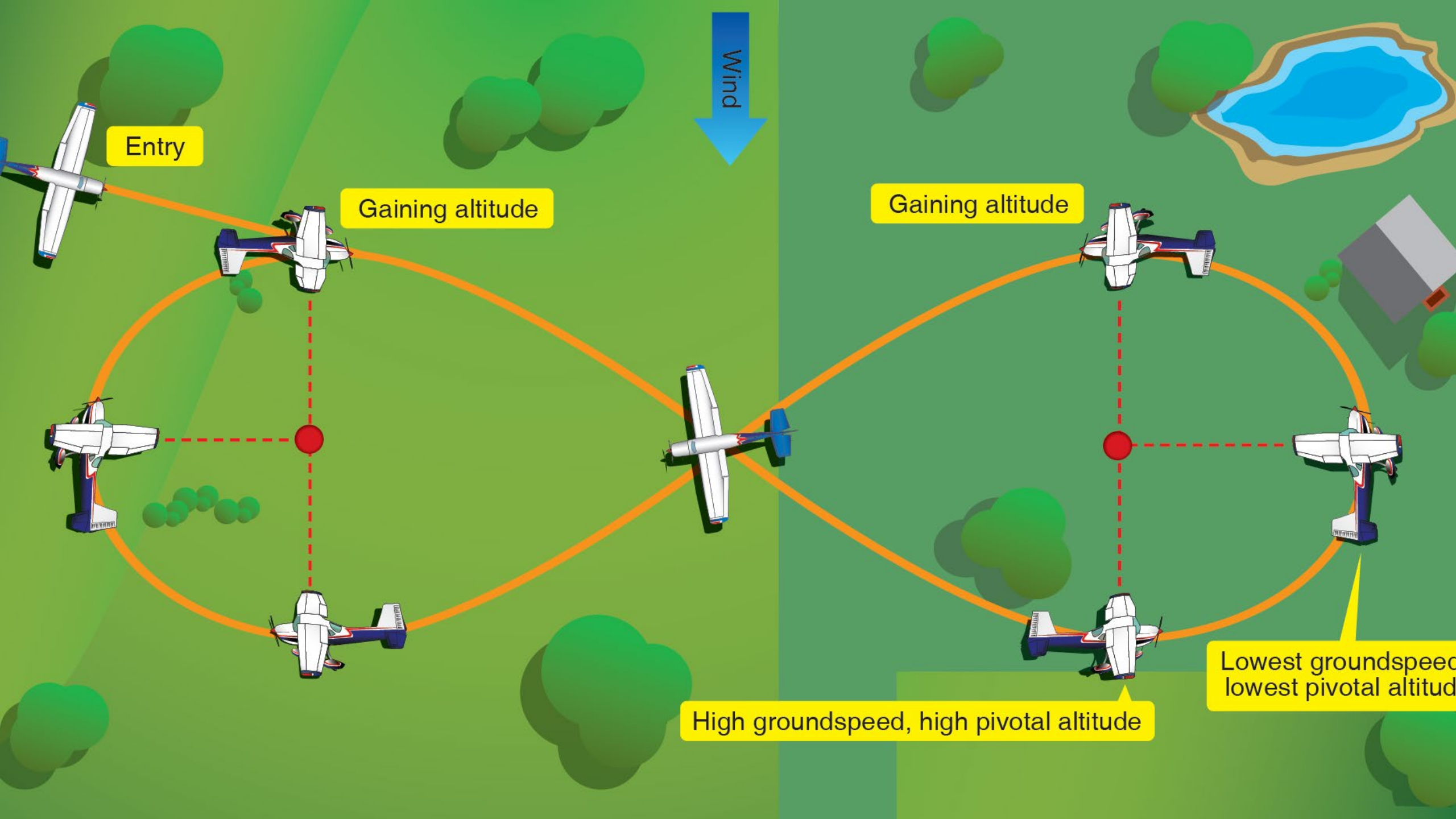
Eights on Pylons

Lesson Objective

This training maneuver involves flying the aircraft in circular paths, alternately left and right, in the form of a figure 8 around two selected points or pylons on the ground. No attempt is made to maintain a uniform distance from the pylon, as the distance from the pylons varies if there is any wind.

The airplane is flown at such a precise altitude and airspeed that a line parallel to the airplane's lateral axis, and extending from the pilot's eye, appears to pivot on each of the pylons, the degree of bank increases as the distance from the pylon decreases.

This maneuver improves the pilot's techniques for airspeed control, wind drift control, planning, orientation, and division of attention.

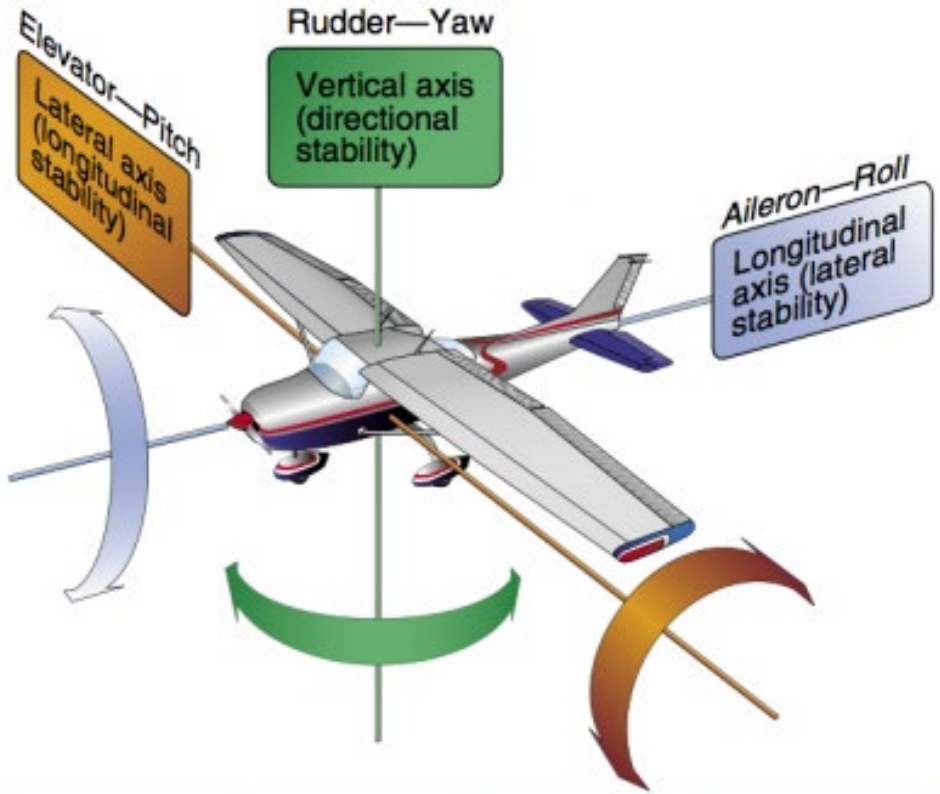

Wind
Entry
Gaining altitude
Gaining altitude
High groundspeed, high pivotal altitude
Lowest groundspeed
lowest pivotal altitud

From AFH

If a taut string extended from the pilot's eyes to the pylon, the string would remain parallel to lateral axis as the airplane makes a turn around the pylon.

The visual reference line, while not necessarily on the wingtip itself, may be positioned in relation to the wingtip (ahead, behind, above, or below), and differs for each pilot and from each seat in the airplane.

In the correct performance of eights on pylons, as in other maneuvers requiring a lateral reference, the pilot should use a visual reference line that, from eye level, parallels the lateral axis of the airplane.



Primary Control Surface	Airplane Movement	Axes of Rotation	Type of Stability
Aileron	Roll	Longitudinal	Lateral
Elevator/ Stabilator	Pitch	Lateral	Longitudinal
Rudder	Yaw	Vertical	Directional

From AFH

The altitude that is appropriate for eights on pylons is called the “pivotal altitude” and is **determined by the airplane's groundspeed**.

In previous ground-track maneuvers, the airplane flies a prescribed path over the ground and the pilot attempts to maintain the track by correcting for the wind.

With eights on pylons, the pilot maintains lateral orientation to a specific spot on the ground.

This develops the pilot’s ability to maneuver the airplane accurately while dividing attention between the flightpath and the selected pylons on the ground.

From AFH

The pivotal altitude is the altitude at which, for a given groundspeed, the projection of the visual reference line to the pylon appears to pivot.

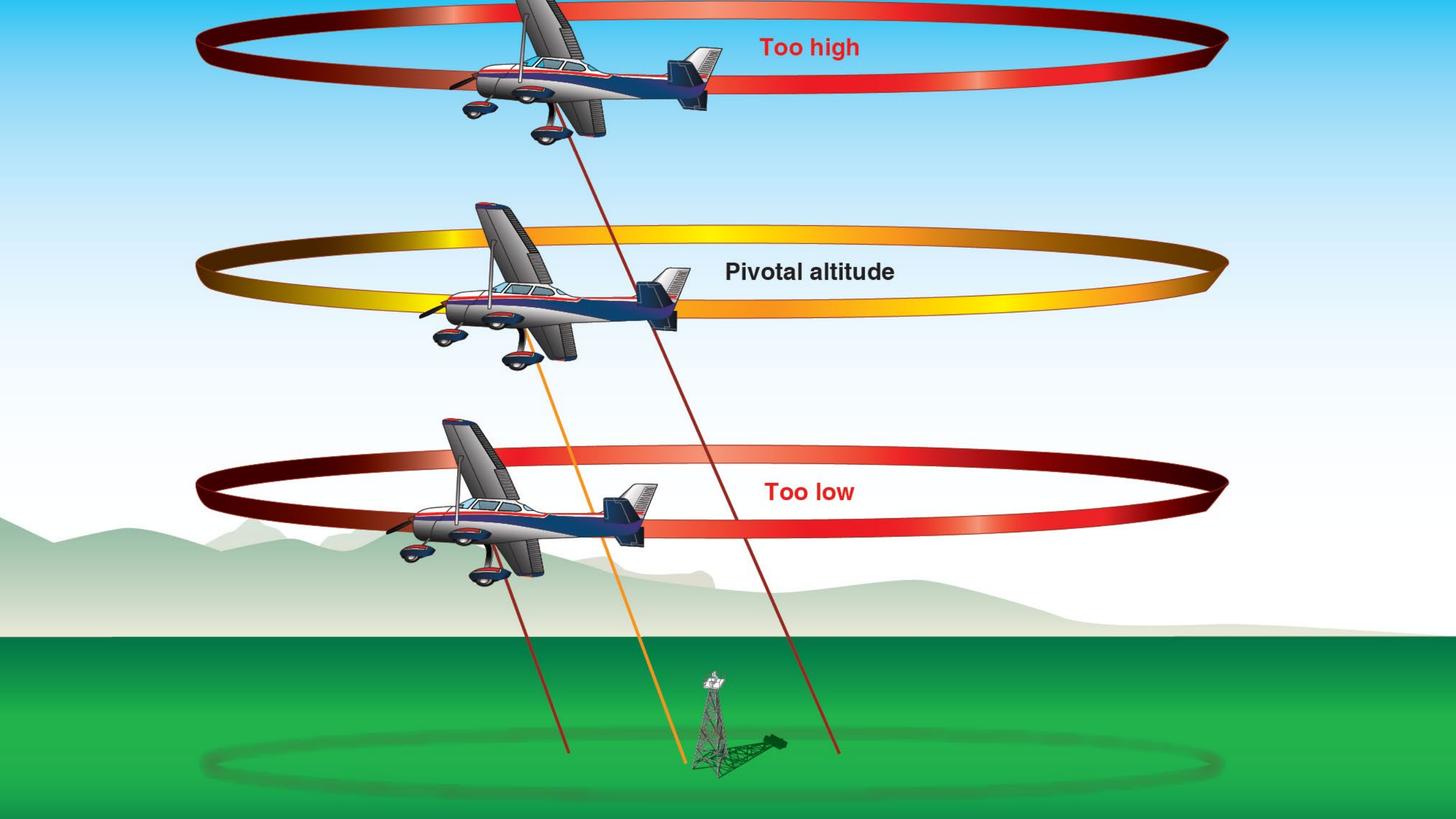
The pivotal altitude does not vary with the angle of bank unless the bank is steep enough to affect the groundspeed.

From AFH

Distance from the pylon affects the angle of bank.

At any altitude above that pivotal altitude, the projected reference line appears to move rearward in a circular path in relation to the pylon.

Conversely, when the airplane is below the pivotal altitude, the projected reference line appears to move forward in a circular path.


Too high
Pivotal altitude
Too low

From AFH

The altitude at which the visual reference line ceases to move across the ground is the pivotal altitude.

If the airplane descends below the pivotal altitude, the pilot should increase power to maintain airspeed while regaining altitude to the point at which the projected reference line moves neither backward nor forward but actually pivots on the pylon.

In this way, the pilot can determine the pivotal altitude of the airplane.

From AFH

The pivotal altitude changes with variations in groundspeed.

Since the headings throughout turns continuously vary from downwind to upwind, the groundspeed constantly changes.

This results in the proper pivotal altitude varying slightly throughout the turn.

The pilot should adjust for this by climbing or descending, as necessary, to hold the visual reference line on the pylons.

From AFH

The pilot should begin the eight on pylons maneuver by flying diagonally crosswind between the pylons to a point downwind from the first pylon, so that the first turn can be made into the wind.

As the airplane approaches a position where the pylon appears to be just ahead of the wingtip, the pilot should begin the turn by lowering the upwind wing to the point where the visual reference line aligns with the pylon.

The reference line should appear to pivot on the pylon.

From AFH

As the airplane heads upwind, the groundspeed decreases, which lowers the pivotal altitude.

As a result, the pilot should descend to hold the visual reference line on the pylon.

As the turn progresses on the upwind side of the pylon, the wind becomes more of a crosswind.

Since this maneuver does not require the turn to be completed at a constant radius, the pilot does not need to apply drift correction to complete the turn.

From AFH

If the visual reference line appears to move ahead of the pylon (pylon appears to move back), the pilot should increase altitude. (GRV: Pull yoke back)

If the visual reference line appears to move behind the pylon (pylon appears to move ahead), the pilot should decrease altitude. (GRV: Push yoke ahead)

Deflecting the rudder to yaw the airplane and force the wing and reference line forward or backward to the pylon places the airplane in uncoordinated flight, at low altitude, with steep bank angles and should not be attempted.

(GRV: Use rudder to stay coordinated but do not cheat with the rudder)

From AFH

Attempting to correct pivotal altitude by the using the altimeter is ineffective.

Eights on pylons are performed at bank angles ranging from shallow to steep.

The pilot should understand that the bank chosen does not alter the pivotal altitude.

So…why?

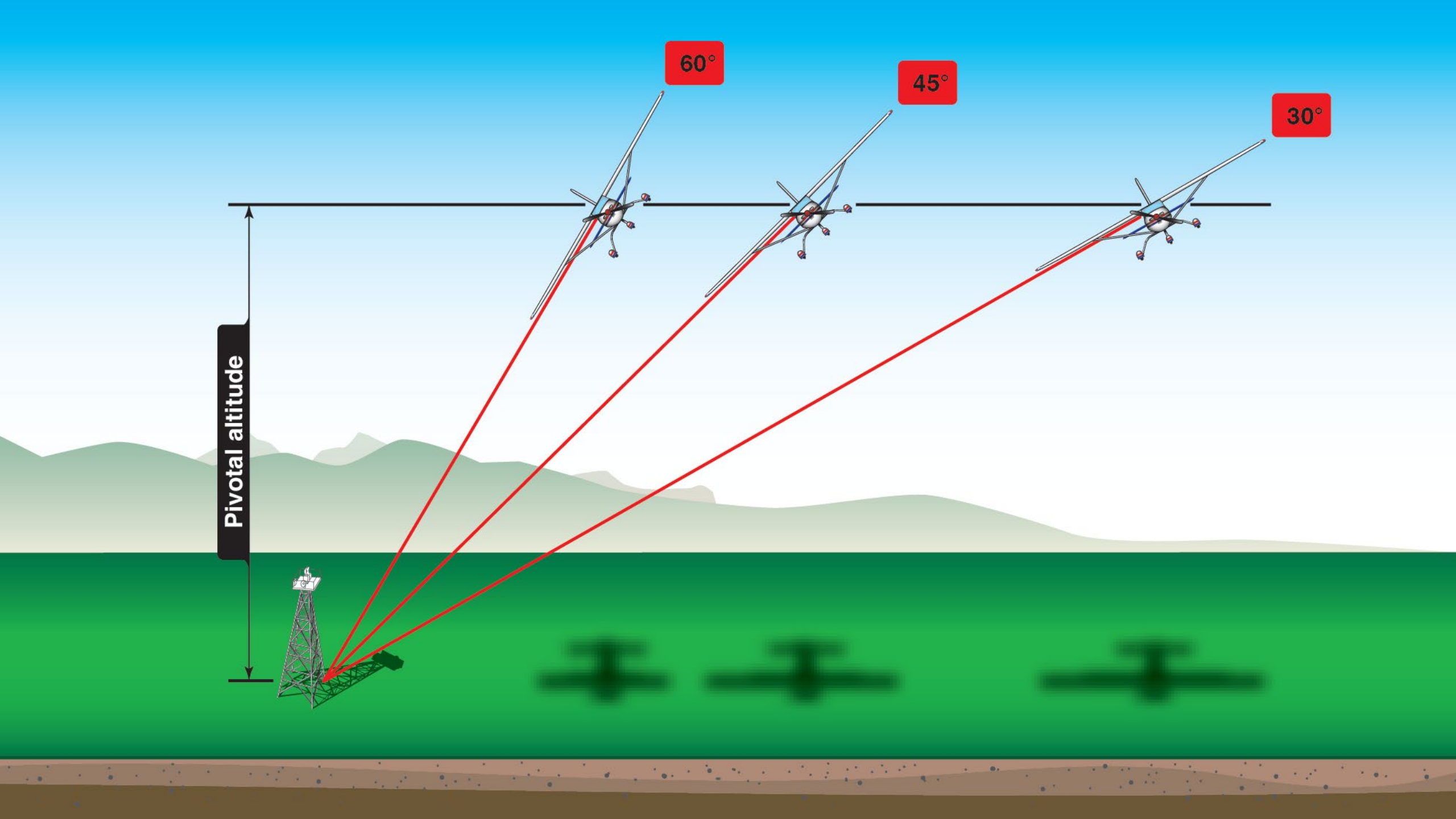
Eights on pylons differs from similar maneuvers in that the objective of eights on pylons is **not to maintain a specific altitude and ground track**, but rather to fly the airplane so that the pylon remains fixed **in place when viewed from the cockpit** along a line parallel to the lateral axis of the aircraft.

This is only possible when the aircraft is flown at the pivotal altitude corresponding to the current groundspeed.

If the aircraft is flying in wind, the groundspeed will vary throughout the maneuver and thus the pivotal altitude will change also.

However, the pivotal altitude varies only with the ground speed and not with the radius of turn or the angle of bank.

Whether the maneuver is flown very close to the pylon with the aircraft banked 60 degrees, or farther from the pylon at 30 degrees bank, the necessary altitude is the same.


60°
45°
30°
Pivotal altitude

Groundspeed		Approximate Pivotal Altitude
Knots	MPH	
87	100	670
91	105	735
96	110	810
100	115	885
104	120	960
109	125	1050
113	130	1130

So…why?

To understand ground speed affects rate and radius

<u>When is this important?</u>

We might need to keep an eye on something on the ground during a search and rescue sortie. Imagine someone with a signal mirror.

We might be doing aerial photography and do not want to get in the bad habits of ‘cheating’ with rudder pedals. When doing photography, you are normally low which is not where you want to get uncoordinated.

Forestry fire patrol is another good example.

Turns Around a Point vs This

Turn around a point is like a pattern around a point. Correct with crab angle, which translates into more or less bank angle since you are constantly turning.

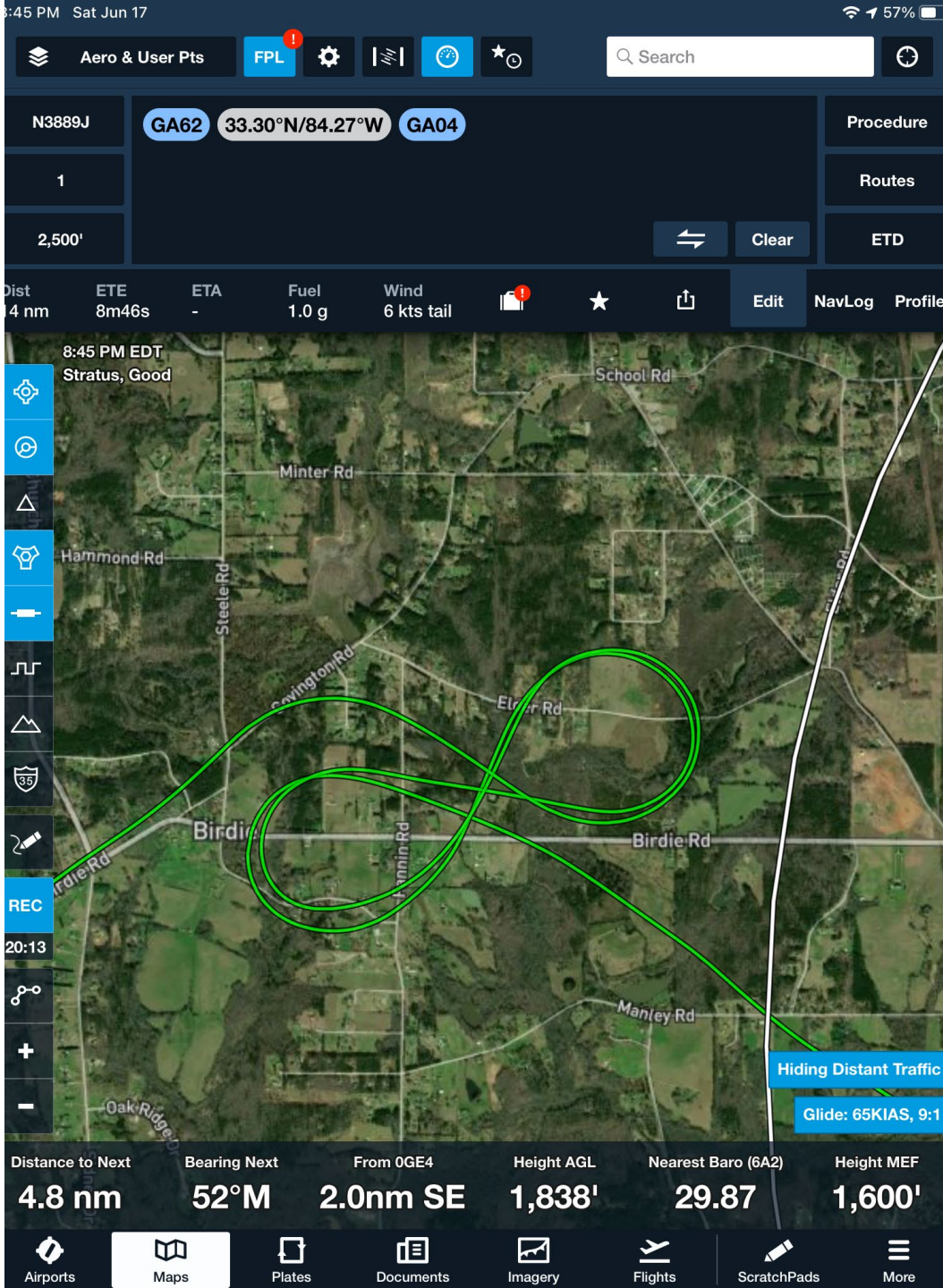
For turns around a point by the ACS, you are attempting to hold a selected altitude within 100 feet.

When performing eights on pylons, you are tasked with keeping the extended lateral line from the wing-tip pointing at the pylon. This requires you to change altitude based upon ground speed and distance from the pylon.

Track Log

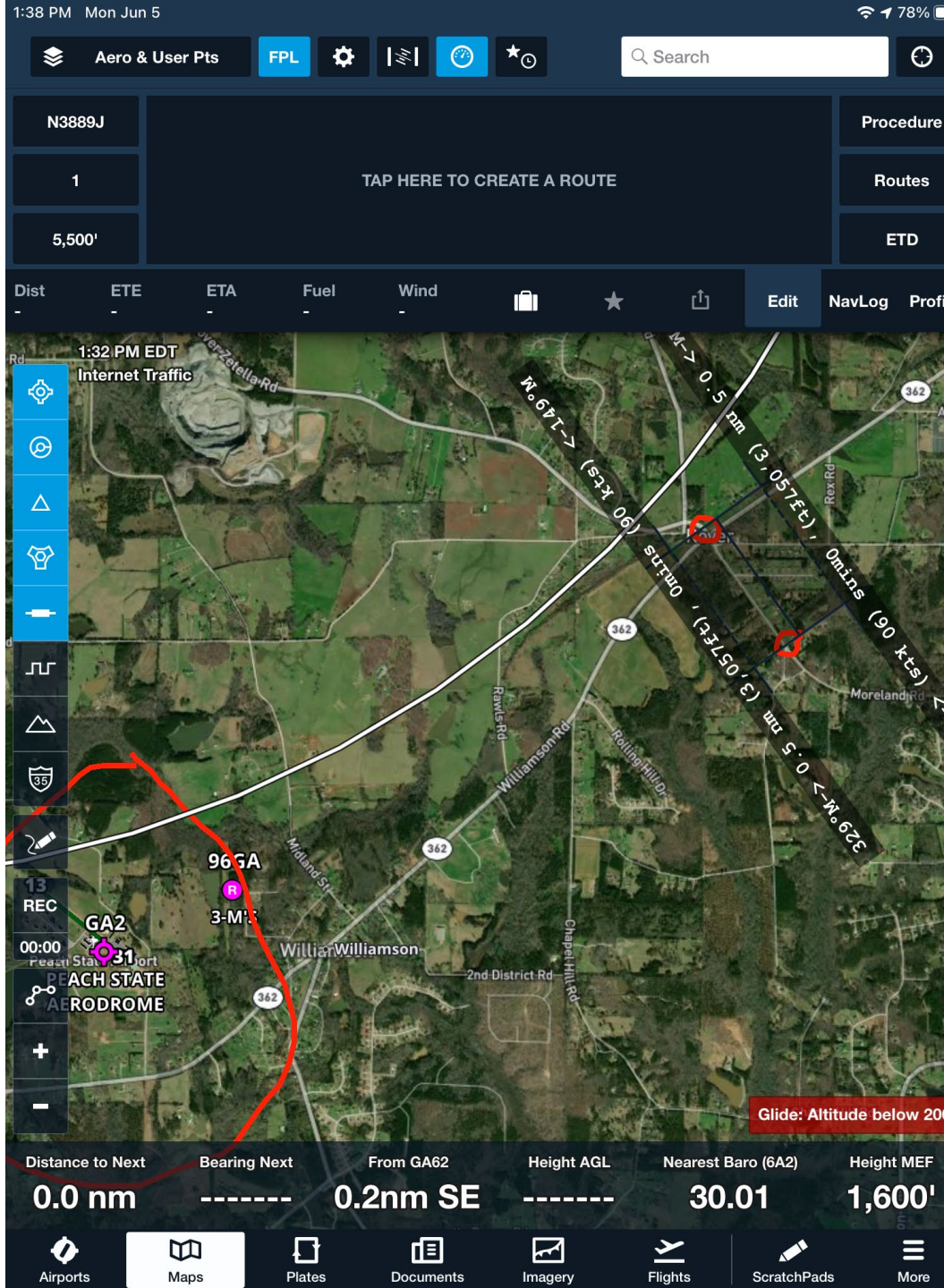
This session the winds were light out of the northwest.

I choose the targets during the demo.



Choosing Pylons On the Ground

For example, if winds were 05008KT we could preplan our pylon locations



Setup

CA.V.D.S1

Clear the area.

Do This

GUMPS/ABCDE/PARE

Setup

CA.V.E.S2

Determine the approximate pivotal altitude.

CA.V.E.S3

Select suitable pylons that will permit straight-and-level flight between the pylons.

AFH: The distance between the pylons should allow for the straight-and-level flight segment to last from 3 to 5 seconds

Do This

- Full power
- Slow to VA or slower (105 kts)
- Determine a suitable landing area in the event of an emergency
- Use ForeFlight as a tool to assist with AGL
- Ideal place for pylons – along straight road or numbers of runway

Fly

CA.V.E.S4
Enter the maneuver in the correct direction and position using an appropriate altitude and airspeed.

CA.V.E.S5
Establish the correct bank angle for the conditions, not to exceed 40°.

Do This
- Enter 45° to downwind
- Position the aircraft at a distance from the pylon that will allow a 30° to 40° bank throughout the maneuver
- Abeam the first pylon, place the wingtip on the pylon.
- Keep the reference point on the pylon by changing altitude

Pylon Coordination

CA.V.E.S6
Apply smooth and continuous corrections so that the line-of-sight reference line remains on the pylon.

CA.V.E.S7
Divide attention between accurate, coordinated airplane control and outside visual references.

CA.V.E.S8
Maintain pylon position using appropriate pivotal altitude, avoiding slips and skids.

Do This
- Keep the aircraft coordinated
- DO NOT CHEAT WITH RUDDER!!
- As GS increases, Pivotal Altitude increases
- AS GS decreases, Pivotal altitude decreases
- Figure a pivotal Altitude {$GS^2/11.3$ = Approximate Pivotal Altitude}

In Between

- Wings level for 3 – 5 seconds
- Roll toward the opposite pylon and repeat

Notes

- Abeam the pylon, begin turn into the wind
- The first part of your turn will be steeper because of a high Ground Speed

- If the pylon moves back, go higher, push yoke back
- If the pylon moves forward, go lower, push yoke forward

Risk Management

CA.V.E.R1

Failure to divide attention between airplane control and orientation.

CA.V.E.R2

Collision hazards, to include aircraft, terrain, obstacles, and wires.

CA.V.E.R3

Low altitude maneuvering including, stall, spin, or CFIT.

Risk Management

CA.V.E.R4

Distractions, loss of situational awareness, or improper task management.

CA.V.E.R5

Failure to maintain coordinated flight.

CA.V.E.R6

Failure to manage energy state.

Risk Management

CA.V.E.R7

Emergency landing considerations.

(GRV Note: Do them around private airports…also the people on the ground might know what you are doing and not freak)

Common Errors

- Not clearing the area
- Failure to adequately clear the surrounding area for safety hazards, initially and throughout the maneuver.
- Skidding or slipping in turns (whether trying to hold the pylon with rudder or not).

(GRV Note: You are dealing with a lot but watch the TC/G5)

- Excessive gain or loss of altitude.
- Poor choice of pylons. (GRV Note: Too far or too close)
- Not entering the pylon turns into the wind.
- Failure to assume a heading when flying between pylons that will compensate sufficiently for drift.
- Failure to time the bank so that the turn entry is completed with the pylon in position.
- Abrupt control usage.
- Inability to select pivotal altitude.

Mike Shiflett from CFI Bootcamp said

The reason in entering this maneuver as depicted in the handbook is so that you will be at the highest pivotal altitude when you start. There is no need to calculate a lower altitude for any other wind condition because the indicated airspeed is allowed to vary. It produces a doubling effect so that if you are higher you will descend and the airspeed will increase.

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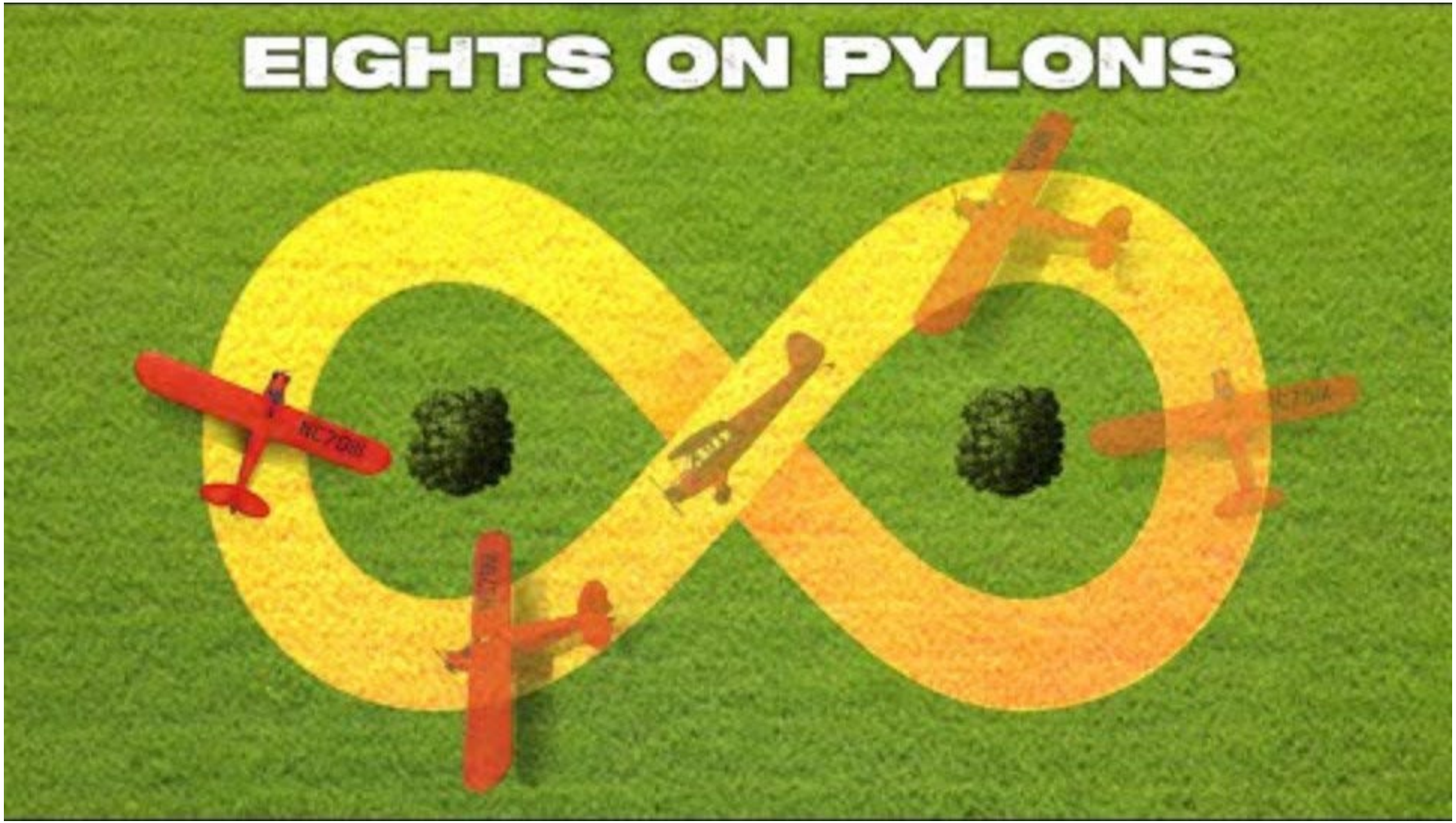

https://youtu.be/UbP_jDYItFY

Any questions I can answer or follow up later on?