Task X.B: S Turns Across a Road

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Lesson Overview

Objective

The student should develop knowledge of the elements related to S-turns as described in the ACS/PTS.

Reference

- Aircraft Flight Manual / Pilot's Operating Handbook
- Airplane Flying Handbook (FAA-H-8083-3B, page(s) 6-[8,9,10])

Key Elements

1. Wind Correction
2. Coordination
3. Emergency Landing Area

Elements

1. Purpose of S-turns
2. Selecting a Suitable Altitude
3. Selecting a Suitable Reference Line
4. The Basics
5. Performing S-Turns

Equipment

1. White board and markers
2. References
3. iPad

Instructor Actions

1. Discuss lesson objectives
2. Present Lecture
3. Ask and Answer Questions
4. Assign homework

Student Actions

1. Participate in discussion
2. Take notes
3. Ask and respond to questions

Schedule

1. Discuss Objectives
2. Review material
3. Development
4. Conclusion

Completion Standards

The student will understand the effects of wind on maintaining equilateral radii on each side of a reference line. The student will be able to make the necessary adjustments throughout the turns due to the airplane's changing position in relation to the wind.

Instructor Notes

Introduction

Attention

This maneuver will provide a much better understanding of how the wind effects turning the airplane. And, it's considered to be easier than the rectangular course you already learned.

Overview

- Review Objectives and Elements/Key ideas

Why

A maneuver in which the airplane's ground track describes semicircles of equal radii on each side of a selected straight line on the ground

Why

S-turns develop the ability to

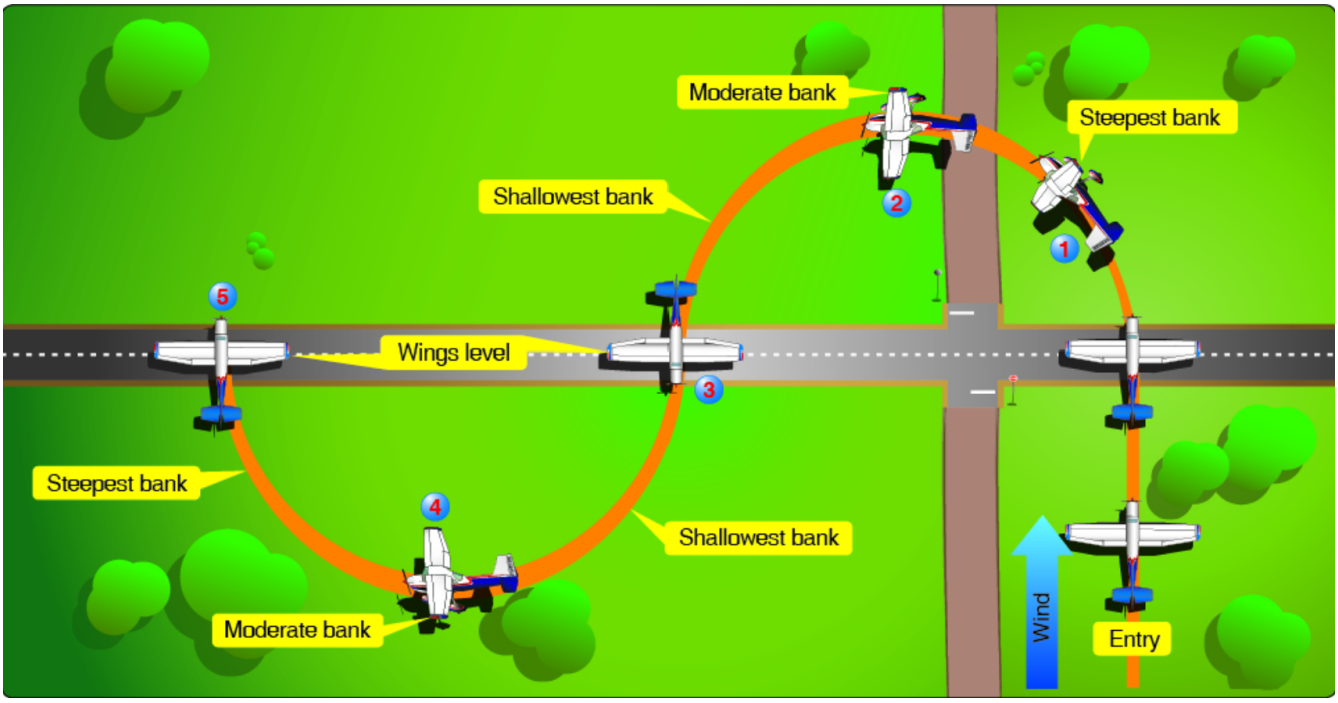
- Maintain a specific relationship between the airplane and the ground
- Divide attention between the flightpath, ground based references, manipulating the flight controls, and scanning for outside hazards and instrument indications
- Adjust the bank angle during turns to correct for groundspeed changes in order to maintain constant radius turns
- Roll out from a turn with the required wind correction angle to compensate for any drift caused by wind
- Establish and correct the wind correction angle in order to maintain the track over the ground
- Compensate for drift in quickly changing orientations
- Arrive at specific points on required headings

Lesson Details

This maneuver helps develop the ability to compensate for drift, orient the flight path with respect to a ground reference, follow an assigned ground track, arrive at specified points on assigned headings, and divide attention. These are general skills that will be utilized in many phases of flight throughout the pilot's flying career.

The maneuver consists of crossing the road at a 90° angle and beginning a series of 180° turns in opposite directions, re-crossing the road at a 90° angle as each 180° turn is completed. To accomplish a constant radius ground track requires changing the roll rate and angle of bank as both will increase and decrease as the groundspeed increases and decreases. On the downwind side the bank is steepest and is gradually reduced as the upwind side is approached.

The aircraft is rolled from one bank into the opposite as the reference on the ground is crossed. As with all ground reference maneuvers attention must be divided between the ground track and the aircraft. Bank is constantly changing to maintain the constant radius turns.



Before Starting

1. First select a starting altitude
    a. Entry altitudes should be between 600 feet and 1,000 feet AGL as per the ACS, with the altitude held within ±100 feet. At 600 feet there is no room for error below, and at 1,000 feet there is no room for error above. Thus 800 feet would be a good altitude to select.
2. Select a suitable reference line
    a. A straight ground reference should be selected, and could be a (straight) road, fence, railroad tracks, or a section line that is easily identifiable. The line must be sufficiently long to make a series of turns. Select a location clear of populations or hazards, and a location which would provide a landing area in case of an emergency during the maneuver.
3. Estimate wind direction using information from METARs, smoke, water, or a 360° turn noting ground track.
4. Perform the pre-maneuver checklist
    a. Fuel Pump - ON
    b. Mixture - RICH
    c. Gauges - GREEN
5. Ensure that the area is clear of traffic
6. Flaps and gear (if retractable) should be in the UP position.
7. The aircraft should be in straight-and-level flight at about 95 knots (but not above Va).

Flying the S-Turn Maneuver

1. Entry is made on the downwind, perpendicular to the line at 800 feet AGL with the aircraft trimmed for the entry altitude and airspeed to minimize workload.

2. When directly over the reference line immediately start the first turn.

Downwind Side

1. On the downwind side the groundspeed is greatest and the rate of departure from the road will be rapid.
    a. The roll needs to be fairly rapid and the bank fairly steep (40/45°) to attain the proper crab angle. This prevents the aircraft from flying too far from the road and from establishing an excessive radius
2. Through the first 90° of turn the aircraft's heading changes from a tailwind to a crosswind with the crab the greatest at the 90° point.
3. In the second 90° of turn the aircraft continues into an increasing headwind which decreases the groundspeed and rate of closure with the road gets slower.
    a. Shallow the bank during the remaining 90°, and adjust the bank angle to reach wings level as the turn is completed directly over the road.

Upwind Side

1. At the instant the road is crossed a turn in the opposite direction should be started.
2. Since the aircraft is still flying directly into a headwind the groundspeed is low therefore the turn will be started with a shallow bank. This will avoid an excessive rate of turn would would establish an excessively small radius turn.
3. Visualize the approach and increase bank slowly during the early part of the turn.
4. The angle of bank should establish a ground track with an equal radius to the previous turn.
5. Since the aircraft is traveling from a headwind to a tailwind the groundspeed will increase, and after 90° of turn the rate of closure with the road will increase rapidly. Therefore the angle of bank and rate of turn will have to be progressively increased so the aircraft will have turned a full 180° when it reaches the road.

Altitude, Airspeed, and Coordination

Throughout the maneuver a constant altitude must be maintained. Back pressure will need to be adjusted in the turns as bank is increased and decreased. This will require that the pilot divide their attention between the maneuver, outside references, as well as instrument indications.

> Maintain coordination during the maneuver, and don't use the rudder to turn the plane.

Maintaining altitude should result in a constant airspeed (±10 knots). Divide attention between the airspeed indicator and the maneuver, making small power adjustments as needed. Do not exceed 45° of bank which should keep the increased load factor from affecting airspeed.

> *Common Errors*
>
> - Faulty entry procedure

- Poor planning, orientation, or division of attention
- Uncoordinated use of flight controls
- Improper correction for wind drift
- An unsymmetrical ground track
- Failure to maintain selected altitude or airspeed
- Selection of a ground reference line without a suitable emergency landing area * in gliding distance

Conclusion

Bank is constantly changing to track a constant radius turn on each side of the reference line as the airplane’s position relative to the wind is changing.

ACS Requirements

CFI PTS Standards

To determine that the applicant

1. Exhibits instructional knowledge of the elements of S-turns across a road by describing:
    a. The purpose of S-turns across a road and their relationship to basic/advanced airmanship skills.
    b. How to select a suitable altitude.
    c. How to select a suitable ground reference line with consideration given to emergency landing areas.
    d. Orientation, division of attention, and planning.
    e. Configuration and airspeed prior to entry.
    f. Entry procedure.
    g. Wind drifts correction.
    h. Tracking of semicircles of equal radii on either side of the selected ground reference line.
    i. How to maintain desired altitude and airspeed.
    j. Turn reversal over the ground reference line.
    k. Coordination of flight controls.
2. Exhibits instructional knowledge of common errors related to S-turns across a road by describing:
    a. Faulty entry procedure.
    b. Poor planning, orientation, or division of attention.

c. Uncoordinated use of flight controls.
d. Improper correction for wind drift.
e. An unsymmetrical ground track.
f. Failure to maintain selected altitude or airspeed.
g. Selection of a ground reference line where there is no suitable emergency landing area within gliding distance.

3. Demonstrates and simultaneously explains S-turns across a road from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to S-turns across a road.

Private Pilot ACS Skills Standards

1. Clear the area.
2. Select a suitable ground reference area, line, or point as appropriate.
3. Plan the maneuver:
4. S-turns: enter perpendicular to the selected reference line, 600 to 1,000 feet AGL at an appropriate distance from the selected reference area
5. Apply adequate wind drift correction during straight and turning flight to maintain a constant ground track around a rectangular reference area, or to maintain a constant radius turn on each side of a selected reference line or point.
6. Reverse the turn directly over the selected reference line.
7. Divide attention between airplane control, traffic avoidance and the ground track while maintaining coordinated flight.
8. Maintain altitude ±100 feet; maintain airspeed ±10 knots.