VIII.B. Precision Instrument Approach

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

Objectives	The student should develop knowledge of the elements related to precision approaches.
Key Elements	1. Ensure you have the correct chart 2. 5 T's at every waypoint: Turn, Time, Twist, Throttle, Talk 3. Brief the Approach
Elements	1. What is a Precision Approach? 2. Approach Charts 3. Approach Categories 4. Choosing the Appropriate Approach and Chart 5. Flying the Approach 6. Cold Weather Corrections
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 has the ability to set up for, brief, and execute precision approaches without the assistance of the instructor.

Instructors Notes:

Introduction:

Attention

Interesting fact or attention-grabbing story

Overview

Review Objectives and Elements/Key ideas

What

A precision approach provides lateral and vertical guidance to a runway (ILS). Because of the addition of vertical guidance (the glide slope), the precision approach has the ability to get an aircraft closer to the ground than a non-precision would allow. The ILS is an expensive system, so although it makes it easier to get into an airport in poor weather or visibility, they are most often located at larger, busier airports.

Why

The ILS system is important to understand since it is used throughout the US, and has the ability to get you down to 200' AGL. The ILS, if available, is normally the default approach assigned by ATC.

How:

1. **What is a Precision Approach?**
   - A. Instrument approach providing course and glidepath information meeting the ICAO Annex 10 standards
     - i. Ex: PAR, ILS, GLS
   - B. Compared to other types of approaches
     - i. Non-Precision: Provides course deviation information but no glidepath deviation information
       - a. Ex: VOR, TACAN, LNAV, NDB, LOC, ASR
     - ii. Approach with Vertical Guidance (APV): Same as precision but doesn't meet the Annex 10 standards
       - a. Ex: LNAV / VNAV, LPV
   - C. DA / DH vs MDA
     - i. Decision Altitude (precision approaches and APV make use of DA / DH)
       - a. Altitude at which a missed approach must be initiated if visual references are not established
       - b. Equivalent of a missed approach point
     - ii. Decision Height
       - a. Height above the threshold at which a decision must be made to continue or go missed
       - b. Used on aircraft with radar altimeters on Category II and III ILS approaches
     - iii. Minimum Descent Altitude (non-precision approaches use an MDA)
       - a. Used when no electronic glideslope is provided on the approach
       - b. Lowest altitude which descent is authorized on final approach or during a circle to land
         - Must level off at or above this altitude if visual references are not in sight
         - May continue at MDA to the missed approach point
2. **Approach Charts** (general overview for NACO and Jeppesen charts)
   - A. NACO – Aeronautical Chart User's Guide (go to pg. 92)
     - i. Top Bar / Chart Info
       - a. City and state, Issue #, Type of Approach / Runway, Airport
     - ii. Briefing Information
       - a. Frequencies, Course, Runway distances, Notes, Missed Approach, Approach Lighting
     - iii. Plan View

a. Overhead view of procedure – Initial Fix through Missed Approach. Contains MSA diagram
iv. Profile View
a. Side view depicting Waypoints, Course, Altitude, Distance, Missed Approach Point, etc.
v. Minimums / Airport Diagram
a. Minimums, Airport Diagram and Time to MAP, if needed
vi. Bottom Bar
a. Amendments, Lat / Long, Airport Identifier, Approach Type and Runway

B. Jeppesen – Jeppesen Chart Legend (go to pg. 76)
i. Top Bar / Chart Info
a. Airport, City and State, Date, Identifier, Type of Approach / Runway
ii. Briefing Strip
a. Frequencies, Course, FAF Altitude, MDA, Elevations, Missed Approach, Notes, MSA
iii. Plan View
a. Overhead view of approach procedure(s) – Initial Fix through Missed Approach
iv. Profile View
a. Side view depicting Waypoints, Course, Altitude, Distance, Missed Approach Point, etc.
v. Minimums
a. Minimums, Time to MAP (if needed), Approach Lighting, Visual Missed Approach Steps

3. Approach Categories

A. General
i. Grouping of aircraft based on landing speed - if not specified, then at 1.3 V_{SO} at max landing weight
ii. Generally, higher minimums apply to higher speed categories
a. Designed this way to contain the aircraft within a safe area based on altitude
- Terrain, turn containment, height loss at decision altitude, missed approach climb, etc.

B. Categories
i. A: Less than 91 knots
ii. B: 91 knots - 120 knots
iii. C: 121 knots - 140 knots
iv. D: 141 knots - 165 knots
v. E: 166 knots or more

C. An airplane is only certified in one approach category
i. Cannot use a lower approach category
ii. Must use the higher category minimums if a faster approach speed is used
a. For example, approaches with inoperative flaps, icing conditions, or heavy weight landings

4. Choosing the Appropriate Approach and Chart

A. ATIS information will often specify the runway and approaches in use
B. Airplane capabilities will dictate which approaches are an option to fly
C. From there, weather (especially ceilings) may help make the decision
i. Ex: A VOR approach with minimums above the current ceiling vs an ILS with minimums below
D. Straight-In vs. Circling Approach
i. Straight-in – Used when available based on aircraft equipment, ground equipment, etc.
a. Generally, lower minimums, simpler procedure, safer and more efficient
ii. Circling – Used due to closed runways, weather (wind), terrain, or equipment dictating a circle
a. Generally, higher minimums and more complex, but can be necessary to land
iii. Ensure you apply the correct minimums
E. Always verify you are reading the appropriate approach chart for the appropriate runway
i. Many similar approaches (ex. ILS 25L vs 25R), especially important after a change of approach

5. Flying the Approach

A. Setup / Pertinent Information
   i. Technique is to use FFIIMMMMS:
      a. **F**ixes
      b. **F**requencies
      c. **I**nbound Course
      d. **I**dentify (more below)
      e. **M**arker Beacons
      f. **M**inimums
      g. **M**inutes
      h. **M**issed Approach
      i. **S**ecurity
   ii. Tune, Identify, Monitor
      a. To identify / verify there are generally two options:
         - G1000 (or similar) will put the navaid ID next to the frequency, indicating it is identified
         - Listen to the Nav for the Morse code identifier
      b. If the identifier is not displayed or heard, the navaid is out of service and should not be used
   iii. Inoperable aircraft navigation equipment will show a flag, indicating that it is not working
B. Brief the Approach
   i. Briefing strip plus any other pertinent information
   ii. Brief should be short and sweet. Technique: Less than 1 min, otherwise people stop paying attention
   iii. CFI should give example brief
C. Maintaining Course, Altitudes, and Airspeed
   i. Stay ahead of the airplane
   ii. Establish, Trim, Crosscheck, Adjust
      a. Keep the crosscheck moving, include everything in your scan
         - Approach chart should be included in the scan
         - Monitor the course and establish wind correction as necessary
   iii. Always ask, “What am I doing next?”
      a. Stay ahead of altitudes, airspeed, track (verify with the chart)
      b. Use the 5 T’s at every waypoint – Turn, Time, Twist, Throttle, Talk
   iv. Keep the localizer needle centered
      a. Be proactive in maintaining the localizer course and make adjustments for wind
         - Bug the heading that will maintain the desired course accounting for wind
         - Make adjustments to the R / L of the heading bug to correct for course deviations
   v. *When the glide slope centers, pitch down approximately 5°
      a. Be proactive in maintain glide slope
         - If the ball moves up / down make small adjustments immediately to arrest the movement
         - As ground speed increases, rate of descent must increase, and vice versa
D. *Configuration and Airspeed, and Checklist
   i. Configuration and Airspeed
      a. Procedure Turn / Localizer Intercept
         - Airspeed: 100 KIAS
         - Power: 18-20” Hg, 2300 RPM
      b. ½ Dot Above Glide Slope
         - Airspeed: Decelerating to 90 KIAS
         - Power: 18-20” Hg 2300 RPM
         - Flaps: Takeoff Flaps

c. Glide Slope Intercept (FAF)
- Airspeed: 90 KIAS
- Power: 13-14" MP 2300 RPM
- Pitch: 5° Nose Down

ii. Checklists
a. Arriving at any Fix – 5 T's: Turn, Time, Twist, Throttle, Talk
b. Pre-Landing Checklist
- LBBGUMPFS - Landing Gear, Boost Pump, Brakes (not set), Gas, Undercarriage, Mixture, Prop, Flaps, Seat Belts

c. Inside Outer Marker / FAF – Reds, Blues, Greens, Whites, Power: 11-13" Hg
- Mixture, Prop, Engine Gauges, Lights, Power

E. Rate of Descent
i. A descent rate of greater than 1,000 FPM is unacceptable during the final stages of an approach
a. This is due to human perceptual limitation and independent of the type of airplane
ii. Configured and on speed, the glide slope will ensure you maintain an appropriate rate of descent

F. Missed Approach (more information in VIII.C. Missed Approach)
i. In the case of a precision approach, Decision Altitude is the MAP
a. Upon reaching the DA, if the required visual references aren't available, fly the missed approach
b. It is expected that the aircraft will momentarily descend below DA. This is OK
- If visual references become available below DA, it is NOT OK to attempt to land. Continue the missed approach

ii. Common reasons for executing the missed approach
a. Required flight visibility doesn't exist or required visual references cannot be seen
b. Descent to landing cannot be made at a normal descent rate with normal maneuvers
c. Men and equipment, or animals on the runway, not stabilized approach, etc.

iii. Reaching DA, execute a go-around and fly the procedure unless instructed otherwise
a. Technique to have the first 2-3 steps of the procedure memorized to reduce workload
b. Ex. Turn left heading xxx°, climb x,xxx'

iv. Obstacles may require steeper climb gradients – published in Notes on the approach chart

G. Radio Communication with ATC
i. Comply with ATC clearances and instructions given
a. Repeat back important information regarding clearances

ii. If unable to comply with an instruction advise ATC "unable"
iii. If you do not understand an instruction from ATC request "say again" or clarification
iv. More detail in V.A. ATC Clearances and V.B. Compliance with Procedures and Clearances

6. Cold Weather Corrections

A. When temperatures are colder than standard, true altitude is less than indicated altitude
i. The colder the temperature, the greater the difference – obstacle clearance may be an issue
ii. The pilot may want to apply temperature corrections to altitudes on the approach
a. Do not correct altitudes specifically assigned by ATC (i.e., "maintain 5,000 ft")

b. If temperature corrections are applied, advise ATC of the correction

B. ICAO Cold Temperature Error Table

Reported Temp °C	Height Above Airport in Feet													
	200	300	400	500	600	700	800	900	1,000	1,500	2,000	3,000	4,000	5,000
+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90
0	20	20	30	30	40	40	50	50	60	90	120	170	230	280
-10	20	30	40	50	60	70	80	90	100	150	200	290	390	490
-20	30	50	60	70	90	100	120	130	140	210	280	420	570	710
-30	40	60	80	100	120	130	150	170	190	280	380	570	760	950
-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1,210
-50	60	90	120	150	180	210	240	270	300	450	590	890	1,190	1,500

i. Enter the chart at the reported temperature

ii. Find the corresponding column for Height Above Airport

a. Height Above Airport = Chart Altitude (FAF altitude, MDA, etc.) minus Airport Elevation

iii. Raise your altitude by the amount shown – interpolate, if necessary

Common Errors

- Failure to have essential knowledge of the information on the instrument approach chart
- Incorrect communications procedures or noncompliance with ATC clearances or instructions
- Failure to accomplish checklist items
- Faulty basic instrument flying technique
- Inappropriate descent below MDA

Conclusion:

Brief review of the main points

PTS Requirements:

To determine that the applicant:

1. Exhibits instructional knowledge of the elements of a precision instrument approach by describing-
   A. selection of the appropriate instrument approach chart.
   B. pertinent information on the selected instrument approach chart.
   C. selection, tuning, identification, and determination of operational status of ground and aircraft navigation equipment.
   D. radio communications with ATC and compliance with ATC clearances, instructions, and procedures.
   E. appropriate aircraft configuration, airspeed, and checklist items.
   F. adjustments applied to the published DH/DA and visibility criteria for the aircraft approach category.
   G. maintenance of altitude, airspeed, and track, where applicable.
   H. establishment and maintenance of an appropriate rate of descent during the final approach segment.
   I. factors that should be considered in determining whether:
      i. the approach should be continued straight-in to a landing;
      ii. a circling approach to a landing should be made; or
      iii. a missed approach should be performed.
2. Exhibits instructional knowledge of common errors related to a precision instrument approach by describing-

   A. failure to have essential knowledge of the information on the instrument approach procedure chart.
   B. incorrect communications procedures or noncompliance with ATC clearances.
   C. failure to accomplish checklist items.
   D. faulty basic instrument flying technique.
   E. inappropriate application of DH/DA.
3. Demonstrates and simultaneously explains a precision instrument approach from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to a precision instrument approach.
5. Exhibits instructional knowledge on the uses of the MFD and other parameters to maintain desired flightpath.

ACS Skills Standards

1. Accomplish the precision instrument approach(es) selected by the examiner.
2. Establish two-way communications with ATC appropriate for the phase of flight or approach segment, and use proper communication phraseology.
3. Select, tune, identify, and confirm the operational status of navigation equipment to be used for the approach procedure.
4. Comply with all clearances issued by ATC or the evaluator.
5. Recognize if any flight instrumentation is inaccurate or inoperative, and take appropriate action.
6. Advise ATC or the evaluator of any inability to comply with a clearance.
7. Establish the appropriate aircraft configuration and airspeed considering turbulence and wind shear, and complete the aircraft checklist items appropriate to the phase of the flight.
8. Maintain altitude ±100 feet, selected heading ±10°, airspeed ±10 knots, prior to beginning the final approach segment.
9. Apply adjustments to the published DA/DH and visibility criteria for the aircraft approach category, as appropriate for factors that include NOTAMs, inoperative aircraft or navigation equipment, or inoperative visual aids associated with the landing environment, etc.
10. Establish a predetermined rate of descent at the point at the point where vertical guidance begins, which approximates that required for the aircraft to follow the vertical guidance.
11. Maintain a stabilized final approach from the Final Approach Fix (FAF) to DA/DH allowing no more than ¾-scale deflection of either the vertical or lateral guidance indications and maintain the desired airspeed within ±10 knots.
12. Immediately initiate the missed approach when at the DA/DH, and the required visual references for the runway are not unmistakably visible and identifiable.
13. Transition to a normal landing approach only when the aircraft is in a position from which a descent to a landing on the runway can be made at a normal rate of descent using normal maneuvering.
14. Maintain a stabilized visual flight path from the DA/DH to the runway aiming point where a normal landing may be accomplished within the touchdown zone.
15. Use an MFD and other graphical navigation displays, if installed, to monitor position, track wind drift, and to maintain situational awareness.