Basic Steps to Standalone FAA CPL

(printable to work through – links clickable)

- First Step is to get a **FAA PPL Validation** on the strength of whatever you are currently holding - that gets you verified by the FAA and you will be in the system with a FAA license number and airman certificate.
- That is a simple 4 step process outlined on my website with 'screen by screen' self-help instructions (FAAServices.net - https://www.faaservices.net/uploads/1/3/5/9/135945758/st…
- Cost is $175-$300 depending if y… in SA.
  It takes about a week to six weeks … …munication between FAA and SACAA

As of March 20th 2024 the video call option is no longer possible!
https://www.faa.gov/documentLibrary/media/Notice/N_8900.689.pdf
A visit to the FSDO or an in person appointment with a FAA DPE is required.

Then, secondly you can present yourself in the US for a CPL (standalone) test, which needs:

1) review of your logbook to make sure you meet all the requirements of CFR 61.129 - (check here: https://www.ecfr.gov/current/title-14/chapter-I/subchapter-D/part-61/subpart-F/section-61.129)
2) training and endorsements depending on prior experience and currency (can be done here) for single engine land ground reference and performance manoeuvres, or for choppers SFAR training (and/or IFR and multi-engine refreshers) – testing standards used by the DPE during the test can be viewed here: https://www.faa.gov/training_testing/testing/acs/
3) sheppardair.com subscription to prep for the written exam(s) - one for CPL VFR, one for IFR privileges if required
4) Medical which can be done in SA by Dr Buchner (https://www.buchnermed.co.za/)
5) travel to the US for testing, cost depends of class of travel accommodation, rental car/Ueber, type of aircraft flown etc. etc. but essentially a R60-100k project for a week to ten days – can possibly be done on a tourist/business visa, might need TSA approval

See next page for local preparation.

On the Point above 2) Local training and endorsements to save time and money in the US:

The CPL VFR test prep depends how good you are -

>1000 local commercial pilots get it in 5-10 hours (airplane) / 2hrs (helicopter)

<500 pilots and PPLs need more time

You can read for yourself the test standard that the FAA examiner will have to use and read up of the performance and ground reference manoeuvres you have to master for the test.

1) Airman certification standard: https://www.faa.gov/training_testing/testing/acs AND https://www.faa.gov/sites/faa.gov/files/training_testing/testing/acs/commercial_airplane_acs_change_1.pdf

2) Book to prep: https://www.faa.gov/sites/faa.gov/files/regulations_policies/handbooks_manuals/aviation/airplane_handbook/00_afh_full.pdf

3) Software to prep written: https://www.sheppardair.com/commercial-pilot.htm

In the appendix are some of the key manoeuvres you have to master for the test.

Cost is $65 an hour (in the US you pay upwards from $85 at the moment) - a C172 goes for about R 2500 at FAGC at the moment. Flight review endorsement is $235. - Sitting down and talking through all this stuff $45 for ground.

For the helicopter pilots an article on the topic can be found here: https://www.faaservices.net/train-with-the-stars.html

Appendix:

- ***Experience Requirements for CPL as per CFR 61.129***
- ***Info on CPL Airplane Test Manoeuvres different to most other nations***

§ 61.129 Aeronautical experience.

(a) ***For an airplane single-engine rating.*** Except as provided in paragraph (i) of this section, a person who applies for a commercial pilot certificate with an airplane category and single-engine class rating must log at least 250 hours of flight time as a pilot that consists of at least:

(1) 100 hours in powered aircraft, of which 50 hours must be in airplanes.

(2) 100 hours of pilot-in-command flight time, which includes at least -

(i) 50 hours in airplanes; and

(ii) 50 hours in cross-country flight of which at least 10 hours must be in airplanes.

(3) 20 hours of training on the areas of operation listed in § 61.127(b)(1) of this part that includes at least -

(i) Ten hours of instrument training using a view-limiting device including attitude instrument flying, partial panel skills, recovery from unusual flight attitudes, and intercepting and tracking navigational systems. Five hours of the 10 hours required on instrument training must be in a single engine airplane;

(ii) 10 hours of training in a complex airplane, a turbine-powered airplane, or a technically advanced airplane (TAA) that meets the requirements of paragraph (j) of this section, or any combination thereof. The airplane must be appropriate to land or sea for the rating sought;

(iii) One 2-hour cross country flight in a single engine airplane in daytime conditions that consists of a total straight-line distance of more than 100 nautical miles from the original point of departure;

(iv) One 2-hour cross country flight in a single engine airplane in nighttime conditions that consists of a total straight-line distance of more than 100 nautical miles from the original point of departure; and

(v) Three hours in a single-engine airplane with an authorized instructor in preparation for the practical test within the preceding 2 calendar months from the month of the test.

(4) Ten hours of solo flight time in a single engine airplane or 10 hours of flight time performing the duties of pilot in command in a single engine airplane with an authorized instructor on board (either of which may be credited towards the flight time requirement under paragraph (a)(2) of this section), on the areas of operation listed under § 61.127(b)(1) that include -

(i) One cross-country flight of not less than 300 nautical miles total distance, with landings at a minimum of three points, one of which is a straight-line distance of at least 250 nautical miles from the original departure point. However, if this requirement is being met in Hawaii, the longest segment need only have a straight-line distance of at least 150 nautical miles; and

(ii) 5 hours in night VFR conditions with 10 takeoffs and 10 landings (with each landing involving a flight in the traffic pattern) at an airport with an operating control tower.

(b) ***For an airplane multiengine rating.*** Except as provided in paragraph (i) of this section, a person who applies for a commercial pilot certificate with an airplane category and multiengine class rating must log at least 250 hours of flight time as a pilot that consists of at least:

(1) 100 hours in powered aircraft, of which 50 hours must be in airplanes.

(2) 100 hours of pilot-in-command flight time, which includes at least -

(i) 50 hours in airplanes; and

(ii) 50 hours in cross-country flight of which at least 10 hours must be in airplanes.

(3) 20 hours of training on the areas of operation listed in § 61.127(b)(2) of this part that includes at least -

(i) Ten hours of instrument training using a view-limiting device including attitude instrument flying, partial panel skills, recovery from unusual flight attitudes, and intercepting and tracking navigational systems. Five hours of the 10 hours required on instrument training must be in a multiengine airplane;

(ii) 10 hours of training in a multiengine complex or turbine-powered airplane; or for an applicant seeking a multiengine seaplane rating, 10 hours of training in a multiengine seaplane that has flaps and a controllable pitch propeller, including seaplanes equipped with an engine control system consisting of a digital computer and associated accessories for controlling the engine and propeller, such as a full authority digital engine control;

(iii) One 2-hour cross country flight in a multiengine airplane in daytime conditions that consists of a total straight-line distance of more than 100 nautical miles from the original point of departure;

(iv) One 2-hour cross country flight in a multiengine airplane in nighttime conditions that consists of a total straight-line distance of more than 100 nautical miles from the original point of departure; and

(v) Three hours in a multiengine airplane with an authorized instructor in preparation for the practical test within the preceding 2 calendar months from the month of the test.

(4) 10 hours of solo flight time in a multiengine airplane or 10 hours of flight time performing the duties of pilot in command in a multiengine airplane with an authorized instructor (either of which may be credited towards the flight time requirement in

paragraph (b)(2) of this section), on the areas of operation listed in § 61.127(b)(2) of this part that includes at least -

(i) One cross-country flight of not less than 300 nautical miles total distance with landings at a minimum of three points, one of which is a straight-line distance of at least 250 nautical miles from the original departure point. However, if this requirement is being met in Hawaii, the longest segment need only have a straight-line distance of at least 150 nautical miles; and

(ii) 5 hours in night VFR conditions with 10 takeoffs and 10 landings (with each landing involving a flight with a traffic pattern) at an airport with an operating control tower.

(c) ***For a helicopter rating.*** Except as provided in paragraph (i) of this section, a person who applies for a commercial pilot certificate with a rotorcraft category and helicopter class rating must log at least 150 hours of flight time as a pilot that consists of at least:

(1) 100 hours in powered aircraft, of which 50 hours must be in helicopters.

(2) 100 hours of pilot-in-command flight time, which includes at least -

(i) 35 hours in helicopters; and

(ii) 10 hours in cross-country flight in helicopters.

(3) 20 hours of training on the areas of operation listed in § 61.127(b)(3) of this part that includes at least -

(i) Five hours on the control and maneuvering of a helicopter solely by reference to instruments using a view-limiting device including attitude instrument flying, partial panel skills, recovery from unusual flight attitudes, and intercepting and tracking navigational systems. This aeronautical experience may be performed in an aircraft, full flight simulator, flight training device, or an aviation training device;

(ii) One 2-hour cross country flight in a helicopter in daytime conditions that consists of a total straight-line distance of more than 50 nautical miles from the original point of departure;

(iii) One 2-hour cross country flight in a helicopter in nighttime conditions that consists of a total straight-line distance of more than 50 nautical miles from the original point of departure; and

(iv) Three hours in a helicopter with an authorized instructor in preparation for the practical test within the preceding 2 calendar months from the month of the test.

(4) Ten hours of solo flight time in a helicopter or 10 hours of flight time performing the duties of pilot in command in a helicopter with an authorized instructor on board (either of which may be credited towards the flight time requirement under paragraph (c)(2) of this section), on the areas of operation listed under § 61.127(b)(3) that includes -

(i) One cross-country flight with landings at a minimum of three points, with one segment consisting of a straight-line distance of at least 50 nautical miles from the original point of departure; and

(ii) 5 hours in night VFR conditions with 10 takeoffs and 10 landings (with each landing involving a flight in the traffic pattern).

Chandelle

Objective:

To develop the pilot's coordination, orientation, planning, feel and accuracy for maximum performance flight,

and to develop positive control techniques at varying airspeeds and attitudes.

Elements:

1. Selection of entry altitude.
2. Entry airspeed and power setting.
3. Division of attention and planning.
4. Coordination of flight controls.
5. Pitch and bank attitudes at various points during the maneuver.
6. Proper correction for torque effect in right and left turns.
7. Achievement of maximum performance.
8. Completion procedure.

Schedule:

Preflight Discussion	0:15
Inflight Demonstration and Student Practice	0:30
Postflight Discussion	0:15
All Times Dependent on Pilot's Ability	

Equipment:

Aircraft	Drawing Surface and Marking Utensil

Instructor's Actions:	Student's Actions:
PREFLIGHT: • Discuss lesson objective • Discuss common student errors in performing the maneuver. • Discuss the FAA's emphasis on safety including collision avoidance and division of attention. **INFLIGHT:** • Demonstrate the maneuver. • Coach student practice.	**PREFLIGHT** • Discuss lesson objective. • Listens and takes notes. • Resolves Questions. **INFLIGHT** • Reviews maneuvers. • Pays attention and asks questions. • Practices maneuver as directed. • Answers questions posed by instructor. **POSTFLIGHT** • Ask pertinent questions.

• Evaluate student understanding of maneuver. **POSTFLIGHT:** • Critique student performance. • Answer student questions. • Assign homework for next lesson.	• Answers questions posed by instructor. • Critiques own performance. • Completes assigned homework.

Commercial Pilot Flight Training
Completion Standards: FAA-H-8081-12B (Commercial PTS, V. C, 1-8)
1. Exhibits knowledge of the elements related to chandelles.
2. Selects an altitude that will allow the maneuver to be performed no lower than 1,500 feet AGL
3. Establishes the recommended entry configuration, power, and airspeed.
4. Establishes the angle of bank at approximately 30°.
5. Simultaneously applies power and pitch to maintain a smooth, coordinated climbing turn to the 90° point, with a constant bank.
6. Begins a coordinated constant rate rollout from the 90° point to the 180° point maintaining power and a constant pitch attitude.
7. Completes rollout at the 180° point, ±10° just above a stall airspeed, and maintaining that airspeed momentarily avoiding a stall.
8. Resumes straight and level flight with minimum loss of altitude.
Common Errors: FAA-H-8083-3A (Chapter 9-4)
1. Failure to adequately clear the area. 2. Too shallow an initial bank, resulting in a stall. 3. Too steep an initial bank, resulting in a failure to gain maximum performance. 4. Allowing the actual bank to increase after establishing initial bank angle. 5. Failure to start the recovery at the 90° point in the turn. 6. Allowing the pitch attitude to increase as the bank is rolled out during the second 90° of turn. 7. Removing all of the bank before the 180° point is reached. 8. Nose low on recovery, resulting in too much airspeed. 9. Control roughness. 10. Poor coordination (slipping or skidding). 11. Stalling at any point during the maneuver. 12. Execution of a steep turn instead of a climbing maneuver. 13. Failure to scan for other aircraft. 14. Attempting to perform the maneuver by instrument reference rather than visual reference.

References:	
FAA-H-8083-3A (Chapter 9-4)	FAA-S-8081-12B (Commercial PTS, V., C. 1-8)
FAA-H-8083-25A	

Things to Remember:
At the completion of the maneuver the stall horn should be just alerting on and off.

Start the maneuver with a quick turn to a 30° bank as you apply power simultaneously.

Chandelle Technique:

SETTING UP FOR MANEUVER

1. Set power to obtain maneuvering speed (Va), cruse speed, or manufacturer recommended
2. Select an altitude that allows maneuver to be performed no lower than 1,500 feet AGL.
3. Clear the area of other aircraft.
4. Trim

STARTING MANEUVER

1. Roll into a 30° bank turn using aileron. Use rudder to stop adverse yaw and coordinate the turn.
2. Pitch airplane up into a climbing turn.
3. Smoothly apply full power, without exceeding maximum RPM. (Fixed pitch propellers)
4. Leave the throttle and RPM in the cruise setting (Constant speed propellers)
5. Maintain coordination.

DURING THE MANEUVER

1. Maintain 30° bank angle until 90° point of the turn.
2. Continue to increase pitch attitude until 90° point or turn.
3. Gradually start rolling out of the bank at 90° point of turn.
4. Maintain the same pitch attitude at the 90 degree point throughout the rest of the turn.
5. Maintain coordination.

NOTE: Altitude is increasing and airspeed is decreasing throughout the Chandelle. Due to torque and P-factor rudder input increases throughout the maneuver reaching maximum at the completion of the maneuver.

COMPLETING MANEUVER

1. Complete rollout to wings level at 180° point of turn.
2. Airspeed is the minimum controllable airspeed
3. Momentarily hold airspeed without stalling

4. Maintain coordination.
5. Resume straight-and-level flight with minimum loss of altitude.
6. Resume normal speed
7. Reduce power to cruise setting
8. Repeat the maneuver in opposite direction.

Instructor Notes:

Chandelle Narrative:

INTRODUCTION

The objective of this maneuver is to develop the pilot's coordination, orientation, planning, and accuracy of control during maximum performance flight.

MOTIVATION

The *chandelle* (which is the French word for candle) is a maximum performance 180°climbing turn and was developed during World War I by French pilots. They would fly to enemy ground troops and toss their bombs out of the cockpit, and then perform the chandelle in an effort to avoid ground fire.

DESCRIPTION

A chandelle is a maximum performance climbing turn beginning from approximately straight-and-level flight, and ending at the completion of a precise 180° of turn in a wings-level, nose-high attitude at the minimum controllable airspeed. The maneuver demands that the maximum flight performance of the airplane be obtained; the airplane should gain the most altitude possible for a given degree of bank and power setting without stalling. Since numerous atmospheric variables beyond control of the pilot will affect the specific amount of altitude gained, the quality of the performance of the maneuver is not judged solely on the altitude gain, but by the pilot's overall proficiency as it pertains to climb performance for the power/bank combination used, and to the elements of piloting skill demonstrated.

EXECUTING THE MANEUVER

BEGINNING

- Prior to starting a chandelle, the flaps and gear (if retractable) should be in the UP position, power set to cruise condition, and the airspace behind and above clear of other air traffic.
- The maneuver should be entered from **straight-and-level flight** (or a shallow dive) and at the airplane's design maneuvering speed (VA) or the recommended speed in the POH.
- The chandelle is started by **smoothly** entering a coordinated turn with an angle of **bank** appropriate for the airplane being flown, not exceed approximately **30°.**

- After the appropriate bank is established, a climbing turn should be started by smoothly **applying back-elevator pressure** to increase the pitch attitude at a constant rate and to attain the highest **pitch attitude** as **90°** of turn is completed.
- **As the climb is initiated** in airplanes with fixed-pitch propellers, **full throttle** may be applied, but is applied gradually so that the maximum allowable R.P.M. is not exceeded.
- In airplanes with constant-speed propellers, power may be left at the normal cruise setting.
- Once the bank has been established, the angle of **bank** should **remain constant until 90°** of turn is completed.
- Although the degree of bank is fixed during this climbing turn it will tend to increase if allowed to do so.
- When the turn has progressed **90°** from the original heading, the pilot should **begin rolling out** of the **bank** at a constant rate while maintaining a constant-pitch attitude.
- Since the angle of bank will be decreasing during the rollout, the vertical component of lift will increase slightly.
- For this reason, it may be necessary to release a slight amount of back-elevator pressure in order to keep the nose of the airplane from rising higher.
- As the **wings are being leveled** at the **completion of 180°** of turn, the pitch attitude should be noted by checking the outside references and the attitude indicator.
- This **pitch** attitude should be **held momentarily** while the airplane is at the minimum controllable airspeed.
- Then the pitch attitude may be gently reduced to return to **straight-and-level cruise flight**. Since the airspeed is constantly decreasing throughout the maneuver, the effects of engine torque become more and more prominent.
- Therefore, right-rudder pressure is gradually increased to control yaw and maintain a constant rate of turn and to keep the airplane in coordinated flight.
- The pilot should maintain coordinated flight by the feel of pressures being applied on the controls and by the ball instrument of the turn-and-slip indicator.
- If coordinated flight is being maintained, the ball will remain in the center of the race.
- To roll out of a left chandelle, the left aileron must be lowered to raise the left wing.
- This creates more drag than the aileron on the right wing, resulting in a tendency for the airplane to yaw to the left.
- With the low airspeed at this point, torque effect tries to make the airplane yaw to the left even more.
- Thus, there are two forces pulling the airplane's nose to the left—aileron drag and torque.
- To maintain coordinated flight, considerable right-rudder pressure is required during the rollout to overcome the effects of aileron drag and torque.
- In a chandelle to the right, when control pressure is applied to begin the rollout, the aileron on the right wing is lowered.
- This creates more drag on that wing and tends to make the airplane yaw to the right.
- At the same time, the effect of torque at the lower airspeed is causing the airplane's nose to yaw to the left.
- Thus, aileron drag pulling the nose to the right and torque pulling to the left, tend to neutralize each other.
- If excessive left-rudder pressure is applied, the rollout will be uncoordinated.
- The rollout to the left can usually be accomplished with very little left rudder, since the effects of aileron drag and torque tend to neutralize each other.
- Releasing some right rudder, which has been applied to correct for torque, will normally give the same effect as applying left-rudder pressure.
- When the wings become level and the ailerons are neutralized, the aileron drag disappears.

- Because of the low airspeed and high power, the effects of torque become the more prominent force and must continue to be controlled with rudder pressure.
- A rollout to the left is accomplished mainly by applying aileron pressure.
- During the rollout, right-rudder pressure should be gradually released, and left rudder applied only as necessary to maintain coordination.
- Even when the wings are level and aileron pressure is released, right-rudder pressure must be held to counteract torque and hold the nose straight.

Commercial Pilot Flight Training

Lesson Plan Notes:

Introduction

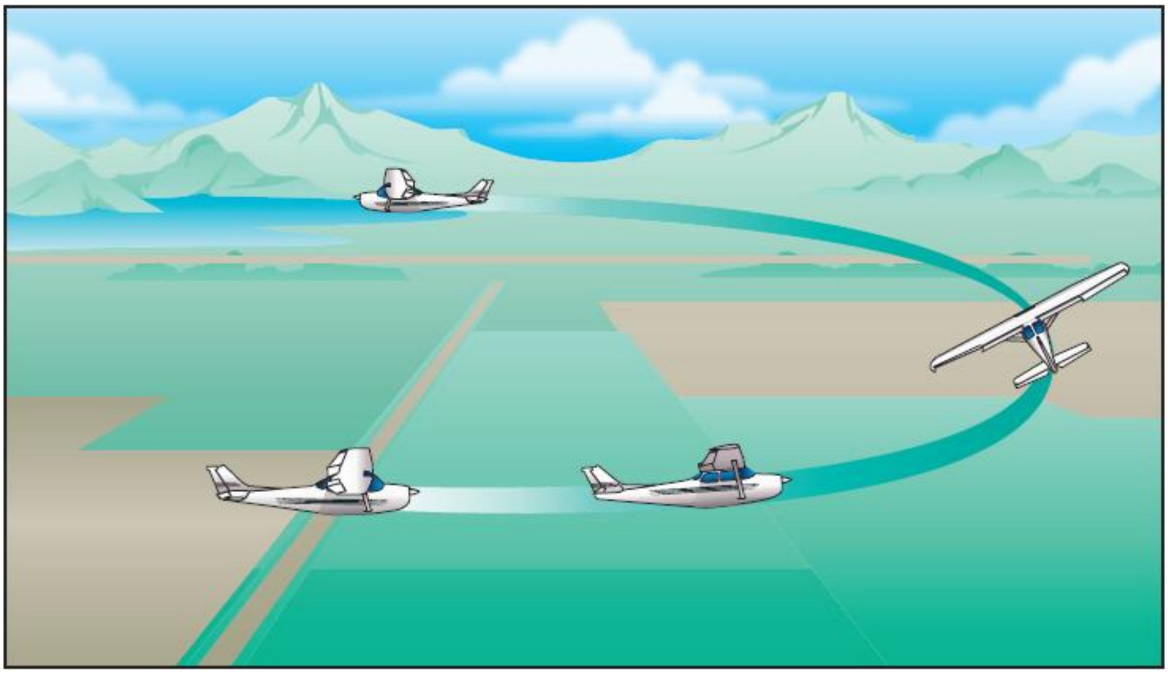
- ❑ A chandelle is a maximum performance climbing turn beginning from approximately straight-and-level flight, and ending at the completion of a precise 180° of turn in a wings-level, nose-high attitude at the minimum controllable airspeed. The maneuver demands that the maximum flight performance of the airplane be obtained; the airplane should gain the most altitude possible for a given degree of bank and power setting without stalling.

Attention

- ❑ The Chandelle will show your ability to control the aircraft during maximum performance flight

DEVELOPMENT

- ❑ Clear the area.
- ❑ Set cruise power, establish a visual reference point and note heading
- ❑ Straight-and level flight, and start the maneuver:
- ❑ Enter a 30º coordinated turn. After bank is established,
- ❑ Apply back elevator pressure (and increase power) to increase pitch constantly:
- ❑ Power: Fixed-pitch prop plane, apply full throttle smoothly. In a constant-speed prop plane, power may be left at cruise setting, or increased slightly.
- ❑ At the 90º point, maximum pitch, 30º bank. Start to roll out, but maintain pitch.
- ❑ Keep pitch constant and keep rolling out
- ❑ At 180º point, pitch just above stall speed, wings level.
- ❑ Gradually pitch down to resume straight-and-level flight at that altitude
- ❑ During rollout after the 90º point, there will be a slight increase in the vertical component of lift, so a slight easing of back pressure may be required to keep from climbing.
- ❑ Since airspeed is constantly decreasing during the maneuver, effects of torque become more pronounced and appropriate (right) rudder control will be needed, even in a left turn. Keep the ball centered.
- ❑ Demonstrate and emphasize smoothness, coordination, orientation & division of attention



Chandelle

Steep Spiral

Objective:

To improve pilot techniques for power-off turns, wind drift control, planning, coordination, orientation, and

division of attention while performing a constant ground-track descent.

Elements:

1. Relationship of bank angle, load factor, and stalling speed.
2. Selection of a suitable altitude and visual reference point
3. Orientation, division of attention, planning of entry and rollout
4. Coordination of flight controls.
5. Proper recovery after third rotation to straight and level flight.

Schedule:

Preflight Discussion	0:15
Inflight Demonstration and Student Practice	0:30
Postflight Discussion	0:15

All Times Dependent on Pilot's Ability

Equipment:

Aircraft	Drawing Surface and Marking Utensil

Instructor's Actions:

PREFLIGHT:

- Discuss lesson objective
- Discuss common student errors in performing the maneuver.
- Discuss the FAA's emphasis on safety including collision avoidance and division of attention.

INFLIGHT:

- Demonstrate the maneuver.
- Coach student practice.
- Evaluate student understanding of maneuver.

POSTFLIGHT:

- Critique student performance.
- Answer student questions.

Student's Actions:

PREFLIGHT

- Discuss lesson objective.
- Listens and takes notes.
- Resolves Questions.

INFLIGHT

- Reviews maneuvers.
- Pays attention and asks questions.
- Practices maneuver as directed.
- Answers questions posed by instructor.

POSTFLIGHT

- Ask pertinent questions.
- Answers questions posed by instructor.
- Critiques own performance.
- Completes assigned homework.

• Assign homework for next lesson.	

Commercial Pilot Flight Training
Completion Standards: FAA-H-8081-12B (Commercial PTS, V. B., 1-6)
1. Exhibits knowledge of the elements related to steep spiral.
2. Selects an altitude sufficient to continue through a series of at least three 360° turns.
3. Selects a suitable ground reference point.
4. Applies wind-drift correction to track a constant radius circle around selected reference point with bank not to exceed 60° at steepest point in turn.
5. Divides attention between airplane control and ground track, while maintaining coordinated flight.
6. Maintains the specified airspeed, ±10 knots, rolls out toward object or specified heading, ±10°.
Common Errors: FAA-H-8083-3A (Chapter 9-2)
1. Failure to adequately clear the area. 2. Failure to maintain constant airspeed. 3. Poor coordination, resulting in skidding and/or slipping. 4. Inadequate wind drift correction. 5. Failure to coordinate the controls so that no increase/decrease in speed results when straight glide is resumed. 6. Failure to scan for other traffic. 7. Failure to maintain orientation.

References:	
FAA-H-8083-3A (Chapter 9-2)	FAA-S-8081-12B (Commercial PTS, V., B. , 1-6)
FAA-H-8083-25A	

Things to Remember:
It's a ground reference maneuver with progressively lowering altitudes

Commercial Pilot Flight Training
Steep Spiral Technique:

BEGINNING

1. Pick a suitable reference ahead for heading reference and one below to spiral over
2. Close the throttle and establish a glide.
3. Start a gliding spiral with a turn of constant radius around the selected spot on the ground.
4. Correct for wind drift by increasing bank on downwind and shallowing the bank on upwind headings.

5. Vary the bank angle (up to 60 degrees) to maintain a fixed radius around the point.
6. Maintain the glide speed throughout the maneuver.
7. After completing three spirals rollout on the original heading

NOTE:

On the **downwind** side of the maneuver, the **steeper** the bank angle, the **lower the pitch attitude** must be to maintain a given airspeed. Conversely, on the **upwind** side, as the bank angle becomes **shallower**, the **pitch attitude must be raised** to maintain the proper airspeed. This is necessary because the airspeed changes as the bank is changed from shallow to steep to shallow.

Clear the engine on the upwind, so as to minimize the effect of increased groundspeed.

Instructor Notes:

Steep Spiral Narrative:

INTRODUCTION

A steep spiral is a constant gliding turn, during which a constant radius around a point on the ground is maintained similar to the maneuver, turns around a point. The radius should be such that the steepest bank will not exceed 60°. Sufficient altitude must be obtained before starting this maneuver so that the spiral may be continued through a series of at least three 360° turns. The maneuver should not be continued below 1,000 feet above the surface unless performing an emergency landing in conjunction with the spiral.

MOTIVATION

The objective of this maneuver is to improve pilot techniques for airspeed control, wind drift control, planning, orientation, and division of attention. The steep spiral is not only a valuable flight training maneuver, but it has practical application in providing a procedure for dissipating altitude while remaining over a selected spot in preparation for landing, especially for emergency forced landings.

NOTE: Operating the engine at idle speed for a prolonged period during the glide may result in excessive engine cooling or spark plug fouling. The engine should be cleared periodically by briefly advancing the throttle to normal cruise power, while adjusting the pitch attitude to maintain a constant airspeed. Preferably, this should be done while headed into the wind to minimize any variation in groundspeed and radius of turn.

EXECUTING THE MANEUVER

BEGINNING

- After the throttle is closed and gliding speed is established, a gliding spiral should be started and a turn of constant radius maintained around the selected spot on the ground.
- This will require correction for wind drift by steepening the bank on downwind headings and shallowing the bank on upwind headings, just as in the maneuver, turns around a point.
- During the descending spiral, judge the direction and speed of the wind at different altitudes and make appropriate changes in the angle of bank to maintain a uniform radius.
- A constant airspeed should also be maintained throughout the maneuver.
- Failure to hold the airspeed constant will cause the radius of turn and necessary angle of bank to vary excessively.
- On the **downwind** side of the maneuver, the **steeper** the bank angle, the **lower the pitch attitude** must be to maintain a given airspeed.
- Conversely, on the **upwind** side, as the bank angle becomes **shallower**, the **pitch attitude must be raised** to maintain the proper airspeed.
- This is necessary because the airspeed tends to change as the bank is changed from shallow to steep to shallow.
- During practice of the maneuver, execute three turns and roll out toward a definite object or on a specific heading.
- During the rollout, smoothness is essential, and the use of controls must be so coordinated that no increase or decrease of speed results when the straight glide is resumed.

Lesson Plan Notes:

Introduction

- ❑ A steep spiral is a continuous gliding turn around a point. The steep spiral maneuver consists of at least 3 gliding 360° turns around a point with a maximum bank angle of 50° to 55° and recovery toward a definite object or on a specific heading.

Attention

- ❑ A steep spiral is a constant gliding turn with a constant radius over a point on the ground.

Motivation

- ❑ The steep spiral is a procedure for dissipating altitude while remaining over a selected spot in preparation for landing, especially for emergency landings.

DEVELOPMENT

- ❑ Review Turns Around A Point
- ❑ Explain the forces acting on an aircraft during a turn, including stability and overbanking tendencies
- ❑ Explain importance of coordinated use of aileron and rudder

INFLIGHT

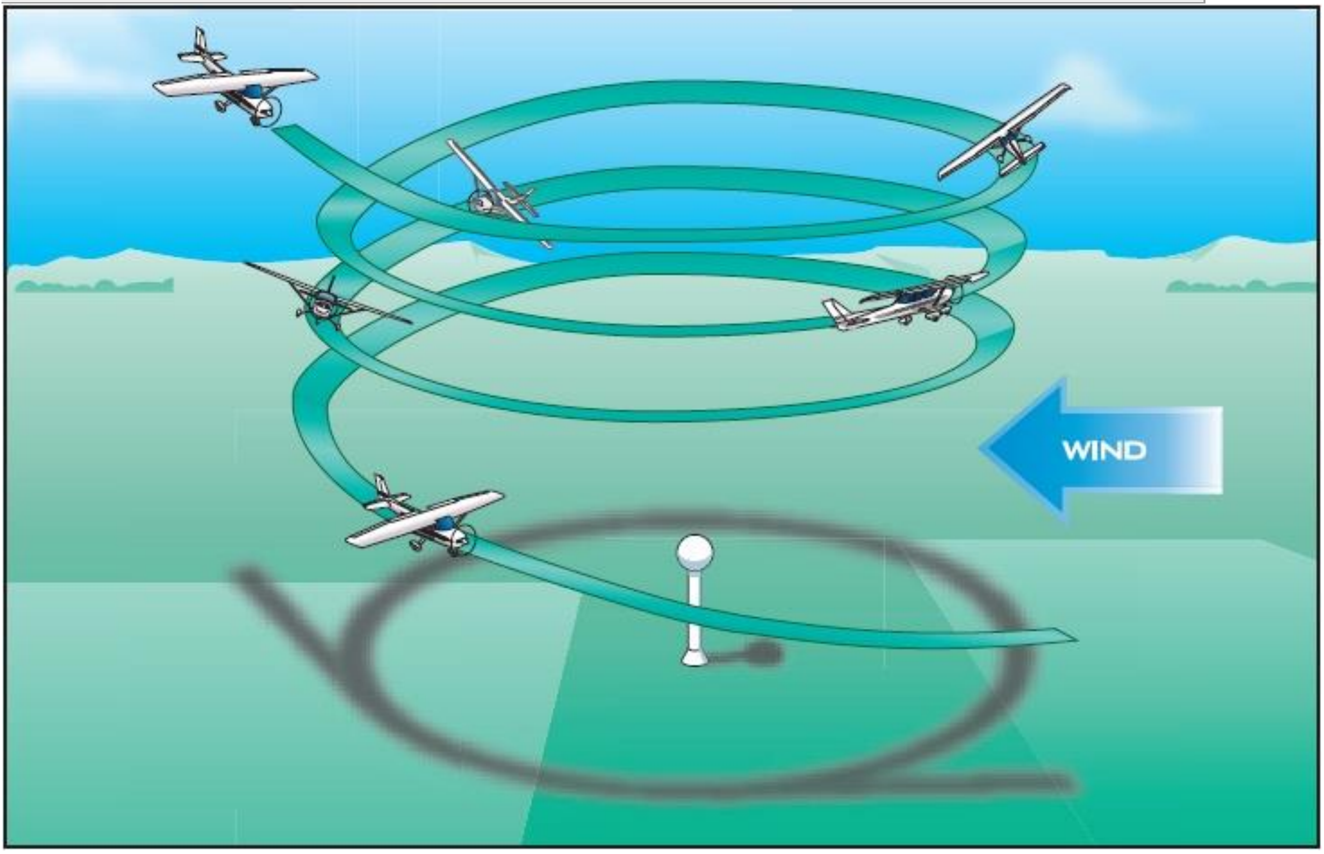
- Altitude > 4500' AGL, **clear the area!**
- Choose a visual reference point, and note the heading and altitude.
- Establish a glide speed.
- Abeam the point, reduce throttle to idle and smoothly roll into the turn
- Explain compensation for wind (steepen bank on downwind side, shallow on upwind)
- Explain the sight picture, and how use other visual references for when sight of the point is obscured.
- Explain how to anticipate roll-out (generally ½ bank angle)
- Demonstrate and emphasize smoothness, coordination, orientation & division of attention

POSTFLIGHT

- Conduct a critique and review procedures and techniques.

TEACHING NOTES

- Constant gliding turn with a constant radius over a point on the ground.
- Techniques for power-off turns, wind drift control, planning, coordination, orientation, and division of attention while performing a constant ground-track descent.
- Useful to dissipate altitude



Steep spiral

Lazy 8's

Objective:

To develop the pilot's feel for varying control forces, and the ability to plan and remain orientated while maneuvering the airplane with positive accurate control as well as developing precise coordination of controls through a wide range of airspeeds and altitudes so that certain accuracy points are reached with planned attitude and airspeed.

Elements:

1. Selection of entry altitude.
2. Selection of suitable reference points.
3. Entry airspeed and power setting.
4. Entry procedure.
5. Orientation, division of attention, and planning.
6. Coordination of flight controls.
7. Pitch and bank attitudes at key points during the maneuver.
8. Importance of consistent airspeed and altitude control at key points during the maneuver.
9. Proper correction for torque effect in right and left turns.
10. Loop symmetry.

Schedule:

Preflight Discussion	0:15
Inflight Demonstration and Student Practice	0:30
Postflight Discussion	0:15
All Times Dependent on Pilot's Ability	

Equipment:

Aircraft	Drawing Surface and Marking Utensil

Instructor's Actions:	Student's Actions:
PREFLIGHT: • Discuss lesson objective • Discuss common student errors in performing the maneuver. • Discuss the FAA's emphasis on safety including collision avoidance and division of attention. **INFLIGHT:** • Demonstrate the maneuver.	**PREFLIGHT** • Discuss lesson objective. • Listens and takes notes. • Resolves Questions. **INFLIGHT** • Reviews maneuvers. • Pays attention and asks questions. • Practices maneuver as directed. • Answers questions posed by instructor.

• Coach student practice. • Evaluate student understanding of maneuver. **POSTFLIGHT:** • Critique student performance. • Answer student questions. • Assign homework for next lesson.	**POSTFLIGHT** • Ask pertinent questions. • Answers questions posed by instructor. • Critiques own performance. • Completes assigned homework.

Commercial Pilot Flight Training

Completion Standards: FAA-H-8081-12B (Commercial PTS, V. D, 1-6)

1. Exhibits knowledge of the elements related to lazy eights.
2. Selects an altitude that will allow the task to be performed no lower than 1,500 feet AGL
3. Establishes the recommended entry configuration, power, and airspeed.
4. Maintains coordinated flight throughout the maneuver.
5. Achieves the following throughout the maneuver—
   a. approximately 30° bank at the steepest point.
   b. constant change of pitch and roll rate.
   c. altitude tolerance at 180° points, ±100 feet from entry altitude.
   d. airspeed tolerance at the 180° point plus ±10° knots from entry airspeed.
   e. heading tolerance at the 180° point ±10°.
6. Continues the maneuver through the number of symmetrical loops specified and resumes straight and level flight.

Common Errors: FAA-H-8083-3A (Chapter 9-6)

8. Failure to adequately clear the area.
9. Using the nose, or top of engine cowl, instead of the true longitudinal axis, resulting in unsymmetrical loops.
10. Watching the airplane instead of the reference pints.
11. Inadequate planning, resulting in the peaks of the loops both above and below the horizon not coming in the proper place.
12. Control roughness, usually caused by attempts to counteract poor planning.
13. Persistent gain or loss of altitude with the completion of each eight.
14. Attempting to perform the maneuver rhythmically, resulting in poor pattern symmetry.
15. Allowing the airplane to "fall" out of the tops of the loops rather than flying the airplane through the maneuver.
16. Slipping and / or skidding.
17. Failure to scan for other traffic.

References:

FAA-H-8083-3A (Chapter 9-6)	FAA-S-8081-12B (Commercial PTS, V., D. 1-6)
FAA-H-8083-25A	

Things to Remember:

No flight control is ever held stationary during this maneuver

Not getting slow enough at the 90 degree point makes it difficult to complete the turn at the 180 degree point

Pilots will find it easier to perform these to the left as P-factor and torque are pulling the airplane that way

Lazy Eights Technique:

1. Clear the area.
2. Set cruise power, establish visual reference points at 45°, 90°, 135° and 180°
3. Set speed to below Va
4. Start from straight-and level flight with the 90 degree reference on the left reference line.
5. Begin a gradual climbing turn. Achieve the highest attitude and 15 degrees of bank at the 45° point
6. At the 45° point begin to lower the pitch attitude and increase the bank angle so that by the 90° point the bank angle is approx 30° and airspeed (5-10 knots above stall) with a level pitch attitude
7. Past 90° lower the pitch attitude and shallow the bank angle so that at the 135° point the pitch is at lowest and bank angle is 15 degrees.
8. From the 135° point begin to level the wings and increase the pitch attitude so that by the 180° point the aircraft is level and at the original airspeed & altitude
9. Immediately start maneuver in opposite direction

NOTE: The flight controls are never stationary during this manoeuvre

Instructor Notes:

Commercial Pilot Flight Training

Lazy 8's Narrative:

INTRODUCTION

The lazy eight is a maneuver designed to develop perfect coordination of controls through a wide range of airspeeds and altitudes so that certain accuracy points are reached with planned attitude and airspeed. In its execution, the dive, climb, and turn are all combined, and the combinations are varied and applied throughout the performance range of the airplane.

MOTIVATION

It is the only standard flight training maneuver during which at no time do the forces on the controls remain constant. The lazy eight as a training maneuver has great value since constantly varying forces and attitudes are required. These forces must be constantly coordinated, due not only to the changing combinations of banks, dives, and climbs, but also to the constantly varying airspeed. The maneuver helps develop subconscious feel, planning, orientation, coordination, and speed sense. It is not possible to do a lazy eight mechanically, because the control pressures required for perfect coordination are never exactly the same.

DESCRIPTION

A lazy eight consists of two 180° turns, in opposite directions, while making a climb and a descent in a symmetrical pattern during each of the turns. At no time throughout the lazy eight is the airplane flown straight and level; instead, it is rolled directly from one bank to the other with the wings level only at the moment the turn is reversed at the completion of each 180° change in heading.

EXECUTING THE MANEUVER

BEGINNING

- Select altitude that will allow for completion of maneuver no lower than 1,500' AGL (3,500' AGL is good).
- Select a Prominent reference points on the horizon.
  - Reference points should be **45°**, **90°**, and **135°** from the direction in which the maneuver is begun.
- Clear the airspace of other air traffic.
- Enter maneuver from straight-and-level flight at normal cruise power, maneuvering speed Va (CE-172RG ~ 95 knots).
- Start from level flight with a gradual climbing turn in the direction of the **45°** reference point.
- Chant "Pitch, Pitch, Roll"
- Slowly rolling the aircraft to reach **15°** bank at the **45°** point.
- Maximum pitch-up attitude is reached at the **45°** point. (**~15-20°** pitch up)
- The rate of rolling into the bank must be such as to prevent the rate of turn from becoming too rapid.
- As the pitch attitude is raised, the **airspeed decreases**, causing the **rate of turn to increase**. Since the bank also is being increased, it too causes the rate of turn to increase.

45° POINT

- At the **45°** point, the pitch attitude should be at maximum (**~ 15-20°** pitch up)
- The angle of bank **~ 15°** and continuing to increase.
- Pitch attitude should start to decrease slowly toward the horizon and the **90°** reference point. (Nose falls)

- Since the airspeed is still decreasing, **right-rudder pressure** will have to be applied to counteract torque.
- As the airplane's nose is being lowered toward the **90°** reference point, the bank should continue to increase to **30°**.
- Due to the decreasing airspeed, a **slight amount of opposite aileron pressure** may be required to prevent the bank from becoming too steep.

90° POINT

- When the airplane completes **90°** of the turn
  - Bank should be at the **maximum angle** (approximately **30°)**
  - **Airspeed** should be at its **minimum** (**5 to 10 knots above stall speed**)
  - Pitch attitude should be **passing through level flight**.
- An imaginary line, extending from the pilot's eye and parallel to the longitudinal axis of the airplane, passes through the **90°** reference point.
- As the reference line passes through the 90° point, the bank should be decreased gradually, and the airplane's nose allowed to continue lowering.

135° POINT

- When the airplane has turned **135°**,
- The nose should be in **its lowest pitch attitude**.
- The bank should be at **~ 15°**.
- The **airspeed** will be **increasing** during this **descending turn**, it will be necessary to gradually **relax rudder** and **aileron pressure** and simultaneously **raise the nose and roll the wings level**.

180° POINT (Completion of the first half of the maneuver)

- Upon returning to the starting altitude and the 180° point, a climbing turn should be started immediately in the opposite direction.

NOTE

- Due to the decreasing airspeed, considerable right rudder pressure is gradually applied to counteract torque at the top of the eight in both the right and left turns. The pressure will be greatest at the point of lowest airspeed.
- More right-rudder pressure will be needed during the climbing turn to the right than in the turn to the left because more torque correction is needed to prevent yaw from decreasing the rate of turn.
- In the left climbing turn, the torque will tend to contribute to the turn; consequently, less rudder pressure is needed.
- It will be noted that the controls are slightly crossed in the right climbing turn because of the need for left aileron pressure to prevent overbanking and right rudder to overcome torque.
- The correct power setting for the lazy eight is that which will maintain the altitude for the maximum and minimum airspeeds used during the climbs and descents of the eight.
- If excess power were used, the airplane would have gained altitude when the maneuver is completed; if insufficient power were used, altitude would have been lost.

Lesson Plan Notes:

Introduction

- A lazy eight consists of two alternating, symmetrical, climbing and descending 180° turns in opposite directions. The name is derived from the manner in which the extended longitudinal axis of the airplane is made to trace a figure 8 lying ("lazily") on its side.

Attention

- The Lazy 8 will show your ability to precisely control the aircraft in a maneuver which requires constantly changing control pressure.

Motivation

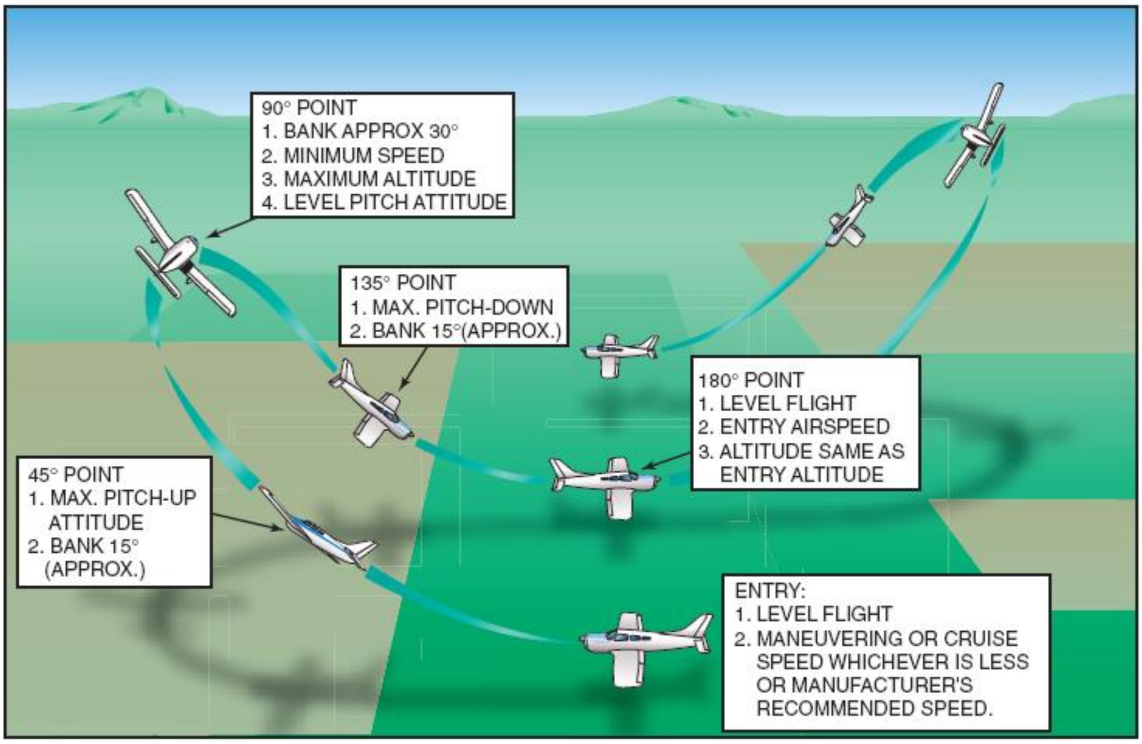
- The Lazy 8 consists of two 180° turns in opposite directions while climbing & descending in a symmetric pattern.

DEVELOPMENT

- Clear the area.
- Set cruise power, establish a visual reference points upwind 45°, 90° and 135°
- Fly crosswind heading (note heading)
- Straight-and level flight, and start the maneuver:
  - Gradual climbing turn. Max pitch up at 45° point
  - At 45° pitch starts to decrease toward horizon, bank continues to increase
  - As nose is lowered toward 90° point bank should continue to increase
  - At 90°, bank max (approx 30°), airspeed min (5-10 knots above stall), pitch passing through level
  - Past 90°, bank decreases
  - At 135° pitch is at lowest point. Airspeed increasing so relax aileron & rudder, start to raise nose
  - At 180°, level attitude & wings level at original airspeed & altitude
  - Immediately start maneuver in opposite direction
- As the name implies, keep them lazy - makes the maneuver easier to fly.

POSTFLIGHT

- Conduct a critique and review procedures and techniques.


90° POINT
1. BANK APPROX 30°
2. MINIMUM SPEED
3. MAXIMUM ALTITUDE
4. LEVEL PITCH ATTITUDE
135° POINT
1. MAX. PITCH-DOWN
2. BANK 15°(APPROX.)
180° POINT
1. LEVEL FLIGHT
2. ENTRY AIRSPEED
3. ALTITUDE SAME AS
ENTRY ALTITUDE
45° POINT
1. MAX. PITCH-UP
ATTITUDE
2. BANK 15°
(APPROX.)
ENTRY:
1. LEVEL FLIGHT
2. MANEUVERING OR CRUISE
SPEED WHICHEVER IS LESS
OR MANUFACTURER'S
RECOMMENDED SPEED.

Lazy eight

Eights-on-Pylons

Objective:
To execute of a circular path of alternating left and right turns, maintaining a pivotal position on a selected pylon.

Elements:

1. How to determine the approximate pivotal altitude.
2. How to select suitable pylons with consideration given to emergency landing areas.
3. Orientation, division of attention, and planning.
4. Configuration and airspeed prior to entry.
5. Relationship of ground speed change to the performance of the maneuver.
6. Pilot's "line-of-sight" reference to the pylon.
7. Entry procedure.
8. Procedure for maintaining "line-of-sight" on the pylon.
9. Proper planning for turn entries and rollouts.
10. How to correct for wind drift between pylons.
11. Coordination of flight controls.

Schedule:

Preflight Discussion	0:15
Inflight Demonstration and Student Practice	0:30
Postflight Discussion	0:15
All Times Dependent on Pilot's Ability	

Equipment:

Aircraft	Drawing Surface and Marking Utensil

Instructor's Actions:	Student's Actions:
PREFLIGHT: • Discuss lesson objective • Discuss common student errors in performing the maneuver. • Discuss the FAA's emphasis on safety including collision avoidance and division of attention. **INFLIGHT:** • Demonstrate the maneuver. • Coach student practice.	**PREFLIGHT** • Discuss lesson objective. • Listens and takes notes. • Resolves Questions. **INFLIGHT** • Reviews maneuvers. • Pays attention and asks questions. • Practices maneuver as directed. • Answers questions posed by instructor. **POSTFLIGHT**

• Evaluate student understanding of maneuver. **POSTFLIGHT:** • Critique student performance. • Answer student questions. • Assign homework for next lesson.	• Ask pertinent questions. • Answers questions posed by instructor. • Critiques own performance. • Completes assigned homework.

Commercial Pilot Flight Training
Completion Standards: FAA-H-8081-12B (Commercial PTS, VI. 1-7)
1. Exhibits knowledge of the elements related to eights on pylons.
2. Determines the approximate pivotal altitude.
3. Selects suitable pylons, that will permit straight and level flight, between the pylons.
4. Enters the maneuver at the appropriate altitude and airspeed and at a bank angle of approximately 30° to 40° at the steepest point.
5. Applies the necessary corrections so that the line-of-sight reference line remains on the pylon.
6. Divides attention between accurate coordinated airplane control and outside visual references.
7. Holds pylon using appropriate pivotal altitude avoiding slips and skids.
Common Errors: FAA-H-8083-3A (Chapter 6-12)
1. Failure to adequately clear the area. 2. Skidding or slipping in turns (whether trying to hold the pylon with rudder or not). 3. Excessive gain or loss of altitude. 4. Over concentration on the pylon and failure to observe traffic. 5. Poor choice of pylons. 6. Not entering the pylon turns into the wind. 7. Failure to assume a heading when flying between pylons that will compensate sufficiently for drift. 8. Failure to time the bank so that the turn entry is completed with the pylon in position. 9. Abrupt control usage. 10. Inability to select pivotal altitude.

References:	
FAA-H-8083-3A (Chapter 6-12)	FAA-H-8081-12B (Commercial PTS, VI. 1-7)
FAA-H-8083-25A	

Things to Remember:
Correction for wind drift is done between the two pylons only Rolling on to a pylon too early makes it look like you need to descend as the pylon is in front of the reference Rolling on to a pylon too late makes it look like you need to climb as the pylon is behind the reference

When approaching the end of the first pylon turn have the student acquire the next pylon and climb to PA

Lesson Plan Notes:

Performing Eights-on-Pylons Maneuver:

MOTIVATION

The pylon eight is the most advanced and most difficult of the low altitude flight training maneuvers.

Because of the various techniques involved, the pylon eight is unsurpassed for teaching, developing, and testing subconscious control of the airplane. As the pylon eight is essentially an advanced maneuver in which the pilot's attention is directed at maintaining a pivotal position on a selected pylon, with a minimum of attention within the cockpit, it should not be introduced until the instructor is assured that the student has a complete grasp of the fundamentals. Thus, the prerequisites are the ability to make a coordinated turn without gain or loss of altitude, excellent feel of the airplane, stall recognition, relaxation with low altitude maneuvering, and an absence of the error of over concentration.

DESCRIPTION

This training maneuver involves flying the airplane in circular paths, alternately left and right, in the form of a **figure 8 around two selected points or pylons on the ground**. There is no attempt made to maintain a uniform distance from the pylon. In eights-on-pylons, **the distance from the pylons varies** if there is any **wind**. Instead, 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**. Also, the degree of bank increases as the distance from the pylon decreases.

The altitude that is appropriate for the airplane being flown is called the **pivotal altitude** and is governed by the **groundspeed**. While not truly a ground track maneuver as were the preceding maneuvers, the objective is similar to develop the ability to maneuver the airplane accurately while dividing one's attention between the flightpath and the selected points on the ground.

In explaining the performance of eights-on-pylons, the term "wingtip" is frequently considered as being synonymous with the proper reference line, or pivot point on the airplane. This interpretation is not always correct. High-wing, low-wing, swept wing, and tapered wing airplanes, as well as those with tandem or side-by-side seating, will all present different angles from the pilot's eye to the wingtip. Therefore, in the correct performance of eights-on-pylons, as in other maneuvers requiring a lateral reference, the pilot should use a sighting reference line that, from eye level, parallels the lateral axis of the airplane. The sighting point or line, while not necessarily on the wingtip itself, may be positioned in relation to the wingtip (ahead, behind, above, or below), but even then it will differ for each pilot, and from each seat in the airplane. This is especially true in tandem (fore and aft) seat airplanes. In side-by-side type airplanes, there will be very little variation in the sighting lines for different persons if those persons are seated so that the eyes of each are at approximately the same level.

An explanation of the **pivotal altitude** is also essential.

There is a specific altitude at which, when the airplane turns at a given groundspeed, a projection of the sighting reference line to the selected point on the ground will appear to pivot on that point. Since different airplanes fly at different airspeeds, the groundspeed will be different. Therefore, each airplane will have its own pivotal altitude. The pivotal altitude does not vary with the angle of bank being used unless the bank is steep enough to affect the groundspeed. A rule of thumb for estimating pivotal altitude in calm wind is to square the **true airspeed** and **divide** by **15** for **miles per hour (m.p.h.)** or **11.3** for **knots**. Distance from the pylon affects the angle of bank. At any **altitude above** that **pivotal altitude**, the projected reference line **will appear 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 will appear to **move forward** in a circular path.

DEMONSTRATION OF WING ALIGNMENT

To demonstrate this, the airplane is flown at normal cruising speed, and at an altitude estimated to be below the proper pivotal altitude, and then placed in a medium-banked turn. It will be seen that the projected reference line of sight appears to move forward along the ground (pylon moves back) as the airplane turns. A climb is then made to an altitude well above the pivotal altitude, and when the airplane is again at normal cruising speed, it is placed in a medium-banked turn. At this higher altitude, the projected reference line of

sight now appears to move backward across the ground (pylon moves forward) in a direction opposite that of flight.

After the high altitude extreme has been demonstrated, the power is reduced, and a descent at cruising speed begun in a continuing medium bank around the pylon. The apparent backward travel of the projected reference line with respect to the pylon will slow down as altitude is lost, stop for an instant, then start to reverse itself, and would move forward if the descent were allowed to continue below the pivotal altitude.

The altitude at which the line of sight apparently ceased to move across the ground is the pivotal altitude.

If the airplane descended below the pivotal altitude, power should be added to maintain airspeed while altitude is regained 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. The pivotal altitude is critical and will change with variations in groundspeed. Since the headings throughout the turns continually vary from directly downwind to directly upwind, the groundspeed will constantly change. This will result in the proper pivotal altitude varying slightly throughout the eight. Therefore, adjustment is made for this by climbing or descending, as necessary, to hold the reference line or point on the pylons. This change in altitude will be dependent on how much the wind affects the groundspeed.

It should be emphasized that the elevator is the primary control for maintaining the reference line on the pylons. Even a very slight variation in altitude effects a double correction, since in losing altitude, speed is gained, and even a slight climb reduces the airspeed. This variation in altitude, although important in holding the pylon, in most cases will be so slight as to be barely perceptible on a sensitive altimeter.

EXECUTING THE MANEUVER

BEGINNING

- Before beginning the maneuver, the pilot should select two points on the ground along a line which lies 90° to the direction of the wind.
- The area in which the maneuver is to be performed should be checked for obstructions and any other air traffic, and it should be located where a disturbance to groups of people, livestock, or communities will not result.
- The selection of proper pylons is of importance to good eights-on-pylons.
- They should be sufficiently prominent to be readily seen by the pilot when completing the turn around one pylon and heading for the next, and should be adequately spaced to provide time for planning the turns and yet not cause unnecessary straight-and-level flight between the pylons.
- The selected pylons should also be at the same elevation, since differences of over a very few feet will necessitate climbing or descending between each turn.
- For uniformity, the eight is usually begun 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 turn should be started by lowering the upwind wing to place the pilot's line of sight reference on the pylon.

- As the turn is continued, the line of sight reference can be held on the pylon by gradually increasing the bank.

- The reference line should appear to pivot on the pylon.
- As the airplane heads into the wind, the groundspeed decreases; consequently, the pivotal altitude is lower and the airplane must descend to hold the reference line on the pylon.
- As the turn progresses on the upwind side of the pylon, the wind becomes more of a crosswind.
- Since a constant distance from the pylon is not required on this maneuver, no correction to counteract drifting should be applied during the turns.
- If the reference line appears to move ahead of the pylon, the pilot should increase altitude.
- If the reference line appears to move behind the pylon, the pilot should decrease altitude.
- Varying rudder pressure to yaw the airplane and force the wing and reference line forward or backward to the pylon is a dangerous technique and must not be attempted.
- As the airplane turns toward a downwind heading, the rollout from the turn should be started to allow the airplane to proceed diagonally to a point on the downwind side of the second pylon.
- The rollout must be completed in the proper wind correction angle to correct for wind drift, so that the airplane will arrive at a point downwind from the second pylon the same distance it was from the first pylon at the beginning of the maneuver.
- Upon reaching that point, a turn is started in the opposite direction by lowering the upwind wing to again place the pilot’s line of sight reference on the pylon.
- The turn is then continued just as in the turn around the first pylon but in the opposite direction.
- With prompt correction, and a very fine control touch, it should be possible to hold the projection of the reference line directly on the pylon even in a stiff wind.
- Corrections for temporary variations, such as those caused by gusts or inattention, may be made by shallowing the bank to fly relatively straight to bring forward a lagging wing, or by steepening the bank temporarily to turn back a wing which has crept ahead.
- With practice, these corrections will become so slight as to be barely noticeable.
- These variations are apparent from the movement of the wingtips long before they are discernable on the altimeter.
- Pylon eights are performed at bank angles ranging from shallow to steep.
- It should be understood that the bank chosen will not alter the pivotal altitude.
- As proficiency is gained, increase the complexity of the maneuver by directing the student to enter at a distance from the pylon that will result in a specific bank angle at the steepest point in the pylon turn.
- The most common error in attempting to hold a pylon is incorrect use of the rudder.
- When the projection of the reference line moves forward with respect to the pylon, many pilots will tend to press the inside rudder to yaw the wing backward.
- When the reference line moves behind the pylon, they will press the outside rudder to yaw the wing forward. The rudder is to be used only as a coordination control.

Lesson Plan Notes:

Introduction

- ❑ Eights-on-pylons is a flight maneuver in which the airplane is flown in an approximate "figure-eight" flight path alternating around two pylons. During the turns on each pylon, a constant "line-of-sight" reference is maintained, so that the airplane appears to pivot around the pylon on the end of this reference line.

Attention

- ❑ While not a ground track maneuver, Eights on Pylons will develop the ability to maneuver the aircraft accurately while dividing attention between flight path and ground reference.

Motivation

- ❑ Eights on Pylons develop ability to control the ground speed of the aircraft during turns by changing airspeed, while developing fine control touch, and dividing attention.

DEVELOPMENT

- ❑ Explain the effect of flight in a moving air mass (boat in river with & without current analogy).
- ❑ As soon as airborne, free of ground friction, it is affected by the air mass it is in
- ❑ Wingtip vs. Proper reference line from pilot's eye level, parallels the lateral axis of the aircraft
- ❑ Explain pivotal altitude:
  - o Specific altitude at which when airplane turns at a given ground speed, a projection of the sighting reference line to the selected point on the ground will appear to pivot.
  - o Will not vary with bank angle
  - o PA = TAS_2 / 11.3 kts 100kts = 884' 106kts = 1000' 110kts = 1071'
- ❑ **Emphasize division of attention** 115kts = 1171' 120kts = 1274' 125kts = 1383'

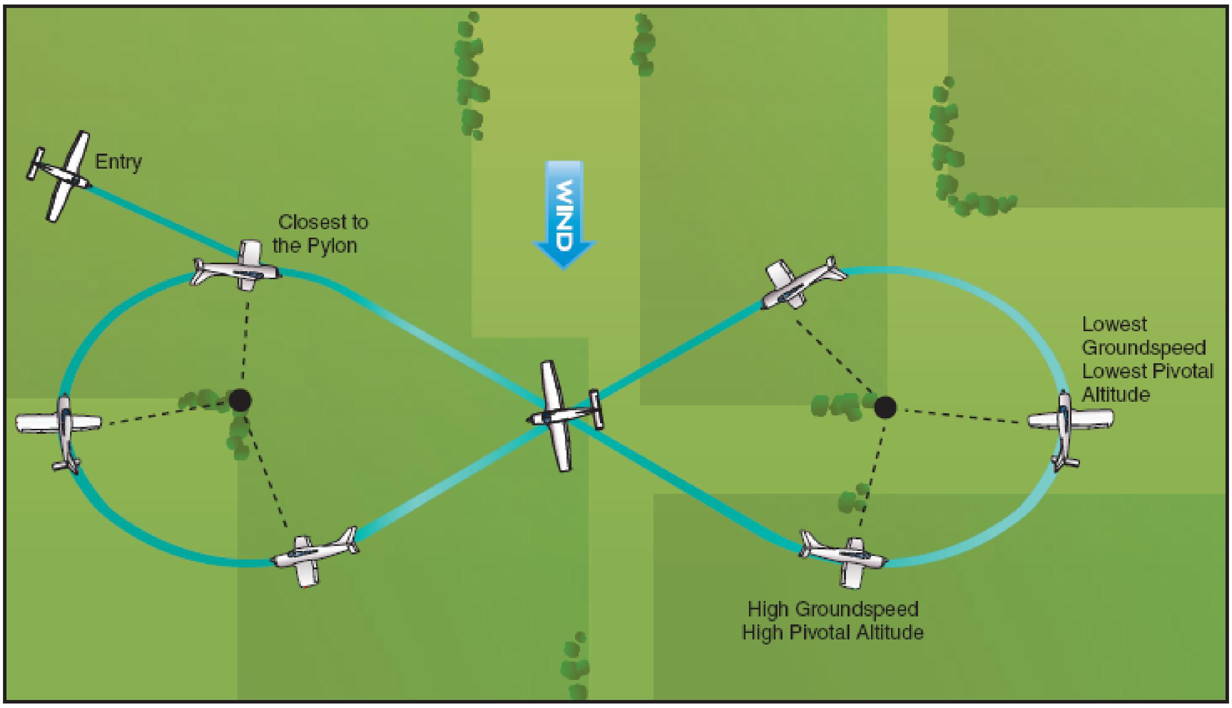
INFLIGHT

- ☐ Entry: Fly **45° to downwind** at **pivotal altitude**, so **first turn is into wind and to the left**
- ☐ **When the pylon is on the reference line, start the turn**. The line of site can be held by gradually increasing bank
- ☐ **Upwind:** GS decreases . PA is lower. Descend to hold reference line on the pylon
- ☐ **Crosswind:** The airplane will drift closer to pylon (constant dist not req, no adjustment). Increase bank to hold reference line while drifting inward.
- ☐ **Downwind:** rollout from the pylon when intercepting the 45 degree line between the two pylons and climb to Pivotal altitude. Crab to maintain correct entry distance for next pylon
- ☐ **Next Pylon:** Turn started in opposite direction. **When the pylon is on the reference line, start the turn**
- ☐ **Upwind:** GS decreases . PA is lower. Descend to hold reference line on the pylon
- ☐ **Crosswind:** The airplane will drift closer to pylon (constant dist not req, no adjustment). Increase bank to hold reference line while drifting inward.
- ☐ **Downwind:** rollout from the pylon when intercepting the 45 degree line between the two pylons and climb to Pivotal altitude. Crab to maintain correct entry distance for next pylon

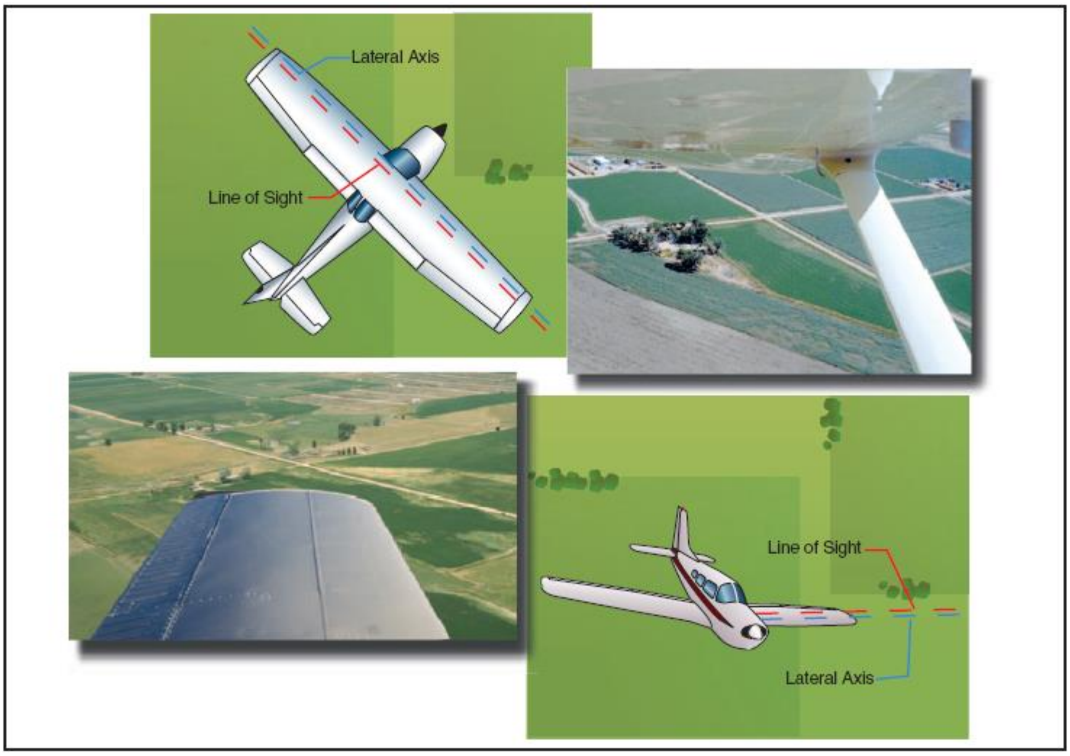
NOTE: If the Pylon is ahead of your reference line pivotal altitude is lower and therefore descend. If the Pylon is behind the reference line pivotal altitude is higher and therefore climb. Avoid using rudder to yaw the reference line into position. Use rudder only to coordinate the turns.

POSTFLIGHT

- ❑ Conduct a critique and review procedures and techniques.



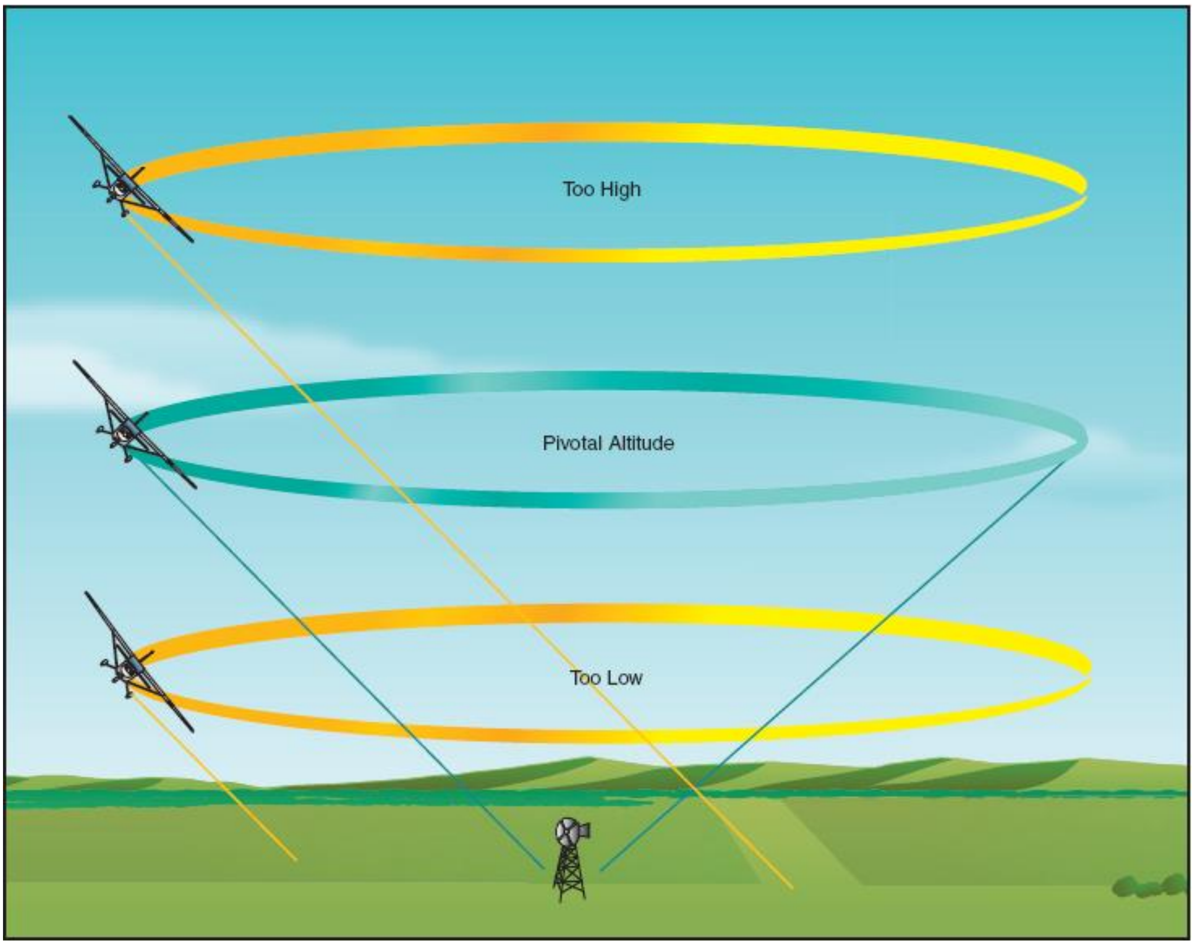
Eights on pylons



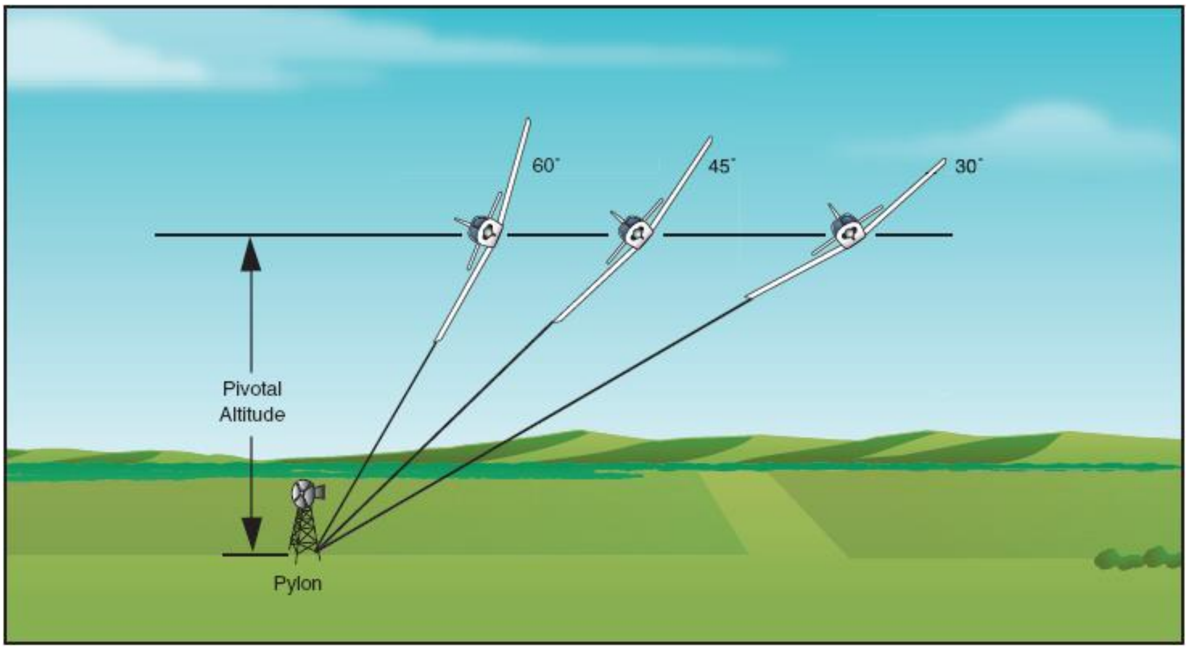
Line of sight

AIRSPEED		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

Approximate pivotal altitude table



Pivotal altitude



Bank angle does not affect pivotal altitude