. Repeat step 3 for remaining checkpoints (except for Final, give airspeed, altitude):

a. Abeam, Parallel, Pattern PA: LK, 90, 45, Final

b. Straight-in PA: 4nm, 3nm, 2nm, 1.5nm, 750 AGL

Example (Parallel Entry):

SNFO (ICS): At LK**,** *"300 feet high, 20 knots fast, 90 is 1500 feet, 175"*

SNFO (ICS): At 90*, "300 feet high, 20 knots fast, 45 is 1000 feet, 165"*

SNFO (ICS): At 45*, "100 feet high, 10 knots fast, final is 330 feet, 160"*

SNFO (ICS): On final*, "300 feet, 150"*

Straight-In PA

Procedures

To perform the Straight-In PA, begin by setting the power to 80% RPM (Figure 8-1). Advise Approach Control of your intention to make a Straight-In PA. At 5,000 ft AGL and 5 nm from the end of the runway lower the gear and half flaps, extend the speed brakes, and complete the landing checklist.

Maintain target airspeed of approximately 175 KIAS and about 3,000-fpm rate of descent to arrive at the following checkpoints—4 nm, 4,000 ft AGL; 3 nm, 3,000 ft AGL; 2 nm, 2,000 ft AGL. At the 1.5 nm checkpoint (1,500 ft AGL), begin to increase pitch attitude while slowing to 165 KIAS, lower full flaps, retract the speed brakes. Flaps should not be lowered to full until runway landing is assured. Continue the approach using speed brakes as necessary to control airspeed and rate of descent.

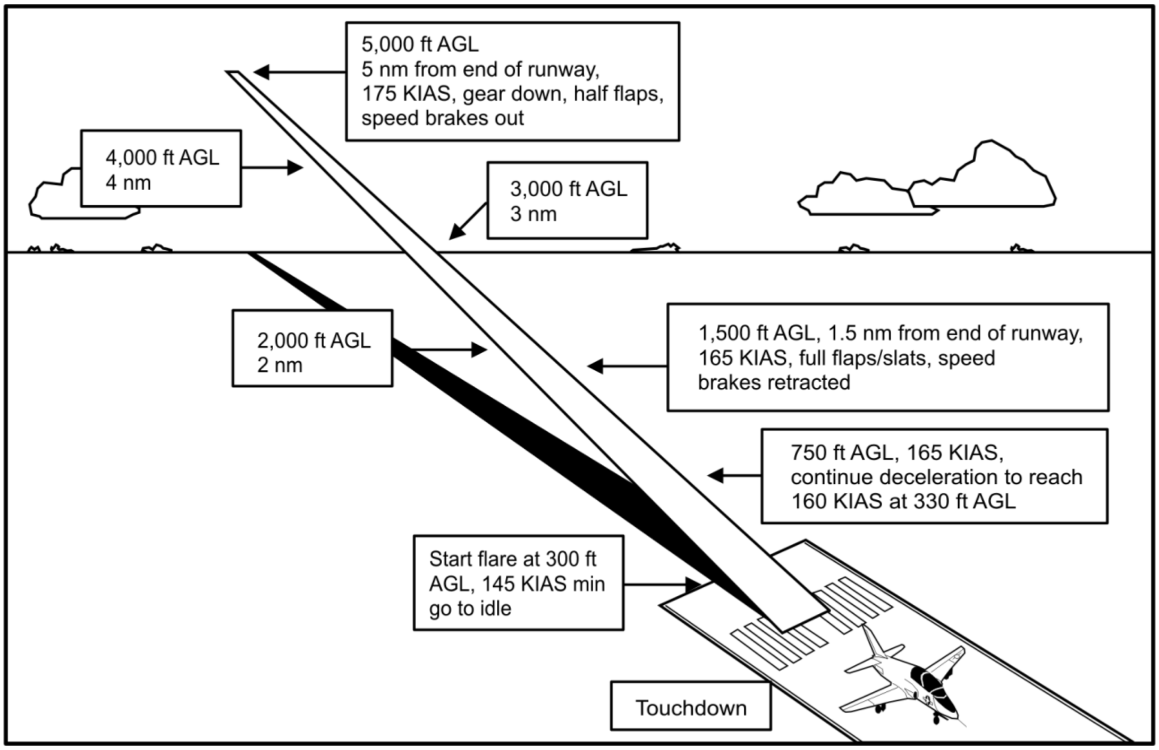

Figure 8-1 Straight-In PA

Do not decelerate below 160 KIAS until establishing round out and flare prior to touchdown. Reduce power to idle and continue to adjust pitch attitude, decreasing rate of descent and bleeding off excess airspeed. Do not decelerate below optimum AOA or land with excessive rate of descent. Touchdown should occur within the first third of the runway. Target checkpoints during the profile are intended as guidelines and do not preclude adjusting aircraft configuration as necessary to fly into the proper landing window.

Techniques

Since your throttle position is fixed during a PA, you need to use other controls to regulate your descent rate. On a straight-in approach, you can use the speed brakes to control your rate of descent. If low, you can delay lowering full flaps or you may raise them, with enough airspeed, if they have been previously lowered. If you have retracted your speed brakes and delayed going to full flaps to correct for a low, don’t forget to lower your flaps and extend the speed brakes prior to touchdown. To correct for being high, you can push the nose over and/or lower full flaps sooner to get back on the proper approach. Remember not to exceed the 200-KIAS landing gear limitation.

Overhead PA

Procedures: Perpendicular Entry

Arrive at the High Key over the approximate landing area at 80% power, 200 KIAS and 5,000 ft AGL on a heading 90 degrees to the landing runway and approximately 4,000 ft down the runway (Figure 8-2). At High Key, lower gear and 1/2 flaps. Approximately three seconds after crossing the runway (High Key), initiate a 25-35 degree AOB turn at 4,700 ft AGL and extend the speed brakes while maintaining 175 KIAS.

The low key is at 3,000 ft AGL, 175 KIAS, approximately 3300-fpm rate of descent at 1.5 nm abeam in a 35-degree AOB turn.

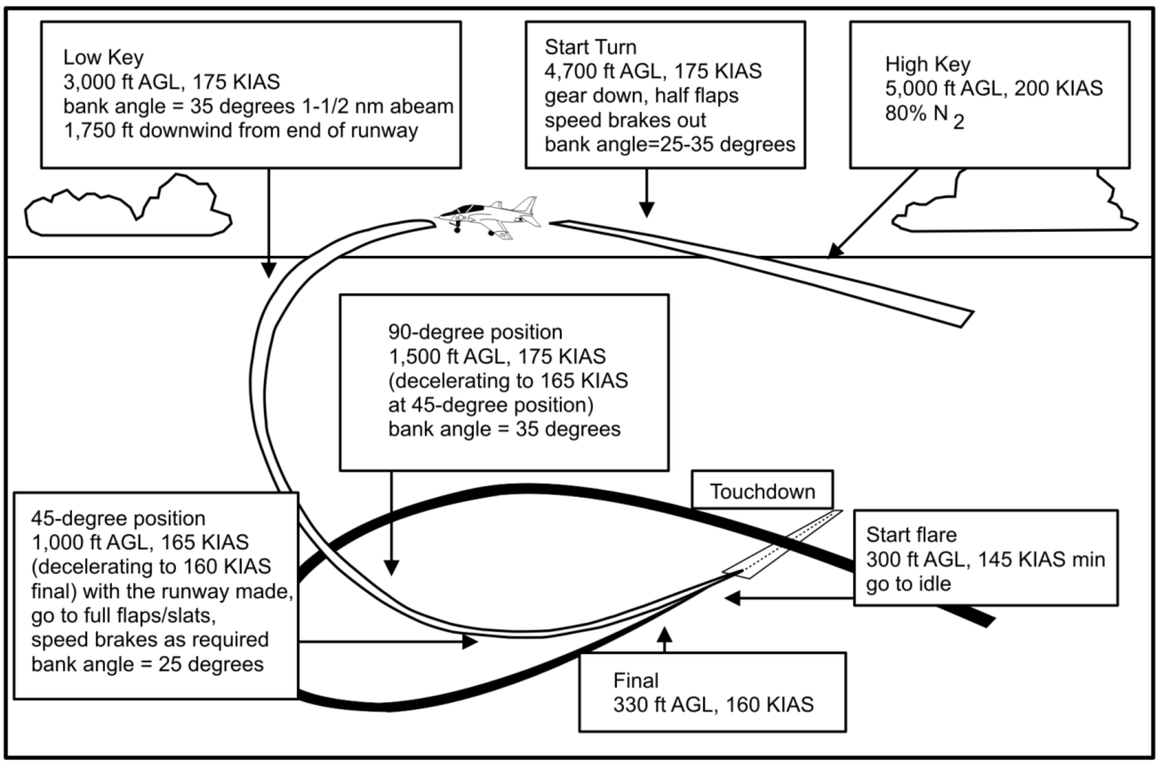

Figure 8-2 Overhead PA (Perpendicular Entry)

Adjust AOB and speed brakes to arrive at the 90-degree position at 1,500 ft AGL and 175 KIAS. At this point begin to increase pitch attitude while decelerating to 165 KIAS. At the 45-degree position with the appropriate altitude and airspeed to assure runway landing, lower full flaps and retract the speed brakes. Intercept the extended runway centerline at 330 ft AGL and 160 KIAS. Continue the approach as discussed for the straight in PA.

Procedures: Parallel Entry

Arrive at High Key at 80% power, 200 KIAS and 5,000 ft AGL on a heading parallel to, and directly overhead the landing point (Figure 8-3). At High Key, lower the gear and 1/2 flaps, initiate a 25-35 degree AOB turn to arrive at low key at 3,000 ft AGL. Continue the approach as discussed for the overhead PA (perpendicular entry).

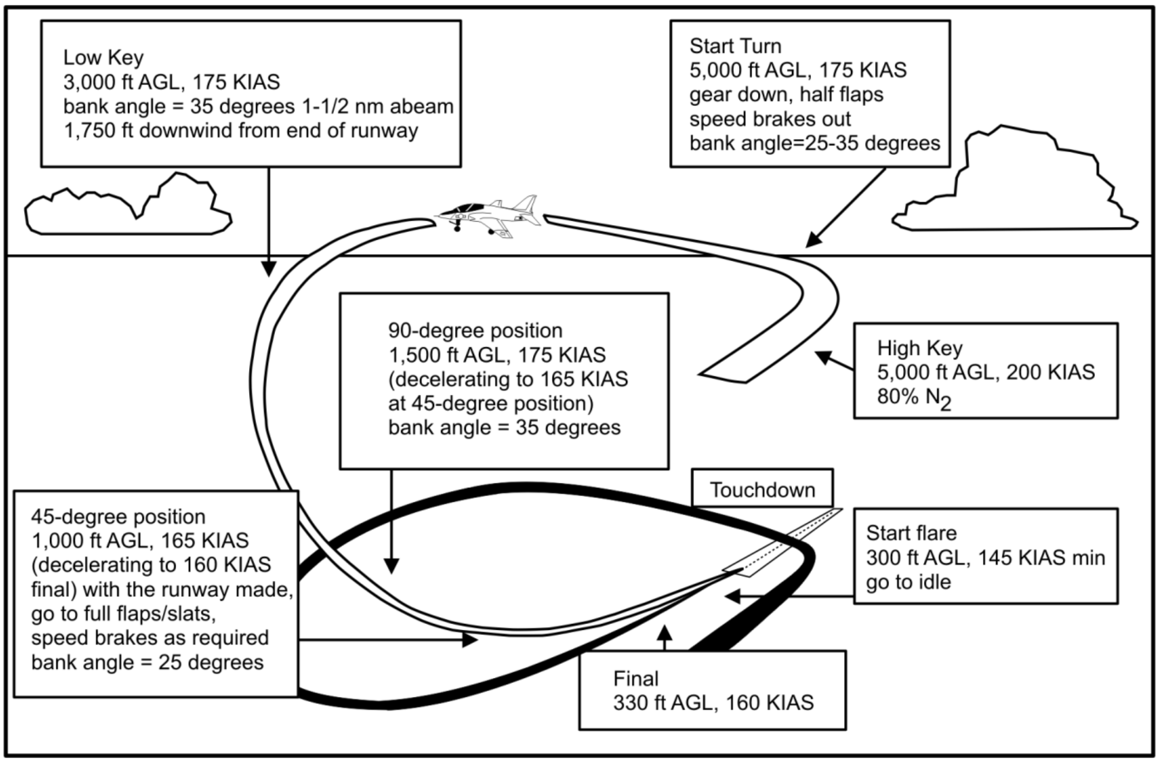

Figure 8-3 Overhead PA (Parallel Entry)

Techniques

During an Overhead PA, you can adjust your turn radius to compensate for deviations from the optimum checkpoint altitudes. If low, you can retract the speed brakes and tighten your turn. If high, you can fly a little wider pattern. In no case should you turn away from the runway to correct for being too high.

Abeam PA

Arrive at the abeam position, at 3,000 ft AGL, approximately 200 KIAS, and 1.5 nm abeam (Figure 8-4). Lower the gear, half flaps, and extend the speed brakes. At low key, commence a 35-degree, 175-KIAS descent turn toward the runway. Complete the landing checklist prior to reaching the 90-degree position. Adjust AOB and speed brakes to arrive at the 90-degree position at 1,500 ft AGL and 175 KIAS. Continue the approach as discussed for the Overhead PA (perpendicular entry).

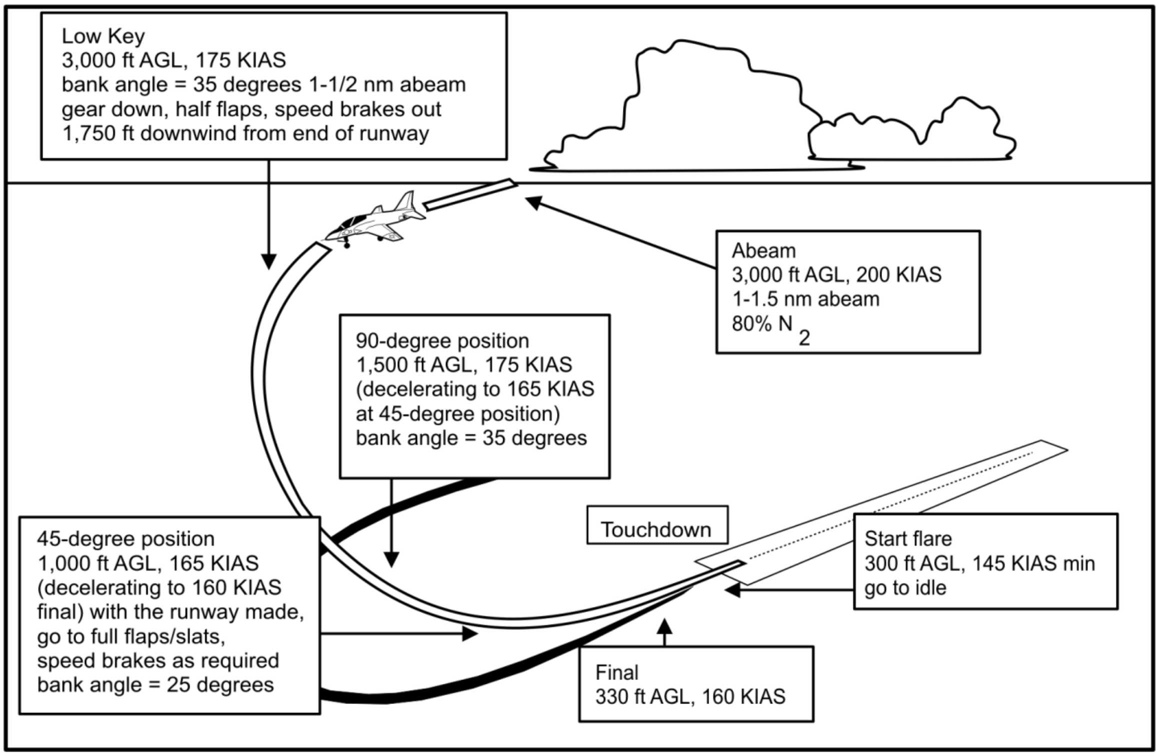

Figure 8-4 Abeam PA

APPENDIX A
GLOSSARY

A100. GLOSSARY

A

AGL: Above ground level. Normally used when referring to an altitude above field level.

AOA: Angle of attack.

AOB: Angle of bank.

B

Ball: Indication of the glideslope as displayed by the Fresnel lens.

Break: Steep AOB decelerating turn from overhead the runway to establish the landing configuration downwind.

Buffeting: Vibration of the airframe as it approaches and is in a stalled condition.

C

Carrier Box: Rectangular painted area just short of the Fresnel lens on the left half of the runway that represents an aircraft carrier's landing area.

D

Decision height or decision altitude (DH/DA)

A decision height (DH) or decision altitude (DA) is a specified lowest height or altitude in the approach descent at which, if the required visual reference to continue the approach (such as the runway markings or runway environment) is not visible to the pilot, the pilot must initiate a missed approach. The specific values for DH and/or DA at a given airport are established with intention to allow a pilot sufficient time to safely re-configure an aircraft to climb and execute the missed approach procedures while avoiding terrain and obstacles.

Downwind: Direction opposite to the heading of the active runway in the landing pattern. Also a position beyond the approach end of the runway toward the initial.

Downwind Entry: Entry into the VFR landing pattern directly into the downwind leg.

F

Final Checker: Ground crew personnel who make a final inspection of the aircraft for proper takeoff configuration and basic airworthiness.

FL: Flight level. Altitudes above 18,000 ft MSL are identified as flight levels, e.g., FL350 = about 35,000 ft MSL.

FPM: Feet per minute. Normally referred to as a rate of climb or descent, e.g., 500-fpm rate of descent.

G

Gouge: Informal hints about approximate control techniques to accomplish a maneuver.

Groove: Wings level portion of the VFR landing pattern that coincides with the extended runway centerline.

I

Inboard Runway: Runway closest to the tower when there are parallel runways.

Interval: Distance between your aircraft and the aircraft ahead of you in the landing pattern. Also refers to the aircraft you are to follow in the landing pattern.

IFR: Instrument flight rules.

IMC: Instrument meteorological conditions.

K

KIAS: Knots indicated airspeed.

L

Line Speed Check: A check for proper takeoff acceleration. A preflight determined minimum airspeed expected after a known distance of takeoff roll.

M

Marshal Area: Area on the ramp where formation flights gather prior to taxiing to the runway.

MOA: Military operating area (major flight training area).

MRT: Military rated thrust (maximum throttle).

MSL: Mean sea level. Used when referring to an altitude above sea level.

N

NM: Nautical mile(s).

NORDO: No radio; lost communication situation.

O

Outboard Runway: Runway farthest from the Tower when there are parallel runways.

R

RDO: Runway Duty Officer. A flight instructor assigned to act as safety observer at the end of the runway.

ROD: Rate of descent.

S

SOP: Squadron operating procedures.

Squirrel Cage: Series of overhead aerobatic maneuvers—Loop, Half Cuban Eight, Immelmann, and Split-S—performed in sequence with no pause between maneuvers.

U

Upwind: Direction same as that of the active runway in the landing pattern. Also a position beyond the approach end of the runway toward the other end of the runway.

V

VFR: Visual flight rules.

VMC: Visual meteorological conditions.

VSI: Vertical speed indicator. The flight instrument that indicates your rate of climb or descent.

W

Wipe Out Cockpit: Cycling the flight controls during post-start checks.

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APPENDIX B
DAYTIME HAND SIGNALS

B100. INTRODUCTION

The following lists each of the daytime ground crew and taxi director signals that you will be required to know. You must be thoroughly familiar with each of the hand signals identified. On the carrier flight deck, there is no room for mistakes. Figures B-1 and B-2 display each of the hand signals discussed in Appendix B.

Ground Crew Signals

Start Engine: Signalman's left hand pointing at engine and right hand making circular motion with two fingers extended at head level.

Engine Fire: Signalman describes a large figure eight with one hand and points to fire area with other hand.

Engine Runup: Signalman's index finger and middle finger make circular motion above head level in response to pilot's identical signal.

Wet Start: Signalman points to engine while plugging nose.

Wipe Out Cockpit: Signalman's right elbow positioned in left palm in front of waist while right fist makes horizontal circular motion above left hand.

Lower Flaps: Signalman's hands in front with palms together horizontally, then opened from wrist.

Open Speed Brakes: Signalman's hands in front with palms together vertically, then opened from wrist.

Clear Engine: Signalman draws vertical circle in front of body.

Raise Launch Bar: Signalman's right elbow in left hand at waist level with right arm horizontal; raises right hand to the vertical position.

Lower Launch Bar: Signalman's right elbow in left hand at waist level with right arm vertical; lowers right hand to horizontal with palm out.

Hook Down: Signalman's right fist with thumb extended downward lowered suddenly to meet horizontal palm of left hand.

Raise Flaps: Signalman's hands together in front of body with palms open horizontally from wrists, then suddenly closed.

Lower 1/2 Flaps: Signalman's hands in front with palms together horizontally, then opened from wrist, followed by crossed hands.

Stabilator Check: Signalman's fist extended from front of chest, then moved to chest and extended again.

Close Speed Brakes: Signalman's hands in front with palms open vertically from wrists, then suddenly closed.

Hook Up: Signalman's right fist, thumb extended upward, raised suddenly to meet horizontal palm of left hand.

Final Checker: Signalman's arms extended above head while making a diamond shape with index fingers and thumbs.

Remove Gear Pins: Signalman forms circle with thumb and forefinger of left hand, then extracts right forefinger from circled fingers of left hand, using "pull away" motion.

Rudder Check: Signalman's arms fully extended horizontally from body with hands raised; left arm pulled in toward body and then extended from body as right arm pulled in toward body (alternating motion).

Aileron Check (Left Stick): Signalman's left elbow resting in right palm at waist level; pivots raised arm to right (approx. 45 degrees), then back to vertical.

Aileron Check (Right Stick): Signalman's right elbow resting in left palm at waist level; pivots raised arm to left (approx. 45 degrees), then back to vertical.

Taxi Director's Signals

Stop/Emergency Stop: Signalman's arms extended above head with hands crossed.

Brakes On: Signalman's arms extended above head, fingers extended; clenches fists and holds.

Remove Chocks: Signalman's arms at sides, fists closed, thumbs pointed outward; swings arms outward.

Engage Nose Wheel Steering: Signalman points to nose with index finger and points to nose wheel with other hand, then waves hand side to side.

Install Chocks: Signalman's arms extended down 45 degrees from body with hands pointed inward, then swings arms outward to inward.

Brakes Off: Signalman's arms extended above head with fists clenched, then alternately extends fingers and clenches fists.

Move Ahead: Signalman's arms extended forward at shoulder level with hands vertical at eye level, palms facing backward; makes beckoning arm motion, speed of arm movement indicating desired speed.

Turn Left: Signalman's right arm points downward while left arm repeatedly moves upward and backward, speed of arm movement indicating desired rate of turn.

Turn Right: Signalman's left arm points downward while right arm repeatedly moves upward and backward, speed of arm movement indicating desired rate of turn.

Slow Down: Signalman's arms down with palms toward ground, then moved up and down several times.

Proceed To Next Marshaler: Signalman pats sides of head with both hands, then points to next marshaler (near arm extended toward new marshaler while other arm moves across chest pointing toward new marshaler).

Cut Engine: Signalman's arms level with shoulder; moves one across throat in a slashing movement while pointing other to engine.

Figure B-1 Day Hand Signals (1 of 2)

B-4 DAYTIME HAND SIGNALS

Figure B-2 Day Hand Signals (2 of 2)

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APPENDIX C
NIGHTTIME HAND SIGNALS

C100. INTRODUCTION

The following lists each of the nighttime ground crew and taxi director signals that you will be required to know. You must be thoroughly familiar with each of the hand signals identified. On the carrier flight deck, there is no room for mistakes. Figures C-1 and C-2 display each of the hand signals discussed in Appendix C.

Ground Crew Signals

Start Engine: Signalman extends left wand overhead while making circular motion with right wand at head level.

Shut Down Engine: Signalman's arms level with shoulder; moves one wand across throat in slashing movement while pointing other wand to engine.

Engine Fire: Signalman describes large horizontal figure eight with one wand and points to fire area with other wand.

Close Speed Brakes: Signalman's hands in front with wands open horizontally from wrists, then closed.

Engine Runup: Signalman makes circular motion with wand above head level in response to pilot's same signal.

Wipe Out Cockpit: Signalman positions left wand horizontally in front of waist and makes horizontal circular motion with right wand above left wand.

Lower Flaps: Signalman's wands in front with wands together and then opened vertically from wrists, crocodile-mouth fashion.

Hook Up: Signalman's right wand pointed upward, then raised to meet horizontal wand in left hand.

Open Speed Brakes: Signalman's wands in front with wands together and then opened horizontally from wrists.

Hook Down: Signalman's right wand extended downward, then lowered to meet horizontal wand in left hand.

Lower Launch Bar: Signalman's right elbow resting in left hand at waist level with right wand vertical; lowers right wand to horizontal.

Remove Gear Pins: Signalman's left wand at shoulder level pointed upward; signalman's right wand aligned horizontally with tip touching midpoint of vertical wand; right wand moves horizontally away from left vertical wand.

Raise Launch Bar: Signalman's right elbow resting in left hand at waist level with wand arm horizontal; raises right wand to vertical position.

Raise Flaps: Signalman's wands in front held open vertically from wrist, then closed crocodile-mouth fashion.

Lower 1/2 Flaps: Signalman's wands in front held together then opened vertically from wrist, followed by crossed wands.

Final Checker: Signalman creates an inverted "V" with wands overhead.

Stabilator Check: Signalman's wands extended in front of chest in vertical position, then moved to chest and extended again.

Rudder Check: Signalman's arms fully extended horizontally from body with wands raised; left arm pulled in toward body and then extended from body as right arm pulled in toward body (alternating motion).

Aileron Check (Left Stick): Signalman's left elbow resting in right palm at waist level; pivots raised wand to right (approx. 45 degrees) and then back to vertical.

Aileron Check (Right Stick): Signalman's right elbow resting in left palm at waist level; pivots raised wand to left (approx. 45 degrees) and then back to vertical.

Taxi Director's Signals

Proceed To Next Marshaler: Signalman pats sides of head with both wands, then points to next marshaler (near arm extended toward new marshaler while other wand moves across chest pointing toward new marshaler).

Brakes On: Signalman's arms extended above head, then crosses wands.

Remove Chocks: Signalman's arms at sides, wands pointed outward; swings arms outward.

Stop/Emergency Stop: Signalman's arms extended above head with wands crossed.

Engage Nose Wheel Steering: Signalman points to nose with one wand and points to nose wheel with other wand.

Brakes Off: Signalman's arms extended above head with wands crossed, then uncrosses wands.

Move Ahead: Signalman's arms extended forward at shoulder level with wands vertical; makes fanning arm motion side to side, speed of wand movement indicating desired speed.

Install Chocks: Signalman's arms extended down 45 degrees from body with wands pointed inward, then swings arms outward to inward.

Turn Left: Signalman's right wand pointed downward while left wand repeatedly moves side to side, speed of wand movement indicating desired rate of turn.

Turn Right: Signalman's left wand points downward while right wand repeatedly moves side to side, speed of wand movement indicating desired rate of turn.

Slow Down: Signalman's wands held horizontal to the ground, then moved up and down several times.

Figure C-1 Night Hand Signals (1 of 2)

NOTE

If you ever have any question as to the correct interpretation of a signal, stop and get clarification.

Figure C-2 Night Hand Signals (2 of 2)

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