X.D. Eights on Pylons

Objectives	The student should develop knowledge of the elements related to the eights on pylons maneuver and have the ability to perform the maneuver as required to commercial ACS.
Key Elements	✈ Point moves forward = forward pressure ✈ Point moves backward = backward pressure ✈ Small, coordinated corrections
Elements	✈ Pivotal altitude ✈ Prior to entry ✈ Selecting suitable pylons ✈ Entry procedure ✈ The maneuver
Schedule	1. Discuss objectives 2. Review material 3. Development 4. Conclusion
Equipment	✈ White board ✈ Markers ✈ References
Instructor's Actions	1. Discuss lesson objectives 2. Present lecture 3. Questions 4. Homework
Student's Actions	Participate in discussion Take notes
Completion Standards	The student understands pivotal altitude and the accompanying concepts to eights on pylons, and can properly fly the maneuver.
References	FAA-H-8083-3B, *Airplane Flying Handbook* (Chapter 6)

Instructor Notes

Introduction

Overview—review objectives and key ideas.
What—advanced maneuver in which the pilot's attention is directed at maintaining a pivotal position on a selected pylon. Maneuver involves flying the airplane in a figure eight path around two points or pylons on the ground.
Why—to develop the ability to maneuver the airplane accurately while dividing your attention between the flight path and the selected points on the ground. Useful in teaching, developing, and testing subconscious control of the airplane.

Pivotal altitude

Specific altitude at which a projection of the sighting reference line to a selected point on the ground will appear to pivot on that point. Keeps point at the same spot on the window, parallel with the lateral axis.

Point appears to be fixed when at the pivotal altitude, but appears to move across the landscape at any other height.

- When turning at an altitude greater than the pivotal altitude—wingtip appears to move backwards over the landscape.
- When turning at an altitude less than the pivotal altitude—wingtip appears to move forward over the landscape.

To estimate…
Pivotal altitude is based on ground speed and does not change with bank.

- In knots: $Pivotal\ Altitude = \frac{GS^2}{11.3} + elevation$
- In mph: $Pivotal\ Altitude = \frac{GS^2}{15} + elevation$

Constantly changing groundspeed will result in the pivotal altitude varying throughout the maneuver—adjust by climbing or descending as necessary. The elevator is the primary control for maintaining the pylon at the reference line.

To correct…
As groundspeed decreases, pivotal altitude also decreases, so the airplane will be above the pivotal altitude.

- Wing appears to move backwards across the landscape.
- Descend to new pivotal altitude, increasing airspeed and pivotal altitude—airplane moving towards pivotal altitude, pivotal altitude moving towards airplane.
- Maintain reference line to pylons.
- Point moves FORWARD—apply FORWARD pressure on controls.

As groundspeed increases, pivotal altitude also increases, so the airplane will be below the pivotal altitude.

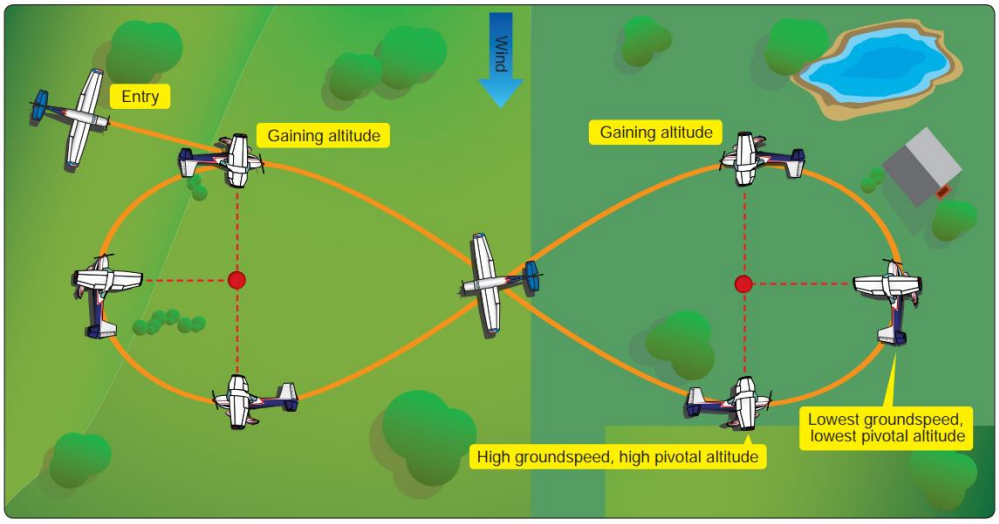
- Wing appears to move forward across the landscape.

	✈ Climb to reach new pivotal altitude, decreasing airspeed and pivotal altitude—airplane moving towards pivotal altitude, pivotal altitude moving towards airplane. ✈ Maintain reference line to pylons. ✈ Point moves BACKWARD—apply BACKWARD pressure on controls. Pitch controls site picture horizontally, bank vertically. Correct as if you are tracking a VOR. Put the correction in, and remove it when the pylon is back into the line of sight reference—don't hold the correction. Greater windspeed = greater variation in pivotal altitudes/increased rate of climb. Extremely strong winds are unsafe because the airplane gets closer to the ground and can also be blown very close to the pylon, requiring large increases in bank angle. CE—poor planning, orientation, and division of attention.
Prior to entry	✈ Pre-maneuver checklist: Lights ON; Fuel Pump ON; Mixture FULL RICH; Gauges GREEN. ✈ Clearing turns—clear area below and above your altitude. ✈ Select pylons. ✈ Straight and level flight at cruise power not above V_A.
Selecting suitable pylons	Select two points on the ground along a line that lies perpendicularly to the wind. ✈ Open area—not near hills or obstructions. ✈ Sufficiently prominent—readily seen when coming back from the maneuver and when completing the turn around one pylon and heading for the next. ✈ Adequately spaced to provide time for planning turns without causing unnecessary straight-and-level flight between pylons (about ½ mile apart; 10-15 seconds of straight-and-level flight between pylons). ✈ Smaller pylons = easier to notice changes in movement. CE—Selection of pylons where there is no suitable emergency landing area within gliding distance. ✈ Always be prepared for emergencies. ✈ Select pylons close to a field that would allow you to do an emergency landing.
Entry procedure	Adjust power to the recommended entry speed—close to V_A. Trim at airspeed and pivotal altitude. Enter at a 45° angle to the right of the downwind to make the first turn to the left around the left pylon.

Fly to the midpoint between the pylons and note the entry heading—it will be the exit heading, as well.
Highest groundspeed = highest pivotal altitude.
Maintain straight and level flight until the pylon is just ahead of the reference line, then roll into a 30°-40° bank, placing the wingtip at the base of the pylon.

CE—faulty entry procedure.
CE—use of an improper "line-of-sight" reference.

The maneuver



The elevator is the primary control for holding the pylons. Use altitude changes to hold the reference point on the pylon—not rudder pressure.

CE—uncoordinated flight control application.
CE—application of rudder alone to maintain "line-of-sight" on the pylon

Entry is at fastest groundspeed.
Continuing through the turn, the headwind increases, decreasing groundspeed and decreasing pivotal altitude—descend to maintain correct visual reference. Wingtip will move back in reference to pylon without corrections.
Coming around the turn, tailwind increases, increasing groundspeed and increasing pivotal altitude—climb to maintain correct visual reference. Wingtip will move forwards in reference to pylon without corrections. Relative wind will push the airplane towards the pylon—increase bank angle to maintain the visual reference.

To transition between pylons, start the rollout as the airplane turns towards a downwind heading, and proceed diagonally to a point on the downwind side of the 2nd pylon, maintaining straight and level flight for 3-5 seconds. Crab into the wind to correct for wind drift while in straight

and level flight. When the pylon is aligned with the wing reference point, initiate a turn.

CE—improper planning for turn entries and rollouts.
CE—improper correction for wind drift between pylons.

The turn around the second pylon is the same as the first one—starts with the fastest groundspeed, and as the turn progresses, headwind decreases pivotal altitude and then tailwind increases pivotal altitude.

Roll wings level and exit on the entry heading after completing one rotation around each pylon.

Common errors

- Faulty entry procedure.
- Poor planning, orientation, division of attention.
- Uncoordinated flight control application.
- Use of an improper "line-of-sight" reference.
- Application of rudder alone to maintain "line-of-sight" on the pylon.
- Improper planning for turn entries and rollouts.
- Improper correction for wind drift between pylons.
- Selection of pylons where there is no suitable emergency landing area within gliding distance.

Conclusion

Brief review of main points.
If the point moves forward, apply forward pressure.
If the point moves backward, apply backward pressure.
Most advanced/difficult of the low altitude flight training maneuvers.
Great for teaching, developing, and testing subconscious control of the airplane because of the various techniques involved.

CFI PTS

Objective: To determine that the applicant:

1. Exhibits instructional knowledge of the elements of eights on pylons by describing:
a. The purpose of eights on pylons and their relationship to basic/advanced airmanship skills.
b. How to determine the approximate pivotal altitude.
c. How to select suitable pylons with consideration given to emergency landing areas.
d. Orientation, division of attention, and planning.
e. Configuration and airspeed prior to entry.
f. Relationship of groundspeed change to the performance of the maneuver.
g. Pilot's "line-of-sight" reference to the pylon.
h. Entry procedure.
i. Procedure for maintaining "line-of-sight" on the pylon.
j. Proper planning for turn entries and rollouts.
k. How to correct for wind drift between pylons.
l. Coordination of flight controls.

2. Exhibits instructional knowledge of common errors related to eights on pylons by describing:
a. Faulty entry procedure.
b. Poor planning, orientation, or division of attention.
c. Uncoordinated use of flight controls.
d. Use of an improper "line-of-sight" reference.
e. Application of rudder alone to maintain "line-of-sight" on the pylon.
f. Improper planning for turn entries and rollouts.
g. Improper correction for wind drift between pylons.
h. Selection of pylons where there is no suitable emergency landing area within gliding distance.

3. Demonstrates and simultaneously explains eights on pylons from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to eights on pylons.

CPL ACS

Objective: To determine that the applicant:

1. Demonstrates understanding of:
a. Purpose of eights on pylons.
b. Aerodynamics associated with the eights on pylons to include coordinated and uncoordinated flight.
c. Pivotal altitude and factors that affect it.
d. Effect of wind on ground track.
e. Phases of the eights on pylons maneuver from entry to recovery.

2. Demonstrates the ability to:
a. Clear the area.
b. Determine the approximate pivotal altitude.
c. Select suitable pylons that will permit straight-and-level flight between the pylons.
d. Correctly enter the maneuver at the appropriate altitude and airspeed.
e. Establish the correct bank angle for the conditions, not to exceed 40°.
f. Apply corrections so that the line-of-sight reference line remains on the pylon.
g. Divide attention between accurate, coordinated airplane control and outside visual references.
h. Maintain pylon position using appropriate pivotal altitude, avoiding slips and skids.