

VI.G. Steep Turns

References: [Instrument Flying Handbook](#) (FAA-H-8083-15)

Objectives	The student should develop knowledge of the elements related to performing steep turns in IMC conditions.
Key Elements	<ol style="list-style-type: none">1. Establish, Trim, Crosscheck, Adjust2. Know and Use Approximate Pitch and Power Settings3. Scan, Scan, Scan
Elements	<ol style="list-style-type: none">1. General2. Full Panel Steep Turn3. Partial Panel Steep Turn
Schedule	<ol style="list-style-type: none">1. Discuss Objectives2. Review material3. Development4. Conclusion
Equipment	<ol style="list-style-type: none">1. White board and markers2. References
IP's Actions	<ol style="list-style-type: none">1. Discuss lesson objectives2. Present Lecture3. Ask and Answer Questions4. Assign homework
SP's Actions	<ol style="list-style-type: none">1. Participate in discussion2. Take notes3. Ask and respond to questions
Completion Standards	The student can complete a steep turn making the proper adjustments in order to maintain altitude and airspeed throughout the turn and recovering on the entry heading.

Instructors Notes:

Introduction:

Attention

Interesting fact or attention-grabbing story

Overview

Review Objectives and Elements/Key ideas

What

Standard rate turns are the desired turns in IMC conditions, but there are situations in which steeper bank angles will be necessary. The student will learn the control inputs necessary to maintain altitude and airspeed at higher angles of bank by reference to the instruments.

Why

Practicing steep turns will not only increase proficiency in the basic instrument flying skills, but also enable smooth, quick, and confident reactions to unexpected abnormal flight attitudes under instrument conditions.

How:

1. General

- A. In instrument flight, any turn greater than standard rate may be considered steep
- B. In principle, techniques for entering, maintaining, and recovering are the same as for shallow turns, but the steeper the bank, the greater the effects of aerodynamic forces on the airplane, thus:
 - a. Errors become more exaggerated, occur rapidly, and are more difficult to correct
 - b. Skill in crosscheck, interpretation, and control is increasingly important

2. Full Panel Steep Turn

- A. Entry and Maintaining the Turn
 - i. Establish the required pitch, bank power in the same way as for a shallow turn
 - a. Smooth, controlled inputs make for a smooth, controlled maneuver
 - b. As the bank steepens, the crosscheck will have to accelerate rapidly
 - c. Because of the greatly reduced vertical lift, pitch will have to be increased to a greater degree
 - Pitch is usually the most difficult part of this maneuver
 - Know and set the approximate pitch attitude required for the turn
 - The faster the roll-in, the faster pitch must be adjusted – slow and smooth is easier
 - d. Increased pitch results in increased drag so power must be increased to maintain airspeed



Figure 7-68. Steep left turn.

- Know and set the approximate power required to maintain airspeed
 - ii. Bank Control – Primary instrument is the Attitude Indicator
 - a. Maintain the bank angle on the Attitude Indicator (45°)
 - Use coordinated aileron and rudder throughout the entirety of the turn
 - Be alert to, and correct for, any overbanking tendency
 - b. Under / Overbanking can lead to large changes in altitude (more below)
 - c. Bank can also be used to correct altitude
 - If high, increased bank angle, without a corresponding pitch change, will reduce lift
 - If low, decreased bank angle, without a corresponding pitch change, increases lift
 - iii. Pitch control – Primary instrument is the Altimeter
 - a. Crosscheck the altimeter, along with the VSI, Airspeed, and Attitude Indicator for changes
 - b. Unless immediately noted and corrected, steep turns can lead to rapid loss of lift
 - The faster the change in bank, the more suddenly the change in lift occurs
 - Use an accelerated crosscheck with smooth, steady back pressure to maintain altitude
 - c. An overbank without a pitch change requires increasingly stronger back pressure to correct
 - The loss of vertical lift and increased wing loading reach a point where back pressure tightens the turn without raising the nose
 - d. Overbanking is recognized by a high bank angle, as well as a rapid downward movement of the altimeter, and VSI, and an increase in airspeed despite added of back pressure (diving spiral)
 - To recover:
 - a Immediately shallow the bank with coordinated aileron and rudder
 - b Hold or slightly relax elevator pressure and increase your crosscheck
 - c Reduce power if airspeed increase is rapid
 - iv. Power Control – Primary Instrument is the Airspeed Indicator
 - a. The power required to maintain a constant airspeed increases with bank and induced drag
 - b. Crosscheck the airspeed indicator during the turn and make necessary changes
- B. Recovery**
- i. Bank, pitch, and power must be coordinated for a smooth, level roll-out
 - ii. Begin the rollout approximately $\frac{1}{2}$ the bank angle prior to the desired heading
 - a. Adjust as you learn your roll-out tendencies / speed
 - iii. As bank is reduced, smoothly decrease pitch and power to return to straight-and-level flight
 - a. Just like the roll-in, smooth and steady is far easier to control
- 3. Partial Panel Steep Turn**
- A. General**
- i. Without an attitude indicator, the exact angle of bank is unknown
 - a. According to the Instrument Flying Handbook, any bank greater than standard is steep
 - ii. Heading indicator is replaced with the magnetic compass
 - iii. Increased rate of crosscheck is *especially* important at high bank angles *and* partial panel
- B. Entry and Maintaining the Turn**
- i. Smooth and steady roll-in, establishing the desired bank, pitch and power
 - ii. Turn coordinator is primary for bank
 - a. Keep the mini aircraft of the turn coordinator stable to maintain a constant turn

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- b. Exact angle of bank is unknown without an Attitude Indicator
- iii. The altimeter is primary for pitch
 - a. As bank increases, increased back pressure is required to maintain altitude
 - Smooth and steady roll-in makes a big difference here
 - b. Crosscheck the altimeter (as well as the VSI) for changes in altitude, adjust accordingly
- iv. The airspeed indicator is primary for power
 - a. Set the approximate known power setting to maintain airspeed during the turn
 - b. Monitor and adjust as necessary
- C. Recovery
 - i. The Magnetic Compass is used for the rollout
 - a. Take into account [compass errors](#) (ANDS, UNOS, etc.)
 - b. Plan ahead – know the compass indication where you will start the rollout
 - ii. Smooth and steady roll-out, establishing straight-and-level flight
 - a. As bank is reduced, lower the nose and reduce power
 - Crosscheck the altimeter and VSI to recognize level flight
 - Set the power setting for cruise flight

Common Errors

- Failure to recognize and make proper corrections for pitch, bank, or power errors
- Failure to compensate for precession of the horizon bar of the attitude indicator
- Uncoordinated use of controls
- Improper trim technique

Conclusion:

Brief review of the main points

PTS Requirements:

To determine that the applicant:

1. Exhibits instructional knowledge of timed turns to steep turns by describing-
 - A. procedure using full panel and partial panel for entry and recovery of a steep turn.
 - B. the need for a proper instrument cross-check.
 - C. roll-in/roll-out procedure.
 - D. coordination of control and trim.
2. Exhibits instructional knowledge of common errors related to steep turns by describing-
 - A. failure to recognize and make proper corrections for pitch, bank, or power errors.
 - B. failure to compensate for precession of the horizon bar of the attitude indicator.
 - C. uncoordinated use of controls.
 - D. improper trim technique.
3. Demonstrates and simultaneously explains steep turns from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to steep turns.

ACS Skills Standards

1. Maintain altitude ± 100 feet during level flight, selected headings $\pm 10^\circ$, airspeed ± 10 knots, and bank angles $\pm 5^\circ$ during turns.
2. Use proper instrument cross-check and interpretation, and apply the appropriate pitch, bank, power, and trim corrections when applicable.