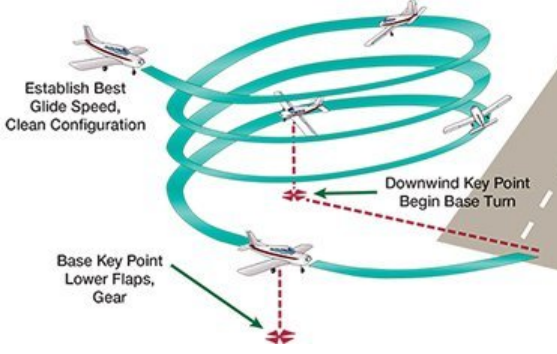


Steep Spirals

Objective	
<p>To ensure the applicant understands the elements of the steep spiral maneuver and how to perform it properly.</p>	
Purpose <p>The steep spiral maneuver is a gliding turn over a fixed ground reference point, commonly used as a tool to remain over a point from which a power off landing can be made. Learning to perform this maneuver correctly provides a valuable tool that can be used in an engine-out emergency scenario.</p>	
Schedule	Equipment
<ul style="list-style-type: none"> ● Ground Lesson: 15 minutes ● Initial <ul style="list-style-type: none"> ■ Flight 1: 30 minutes - <i>Introduction to Maneuver</i> ■ Flight 2: 30 minutes - <i>Improve Proficiency (Dual)</i> ● Solo <ul style="list-style-type: none"> ■ Flight 3: 20 minutes - <i>Improve Proficiency</i> ● Pre-Checkride <ul style="list-style-type: none"> ■ Flight 4: 20 minutes - <i>Demonstrate Proficiency</i> ● Debrief: 10 minutes (<i>per flight</i>) 	<ul style="list-style-type: none"> ● n/a
Student Actions	Instructor Actions
<ul style="list-style-type: none"> ● Ask any questions, receive study material for the next lesson. ● Watch linked video. ● Review listed references. ● After lesson, practice maneuver solo, ideally transitioning to a power-off 180 landing. 	<ul style="list-style-type: none"> ● Deliver the ground lesson (below). ● Demonstrate the maneuver in flight. ● Debrief after each flight.
Completion Standards	
<ul style="list-style-type: none"> ● Ground: Student can explain the purpose of the maneuver and how to execute it properly. ● Flight: Student can perform the maneuver to the applicable ACS standards. <ul style="list-style-type: none"> ● See expanded Completion Standards below. 	

References

- MzeroA Flight Training - Steep Spiral Landing
 - YouTube - https://www.youtube.com/watch?v=4t_Z7ZtkmcY
- FAA-H-8083-3B (Airplane Flying Handbook) - Chapter 9, Page 4 [Maneuver Description]
- FAA-H-8083-25B (Pilot's Handbook of Aeronautical Knowledge) - Chapter 5, Page 34 [Load Factors in Steep Turns]
- FAA-S-ACS-7A (Commercial Pilot ACS) - Area V Task B
- FAA-S-8081-6D (CFI PTS) - Area IX Task B

Ground Lesson Outline

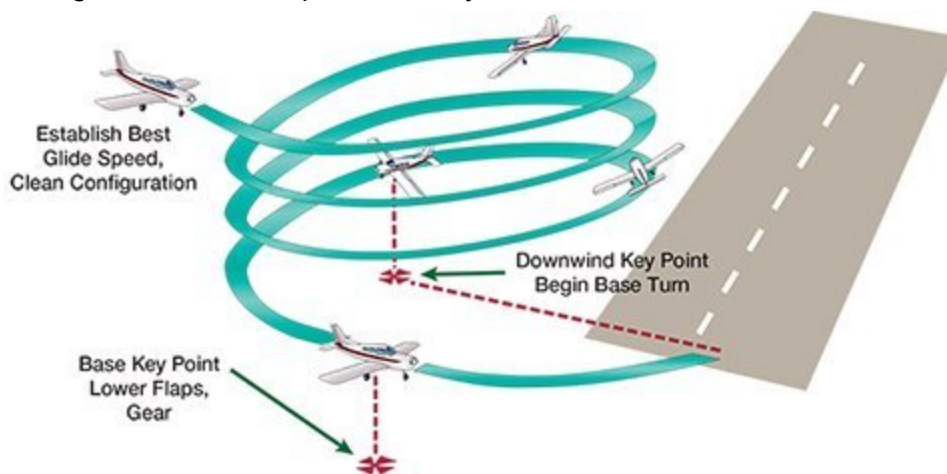
- When to use a Steep Spiral
 - Leads to an emergency landing/power off 180
- Positive load factor
 - Dissipate altitude quickly
- Managing bank angle
 - Relationship to ground speed
 - Bank more steeply downwind, etc.
- Safety considerations
 - Use of checklists
 - Visual traffic scanning
 - Clearing engine
- Maneuver Description - step-by-step
 - Entry position, airspeed, etc.
- Expanded Completion Standards

Common Errors

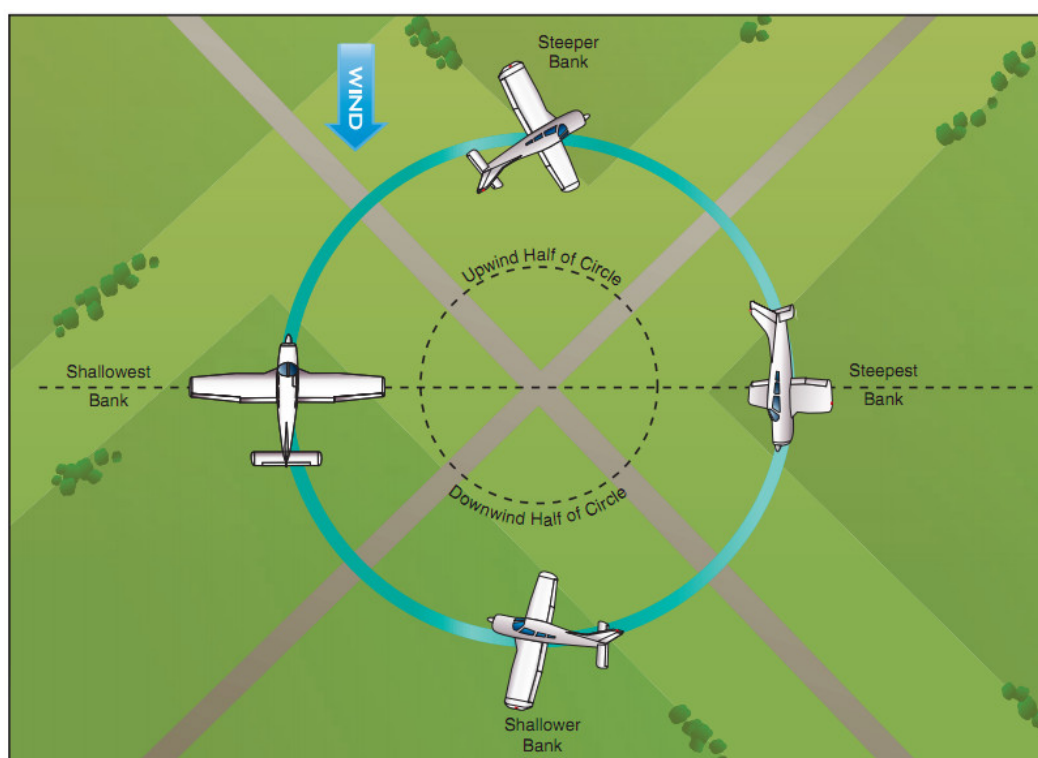
- Not clearing the area
- Inadequate pitch control on entry or rollout
- Gaining altitude
- **Not correcting the bank angle to compensate for wind**
- **Poor flight control coordination**
- Ineffective use of trim
- **Inadequate airspeed control**
- Becoming disoriented
- **Performing by reference to the flight instruments rather than visual references**
- Not scanning for other traffic during the maneuver
- **Not completing the turn on designated heading or reference (losing track of the number of revolutions or being disoriented)**
- Failing to clear the engine once per revolution

Ground Lesson Content

- **When To Use A Steep Spiral** - The steep spiral is used to lose altitude quickly while remaining over a point on the ground. In many emergency scenarios, this point is selected to be a point from which a power off landing could be accomplished safely.



- **Positive Load Factor** - By keeping the bank angle at a moderate value, typically 30-45 degrees, a significant amount of lift is directed towards the inside of the turn, necessitating a higher overall load factor to maintain a stable descent. This helps with dissipating altitude quickly, while remaining over the designated point.
- By performing this maneuver at a slow (near best glide) airspeed, the rate of turn will be high and the aircraft will remain close to the reference point.
- **Managing the Bank Angle** - In order to remain over the ground reference point, the angle of bank must be varied throughout the maneuver to account for the wind. As groundspeed decreases while upwind, less bank is required, but as groundspeed increases while downwind, more bank is required. *Constantly changing bank will require close attention to the coordination of the turns.*



- **Safety Considerations**

- **Checklists** - Pilots should complete a pre-maneuver checklist before beginning the maneuver.
- **Visual Traffic Scanning** - Pilots must remember to keep up their traffic scan throughout the maneuver.
- **Clearing the Engine** - Because the maneuver is performed while the engine is at idle for an extended period of time, carb heat may be required, and the engine should be periodically cleared (brought up to high power briefly), at least once per revolution, to prevent spark plug fouling.

Maneuver Description

- **Selecting a Ground Reference** - Select a prominent point, which is easy to identify and is clear of hazards on the ground. The point should ideally be something like a road intersection, selected over an unpopulated area. Do not plan to spiral over houses or other structures which could cause a nuisance.
- **Entry Position and Heading** - Aim to begin the maneuver approximately half a mile abeam the reference point. From high altitude, this may appear to be nearly straight down. Note the entry heading, and count the revolutions from this point. The maneuver should end on this heading, after 3 revolutions.
- **Entry Altitude** - A steep spiral should be *completed no lower than 1,500ft* AGL. The amount of altitude lost per revolution depends on the radius of the turn, airspeed, and other factors affecting glide performance. It is generally best to assume that each revolution may lose 600-700ft, and 3 full revolutions are required. Therefore, an entry altitude of at least *3,500ft* AGL should be planned.
- **Entry Airspeed** - The steep spiral is a gliding maneuver, and should be entered at approximately the **best glide** speed, with the engine power at idle.
- **Bank Angle** - Select a bank angle initially between *30 and 45 degrees*, and *at all times less than 60 degrees*, varying the bank angle to maintain a constant radius over a ground point. Because of the varying ground speed, this bank angle will not be constant. Aim to bank *no less than 30 degrees*, both to maintain positive load factors and to ensure each revolution will not lose excessive altitude and require the maneuver to be started at an impractically high entry altitude.
- **Coordination** - To track a constant radius around the reference point, the angle of bank will vary, which will require close attention to coordination. Proper coordination must be maintained at all times, as banking steeply at relatively low airspeeds requires caution to avoid a stall or spin.
- **This is a visual maneuver!** Eyes should remain outside the cockpit as much as possible to scan for traffic and ensure proper tracking of the ground reference point.

Expanded Completion Standards

- The pilot can explain the purpose of the steep spiral maneuver and how the various factors affect the performance of the maneuver.
- The pilot can perform the maneuver to the following standards:
 - Pilot clears the area, selects an altitude high enough for three 360 degree turns, selects a suitable ground reference point, and begins a descent at approximately best-glide speed.
 - Pilot begins a turn around the ground reference point at a distance such that the bank angle remains less than 60 degrees.
 - The pilot completes three 360 degree turns, clearing the engine once per revolution, and finishes above 1,500 ft AGL.
 - The pilot maintains coordinated flight, +/- 10 KIAS, and rolls out on the entry heading +/- 10 degrees.