NAVAL AIR TRAINING COMMAND

NAS CORPUS CHRISTI, TEXAS **CNATRA P-1212 (Rev. 10-10) PAT**

FLIGHT TRAINING INSTRUCTION

FAMILIARIZATION
T-45 STRIKE

2010

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

CNATRA P-1212
N715
28 Feb 11

CNATRA P-1212 (REV. 10-10)

Subj: FLIGHT TRAINING INSTRUCTION, FAMILIARIZATION T-45 STRIKE

1. CNATRA P-1212 (Rev. 10-10) PAT, "Flight Training Instruction, Familiarization T-45 Strike" is issued for information, standardization of instruction and guidance to all flight instructors and student aviators within the Naval Air Training Command.

2. This publication shall be used as an explanatory aid to support the T-45 Combined Multi-Service Pilot Training System. 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 1550.6 series.

4. CNATRA P-1212 (01-00) PAT is hereby cancelled and superseded.

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

FLIGHT TRAINING INSTRUCTION

FOR

FAMILIARIZATION

T-45 STRIKE

LIST OF EFFECTIVE PAGES

Dates of issue for original and changed pages are:
Original...0...15 Jan 00 (this will be the date issued)
Change Transmittal…1…17 Jul 01
Change Transmittal…2…09 Oct 01
Change Transmittal…3…27 Sep 02
Change Transmittal…4…26 Jan 05
Change Transmittal…5…08 Sep 08
Revision…0…28 Feb 11
Change Transmittal…1…28 Nov 11

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 132 CONSISTING OF THE FOLLOWING:

Page No.	Change No.	Page No.	Change No
COVER	0	9-1	0
LETTER	0	9-2	1
iii – xiv	0	9-3	1
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2-1 – 2-5	0	10-1 – 10-7	0
2-6 (blank)	0	10-8	1
3-1 – 3-7	0	10-9 – 10-10	0
3-8 (blank)	0	A-1 – A-4	0
4-1 – 4-6	0	B-1 – B-6	0
5-1 – 5-5	0	C-1 – C-5	0
5-6 (blank)	0	C-6 (blank)	0
6-1 – 6-13	0	D-1 – D-3	0
6-14 (blank)	0	D-4 (blank)	0
7-1 – 7-2	0	E-1 – E-3	0
8-1 – 8-14	0	E-4 (blank)	0
8-15	1		
8-16 – 8-19	0		
8-20 – 8-22	1		

INTERIM CHANGE SUMMARY

The following Changes have been previously incorporated in this manual:

CHANGE NUMBER	REMARKS/PURPOSE
1	Changes made per transmittal letter (11-28-11)

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

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HOW TO USE THIS FTI

This Flight Training Instruction (FTI) is your textbook for the Familiarization stage of your undergraduate Jet Pilot Training and is the source document for all procedures related to FAM. In addition, it includes suggested techniques for performing each maneuver and making corrections.

Use your FTI to prepare for and afterward to review lessons and flights. Your Lesson Guides require specific reading from the FTI prior to flight procedure lessons. This information will help you effectively prepare for lessons: know all the procedures in the assigned section(s), review the glossary, and be prepared to ask your instructor about anything that remains unclear. Then you can devote your attention to flying the T-45. After a flight, review the FTI materials to reinforce your understanding and to clarify any difficult maneuvers or procedures.

Note that this FTI also contains information on emergencies related to this stage. This section of the FTI amplifies but does **not** supplant the emergency procedures information contained in the T-45 NATOPS manual.

NOTES

INTRODUCTION

General

As their names suggest, the purpose of the FAM and NFAM stages is to familiarize you with preflight, in-flight (normal and emergency), and postflight procedures for day and night flying. These blocks emphasize system operations, flight characteristics, and landing techniques. Area familiarization will be accomplished on dual flights.

Aircrew Coordination

Coordination between you and other individuals or agencies is a part of every flight you make. Good crew coordination begins with the briefing where you and your IP go over all mission details. When you communicate with the plane captain via hand signals, you need to ensure that you both are saying and understanding the same thing.

Good radio communication must become second nature to you, in all phases of flight. When you are taxiing, you need to be cognizant of wingtip clearances and exhaust blast (both from your aircraft and others). If an abort is made, you need to transmit your intentions quickly and ensure that you follow the NATOPS procedures.

The emphasis of the FAM phase is to get familiar with the T-45, but good crew coordination is a part of every flight.

When passing control between cockpits, always say, “I have the controls”, or “you have the controls”. Never say, “I’ve got it”. In the past, several instances have occurred when a pilot thought that “I’ve got it” meant that the other pilot had the aircraft, but what he was referring to was that he had acquired a visual target, that he had the airfield in sight, or something similar to this. In these cases, no one was actually flying the aircraft, because each pilot thought the other had control of the aircraft. Don’t let this happen to you!!

OPERATING LIMITATIONS/WEATHER RESTRICTIONS

1. Refer to Part I, Chapter 4, "Operating Limitations," of your T-45 NATOPS Flight Manual, A1-T45AC-NFM-000 or A1-T45AC-NFM-000 as appropriate for a full explanation of the operating limitations of the T-45 Goshawk.

2. Refer to CNATRAINST 1542.150/159/160/167 for syllabus weather minimums.

3. Refer to OPNAVINST 3710.7U for additional cross-country operational flight restrictions.

4. Refer to course rules and squadron operating procedures (SOP) for site-specific procedures.

NOTES

CHAPTER ONE
GROUND OPERATIONS

100. INTRODUCTION

Fulfilling your role in ground operations professionally is a critical component of your duties as a naval aviator. You must perform all procedures IAW the NATOPS manual, the Pilot's Pocket Checklist (PCL), the course rules, and the SOP.

In addition to the preflight checks that you must complete, you are also required to perform specific activities in response to the plane captain's signals. Respond promptly but safely to these signals in order to complete prelaunch checks expeditiously.

101. GROUND PERSONNEL SIGNALS

Primarily, you use hand signals to communicate with the plane captain during pre-start and post-start checks. As a qualified naval aviator, you must thoroughly comprehend these signals—any confusion may lead to equipment damage and/or injury to yourself or the ground crew. Refer to Appendix B, "Daytime Hand Signals," for a complete description of these signals. Ground crew intercom is available through the aircraft ICS and is useful during troubleshooting.

102. LINE PROCEDURES

Because correctly performed preflight operations contribute to your safety and the success of the mission, you must ensure that all preflight checks are conducted IAW NATOPS and SOP.

Prior to accepting and signing for the aircraft, thoroughly review the aircraft maintenance discrepancy book and ensure that all required maintenance has been completed. Pay particular attention to repeated discrepancies and discrepancies from the previous flight. Also note fuel and oil quantities. As you approach the aircraft, look for the obvious—e.g., chocks, warning flags, leaks. Perform the exterior inspection IAW your PCL, noting any discrepancies. During your preflight inspection, also check the mat area around the aircraft for FOD. Pay particular attention to pad eyes and the area around each intake for a 20-foot radius. With the exterior inspection complete, enter the cockpit, strap in (with the plane captain's assistance), and perform all pre-start cockpit checks.

WARNING

Prior to applying electrical power on deck, ensure personnel are clear of the NLG forward doors. With the NLG door ground safety pin removed and the EMER GEAR handle not fully stowed, the NLG doors will close when electrical power is applied.

NOTE

Pages 1-2 through 1-6 refer to T-45C Waypoint procedures.

Waypoints

On start, up to ten active tactical waypoints, plus waypoint zero from the last flight, may be retained in the display system. Waypoint zero is distinguished from other waypoints because it is used for the GPS/INS alignment and is not normally used for a navigation point except for returning to home field. Changing waypoint zero prior to a full alignment will delay the alignment as the system resolves any difference between the location of the pilot-entered waypoint zero and the actual location of the aircraft. Waypoint data in the system can be changed in two ways:

1. transferring waypoint data from one of 200 waypoints in the mission data loader (GPS option), or

2. manually changing the latitude, longitude, elevation and/or magnetic variation of a tactical waypoint (WYPT option).

Waypoint Data Entry - Transferring Data From the Mission Data Loader

Select DATA from the HSI, ADI, or MENU display. 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. Select GPS to bring up the Global Positioning System Display (Figure 1-1).

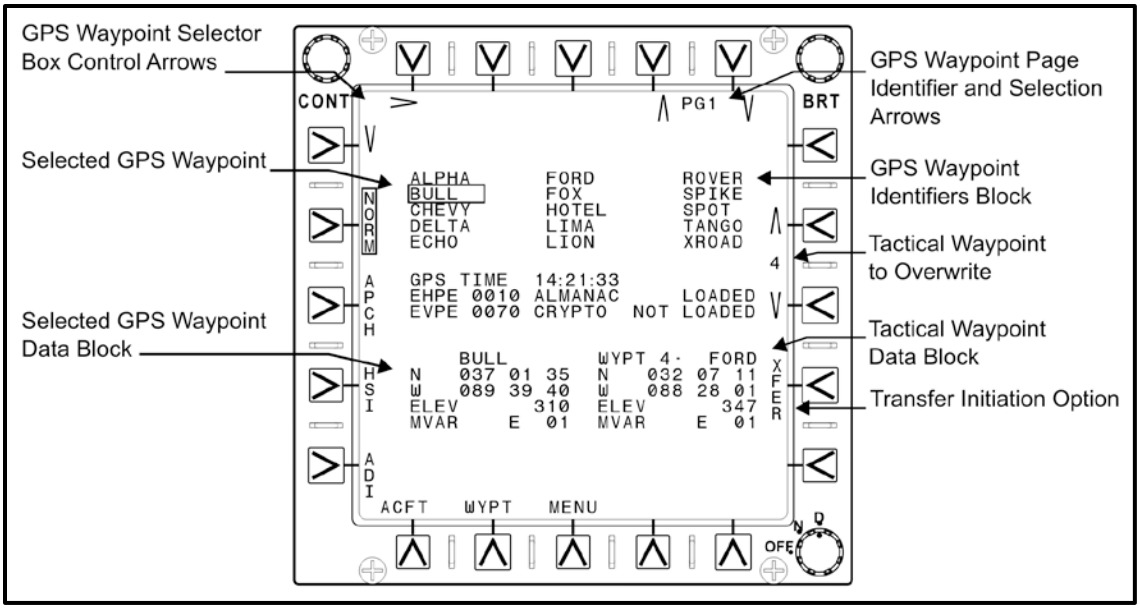

Figure 1-1: Global Positioning System Data Display

The first 15 waypoints in the Mission Data Loader are displayed at the top of the screen in the GPS waypoint identifiers block. The waypoints are in alphabetical order by column. 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 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.

Waypoint Data Entry - Manually Changing Waypoints

From the HSI, ADI, or MENU display select DATA. Then select WYPT if required. (Figure 1-2).

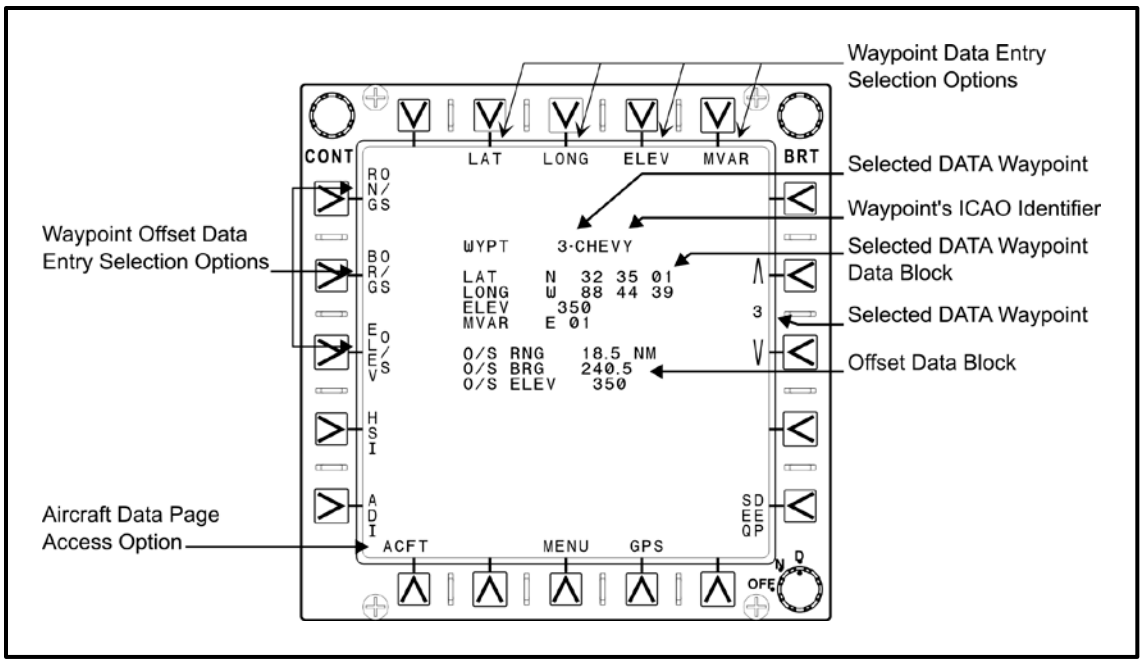

Figure 1-2: Waypoint Display Page

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 MFD and HUD; other data options are blanked (Figure 1-3). 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.

NOTE

Waypoint elevation is only used for CCIP bombing computations when using barometric altitude ranging vice radar altitude ranging; not for waypoint steering or time-to-go.

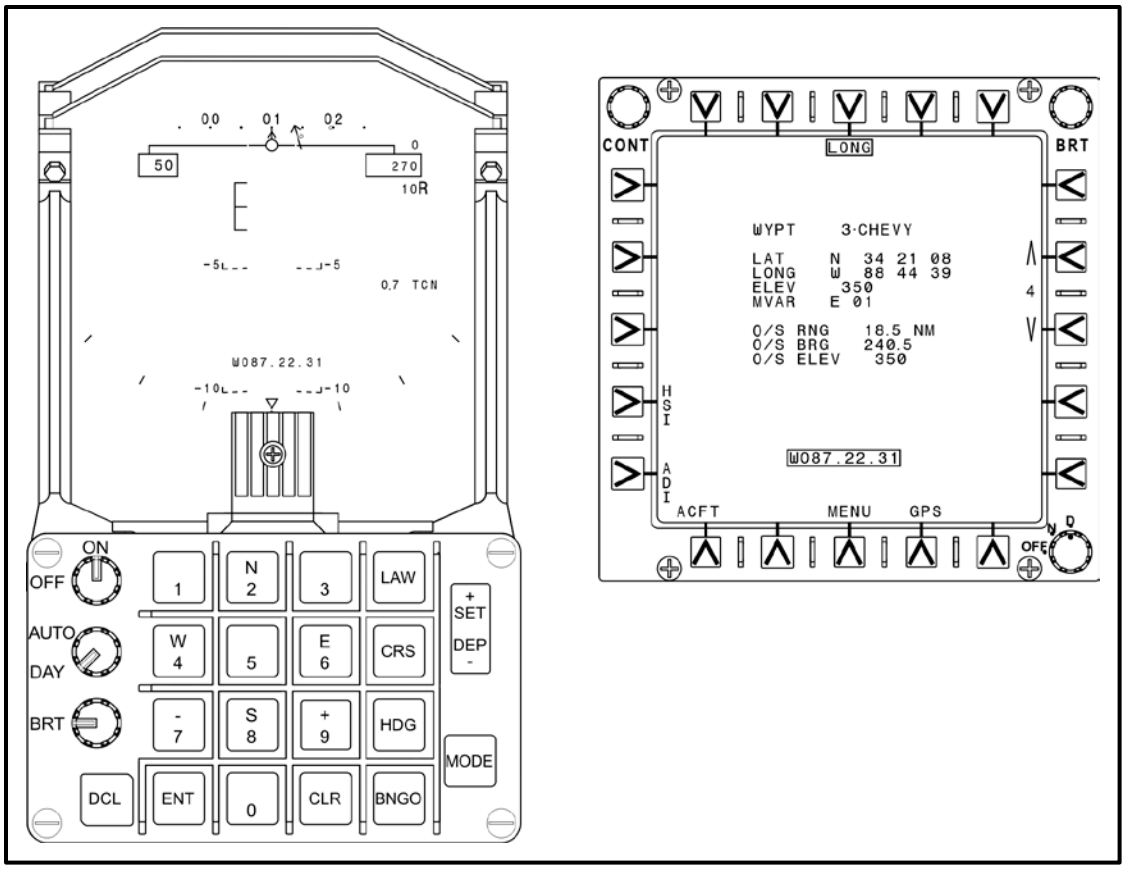

Figure 1-3: Waypoint Data Entry

103. WAYPOINT OFFSET

Each waypoint can have a defined offset (O/S), or none. The options and headers for offset data entry are displayed on the Waypoint Display (Figure 1-2). Offset entry options are located on the left bezel of the MFD: 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 a 0.0 nm. Range is limited to 0.0 to 99.9 nm in tenths of a mile increments. Bearing is 000 to 359.9 degrees in tenths of a degree increments (360 may be entered for 000). The decimal is not displayed on the scratch pad, but is automatically entered before the last digit, once 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 9999 feet in one foot increments. Changing the position of the waypoint after entering offset data automatically sets offset data for that waypoint to zero and all offset data is blanked (Figure 1-3).

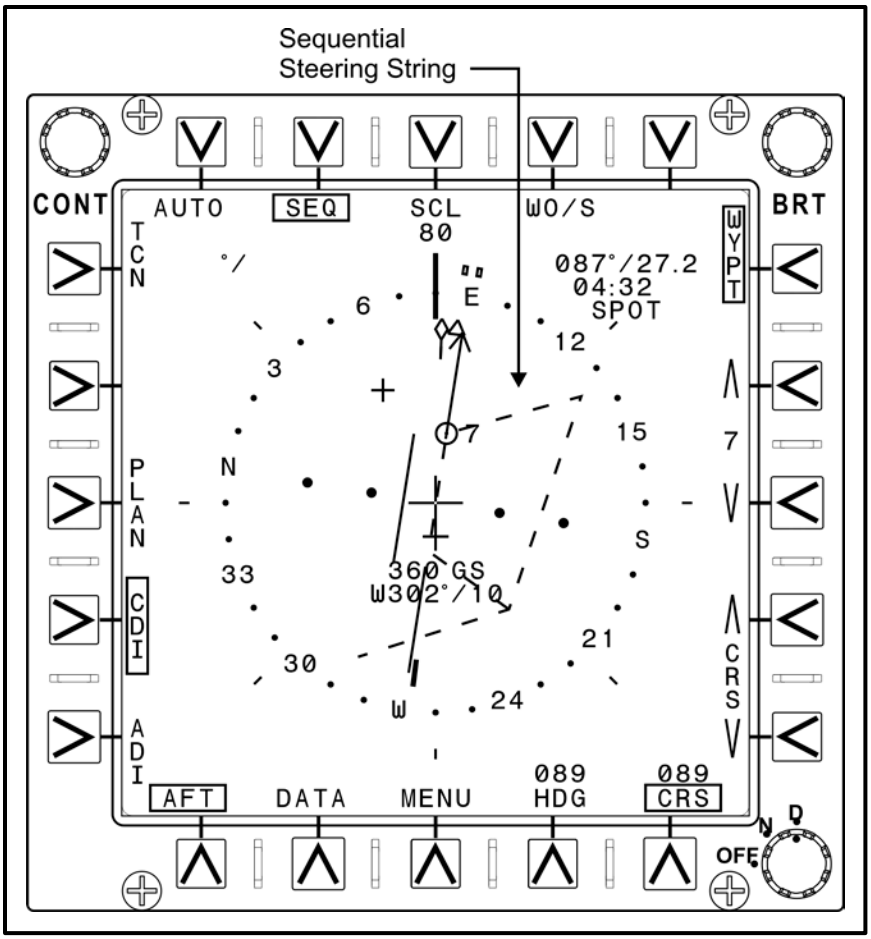

Figure 1-4: Waypoint Sequential Navigation – CDI

104. WAYPOINT SEQUENCING

Waypoint sequential navigation allows the pilot to select the sequence of waypoints when sequential (SEQ) is selected on the HSI display (Figure 1-4). On power-up waypoint data initializes with the last entered waypoint sequence string displayed across the bottom of the Waypoint Display (Figure 1-5).

Selecting (boxing) SEQ DEP blanks the old waypoint sequence string and enables the DEP and scratchpad for entry of a new string. Selecting a waypoint number on the DEP and depressing ENT inserts the waypoint into the string. As each waypoint is entered, the waypoint number is displayed in the order in which it is entered, from left to right. Up to ten waypoints can be entered into the string, and multiple entry of the same waypoint is allowed. An invalid waypoint entry (a number greater than 10) will flash until cleared by depressing CLR on the DEP. Selecting SEQ DEP option on the Waypoint Display or entering the tenth waypoint will save the waypoint string, and deselect (unbox) the SEQ DEP option. When a waypoint string of two or more is entered in the waypoint string, the SEQ and AUTO option on the HSI display are enabled.

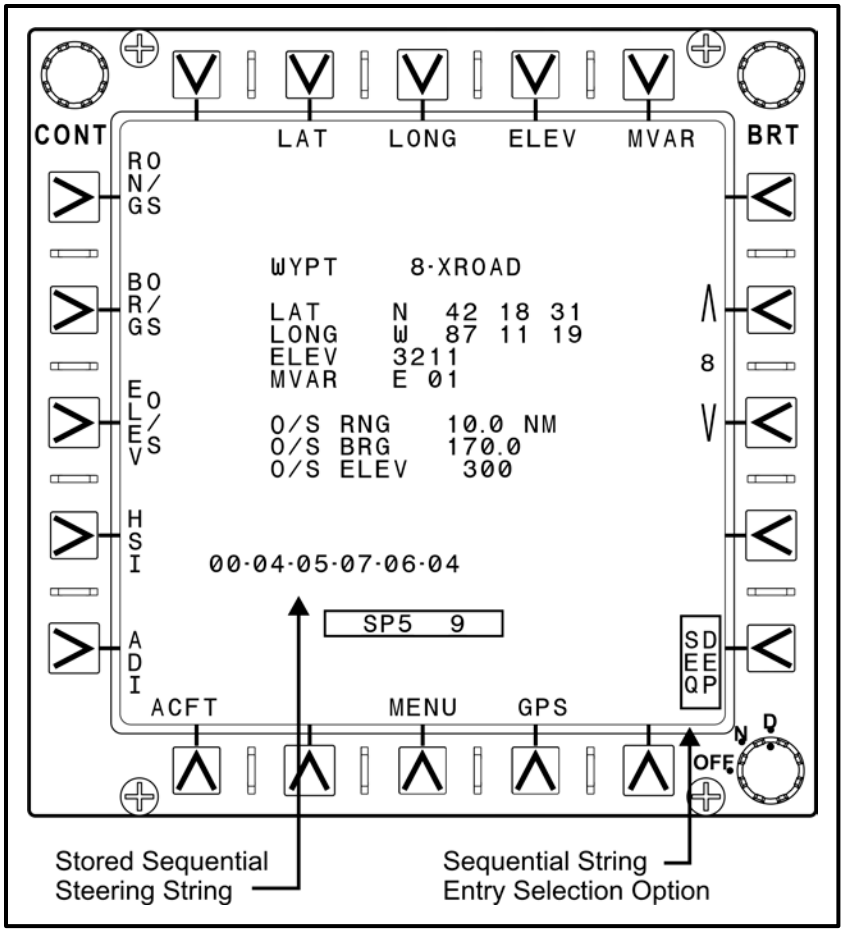

Figure 1-5: Waypoint Sequential Entry

When SEQ is selected the sequence steering string is displayed on the HSI as dashed lines (Figure 1-4). By starting/ending a SEQ DEP with the same waypoint, an operating area may be boxed on the HSI by selecting SEQ. Steering to any waypoint, not just those in the sequence string, is selected with the waypoint increment/decrement arrows.

After completing the pre-start checks, give the turn-up signal to the plane captain. He will ensure that the area behind the aircraft is clear before passing the start engine signal. Then you will begin the start sequence in accordance with NATOPS.

NOTE

If you or the plane captain wants to run up the engine in the line area, either of you can give the runup signal. If you initiate the request, the plane captain will again check to ensure that the area behind the aircraft is clear and then return the runup signal. If the plane captain initiates the request, run up the engine as directed. (Normally, if the plane captain wants an engine runup during post-start checks, he will discuss this with you prior to man-up.)

105. POST-START/PRE-TAXI

After completing the post-start checks, perform the following (in accordance with NATOPS):

1. RUDDER TRIM CHECK

2. STABILATOR TRIM/STBY STAB TRIM CHECK

3. AILERON TRIM CHECK (left/right)

4. CONTR AUG BIT

5. OBOGS BIT

Give the thumbs-up to the plane captain, who will then present the following signals (respond promptly to each):

1. WIPE OUT COCKPIT

2. FLAPS DOWN

3. EXTEND SPEED BRAKES

4. EXTEND LAUNCH BAR (IAW NATOPS, ensure NWS has been engaged prior to extending launch bar)

5. EXTEND ARRESTING HOOK

At this point, the plane captain gives the hands out of the cockpit signal. Respond by raising your hands above the canopy rail to preclude inadvertently moving a switch or flight controls. The plane captain will then check the aircraft for hydraulic leaks and for proper configuration. When the plane captain reappears in front of the aircraft, he will give a thumbs-up and then the following signals:

1. RETRACT LAUNCH BAR

2. RETRACT SPEED BRAKES

3. RETRACT ARRESTING HOOK

4. RAISE FLAPS TO 1/2

NOTE

Remember to obtain ATIS for current weather and runway information, and receive your clearance prior to taxiing.

After you have completed the above checks and are ready to taxi, give the plane captain a thumbs-up to indicate you are ready to taxi forward to the final checker. Again, keep your hands above the canopy rail as the final checkers complete their walkaround. The final checker inspects the aircraft for leaks and proper trim and flap/slat setting before giving you the THUMBS-UP and walking away from the aircraft. Stopping for the final checker is where you'll also test your brakes for proper operation.

Taxi Procedures

When you are ready to taxi, give the remove chocks signal to the plane captain who will respond with the brakes on signal and then signal the ground crew, below the waist, to remove chocks or remove them himself. The plane captain then moves out in front of the aircraft and gives the move ahead signal. At this point, hold the brakes, release the parking brake, and after ensuring that your rudder pedals are centered, engage nose wheel steering, start your forward motion by releasing the pressure on the brakes and adding a little power.

CAUTION

If the EMER GEAR handle is not fully stowed, nose wheel steering authority may be diminished.

Use a maximum RPM of 70% to start movement. Once the aircraft begins moving, move ahead according to the plane captain's directions. Be sure to follow his directions, and be prepared to stop at any time. Use the nose wheel steering to turn out of the chocks. Remember to reduce the power to IDLE and to observe tail pipe courtesy prior to turning. Maintain enough momentum to complete the turn—an aircraft allowed to stop midway in a turn will require excessive power to begin moving again. Adjust your turn to position the aircraft on the center of the taxiway. Control your taxi speed by tapping the brakes lightly—don't ride them.

Once you are on the taxiway, the plane captain may pass control to a taxi director or give you a salute. If the plane captain salutes, return the salute and taxi on your own.

Safety Concerns

Always adhere to the following guidelines in your efforts to prevent unsafe practices.

1. Do not blindly follow the taxi director. If in doubt, stop the aircraft and do not proceed until the situation is clarified. Remember that you, not the taxi director, are responsible for the safety of the aircraft.

2. Parking areas are congested, so your taxi speed should be very slow. Check wingtip clearances to your own satisfaction.

3. At IDLE, the T-45's exhaust danger area extends 40 ft behind the aircraft and increases to 100 ft at military rated thrust (MRT). Exhaust blast must be directed so as not to injure personnel or damage other aircraft or equipment. Also be sure to avoid the exhaust blast of other

aircraft and to provide sufficient lateral and longitudinal separation to preclude foreign object ingestion.

4. Be sure to monitor the appropriate radio frequencies in order to receive the taxi directions and clearances issued by the control tower.

106. TAXIING

Taxiing a jet aircraft is a task requiring no less care on your part than actual flight. Don't allow the combination of excellent forward visibility, hydraulic brakes, nose wheel steering, and tricycle landing gear to give you a false sense of security that could result in excessive taxi speed and careless lookout procedures. Even at IDLE, the T-45 may taxi at excessive speeds due to high residual thrust.

107. COMMUNICATIONS PROCEDURES

Now you're ready to obtain taxi clearance. Call ground control and include the letter designation of the ATIS information you have received. When cleared by ground control, taxi to the runway on the taxiway centerline. The minimum distance between you and the preceding aircraft will be IAW NATOPS/SOP.

Stop the aircraft at an appropriate spot in the hold short area closest to the painted hold short line and perform the takeoff checklist. When ready for takeoff, double-check that the canopy is down and locked and call the tower for takeoff. Repeat the clearance from the tower to avoid possible misunderstanding.

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CHAPTER TWO
TAKEOFF/DEPARTURE

200. INTRODUCTION

As with the landing pattern, the takeoff is one of the most critical phases of flight because your allowable margin for error is extremely small, so your preflight planning of takeoff performance parameters must be accurate. The aircraft performance data in Part XI of the T-45 NATOPS contains several charts to help you calculate expected takeoff performance.

201. NORMAL TAKEOFF

After you complete the takeoff checklist in the hold short area, check the windsock and request takeoff clearance.

When you are cleared for takeoff, ensure proper wingtip clearance and remember to practice proper tail pipe courtesy when exiting the hold short area. Position your aircraft on the runway by lining up on the runway centerline. Taxi straight ahead a short distance to ensure that the nose wheel is straight. Once in position, verify that the ADI and HSI are properly aligned with the runway. For T-45C, the recommended configuration is to set the ADI display on the left MFD and the HSI display set on the right MFD to keep the MFD ADI on the same side of the instrument panel as the standby AI and the analog flight instruments.

While holding the brakes, advance the power to MRT and cycle the flight controls. Check that engine RPM, EGT, and fuel flow are within limits. Also check that no warning (red) or caution (amber) lamps are illuminated on the WCP. Use your peripheral vision to watch for any aircraft movement while checking engine instruments. Check time of takeoff and, with IP concurrence, release the brakes. Use NWS to maintain directional control until the aircraft is airborne.

It is imperative to utilize primarily an outside scan during the takeoff phase in order to detect and correct any line up deviations as early as possible, however, at the selected distance marker, check your line speed to ensure that your aircraft is accelerating as expected and has achieved the predicted speed. Aborting at the maximum abort speed will require you to use optimum braking techniques to stop the aircraft on the remaining runway.

Begin your rotation 5-10 KIAS prior to your predicted takeoff airspeed. Rotate the nose to 10 degrees (or 17 units AOA, at 120 KIAS) and allow the aircraft to fly off the runway (don't exceed optimum AOA). When safely airborne, call to raise landing gear. Maintain the initial climb attitude and accelerate to flaps/slats up speed and call to raise the flaps at 140 KIAS. Remember, gear, flaps, and slats must be up and locked prior to 200 KIAS. You will be required to receive acknowledgement from your IP prior to raising the gear and flaps, and report over the ICS, "Gear and flaps up prior to 200."

NOTE

Once gear indicated up and locked (less than 200 KIAS), check gear seated in proper uplock detent by applying light force (less than 6 lbs) directly down (do not pull out). Once completed report "handle checked."

As the aircraft accelerates, hold your climb attitude and trim out stick pressure. As the flaps/slats come up, a small increase in pitch will be required to avoid settling.

202. CROSSWIND TAKEOFF

As you know, maintaining directional control during crosswind takeoffs is more difficult than during normal takeoffs. Depending upon conditions, you could find yourself heading toward the edge of the runway if you haven't made the proper control inputs.

Limitations

For an SNA solo flight or dual flight, adhere to the maximum crosswind limitations as listed in NATOPS or SOP.

Procedures

To prevent the upwind wing from lifting, apply aileron into the crosswind during your takeoff roll and maintain directional control with NWS. As your speed increases, the control surfaces become more effective, so you need less aileron deflection. Maintain wings level at lift-off and center the rudder; after lift-off, establish a crab into the wind to track a course along the runway departure path.

203. ABORTED TAKEOFF

Once the decision to abort is made, initiate the abort according to NATOPS procedures. If you have any doubt about your ability to stop on the remaining runway, lower your hook. Under no circumstances should you delay your decision to abort because arresting gear is available. If you decide to take the gear, lower the hook so that it is down 1,000 ft prior to the arresting gear and attempt to take the gear on the centerline. However, if you are off center, it is better to engage the arresting gear straight ahead, parallel to the runway centerline, than at an angle. Due to the A/Cs tendency to hook skip at the field, it is recommended that backstick be applied just prior to the arresting gear. This should ensure a good "hook set." When the aircraft is under control notify tower of your intentions.

NOTE

Off-center engaging limits by arresting gear type are listed in NATOPS.

Communications Procedures

IAW local course rules/SOP.

204. DEPARTURE/CLIMB

Close adherence to departure procedures is necessary to ensure the safety of all aircraft in a congested area and to avoid intrusion into civilian areas surrounding the field. The performance of your aircraft during a climb is of vital concern. Remember, turbojet and turbofan engines don't realize their best fuel efficiency until they are at altitude. The method or type of climb that you use will be determined by the mission. Some of the items that you want to consider during preflight planning are the aircraft's maximum climb rate, its cruise speed at altitude, and its maximum range climb. During normal training flights, speed restrictions, turn requirements, and noise abatement are considered along with fuel considerations.

Climb Schedule for Departure/Climbout

Normally, you will maintain 250 KIAS during the climbout until you are established in the MOA or above 10,000 ft MSL. In addition, you must fly the departure as published until you "terminate" the local instrument departure. Set the proper attitude to maintain your climb airspeed and trim out stick pressure. Don't forget to check the ball for proper rudder trim.

10,000 Foot Checklist

1. Check all instruments for normal indications.

2. Verify proper cabin pressurization.

NOTE

Make sure that you continue to comply with your departure clearance while conducting the 10,000 Foot Checklist.

Lookout Doctrine

Since there is no radar separation of aircraft when they are operating under VFR conditions or MARSA in the MOA, you must constantly clear the airspace into which you will be flying. If you are on an IFR flight and the actual conditions are VMC, you are still responsible for visually clearing your airspace. The dangers of midair collisions cannot be overemphasized. The "big sky, little airplane" theory can't be depended upon.

Sector Scanning

When properly performed, sector scanning is very effective for locating other aircraft operating in or near your immediate airspace. Simply looking outside the cockpit in a random manner does not suffice, since your eyes are probably focused a short distance from the aircraft. By

focusing your eyes on a distinct point, such as a ground reference, cloud, or over a wingtip, you will find it easier to spot aircraft in the vicinity. You can maintain an effective lookout doctrine by alternately scanning 20- to 30-degree segments of the horizon both laterally and vertically and then returning to the cockpit to monitor the performance instruments.

15-Minute Reports

After level off and at about 15-minute intervals, report your fuel quantity and engine status to the instructor. This procedure develops a habit pattern of periodically checking your fuel and instruments.

NOTE

Perform the same checks for the 15-minute reports as you did for the 10,000 Foot Checklist.

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CHAPTER THREE
NORMAL FLIGHT

300. INTRODUCTION

During this stage of your training, you will learn to perform level off, cruise, and turn pattern procedures as well as accels and decels. These building-block procedures require mastery before you progress to aerobatic flight.

301. LEVEL OFF

Begin level off 1,000 ft below your desired level off altitude. If your desired cruise speed will be the same as your climb speed, level off by simultaneously reducing the power and adjusting the nose attitude so as to execute a smooth transition to level flight. Trim as necessary to maintain your cruise speed at the desired altitude. If your desired cruise speed is greater than your climb speed, begin level off as previously described but leave your power at MRT and accelerate to the desired cruise speed. If your desired cruise speed is less than your climb speed, level off as before but reduce the power to a little less than required for your desired cruise speed. Fly the aircraft by exterior references, using your instruments for additional information only. During the transition to level flight, set an attitude and then trim out stick pressures. Complete the level off checklist by reporting altitude, airspeed, and heading to the instructor.

302. CRUISE PROCEDURES

Normal cruise will be flown at 250 KIAS at all altitudes in the FAM stage.

303. TURN PATTERN PROCEDURES

You will practice the turn pattern to develop smooth control techniques and to get acquainted with the relationship between lift, AOA, and thrust required to maintain constant airspeed level flight through varying angles of bank.

The turn pattern consists of two 30-degree angle of bank (AOB) turns for 60 degrees of heading change each, two 45-degree AOB turns for 90 degrees of heading change each, and two 60-degree AOB turns for 120 degrees of heading change each. All turns are connected by smooth reversals. You will trim the aircraft for a 250 KIAS level cruise prior to performing the maneuver (Figure 3-1).

NOTE

The turn pattern may be adjusted for weather and/or MOA boundaries.

Procedures

The turn pattern commences from level flight at 250 KIAS, normally aligned on a cardinal heading. Smoothly enter a 30-degree AOB turn in either direction. You will need to make slight adjustments in the power and the nose attitude in order to maintain altitude and airspeed.

Just prior to reaching 60 degrees of heading change, initiate a smooth reversal to 30 degrees AOB in the opposite direction. Make sure that you lead the reversal enough to accomplish the reversal on the desired heading. You will need to adjust the nose attitude throughout the reversal to maintain a constant altitude.

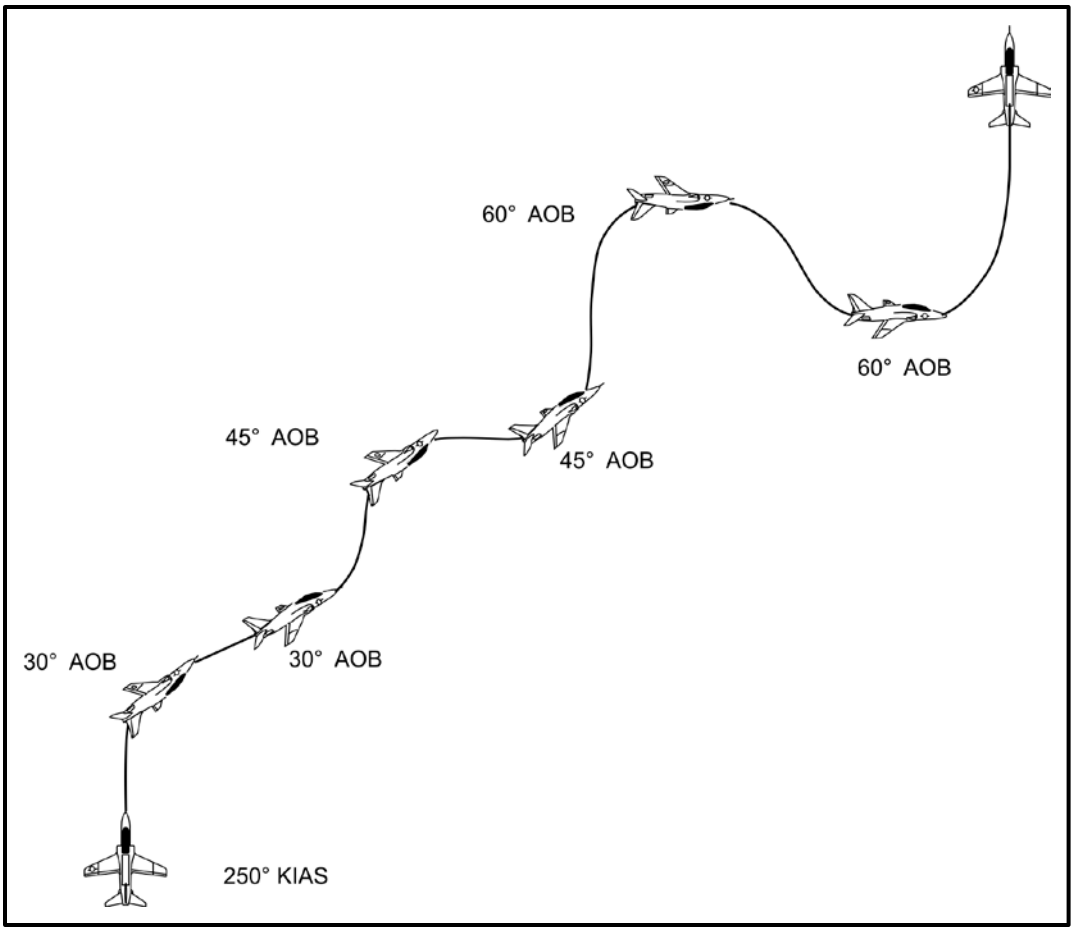

Figure 3-1: Turn Pattern

As you complete the second 30-degree AOB turn, reverse into a 45-degree AOB turn for 90 degrees of heading change. As you enter the 45-degree AOB turn, you will need to increase the power and adjust back stick pressure to achieve a little higher nose attitude than for the 30-degree AOB turn in order to maintain a constant altitude and airspeed. As the aircraft approaches the reversal heading, remember to lead the reversal. As the wings approach the level position, decrease the nose attitude in order to maintain a constant altitude. As you continue the

rolling reversal and as you approach 45 degrees AOB, you will need to adjust back stick pressure and the power in order to continue to maintain a constant altitude and airspeed.

At the completion of the second 45-degree AOB turn, lead the reversal and roll into a 60-degree AOB turn in the opposite direction for 120 degrees of heading change. Remember, more power and back stick pressure will be required to maintain a constant airspeed and altitude. In the 60-degree AOB reversal, use the same technique as in the 45-degree AOB reversal, except that the amount of heading lead and nose attitude change will be greater. Upon completion of the second 60-degree AOB turn, resume straight and level flight at 250 KIAS.

Techniques

When properly performed, your AOB should remain constant throughout each turn. However, if you experience a high rate of descent during the 60-degree AOB turn, you may have to decrease AOB in order to reestablish the proper nose attitude prior to reestablishing the proper AOB.

Your primary visual cues should come from outside the cockpit, but also cross-check the altimeter, VSI, and airspeed indicator (T-45A), or the MFD altitude, HUD, VSI, and airspeed readout (T-45C) to ensure proper performance. Prior to entering the turn pattern and when established on altitude and airspeed, note where the horizon transects the windscreen and where your power is set by monitoring the fuel flow indicator and rpm. These are the 250 KIAS level flight attitude and power reference points that you should use for attitude and the power adjustments during the turn pattern.

If you need to correct for improper attitude, make a definite pitch correction in relation to the outside horizon and hold it. Cross-check your altimeter, VSI, and HUD (T-45C) to see if the desired performance is attained. If it isn't, make another correction in the same manner.

NOTE

> Do not chase the altimeter with the nose of the aircraft. The VSI will give the first indication of an impending change in altitude; use it as a trend indicator.

The same technique applies to airspeed errors. Make a specific power correction and then check your airspeed to see if the desired performance is attained. Remember that both for pitch and power corrections, a re-correction will be required to maintain the pattern altitude and airspeed. Also modify your technique to correct for reversal pattern errors—e.g., if you're low, don't lower the nose as much during the reversal.

304. ACCELS AND DECELS

You will perform accelerations and decelerations to familiarize yourself with the trim and pitch changes required to maintain level flight as airspeed changes.

Procedures

To accelerate, go to MRT, verify that your speed brakes are retracted, maintain altitude by adjusting pitch, and trim to relieve stick pressure. Approximately 5 KIAS prior to reaching desired airspeed, adjust the power to the appropriate setting.

To decelerate by more than 25 KIAS, reduce the power to idle, extend the speed brakes, adjust pitch, and trim as necessary. Five KIAS prior to desired airspeed, retract the speed brakes and adjust the power as required to maintain airspeed. Maintain altitude by setting an attitude and trimming out stick pressures.

NOTE

The speed brakes can be operated without restrictions throughout the entire flight envelope; however, they will not fully extend above 340 KIAS.

To reduce airspeed by less than 25 KIAS, reduce the power to the appropriate setting, adjust pitch, and trim as necessary to maintain level flight. Adjust the power as necessary to maintain desired airspeed.

NOTE

Although the speed brake stabilator interconnect counters pitch transients during speed brake operation, some pitch adjustment is still required when speed brakes are extended or retracted during cruise. On extension, a slight nose-up pitch occurs that requires forward stick and retrimming. The opposite occurs when the speed brakes are retracted. The amount of pitch change in the landing configuration is negligible.

305. SLOW FLIGHT EXERCISE

The slow flight exercise familiarizes you with the flight characteristics of the T-45 in the landing configuration at optimum AOA, but you will practice it at altitude (Figure 3-2).

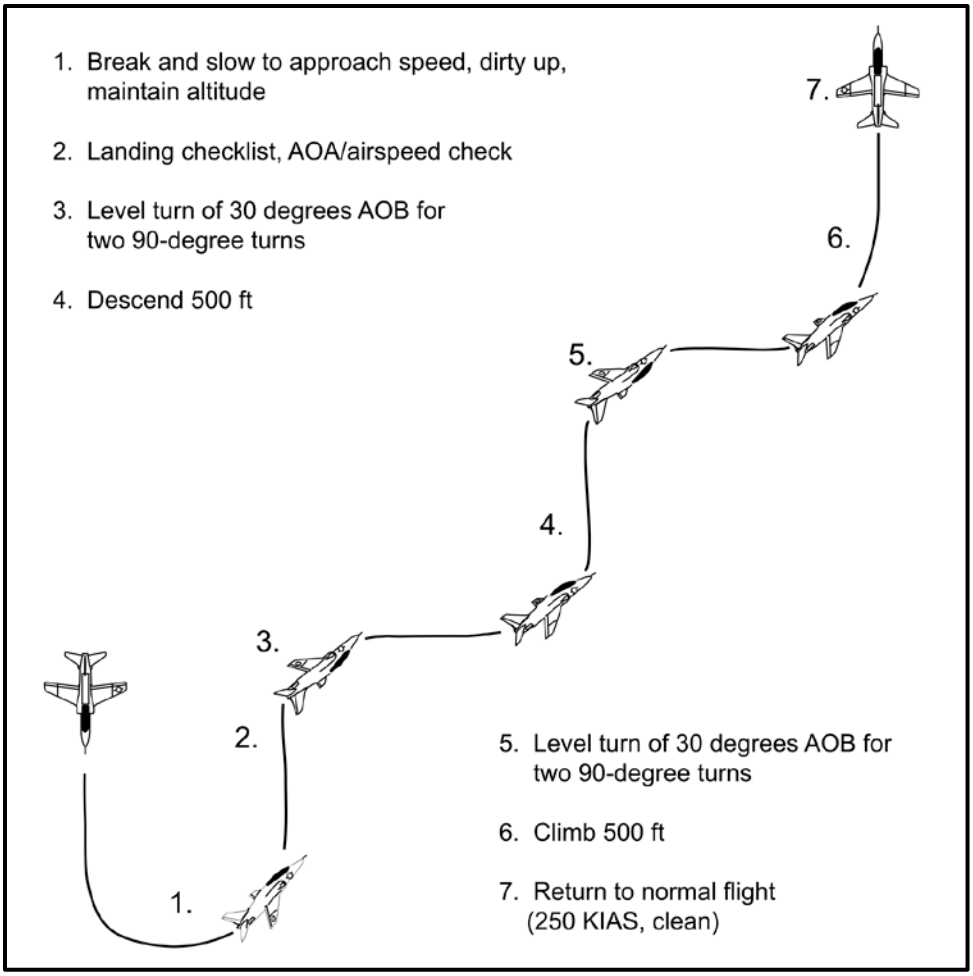

Figure 3-2: Slow Flight Exercise

Procedures

To perform the slow flight exercise, execute a break, reduce the power to idle, extend speed brakes, and as your airspeed decreases, increase the nose attitude to maintain altitude. At 200 KIAS, lower the landing gear and extend full flaps/slats. As the flaps and slats extend, counter the ballooning with a little forward stick and then begin increasing the nose attitude as the aircraft slows to approach speed. Trim the aircraft throughout the dirty-up. As airspeed approaches 120 KIAS, increase the power to approximately 90-94% rpm to maintain optimum AOA. Complete the landing checklist, the AOA/airspeed check, and trim as necessary. Continue to maintain optimum AOA of 17 units by adjusting the nose attitude. Use the power as necessary to maintain altitude.

Execute a coordinated, level 30-degree AOB turn for 90 degrees of heading change with reversal while maintaining altitude and optimum AOA. Descend 500 ft at 500 fpm by reducing the power approximately 5% below what is required to maintain level flight while maintaining optimum AOA. Fifty feet prior to reaching the desired altitude, increase the power and adjust the nose attitude to resume level flight. Execute another coordinated, level 30-degree AOB turn for 90 degrees of heading change with reversal while maintaining altitude and optimum AOA.

NOTE

This exercise may be adjusted for weather and/or MOA boundaries.

Climb 500 ft by increasing the power by approximately 5% above what is required to maintain level flight and climb at 500 fpm while maintaining optimum AOA. Fifty feet prior to reaching the desired altitude, reduce the power and adjust the nose attitude to resume level flight.

Resume normal flight by increasing the power to MRT, retracting the speed brakes, and raising the landing gear. Raise the flaps and slats at 140 KIAS. Maintain level flight while accelerating to 250 KIAS. Trim as required to relieve stick pressure as the aircraft accelerates. Reduce the power as necessary to maintain 250 KIAS in level flight.

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CHAPTER FOUR
STALLS

400. INTRODUCTION

This phase of your training introduces the procedures for entering and 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 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 recover from an impending stall is a critical component of your skills as a qualified Naval aviator.

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 you pull too hard and stall 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 backstick 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.

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.

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. Flying the

aircraft out of rudder shaker while maintaining attitude is the goal of the following recovery procedures.

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 altimeter (T-45A) or MFD altitude (T-45C) and the VSI.

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. 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.

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

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.

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.

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.

NOTES

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.

502. NOSE-HIGH UNUSUAL ATTITUDES

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.

Causes

An unintentional Nose-High Unusual Attitude is typically caused by an improperly executed overhead aerobatic or tactical stage maneuver.

Recovery

When given control of the aircraft, simultaneously neutralize the flight controls (i.e., ailerons, stabilator, 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.

503. NOSE-LOW UNUSUAL ATTITUDES

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.

Causes

Inadvertent Nose-Low Unusual Attitudes are typically caused by improperly executed overhead aerobatic or tactical stage maneuvers.

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.

504. 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).

505. 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.

Clearing an Engine Stall

To prevent a flameout and/or damage to the engine, neutralize controls, throttle to idle, monitor EGT, RPM, and fuel flow. If the engine isn’t cleared by going to IDLE, shut it down and perform an Immediate Airstart IAW NATOPS. However, if the throttle is at IDLE when an engine stall occurs, it may not be apparent in some situations until the throttle is advanced above IDLE.

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CHAPTER SIX
AEROBATICS

600. INTRODUCTION

You perform aerobatics to learn the standard aerobatic maneuvers while improving your basic air-work, increasing your confidence, and extending mastery over a larger portion of the maneuvering envelope. As aerobatic flight improves your coordination, your timing, and your ability to remain oriented, it also furthers your sense of feel for the T-45.

Aerobatic flight also familiarizes you with the unusual attitudes that are possible in the aircraft. By employing the proper recovery methods, your confidence in both the aircraft and in your abilities will increase. To fly the aircraft through the various aerobatic patterns, you must apply varying control pressures in order to compensate for the effects of gravity and constantly changing attitudes and airspeeds. Aerobatic training is essential to your development as a tactical Naval Aviator.

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 to complete the maneuver and return to straight and level flight without descending below 10,000 ft AGL. You will use visual cues outside the cockpit as your primary aerobatic references during 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.

601. GENERAL AEROBATIC PROCEDURES

Upon entry into a maneuver:

1. Note aircraft airspeed, altitude, and heading parameters

2. Attempt to exit the maneuver with similar parameters

3. Use inside/outside scan technique

4. Zero G’s for greater than 30 seconds is prohibited

602. BASIC MANEUVERS

Minimum Radius Turn

A Minimum Radius Turn is a tight, high AOA (17 units), constant airspeed turn. In FAM the minimum radius turn consists of two 360-degree turns in opposite directions. You practice the minimum radius turn maneuver to develop your skills in precise control of the aircraft through steep AOB and high g forces (Figure 6-1).

Procedures

Complete the pre-stall and aerobatic checklist prior to performing the Minimum Radius Turn. Begin the maneuver at 300 KIAS, at the desired altitude, and aligned on a cardinal heading, prominent terrain feature or section line for use as a visual reference. Roll into an approximate 85-degree AOB turn. Simultaneously increase the power to MRT and back stick to obtain optimum AOA (17 units) while continuing to maintain entry airspeed. You may sacrifice altitude as necessary to maintain airspeed throughout the 360-degree turn.

Begin the reversal on the terrain feature you used to start the maneuver. Use a moderate rate of roll to achieve 85 degrees AOB in the opposite direction. Release back stick pressure during the reversal to prevent the nose attitude from ballooning. As you roll into an 85-degree AOB turn in the opposite direction, feed in back stick to maintain optimum AOA (17 units) and adjust the nose attitude as required to maintain airspeed. Maintain power at MRT, optimum AOA, and entry airspeed throughout the 360-degree turn. Roll out of the turn so the nose of the aircraft reaches the referenced terrain feature. As your wings reach level, adjust the power and the nose attitude to maintain 300 KIAS in level flight.

NOTE

Angle of attack is very sensitive during the Minimum Radius Turn: small changes in g will cause a significant change in the AOA.

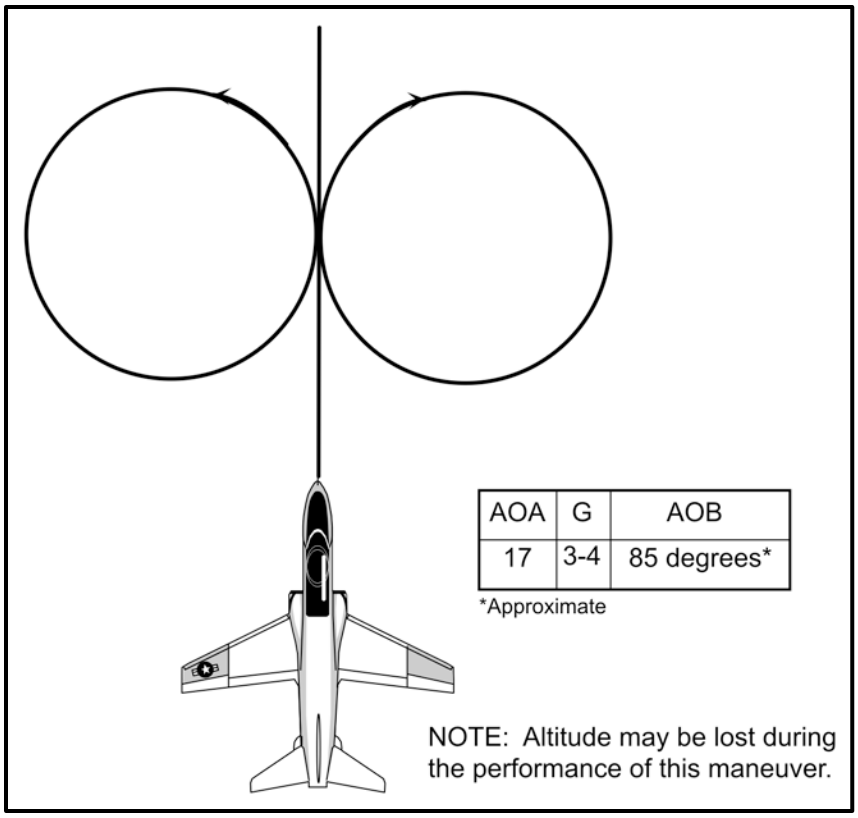

Figure 6-1: Minimum Radius Turn

Techniques

Remember, the airspeed is directly related to the nose attitude. As you decrease AOB (and therefore raise your nose attitude), your airspeed will decrease. As you increase AOB (and therefore lower your nose attitude), your airspeed will increase.

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 6-2).

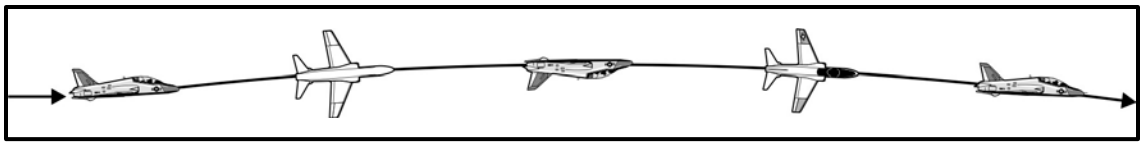

Figure 6-2: Aileron Roll

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.

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 6-3).

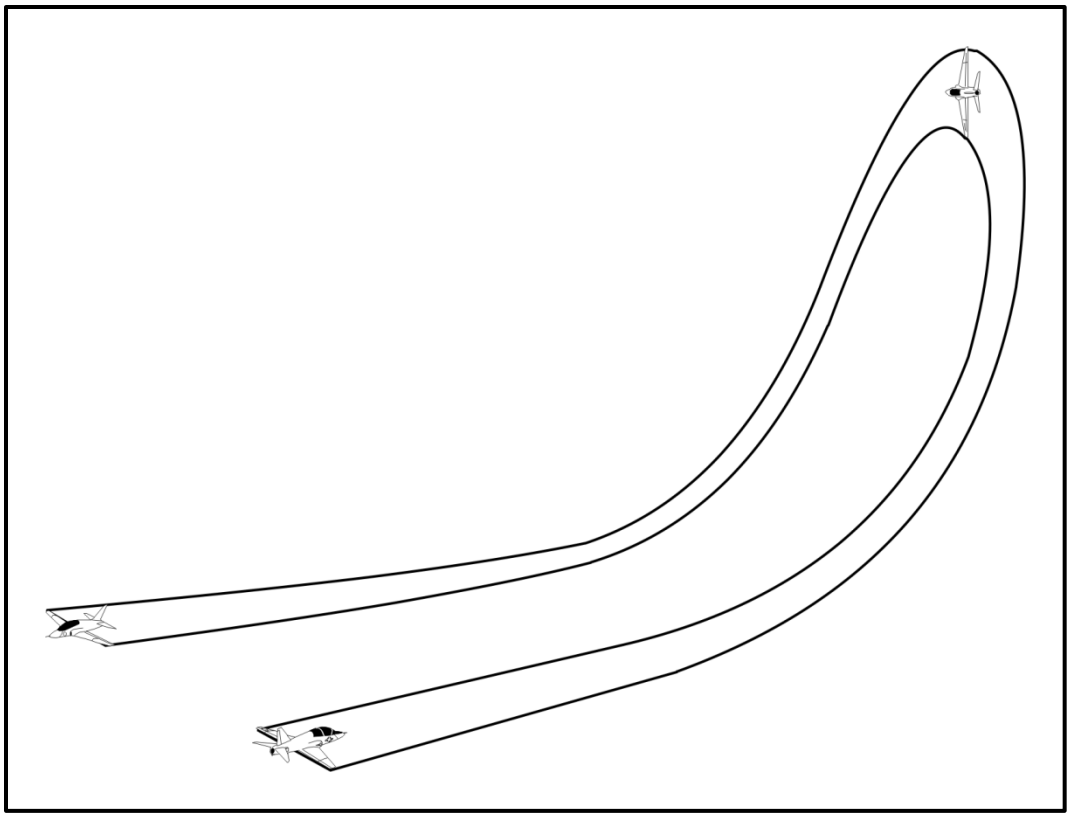

Figure 6-3: Wingover

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.

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 noseup, 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 6-4).

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.

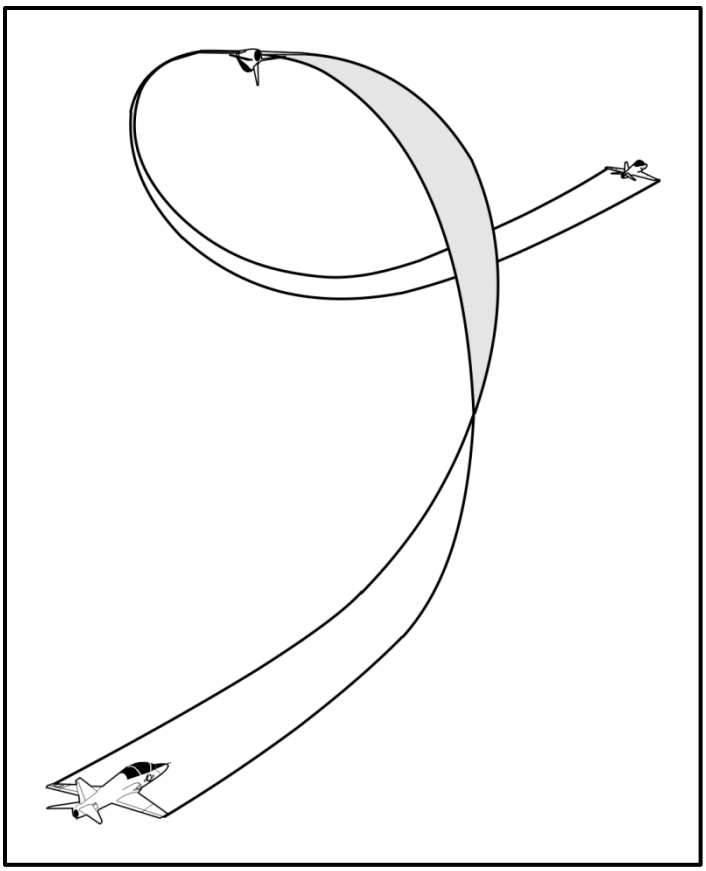

Figure 6-4: Barrel Roll

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.

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.

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 6-5).

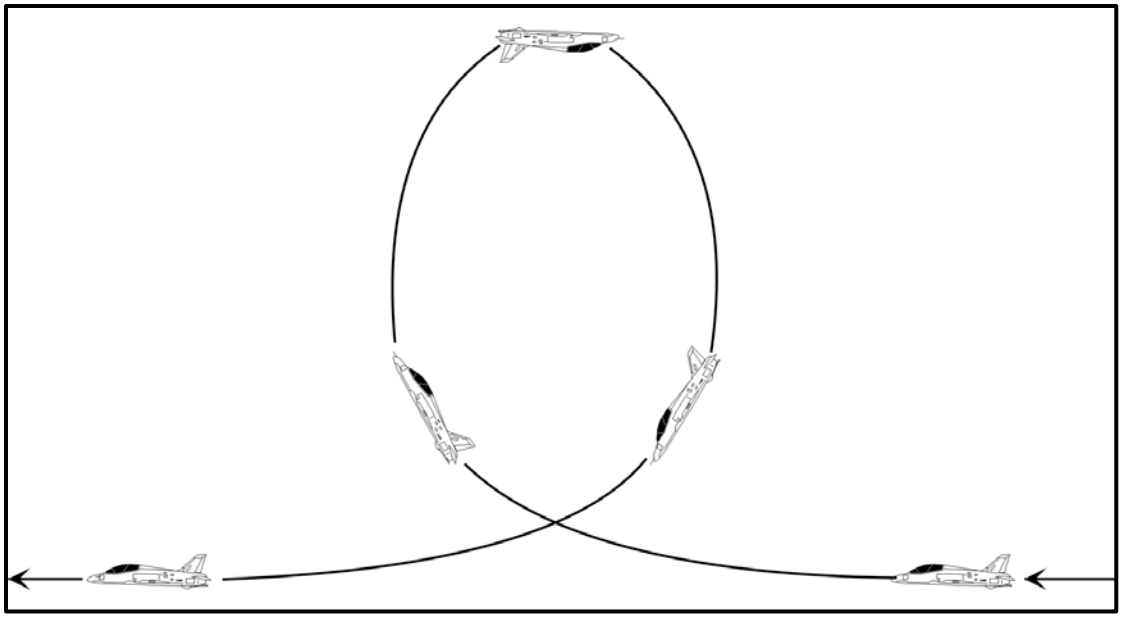

Figure 6-5: Loop

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 6-6).

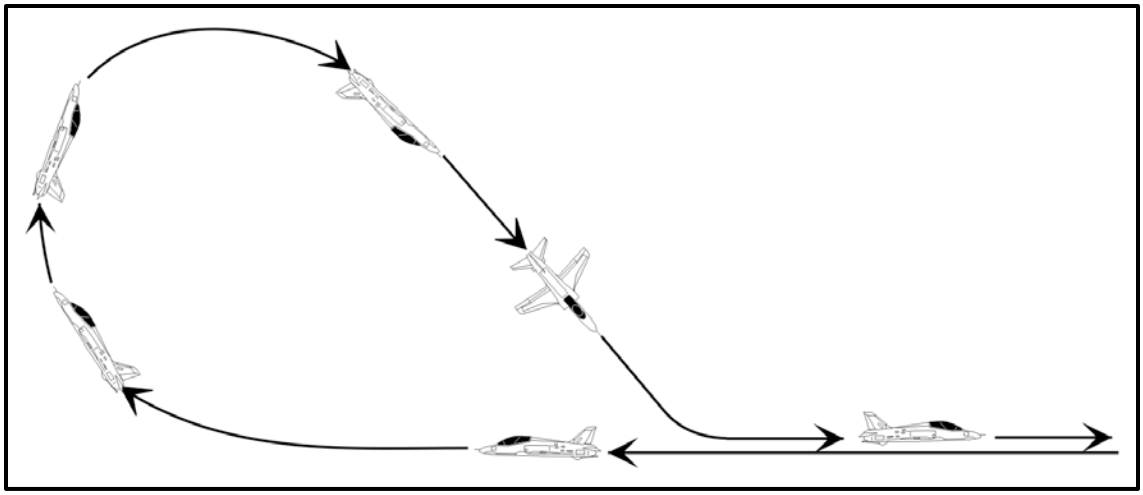

Figure 6-6: Half Cuban Eight

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 6-7).

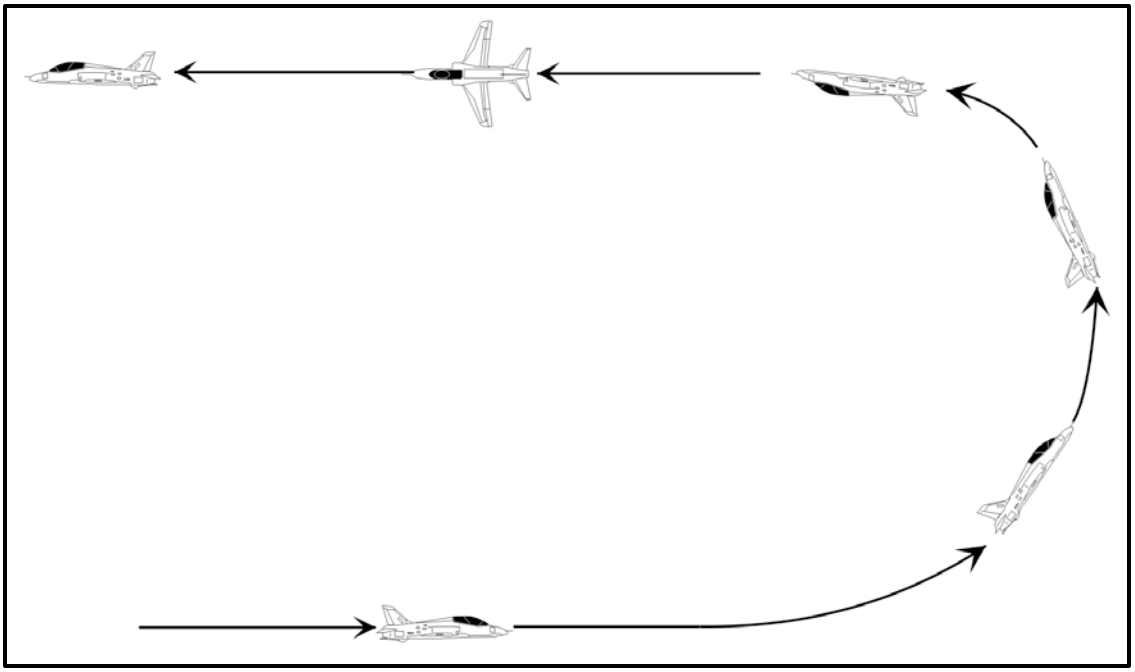

Figure 6-7: Immelmann

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 6-8).

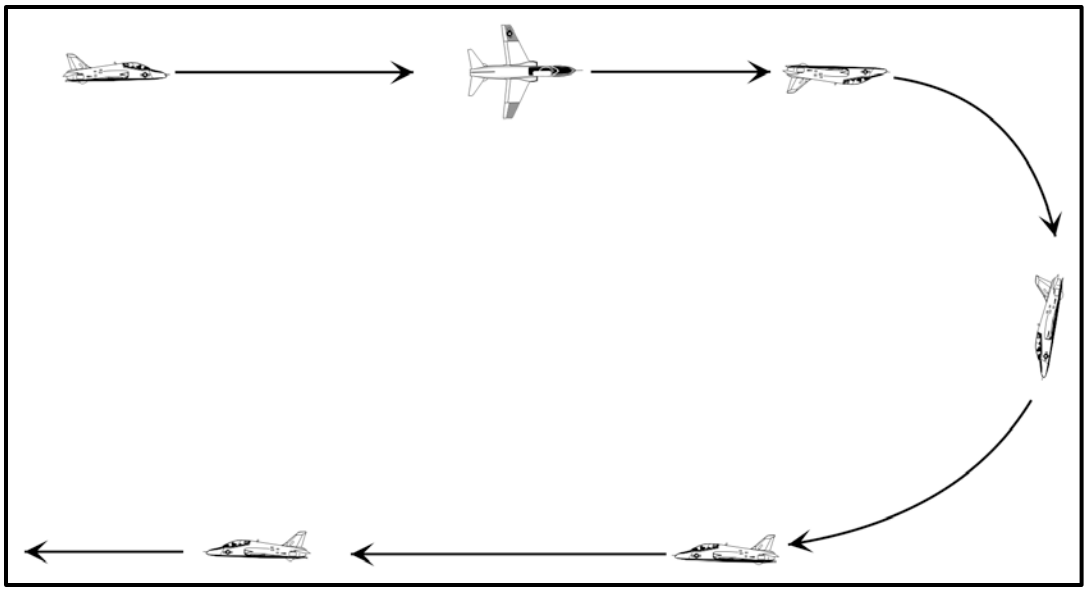

Figure 6-8: Split-S

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 6-9).

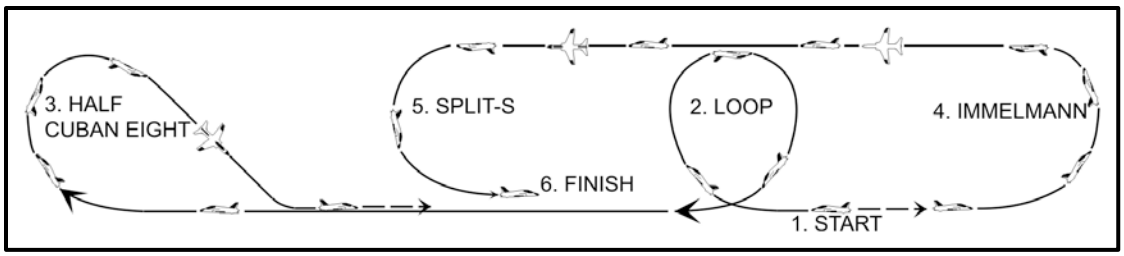

Figure 6-9: Squirrel Cage

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.

NOTES

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CHAPTER SEVEN
APPROACH

700. INTRODUCTION

During this phase of your training we will be covering slow flight exercises and various descents—including the jet penetration descent, the enroute/idle descent, the maximum range/idle descent, and the cruise descent.

701. DESCENTS

Factors affecting your descent include enroute or terminal weather, fuel, the presence of an emergency, and the mission you are flying.

Jet Penetration

Use the jet penetration for quick descent to lower altitudes associated with instrument approaches, for VFR entry to the landing pattern, when fuel is not a primary consideration, and when you do not want to gain excessive airspeed or cover a large horizontal distance.

Procedures

To perform this descent, reduce the power to IDLE (if above 30K-75% minimum) and extend the speed brakes as required. Establish a descent rate of 4,000 to 6,000 fpm while adjusting the nose attitude to maintain 250 KIAS. At 10% of the rate of descent (in feet) above the desired altitude, retract the speed brakes and initiate level off. Adjust the power to maintain 250 KIAS.

NOTE

> The rate of descent should not exceed your altitude above the ground in feet per minute when you are below 5,000 ft AGL. This precaution is commonly referred to as the “minute to live” rule.

Enroute Idle Descent

The enroute idle descent minimizes fuel consumption while descending at enroute airspeed.

Procedures

To perform this descent, reduce the power to IDLE (if above 30K-75% minimum) and begin the descent when the distance to your destination in nautical miles is approximately 2.5 times your altitude in thousands of feet above the desired altitude. Maintain cruise airspeed throughout the descent. Begin level off when you are at 10% of the rate of descent (in feet) above the desired altitude.

EXAMPLE: If you want to descend from FL350 to 15,000 ft MSL, calculate the beginning point of your descent as follows:

2.5 x 20 (number of thousands) = 50 nm

Remember, this equation is simply a best guess as to when to start your descent. It does not account for wind.

Maximum Range Idle Descent

The maximum range idle descent maximizes descent distance while minimizing fuel consumption.

Procedures

Begin the descent when the distance to your destination is approximately 3 times your altitude in thousands of feet above desired altitude. To perform this procedure, reduce the power to IDLE (if above 30K-75% minimum) and maintain altitude until the aircraft decelerates to 190-200 KIAS. Lower the nose to maintain 190-200 KIAS during the descent. Begin level off when you are at 10% of the rate of descent (in feet) above the desired altitude.

EXAMPLE: If you will be descending 15,000 ft, e.g., FL180 to 3,000 ft MSL, calculate the beginning point of your descent as follows:

3 x 15 (number of thousands) = 45 nm

Again, this equation is simply a best guess as to when to start your descent. It does not account for wind.

Cruise Descent Procedures

The cruise descent maintains your enroute speed. To perform the cruise descent, maintain enroute airspeed and reduce the power as necessary to establish and maintain a 1,500 to 2,000 fpm rate of descent. Adjust the nose as required to maintain enroute or assigned airspeed. Begin level off when you are at 10% of the rate of descent (in feet) above the desired altitude. During FAM flights, the cruise descent is done at 250 KIAS. If entry airspeed is above 250 KIAS, reduce power first and slow to 250 KIAS, then lower nose to maintain a 1,500- to 2,000-fpm descent. If entry speed is below 250 KIAS, lower the nose first and accelerate to 250 KIAS, then adjust power to maintain a 1,500- 2,000-fpm descent.

CHAPTER EIGHT
LANDING PROCEDURES

800. INTRODUCTION

One of the major goals of the Familiarization stage is to ensure that you are able to perform the landing pattern and touchdown consistently. Upon completion of the Familiarization stage, you should be able to fly a consistent landing pattern, regardless of weather conditions (e.g., crosswinds).

801. NORMAL VFR RECOVERY

Use the normal VFR recovery to enter the landing pattern from the MOA when the field is accepting break traffic.

Procedures

Monitor ATIS prior to leaving the MOA to get the latest weather and airport information. Follow the course rules to arrive at the VFR initial and report your position to the tower. At this point, follow Tower's directions.

When cleared by the Tower and with proper interval, execute a level break using approximately 70- to 80-degree AOB turn while extending the speed brakes and reducing your power to idle. Break within the first two-thirds of the runway if you are cleared and your interval permits. At 200 KIAS, lower the gear and position the flaps/slats as required.

To establish a correct landing interval, you will have to break when the aircraft immediately ahead of you in the pattern is:

1. 30 degrees aft of your wing if the aircraft is established on the downwind leg in a dirty configuration.

2. Between 10 and 30 degrees aft of your wing if the aircraft is executing a break.

Make allowances for different patterns, if known (e.g., no flaps, dissimilar aircraft, etc.).

NOTE

> Ensure that you observe the landing configuration limitations for the landing gear, flaps and slats: they should not be extended at airspeeds above 200 KIAS or greater than 2 g's.

When you are wings level on the downwind leg, approximately 1 nm abeam descend to 600 ft AGL, establish optimum AOA (17 units), and cross-check AOA with airspeed. Since optimum AOA airspeed varies with weight, you must add the fuel state to the aircraft weight to determine gross weight. To do so, check your fuel state. Given a fuel state of 2,000 pounds, the gross

weight of your aircraft is about 12,500 pounds. Airspeed at optimum AOA at 12,500 pounds is 118 + 2 KIAS. At optimum AOA, your airspeed will change 2.5 KIAS for every 500 pound change in your gross weight.

Check your AOA indexers for correct operation with respect to your AOA indicator. Complete the landing checklist prior to reaching the abeam position. Trim the aircraft for hands-off flight at optimum AOA to help you stay on-speed during the landing approach.

802. LANDING PATTERN

FULL FLAP/SLAT (NORMAL)

1. Abeam—600 ft AGL, on-speed, and approximately 1 nm laterally across from the touchdown position on the runway

2. 180-degree—600 ft AGL, on-speed, zero rate of descent, 15 seconds past abeam with time adjusted for wind

3. 135-degree—on-speed, approximately 200-300 fpm rate of descent

4. 90-degree—450 ft AGL and on-speed, approximately 500 fpm rate of descent

5. 45-degree—325 to 375 feet AGL and on-speed, approximately 500-700 fpm rate of descent

6. The start—on centerline, on-speed, a centered ball, approximately 500-700 fpm rate of descent

NOTE

A proper pattern will result in a correct groove length of 15 to 18 seconds (Figure 8-1). The primary emphasis of the landing pattern is an outside scan, cross-checking the instruments.

Procedures

To perform the landing pattern correctly, you must arrive at the proper abeam position, on-speed, on altitude, and trimmed up. Call abeam to notify the Tower of your intentions and to advise that your gear are down and locked, i.e., “(call sign) abeam, gear, touch and go.”

Continue wings level from abeam at 600 ft AGL and on-speed for 15 seconds. Adjust for winds by subtracting 1 second for each knot of headwind component. Perform the initial 90 degrees of the approach turn primarily on instruments to establish a consistent rate of turn/rate of descent. Roll into a 27-30 degree AOB turn, adjust the power, and lower the nose slightly to establish a 200-300 fpm rate of descent. Use the nose attitude to maintain optimum AOA and use the power to control your rate of descent. Check your position in relation to the extended centerline and adjust your AOB and rate of descent to arrive at the proper 90 degree position. Concentrate on

performing an instrument approach through the first 90 degrees of turn. Scan the following flight instruments throughout the approach:

1. VSI
2. Radar altimeter
3. ADI (AOB and heading)
4. AOA (indexer and gauge)
5. Barometric altimeter

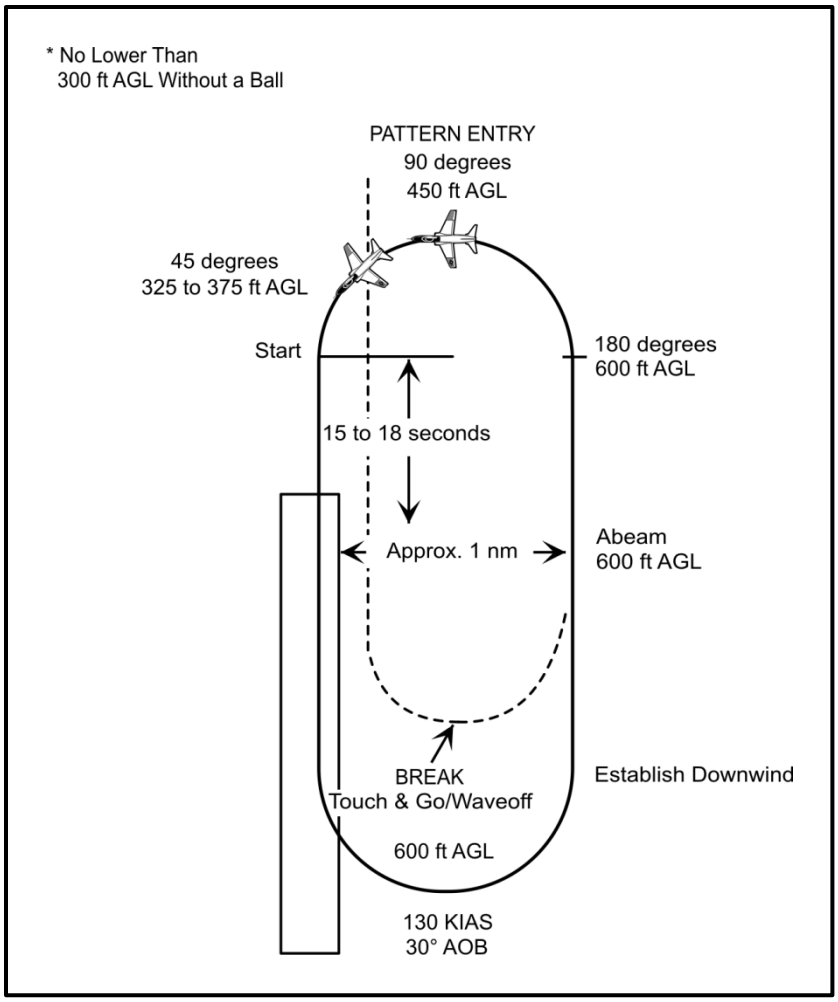

Figure 8-1: Normal Landing Pattern

NOTE

It is important to remember fundamental distinctions between the ADI display and the HUD. Using a waterline symbol, the ADI displays instantaneous aircraft pitch attitude as measured from a pilot adjusted pitch reference line. By contrast, the HUD displays a velocity vector symbol that shows the aircraft's angular direction of movement as measured from a GINA-stabilized HUD horizontal flight line. When the velocity vector is centered on the horizontal flight line, the aircraft is in level flight. The ADI and HUD display are not synonymous. For example, it is quite possible to have a positive pitch angle displayed on the pitch ladder while the GINA generates a negative or level flight velocity vector displayed on the HUD flight path ladder (Figure 8-2).

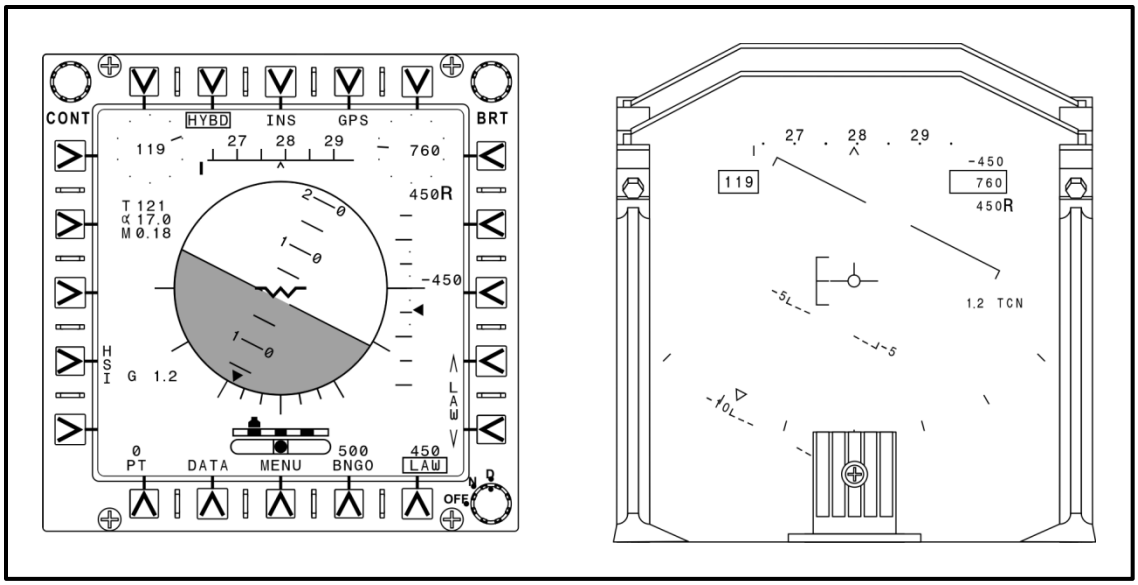

Figure 8-2: Typical ADI and HUD Display In The Landing Pattern

NOTE

The ADI and HUD display different bank angle reference marks that must not be inadvertantly confused:

* ADI display 10° 20° 30° 60° 90°
  (caret not displayed past 90°)
* HUD 5° 15° 30° 45°
  (caret flashes from 47.5° to 90°, not displayed past 90°)

Reaching the 90-degree position, increase your rate of descent to approximately 450 fpm. You should be at 450 ft AGL and on-speed. Continue to adjust your AOB so that you will roll out on the extended runway centerline. Use the entire runway as a reference for lineup, not just the landing area, to avoid angling or overshooting approaches. You should have a visual "howgozit" during the approach turn, and you should make any necessary corrections. At the 45-degree position, you should be at 325-375 feet AGL, and you should be able to pick up the ball.

You enter the groove out of the start position at which point you should be at optimum AOA, trimmed up, and on the runway centerline with 15-18 seconds of straightaway to touchdown. You should also have a centered ball and approximately 500-700 fpm rate of descent.

NOTE

A slight power reduction will be required as you roll wings level in the groove. The optimum AOA airspeed is 2 to 3 KIAS slower in wings level flight than it is during the turn. Failing to reduce the power will cause you to go high, fast, or both. Even though the airspeed changes from the 180 through wings level in the groove, you will still maintain optimum AOA throughout the approach turn.

No Flap/Slat

1. Abeam—altitude per Course Rules, on-speed, and between 1.8 and 2.0 nm laterally across from the touchdown position on the runway

2. 180-degree - altitude per Course Rules, on-speed, 15 seconds past abeam with time adjusted for wind

3. 90-degree—on-speed

4. 45-degree—on-speed

5. The start—on runway centerline, on-speed, and a centered ball

Because the no flap/slat configuration simulates a combined HYD 1 and wheel brake/emergency flap accumulator failure, the speed brakes will not be used (Figure 8-3).

NOTE

Due to the large tendency to overshoot, special attention should be given to the center line when rolling out in the groove.

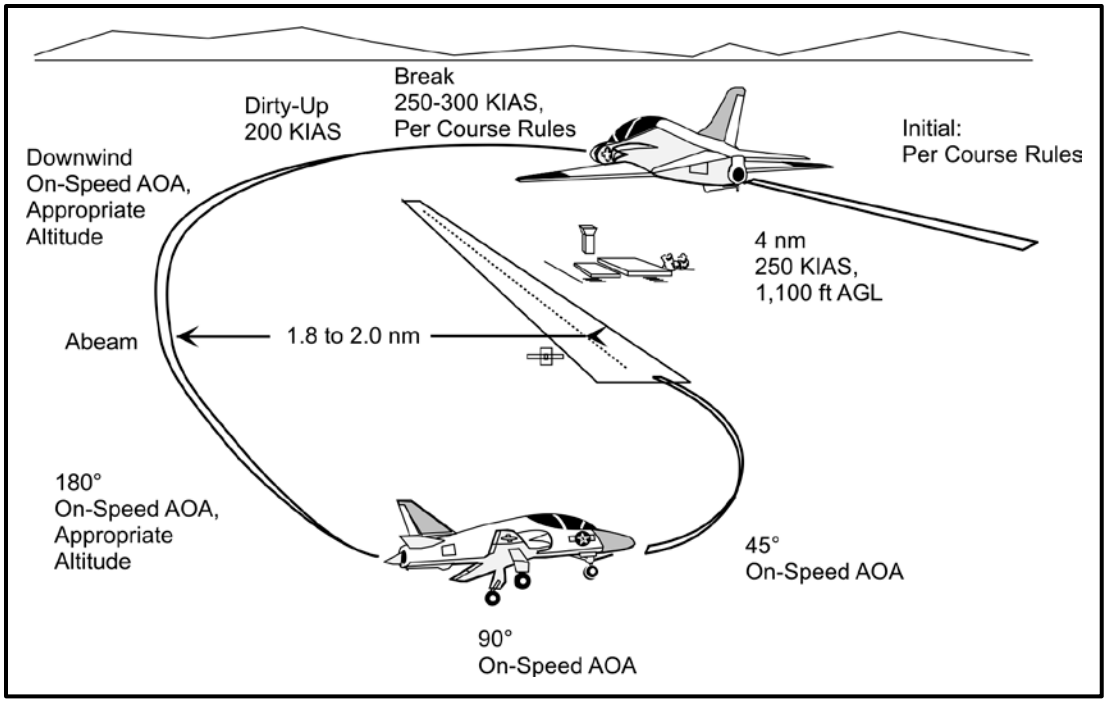

Figure 8-3: No Flap/Slat Landing Pattern

Procedures

When in the pattern, transition from a full flap/slat configuration during the upwind leg. At 140 KIAS, wings level, and above 500 ft AGL, raise the flaps and slats. Turn downwind with the proper interval established, at or above 500 ft AGL, or as directed by the tower, utilizing approximately 170 KIAS and 25-degree AOB. Establish the downwind leg at 1.8 to 2.0 nm abeam—remember, no flap/slat patterns are wider due to increased airspeed. Continue to maintain optimum AOA, remembering that your airspeed will be -approximately 35 KIAS faster than for full flap/slat landings. Complete the landing checklist prior to reaching the abeam position and verify the AOA/airspeed check.

As you reach the 180, roll into a 30-degree AOB, on-speed, level turn. Because the no flap/slat pattern is wider and faster, you will be deeper throughout the approach turn. Follow established procedures for local field operations in order to intercept glideslope and extended runway centerline. Fly the ball to the in-close position, then flare in order not to exceed 600 fpm on touchdown. The goal is to land prior to the arresting gear due to the simulated HYD 1 failure.

NOTE

In the event of an actual HYD 1 failure, you would execute a straight-in No Flap/Slat approach.

Technique

The no flap/slat approach produces less drag. You will be operating at reduced power settings, thus increasing engine response time relative to a full flap/slat approach.

803. PATTERN CORRECTIONS—OVER/UNDERSHOOTING CROSSWINDS

During the FAM stage, a major point of concern is your ability to fly a consistent pattern for every approach, so you must consider the wind during each approach. If you do not correct for the wind, you will end up having to make significant pattern corrections in order to land. The key points for consistency are the abeam, the 90, and the start. An inconsistent 180 will make it very difficult to get a good start and groove and will hamper your ability to learn how to land the T-45 with the precision required of a carrier pilot. The following lists the pattern corrections required when either an undershooting or an overshooting crosswind condition exists.

Overshooting Crosswind

If an overshooting wind condition exists and you fail to make the necessary corrections, you will overshoot the runway centerline as you roll into the groove (as illustrated in Figure 8-4). To correct for this condition, use less AOB in the break and establish a crab into the wind to maintain the proper abeam distance. In order to arrive at a good 90, you will need to increase your AOB during the approach turn. The steeper AOB will increase your rate of turn and thus require a slight increase in your rate of descent. When on glideslope, use a wings level, crabbed crosswind technique to maintain the lineup.

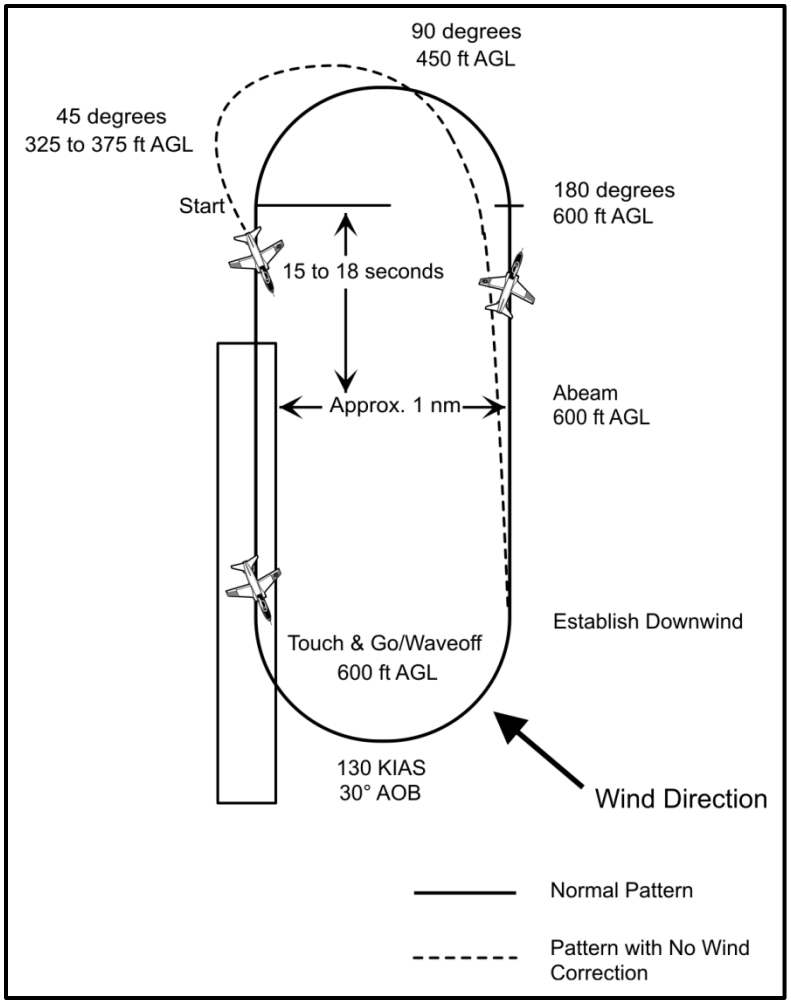

Figure 8-4: Pattern Corrections, Overshooting Winds

Undershooting Crosswind

If an undershooting wind condition exists and you fail to make the necessary corrections, you will undershoot the runway and have an angling approach, which will result in too short a groove (as illustrated in Figure 8-5). To correct, increase the AOB in the break and establish a crab angle into the wind to maintain the proper abeam distance. In order to arrive at a good 90, you will need to shallow your AOB during the approach turn. The shallow AOB reduces your rate of turn and requires a slight decrease in your rate of descent to arrive at the 90 on altitude. When on glideslope, use a wings level, crabbed crosswind technique to maintain lineup.

804. PATTERN CORRECTIONS—GENERAL

Properly identifying the abeam position is a critical component of the landing pattern; verify that you are, in fact, directly across from the touchdown area of the runway (abeam the optical landing system). Upon reaching the proper abeam position, you must time for 15 seconds to start

the approach turn correctly at the 180. Remember to adjust your timing by 1 second for each knot of head wind component (Example: If your head wind component was 8 knots, subtracting 8 seconds from 15 would result in timing 7 seconds from the abeam before starting your approach turn). If you arrive at the abeam and 180-degree positions correctly and make the necessary adjustments during the approach turn, you will reach a consistent 90 and start position with the proper groove length.

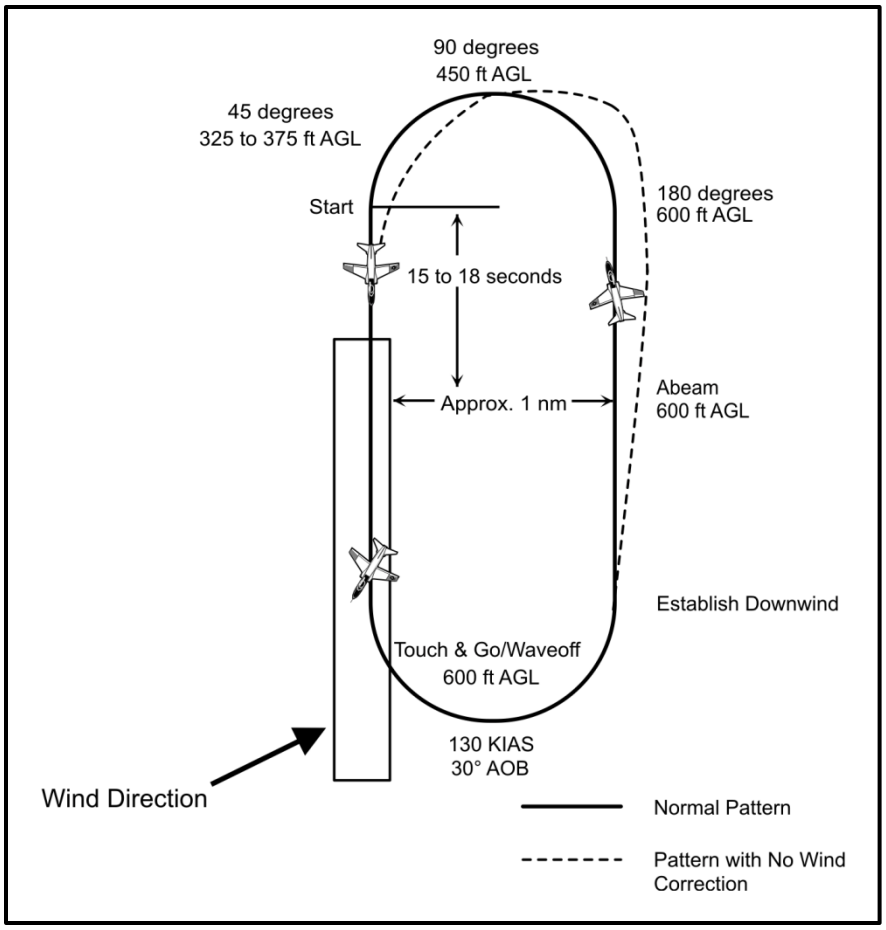

Figure 8-5: Pattern Corrections, Undershooting Winds

805. TRACKING THE GLIDESLOPE—CORRECTIONS

Fresnel Lens

The glideslope is projected by the Fresnel lens, an electro-optical landing aid that provides a visual reference of optimum glideslope to pilots on approach to landing. It consists of a lens assembly, “cut” lights, waveoff lights, and datum lights.

The lens assembly is a box 1 foot wide by 4 feet high that contains 5 vertical light cells, called “source lights.” Depending on your position in relation to the glideslope, 1 of the 5 cells will be illuminated (upper 4—amber, bottom—red). Cut lights (four green lights mounted horizontally

and centered above the lens box) are used during NORDO conditions at the ship to signify "roger, ball" and that power must be added. The red waveoff lights, mounted vertically on each side of the lens box, indicate the LSO's mandatory command to wave off the approach immediately. In addition, some waveoff lights are controlled by the tower. The green datum lights, horizontally aligned on either side of the lens box, indicate a datum for a centered ball. Figure 8-6 presents the indications you can expect to encounter while tracking the glideslope.

Glideslope Description

The glideslope is a wedge-shaped projection from the Fresnel lens at a 3.5-degree angle with glideslope information present from 3/4 degrees above to 3/4 degrees below the projected glideslope. In addition, the meatball can be seen from up to 20 degrees on either side of the runway centerline. Because the glideslope is wedge shaped, its lateral and vertical tolerance is wide at the start and narrows to a point at the lens.

Procedures

Use the Fresnel lens to maintain proper glideslope. Remember, the Fresnel lens gives you only glideslope, not lineup, information. Use peripheral vision to scan the AOA indexer for maintaining proper AOA.

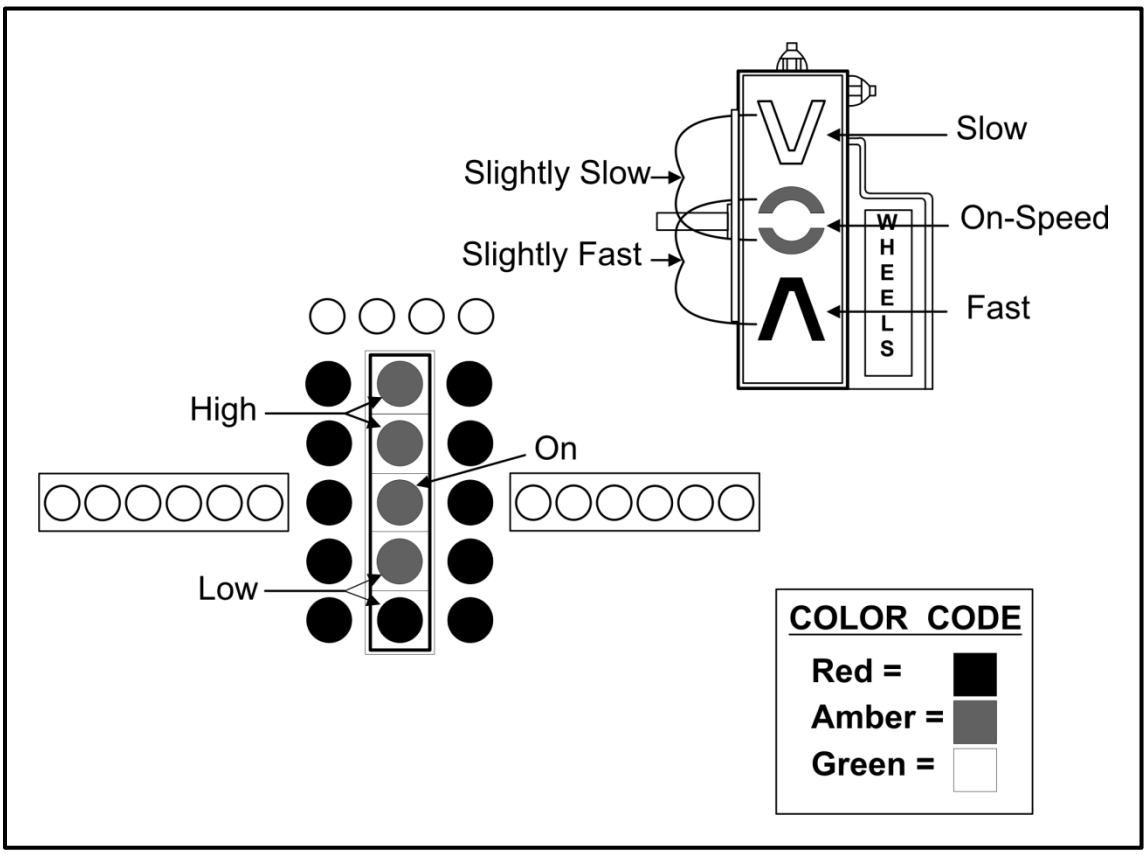

Figure 8-6: Glideslope Indications (Fresnel Lens/AOA Indexer)

The following list presents various glideslope/AOA indications you can expect to see and the associated corrections required to adjust back to the on-speed and centered ball approach. Remember, the glideslope is wedge shaped and progressively narrows as you get closer to the runway, so you must decrease the magnitude of a correction for an equivalent amount of ball movement as you approach touchdown. Figure 8-7 graphically depicts the glideslope corrections required during various situations.

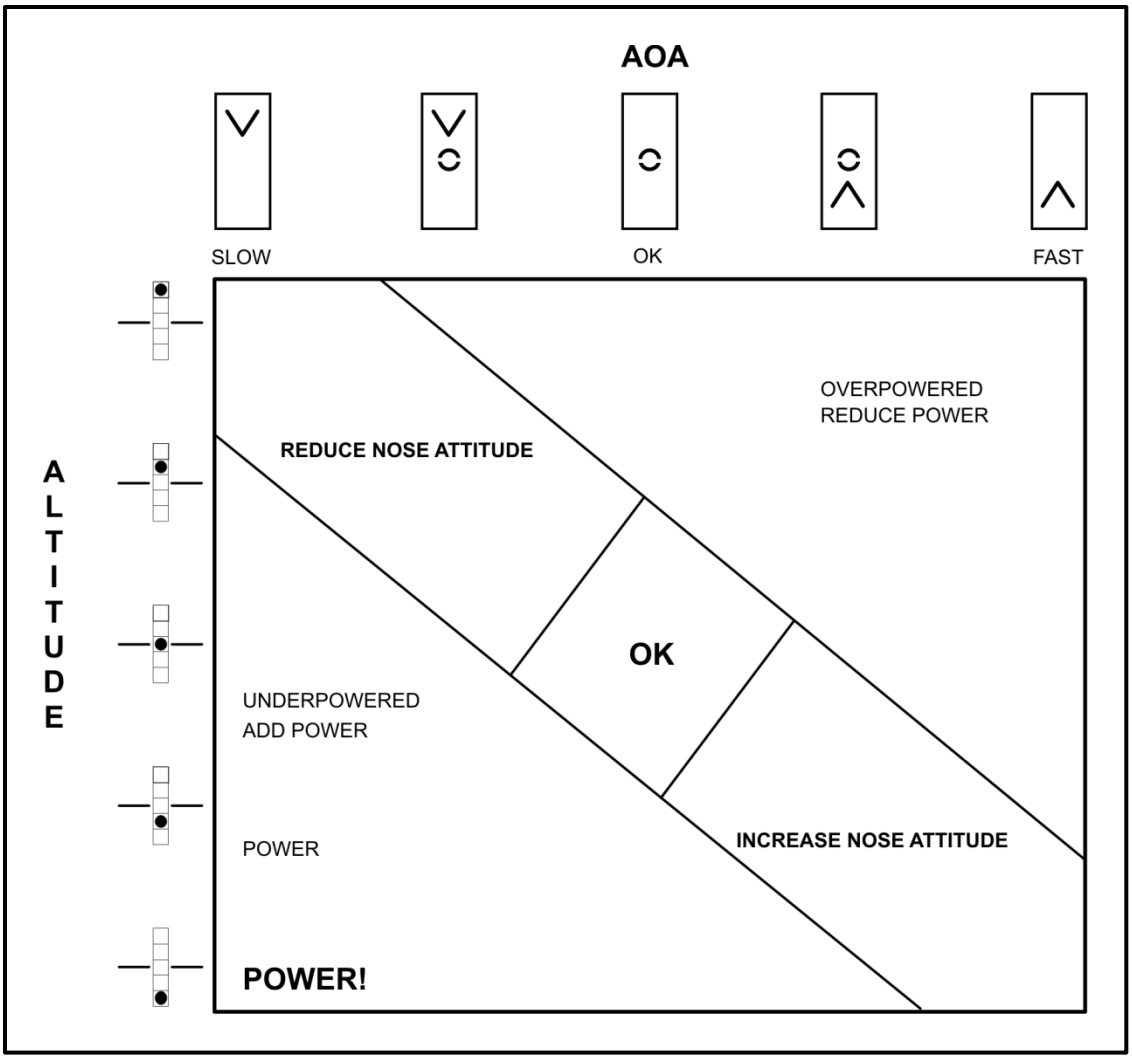

Figure 8-7: Glideslope Corrections

High Energy

1. HIGH. Reduce the power to increase your rate of descent and adjust the nose attitude to maintain optimum AOA. As the ball begins to move toward the center, add just enough power to reestablish and maintain the proper glideslope and readjust your nose attitude to maintain optimum AOA. Almost immediately following this countercorrection, make a third adjustment: reduce the power slightly in order to maintain the rate of descent required to hold the ball centered.

If the ball goes high in close or at the ramp, stop the movement but do not attempt to re-center the ball, which will inevitably result in a high rate of descent ("dive for the deck") and a hard landing—and, potentially, blown tires and structural damage. Avoid the temptation to drastically reduce power when you are high or climbing in close, accept a high or a bolter pass.

2. FAST. Reduce power. As your aircraft decelerates, increase the nose attitude to maintain a centered ball and to achieve optimum AOA. A noseup correction performed too rapidly generates excess power and will cause the aircraft to go high. Not enough noseup will leave you fast and low. Approaching optimum AOA, add power if necessary to maintain glideslope and readjust the nose attitude as necessary to maintain optimum AOA. Once more, you will have to make a third correction: reduce the power and readjust nose slightly.

3. HIGH AND FAST. As in the high and on-speed, you must raise the nose attitude and reduce the power. This time, however, reduce more power in order to correct in a timely manner. The ball will begin to move toward the center. Once on-speed, apply power and readjust and retrim the nose to hold the correct glideslope and AOA. If your aircraft approaches on-speed prior to regaining a centered ball, adjust the power to control your rate of descent and maintain proper AOA. As the ball approaches the center, use the nose attitude and the power to stabilize on the proper AOA and glideslope.

Low Energy

1. LOW. Add power and adjust the nose attitude to maintain optimum AOA. As the ball becomes centered, reduce the power to reestablish your glideslope and readjust your nose attitude to maintain optimum AOA. Now, you have to make an inevitable third correction to stabilize your approach. Add a small amount of power to prevent going low again. **Never accept a low ball.**

2. SLOW. Add power. As your aircraft accelerates, decrease the nose attitude to obtain optimum AOA and then readjust the nose attitude to maintain AOA and reduce the power to maintain glideslope. To stabilize your approach, add a small amount of power and readjust the nose attitude.

3. LOW AND SLOW. In this situation the aircraft is cocked up. Since the nose attitude is already high, initiate the correction by adding power and holding the nose attitude constant, which will move the ball upward and may or may not accelerate the aircraft. If the ball approaches the center prior to your regaining the proper AOA, adjust the nose to obtain on-speed and reduce the power to stay on the glideslope. If the aircraft accelerates while the ball is moving toward the center, adjust the nose attitude to maintain proper AOA while waiting for the glideslope correction to be completed. When the ball is centered, adjust the nose attitude and reduce the power simultaneously to maintain proper glideslope and airspeed.

OK Energy

1. HIGH AND SLOW: If your aircraft is not excessively slow, you may need only to lower your nose attitude to initiate the correction. However, if it is excessively slow, you will also

have to add power. Readjusting the attitude and the power should move the ball down toward the center.

If your aircraft accelerates to on-speed before the ball reaches the center, a small power reduction is necessary. If the AOA continues to indicate that you are slow, add power as the ball approaches the center to stop the excessive rate of descent and accelerate your aircraft to the proper AOA.

2. LOW AND FAST: Raise the nose to decelerate to optimum AOA. If the aircraft slows to on-speed AOA prior to the ball being centered, add power to continue the ball movement and to maintain on-speed. With the ball centered, reduce the power to reestablish your glideslope and adjust your nose attitude to maintain optimum AOA. If you're still fast when the ball reaches center, readjust the nose attitude and reduce the power if necessary to maintain a centered ball and to decelerate the aircraft to optimum AOA. Approaching proper AOA, add power to stop the deceleration and to maintain proper glideslope.

CAUTION

Never accept a low ball. If you are low, make corrections immediately. Do not reduce the power until the ball is centered.

Techniques

One mistake often made by pilots is to wait for noticeable ball movement before making a correction rather than making a correction when they think they need one. Another common approach error made by pilots is to not make the third correction. If this correction is not made, the original error will re-develop. Make corrections based on seat of the pants feel prior to ball movement. Remember, the ball tells you where you are; seat of the pants feel tells you where you're going.

806. LANDINGS

You 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, your instructor, or the wheels watch/RDO. When a waveoff is directed, you 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.

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. Or the 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 160 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 160 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, 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, 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, advance power to MRT. Once the aircraft is accelerating and 5-10 KIAS prior to the predicted takeoff speed, 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 SNA 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 8-8.

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 8-8.

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.

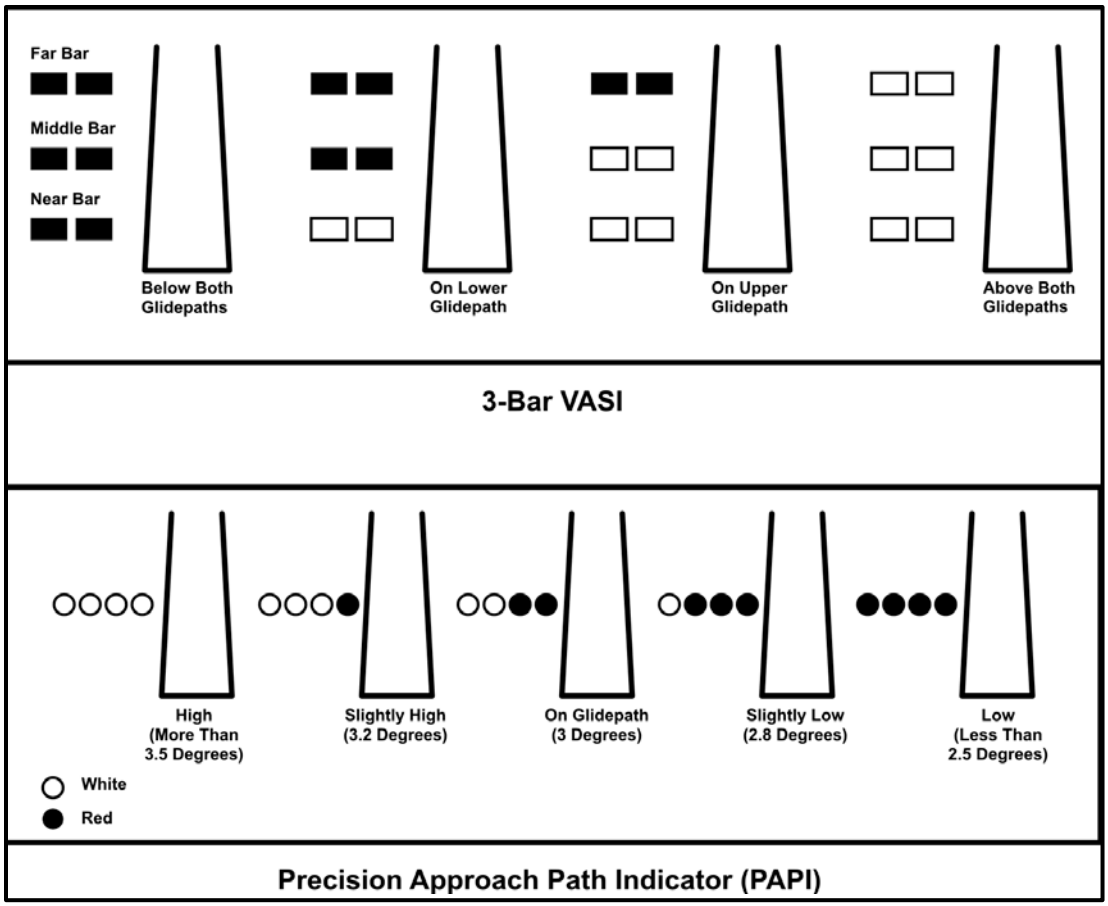

Figure 8-8: VASI (Three-bar) and Papi

Landing at a Field with No Landing Aide

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, HAWK 211, 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, HAWK 211 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 (see T-45 Standard Operating Procedure for line speeds). 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 IAS 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.

CHAPTER NINE
ALTERNATE ENTRIES AND PRECAUTIONARY APPROACHES

900. INTRODUCTION

Alternate entries are used to expedite entry to the landing pattern from a point other than the initial due to weather, low fuel, or traffic congestion. 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.

901. ALTERNATE ENTRIES

Downwind Entry

The downwind entry into the VFR landing pattern will familiarize you with an alternative means of entering the touch and go landing pattern. You or the Tower can request it to expedite entry into the landing pattern from a direction opposite the duty runway (Figure 9-1).

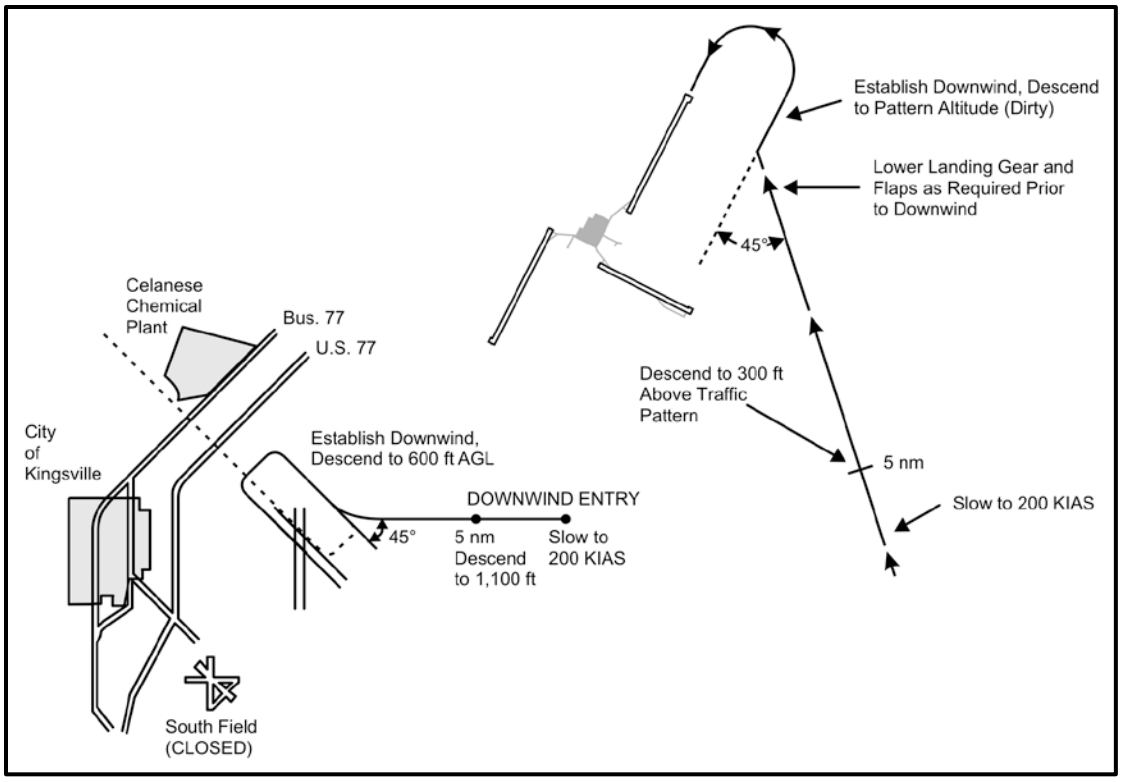

Figure 9-1: Downwind

Procedures

Enter at or below 200 KIAS at the altitude published in the course rules from a position 5 nm upwind of the landing runway and outboard of the extended runway centerline on the pattern side. Upon receipt of clearance from the Tower, proceed towards the airfield to intercept the pattern at about a 45-degree angle. As you approach the pattern, dirty up and complete the landing and AOA/airspeed checks. Look for your interval; the Tower may give you traffic information to fit you into the pattern. When established on the downwind leg, descend to pattern altitude and continue with a normal landing pattern.

VFR Straight-In Approach

Advise Approach of your intentions to make a straight-in approach. Ensure the aircraft is configured for landing approaching 5 miles. Begin the visual straight-in at 5 miles and 1,500 ft AGL on runway centerline. Plan to lose 300 ft per mile. The profile will mark the following checkpoints: 1,500 ft AGL at 5 miles, 1,200 ft AGL at 4 miles, 900 ft AGL at 3 miles, 600 ft AGL at 2 miles, 300 ft AGL at 1 mile. Note: Distances are from your intended pt of landing, not the approach end of the runway. Utilize the visual landing aid system if available (IFLOLS, VASI , PAPI). At night, do not descend below 300 ft AGL without suitable glideslope information from the available visual aid. The VFR straight-in approach has many applications in the fleet—e.g., weather, hung ordnance, expediting recovery, some emergencies (Figure 9-2).

Procedures

Advise Approach of your intentions to make a straight-in approach prior to reaching the Initial. Descend to altitude IAW local course rules. Complete the landing checklist, perform the AOA/airspeed check by 3 nm. Remain on glideslope, on centerline, and on-speed until you acquire the visual glideslope (using the ball or VASI). Then fly the ball all the way to touchdown.

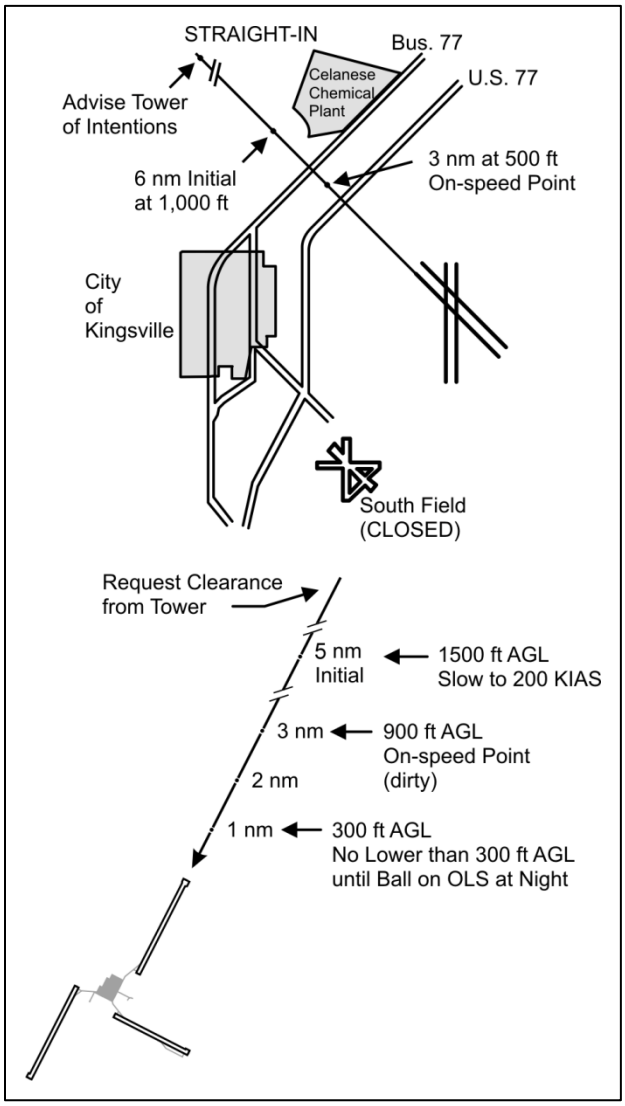

Figure 9-2: Straight-In Approach

902. PRECAUTIONARY APPROACHES

Precautionary approaches are designed to keep the pilot 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 precautionary approach, don't rotate to takeoff attitude until you achieve flying speed and the power is at 100% RPM. For a real precautionary approach the throttle must be pulled to ground idle after the approach idle stop is released on touchdown.

Straight-In Precautionary Approach

Procedures

To perform the Straight-In Precautionary Approach, begin by setting the power to 80% RPM (Figure 9-3). Advise Approach Control of your intention to make a Straight-In Precautionary Approach. 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.

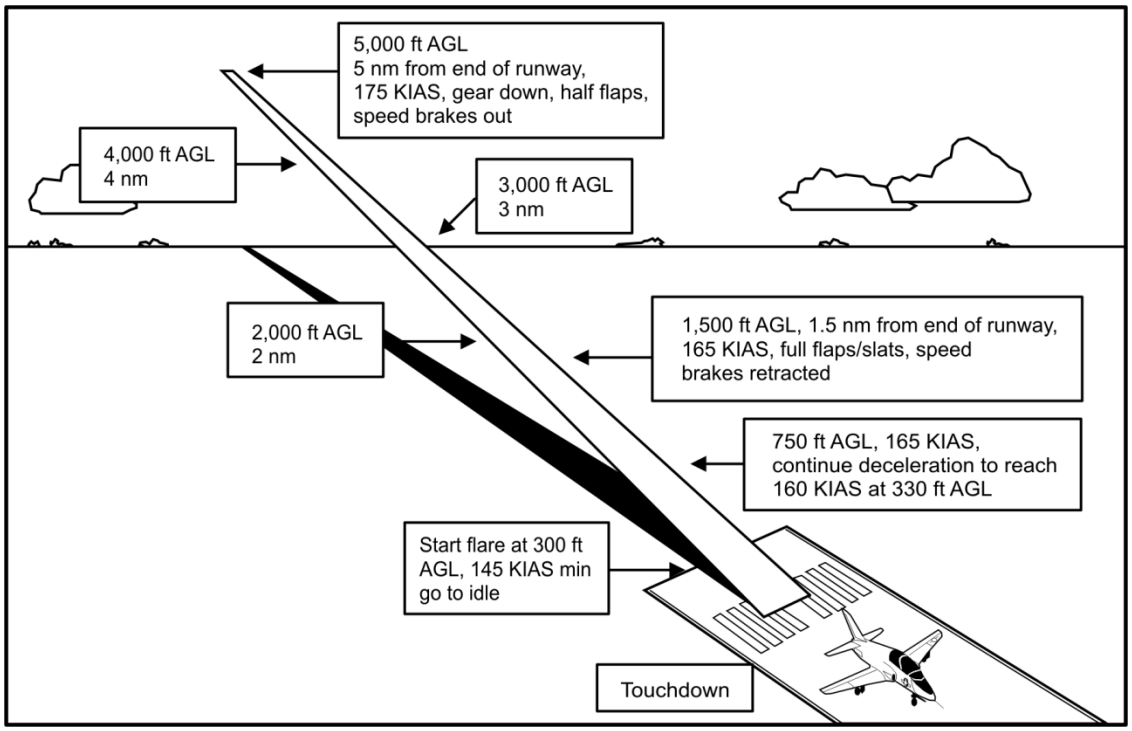

Figure 9-3: Straight-In Precautionary Approach

Do not decelerate below 160 KIAS until establishing roundout 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 precautionary approach, 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 Precautionary Approach

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 9-4). 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.

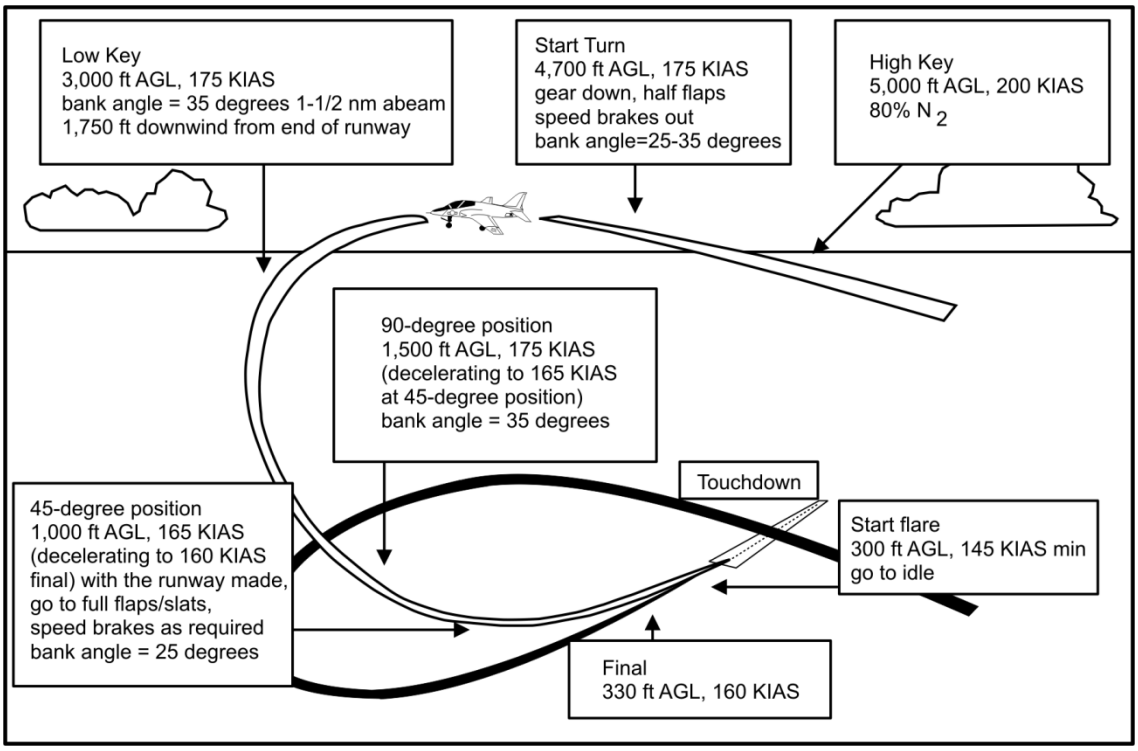

Figure 9-4: Overhead Precautionary Approach (Perpendicular Entry)

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 precautionary approach.

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 9-5). 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 precautionary approach (perpendicular entry).

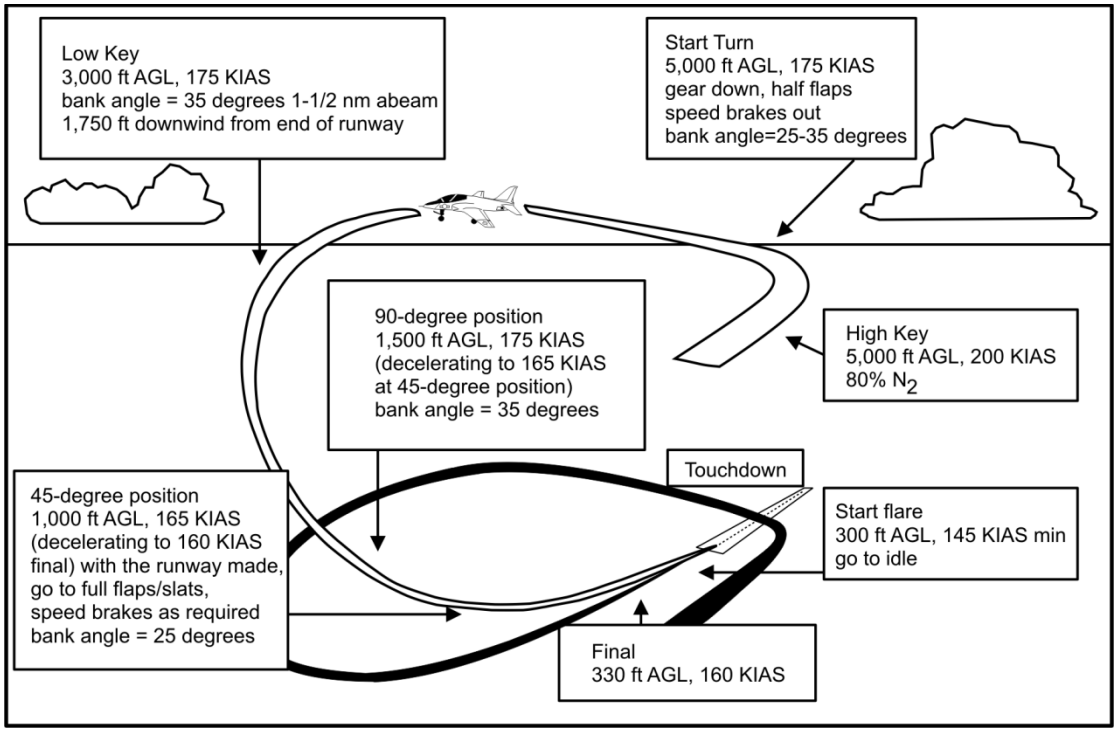

Figure 9-5: Overhead Precautionary Approach (Parallel Entry)

Techniques

During an Overhead Precautionary Approach, 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 Precautionary Approach

Arrive at the abeam position, at 3,000 ft AGL, approximately 200 KIAS, and 1.5 nm abeam (Figure 9-6). 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 Precautionary Approach (perpendicular entry).

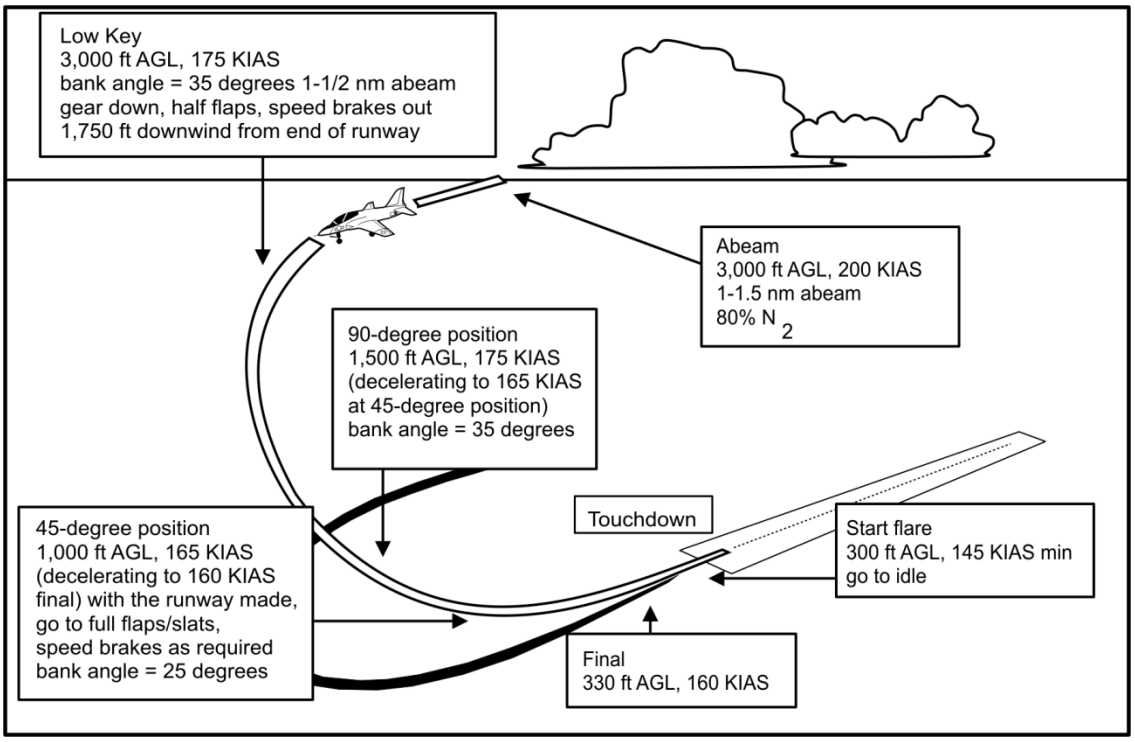

Figure 9-6: Abeam Precautionary Approach

NOTES

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CHAPTER TEN
NIGHT OPERATIONS

1000. INTRODUCTION

You are now ready to enter one of the most interesting and challenging phases of your flight training—night flying. You should not approach this phase with any more apprehension than you did when you began night driving. By this point, your skills as a pilot are fairly well developed and you should find this transition relatively simple to accomplish.

The Night Familiarization block is not intended to teach you everything you need to know about flying at night but instead to familiarize you with the basic principles of night flight. Good night flying, like good night driving, requires increased care and attention to your surroundings. You will have to identify obstructions and other aircraft not by outline but by such small identifying features as a few colored lights—not as difficult as it sounds if you leave the ground well prepared for the conditions you will find when airborne. Once you are airborne and clear of all ground obstructions, the only possible obstruction remaining is other aircraft, so, obviously, it is essential that you maintain a good lookout doctrine.

1001. HUMAN FACTORS OF NIGHT FLYING

Night Vision

An object must be illuminated by some light source before it can be perceived by the human eye, and 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.

Factors Affecting Night Vision

The following factors affect your ability to interpret what you see at night:

1. Few lighted landmarks
2. Limited depth perception
3. Oxygen level in blood
4. Fatigue
5. Anxiety
6. Autokinesis
7. Cockpit light intensity

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. To perceive depth and relative motion accurately is extremely difficult at night, so exercise care to avoid setting up excessively high rates of closure and descent.

Oxygen

Essential to good vision, especially at night, proper oxygen flow cannot improve your night vision beyond your normal limits, but 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, so be sure to use oxygen from takeoff to landing. Along with oxygen, vitamin A, physical fitness, clean windshields, and clean visors all improve your night vision abilities.

Vertigo

Aviators can experience vertigo while flying during the day with good visibility. Some pilots have even experienced vertigo while taxiing. However, night flying combines all of the elements likely to cause vertigo: poor visibility is a frequent cause of vertigo, as are 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: for example, as you look down and adjust some controls that are slightly behind and to one side of you, the aircraft rolls slightly to one side, and when you straighten up and look ahead you experience vertigo. These impressions are increased during letdown or when you are performing penetration turns, so whenever possible, set up the cockpit before beginning such maneuvers.

You can also experience vertigo when you suddenly go from an area of good light reference to an area with few or no external light references, say, as 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.

Your 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.

1002. VISUAL NIGHT NAVIGATION PLANNING PROCEDURES

Although the principles of visual navigation are the same for night as for day, night navigation does present some additional difficulties. When planning a night flight, you should plot the course using well-lighted landmarks. The bridge or road that you normally use during daylight may not be visible at night. Additionally, you must identify both lighted and unlighted obstacles along the flight path and locate alternate airfields along the route in the event of an emergency. As you plan your divert fields, determine which airfields along your flight path are suitable for an emergency divert. Divert airfields must have lighted runways at least 6,000 ft long. After identifying appropriate divert airfields, determine and plot the heading, distance, and Tower frequency from each checkpoint to the nearest emergency divert field. You also need to determine and plot the heading and distance from each checkpoint to home base in the event that you experience a noncritical malfunction while in flight.

You also need to be concerned with proper VFR altitude selection. If your course is between 000 and 179 degrees, use odd altitudes plus 500 ft (e.g., 15,500 ft). If your course is between 180 and 359 degrees, use even altitudes plus 500 ft (e.g., 14,500 ft).

After you have plotted your course and identified the various checkpoints along the flight path, compute the magnetic heading and distance in nautical miles between each set of checkpoints. Be sure to account for the forecast winds when determining your actual heading and ground speed and also consider any possible weather problems to ensure that your projected flight path allows you to maintain VMC at all times. After you have completed all the required route calculations, complete a single-engine jet log and calculate your fuel requirements and estimated flight time.

1003. GROUND OPERATIONS

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 when preflighting so you can see hydraulic fluid leaks. Turn on the battery and all exterior lights and then check that all exterior lights work. Figure 10-1 depicts the location of the T-45's exterior lights.

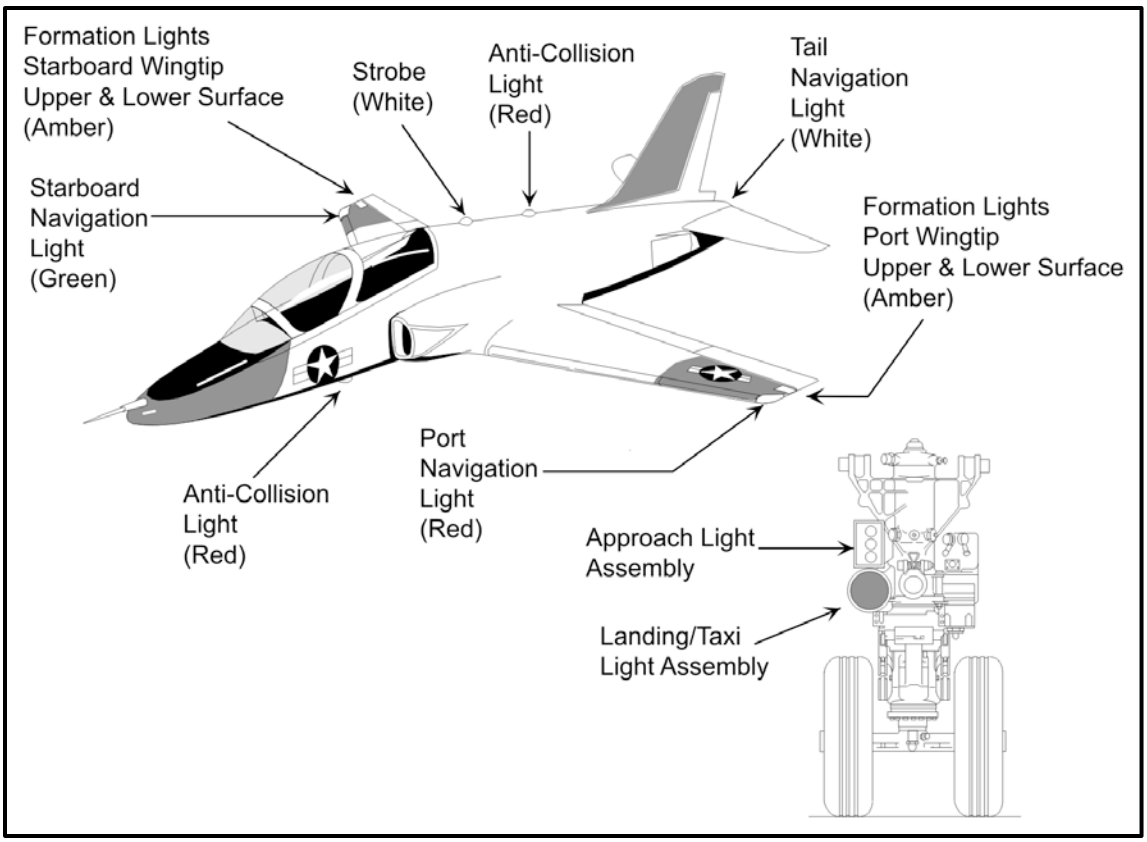

Figure 10-1: T-45 Exterior Lights

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.

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 10-2).

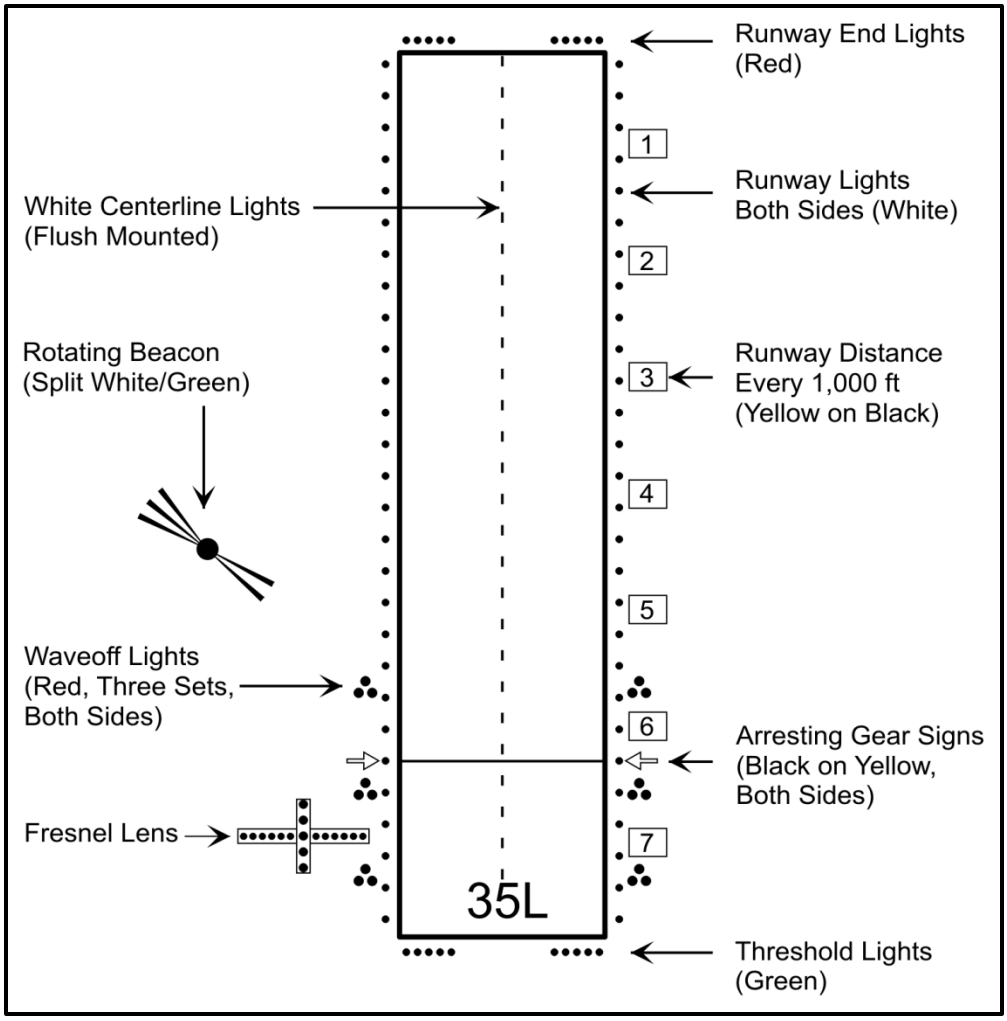

Figure 10-2: Airfield Lighting

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 and, in pairs, 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.

Red lights typically identify areas requiring caution; and they can be used to mark obstructions, equipment on taxiways, the end of the runway, and the waveoff lights. They are also used to mark the top of obstructions in and around the airport.

Field Equipment

There are three basic types of wind direction indicators, the wind tee, the wind sock, and the 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 and is also free-swinging.

The location of the arresting gear is identified by internally lit arrows.

Taxi Procedures

Night taxi procedures are similar to day procedures except for required variations because of limited visibility and depth perception. Use the taxi/landing light during taxi whenever its use is required and taxi more slowly at night than you would during the day and always on the centerline.

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 Appendix B, “Nighttime Hand Signals,” for a description of each nighttime hand signal.

1004. TAKEOFF AND DEPARTURE PROCEDURES

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.

Takeoff

Night takeoff procedures are identical to those for the day except that you rotate and perform initial climbout on 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 with the flight instruments.

1005. NIGHT NAVIGATION

Determining Present Position

You have three basic methods of determining your present position: pilotage, dead reckoning, and navigational aids (NAVAIDs).

In pilotage you maintain your position by referencing a chart. Remember to locate a feature on the map first and then scan outside to locate recognizable landmarks (e.g., cities, towers, airfields, obstructions) that compare to your estimated position on your map.

Dead reckoning allows you to estimate your position by using your course, ground speed, and elapsed time from your last known position. Remember to account for the winds when making these determinations. Calculating your ground speed as soon as possible after you level off is a good idea when using this method of navigation. Recalculate your ground speed after you make significant changes in course or whenever you have nothing else to do.

You may also use your navigational aids in the T-45 (TACAN/DME, VOR and in T-45C GPS/INS readouts) to determine your position, but during Night Familiarization your primary means of navigation is pilotage.

Computing Distance From Last Known Position

In order to determine your distance from the last known position, you need to know your ground speed. Determining your ground speed is accomplished by timing for a known distance (i.e., between checkpoints) and then dividing distance by time.

EXAMPLE: To calculate ground speed, if the distance between checkpoints is 30 nm and it takes 5 minutes to fly between them:

30 (nm) divided by 5 (minutes) = 6 nm per minute or 360 knots

Next, you need to calculate the time flown from your last known position. With these two variables, you can determine how far you have flown.

EXAMPLE: To calculate the distance flown in 4 minutes at a ground speed of 360 knots (6 nm per minute), multiply ground speed by time:

6 (nm per minute) X 4 (minutes) = 24 nm

Now, using distance flown and the course maintained, you can estimate your present position.

Voice Communications

As you pass each checkpoint on your route, you are required to communicate your current status. Communications must include aircraft side number, checkpoint name, fuel state, and next checkpoint's name.

1006. INADVERTENT IMC

If you inadvertently go into a cloud, transition to instruments and maintain wings level. If you don't immediately go VMC again, make a 30-degree AOB turn for 180 degrees and return to VMC conditions. Report your situation to the safety pilot.

1007. 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. Accelerate to and break at no greater than 300 KIAS to arrive at the proper abeam distance.

1008. LANDING PROCEDURES

Night landing procedures are nearly identical to those performed during the day. However, from the 180 on, you will need to rely more on your instruments—the AOA indicator/indexer, the radar altimeter, the VSI, ADI, and in T-45C the Velocity Vector. Believe what your instruments tell you because the lack of distinct external visual references in combination with lighting could lead to a sensation of vertigo.

The key to a good night landing is to include the runway as part of your scan. Use your instruments to establish your altitude and heading and use the runway to check your pattern. During your approach, establish and maintain your rate of descent, turn, and AOA on instruments but also scan the runway to determine the status of your approach. If you see the need for a correction, look back inside and make the correction on instruments. Continue with this inside-outside scan until you pick up the ball. Remember, don't descend below 300 ft AGL unless you have the ball. Use the ball for glideslope information, the runway for lineup, and the AOA indexer for airspeed control.

For a night touch and go, use your instruments to rotate to the takeoff attitude and during the initial climbout. As you pass 300 ft AGL, begin your inside-outside scan so that you can pick up your interval. Climb to 500 ft AGL prior to turning downwind.

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.

1009. 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 for the remainder of your flight or as directed by ATC. Also, 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 and also remember to turn on your 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 your 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 are solo and NORDO, another aircraft may join on you in loose formation. If you have no other problems, continue with a NORDO recovery as described above. The other aircraft will follow in loose formation, but don't worry about that aircraft: fly your own aircraft. If you have another problem in addition to being NORDO, 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

NOTES

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

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.

B-2 DAYTIME HAND SIGNALS

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)

NOTES

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.

C-2 NIGHTTIME HAND SIGNALS

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.

C-4 NIGHTTIME HAND SIGNALS

Figure C-2: Night Hand Signals (2 of 2)

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APPENDIX D
STUDY RESOURCES

D100. INTRODUCTION – N/A

Study Resources for Familiarization Flight Procedures:

[A] T-45A NATOPS Flight Manual, A1-T45AB-NFM-000 or T-45C NATOPS Flight Manual A1-T45AC-NFM-000

[B] In-Flight Guide, TRAWING In-Flight Guide

[C] T-45 Familiarization FTI

[D] T-45 Carrier Qualification FTI

FAMFP-01: "FAM Flight Procedures" 3.4 hrs Classroom

Lesson Preparation:

[A] Part III, "Normal Procedures"

[A] Part IV, "Flight Characteristics"

[A] Part VII, Section 21.6, "Deck Ground Handling Signals"

[A] Part XI, "Performance Data"

[C] T-45 Familiarization FTI (All, except "Night Familiarization" section.)

[D] T-45 Carrier Qualification FTI, "Optical Landing System," "Field Carrier Landing Practice," and "Definitions"

Reinforcement:

[B] In-Flight Guide, TRAWING In-Flight Guide

Lesson objectives for FAMFP-03X exam preparation:

* Recall information provided by stage briefing board
* Recall communications procedures for taxi/ground operations
* Recall communication procedures for takeoff
* Recall procedures for departure communications
* Recall ground operations procedures
* Identify ground crew signals
* Interpret taxi director's signals
* Recall procedures for final checker's inspection
* Recall procedures for operating parking brake
* Recall procedure for nose wheel steering check

* Recall nose wheel steering operation
* State power settings and limitations for taxi
* Recall procedures and techniques for positioning aircraft on runway
* Recall procedures for normal takeoff
* Recall crosswind limitations
* Recall procedures/techniques for crosswind takeoff
* Recall climb schedule procedures for departure/climbout
* Recall procedures for standard departure
* Recall procedures for inadvertent IMC
* Recall procedures for level off checklist
* Recall procedures for cruise
* Recall procedures and techniques for performing descents
* Recall procedures and techniques for flying accels and decels
* Recall procedures/techniques for flying the Turn Pattern
* Recall procedures and techniques for Slow Flight Exercise
* Recall procedures and techniques for establishing optimum AOA
* Recall minimum altitudes/weather requirements for performing stalls and aerobatics
* Recall procedures/techniques for performing Break Turn Stall and Recovery
* Recall procedures and techniques for performing power off stalls
* Recall procedures and techniques for performing Landing Attitude Maneuvers
* Recall procedures and techniques for performing Landing Attitude Stall and Recovery
* Recall procedures and techniques for performing Approach Turn Stall and Recovery
* Recall procedures/techniques for performing Accelerated Stall and Recovery
* Recall procedures/techniques for flying Minimum Radius Turns
* Recall procedures/techniques for performing unusual nose-high recoveries
* Recall procedures/techniques for performing nose-low recoveries
* Recall procedures/techniques for performing Aileron Roll
* Recall procedures/techniques for performing Wingover
* Recall procedures/techniques for performing Barrel Roll
* Recall procedures/techniques for performing Loop
* Recall procedures/techniques for performing Half Cuban Eight
* Recall procedures/techniques for performing Immelmann
* Recall procedures/techniques for performing Split-S
* Recall procedures/techniques for performing Squirrel Cage

D-2 STUDY RESOURCES

FAMFP-02: "FAM Flight Procedures" 3.3 hrs Classroom

Lesson Preparation:

[A] Part III, "Normal Procedures"

[A] Part IV, "Flight Characteristics"

[A] Part VII, Sections 21.6, "Deck Ground Handling Signals"

[A] Part XI, "Performance Data"

[C] T-45 Familiarization FTI (All, except "Night Familiarization" section.)

Lesson objectives for FAMFP-03X exam preparation:

* Recall procedures and techniques for performing normal VFR recovery
* Recall procedures for alternate entries
* Recall procedures and techniques for performing downwind entry
* Recall procedures and techniques for performing Straight-In Precautionary Approach
* Recall procedures and techniques for performing Overhead Precautionary Approach
* Recall procedures and techniques for performing Abeam Precautionary Approach
* Recall landing configuration limitations
* Recall procedures and techniques for performing overhead pattern (brake)
* Recall procedures and techniques for performing touch and go landing (full flaps/slats)
* Recall procedures and techniques for performing full flaps/slats landing
* Recall procedures and techniques for performing full flaps/slats normal landing pattern
* Recall pattern corrections for all landing configurations
* Recall procedures and techniques for tracking glideslope
* Recall procedures and techniques for performing crosswind landings
* Recall procedures and techniques for waveoff
* Recall procedures and techniques for performing roll and go (full flaps/slats)
* Recall procedures and techniques for performing touch and go landing (no flaps/slats)
* Recall procedures and techniques for performing no flaps/slats landing

FAMFP-03X: "Familiarization Block Examination" 1.0 hrs CAI

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