IX.D. Instrument Approach and Landing with an Inoperative Engine (by Ref to Instruments)

References: 14 CFR part 91, Instrument Flying Handbook (FAA-H-8083-15), IAP, POH/AFM

Objectives	The student should develop knowledge of the elements related to a single engine instrument approach.
Key Elements	1. Zero Sideslip 2. Never go below V_{MC} 3. Maintain directional control (Fly the Airplane!)
Elements	1. Managing an Engine Failure 2. Maintaining Altitude, Airspeed, and Track 3. Appropriate Rate of Descent 4. Approach Procedures 5. Landing
Schedule	1. Discuss Objectives 2. Review material 3. Development 4. Conclusion
Equipment	1. White board and markers 2. References
IP's Actions	1. Discuss lesson objectives 2. Present Lecture 3. Ask and Answer Questions 4. Assign homework
SP's Actions	1. Participate in discussion 2. Take notes 3. Ask and respond to questions
Completion Standards	The student can competently fly a precision and non-precision approach solely by reference to the instruments.

Instructors Notes:

Introduction:

Attention

Interesting fact or attention-grabbing story

Overview

Review Objectives and Elements/Key ideas

What

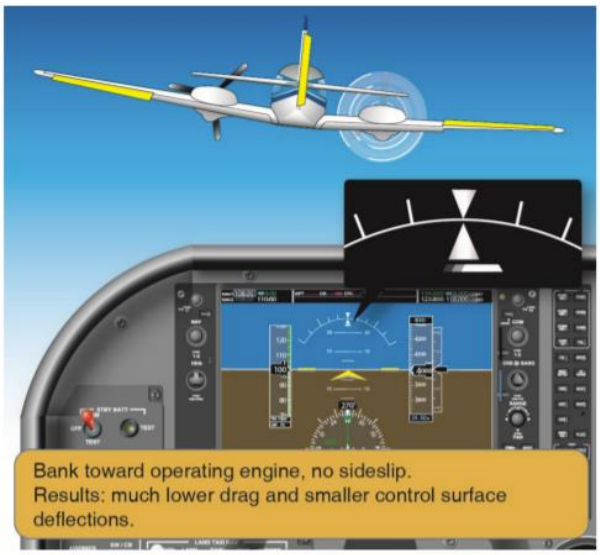
This lesson will discuss how to perform an instrument approach with an inoperative engine.

Why

An instrument approach in a single vs multi engine aircraft is basically the same thing (other than different speeds / power settings). The primary difference, though, is that in a multi-engine aircraft it is possible to continue flight with an engine failed. For this reason, if you want instrument privileges on your multi engine rating you must prove to the examiner that you can handle an instrument approach with a failed engine.

How:

1. **Managing an Engine Failure**
   - A. Recognize the Engine Failure
     - i. Unexpected yaw / roll in the direction of the failed engine
     - ii. Abnormal engine indications, sounds, feelings
   - B. Establish a zero-sideslip
     - i. Zero sideslip will vary based on the aircraft flown, but 1-3° bank toward the operating engine and ½ ball deflection (on the Turn Coordinator) toward the operating engine should be close
     - ii. Done strictly by instruments
   - C. Use the same steps as an engine failure in visual conditions:
     - i. Full Power
     - ii. Reduce Drag
     - iii. Identify
     - iv. Verify
     - v. Fix or Feather
     - vi. Restart the Inoperative Engine, if possible
   - D. Pay even more attention to your instrument scan, and flying the aircraft
     - i. Between every step stop and check airplane performance and control
       - a. Zero sideslip, correct airspeed, heading and altitude, monitor engine indications
     - ii. Fly first (aviate, navigate, communicate)



2. **Maintaining Altitude, Airspeed, and Track**
   - A. Establish, Trim, Crosscheck, Adjust
     - i. Maintain the zero sideslip while focusing on the approach
   - B. Keep the scan moving, include everything in your scan
     - i. Occasionally include the approach chart in the scan
   - C. Always know where you are and ask, “What am I doing next?”

i. Stay ahead of altitudes, airspeed, track
ii. Use the 5 Ts at every waypoint (Turn, Time, Twist, Throttle, Talk)

D. Keep the course needle centered
i. Be proactive in maintaining course
a. Adjust for wind
- Bug the heading that will maintain the desired course
- Make adjustments to the right / left of the heading bug to correct for course deviations

E. Be proactive in maintaining glide slope
i. If the ball starts to move up / down make small adjustments immediately to fix the movement
ii. As ground speed increases, rate of descent must increase, and vice versa

3. Appropriate Rate of Descent

A. A descent rate of greater than 1,000 FPM is unacceptable during the final stages of an approach
i. Due to human perceptual limitations, independent of the type of airplane
ii. Maintain a controlled and stabilized approach – Especially applicable in a single engine situation

B. A descent rate should be used that will ensure reaching the DA at a distance from the threshold that will allow landing in the touchdown zone
i. The glide slope will ensure you maintain the appropriate rate of descent, follow it

4. Approach Procedures

A. In all phases, use the Basic Attitude Instrument Procedures – Establish, Trim, Crosscheck, Adjust

B. Brief the Approach
i. Normal approach brief
ii. Speeds and aircraft configuration will change but the approach itself stays the same

C. *Precision Approach
i. Configuration
a. Maintain a zero sideslip
- As power is reduced, rudder should be reduced as well
- Scan will have to be increased to maintain scan as well as glideslope / localizer

b. Procedure Turn (inbound/Outbound), Localizer Intercept – Airspeed: 100 KIAS; Power: 80%
c. ½ Dot Below Glide Slope – Airspeed: Decelerating to 90 KIAS; Power: 65%; Flaps: As necessary
d. Glide Slope Intercept (FAF) – Airspeed: SE Approach (no slower than V_{YSE})
- Power: Approximately 65%; Pitch: Approximately 5° Nose Down

ii. Checklist Items
a. Arriving at any Fix (5 T's – Turn, Time, Twist, Throttle, Talk)
b. Before Landing Checklist

D. *Non-precision Approach
i. Configuration
a. Maintain a zero sideslip
- As power is reduced on the approach, rudder should be reduced as well
- Scan will have to be increased to maintain scan as well as course and monitor step downs

b. Procedure Turn (Inbound / Outbound), Localizer Intercept – Airspeed: 100 KIAS; Power: 80%
c. 1 nm from FAF – Airspeed: Decelerating to 90 KIAS; Power: 65%; Flaps: As necessary
d. FAF – Airspeed: SE Approach (no slower than V_{YSE}); Power: Approximately 55%
- Pitch: Approximately 6° Nose Down
- Descent is faster than Precision Approach to reach MDA prior to missed approach point

e. MDA / Step Down
- Level off without going below MDA / Step down altitude
  a Approximately 80% power, do not slow below V_{YSE}

b. With increased power comes increased rudder, maintain a zero sideslip

ii. Checklist Items
   a. Arriving at any Fix (5 T's – Turn, Time, Twist, Throttle, Talk)
   b. Before Landing Checklist

5. Landing

A. Transition from instrument to visual conditions
   i. Once visual, the majority of attention should be outside; continue to crosscheck the instruments
      a. Maintain a zero sideslip as well as the course and glideslope
         - Tendency to "look up, fly up." Maintain a constant pitch attitude / remain on the glide slope
   ii. Transition to VASIs / PAPIs, if available

B. The landing is basically normal
   i. During the roundout / flare reduce power to idle
      a. As power is reduced, rudder pressure is reduced
      b. If rudder pressure is not reduced the aircraft will yaw in the direction of the rudder pressure
         - Rudder is counteracting the yaw caused by the thrust of the operating engine
         - When the thrust is removed it removes the yaw, therefore the rudder must be reduced
   ii. With the power at idle, make a normal landing on the centerline

Common Errors:

- Failure to have essential knowledge of the information that appears on the selected instrument approach chart
- Failure to use proper communications procedures
- Noncompliance with ATC clearances
- Incorrect use of navigation equipment
- Failure to identify and verify the inoperative engine and to follow the emergency checklist
- Inappropriate procedure in the adjustment of engine controls and the reduction of drag
- Inappropriate procedure in the establishment and maintenance of the best engine inoperative airspeed
- Failure to establish and maintain the proper flight attitude for best performance
- Failure to maintain positive aircraft control
- Faulty basic instrument flying technique
- Inappropriate descent below the MDA or DH
- Faulty technique during roundout and touchdown

Conclusion:

Brief review of the main points

Fly first; maintain control of the aircraft (keep up the scan) during the entire process.

PTS Requirements:

To determine that the applicant:

1. Exhibits instructional knowledge of the elements related to an instrument approach with one engine inoperative by describing-
   A. maintenance of altitude, airspeed and track appropriate to the phase of flight or approach segment.
   B. procedure if unable to comply with an ATC clearance or instruction.
   C. application of necessary adjustments to the published MDA and visibility criteria for the aircraft approach category.

   D. establishment and maintenance of an appropriate rate of descent during the final approach segment.
   E. factors that should be considered in determining whether:
      i. the approach should be continued straight-in to a landing; or
      ii. a circling approach to a landing should be performed.
2. Exhibits instructional knowledge of common errors related to an instrument approach with one engine inoperative by describing-
   A. failure to have essential knowledge of the information that appears on the selected instrument approach chart.
   B. failure to use proper communications procedures.
   C. noncompliance with ATC clearances.
   D. incorrect use of navigation equipment.
   E. failure to identify and verify the inoperative engine and to follow the emergency checklist.
   F. inappropriate procedure in the adjustment of engine controls and the reduction of drag.
   G. inappropriate procedure in the establishment and maintenance of the best engine inoperative airspeed.
   H. failure to establish and maintain the proper flight attitude for best performance.
   I. failure to maintain positive aircraft control.
   J. faulty basic instrument flying technique.
   K. inappropriate descent below the MDA or DH.
   L. faulty technique during roundout and touchdown.
3. Demonstrates and simultaneously explains an instrument approach with one engine inoperative from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to an instrument approach with one engine inoperative.

ACS Skills Standards

1. Promptly recognize an engine failure and maintain positive aircraft control. Set the engine controls, reduce drag, identify and verify the inoperative engine, and simulate feathering of the propeller on the inoperative engine. (Evaluator should then establish a zero-thrust on the inoperative engine).
2. Use the flight controls in the proper combination as recommended by the manufacturer, or as required to maintain best performance, and trim as required.
3. Follow the manufacturer's recommended emergency procedures.
4. Monitor the operating engine and make necessary adjustments.
5. Request and follow an actual or a simulated ATC clearance for an instrument approach.
6. Maintain altitude ±100 feet or minimum sink rate if applicable, airspeed ±10 knots, and selected heading ±10°.
7. Establish a rate of descent that will ensure arrival at the MDA or DH/DA with the aircraft in a position from which a descent to a landing on the intended runway can be made, either straight in or circling as appropriate.
8. On final approach segment, maintain vertical (as applicable) and lateral guidance within ¾-scale deflection.
9. Avoid loss of aircraft control, or attempted flight contrary to the operating limitations of the aircraft.
10. Comply with the published criteria for the aircraft approach category if circling.
11. Execute a normal landing.
12. Complete the appropriate checklist.