Task X.A: Rectangular Course

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Lesson Overview

Objective

The student should develop knowledge of the elements related to the rectangular course and the elements involved in maintaining a proper ground track. The student will have the ability to perform the maneuver as required in the ACS/PTS.

Reference

- Aircraft Flight Manual / Pilot's Operating Handbook
- Airplane Flying Handbook (FAA-H-8083-3 Pages 6-[6,7])

Key Elements

1. Plan Ahead
2. Wind Corrections
3. Coordination

Elements

1. Selecting a Suitable Altitude
2. Selecting a Suitable Reference Point
3. The Basics
4. Performing the Rectangular Course

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 understands how wind can affect the ground track of the airplane and has the ability to make the necessary corrections in order to maintain a uniform ground track, especially while in the traffic pattern.

Instructor Notes

Attention

This maneuver will make the traffic pattern much more natural and easier…

Overview

- Review Objectives and Elements/Key ideas

What

A training maneuver in which the ground track of the airplane is equidistant from all sides of a selected rectangular area on the ground.

Why

- This maneuver simulates the conditions encountered in a traffic pattern and therefore prepares the student for traffic pattern work.
    a. Maintaining a specific relationship between the airplane and the ground
    b. Dividing attention between the flightpath, ground based references, manipulating the flight controls, and scanning for outside hazards and instrument indications
    c. Adjusting the bank angle during turns to correct for groundspeed changes in order to maintain constant radius turns
    d. Rolling out from a turn with the required wind correction angle to compensate for any drift caused by wind

e. Establishing and correcting the wind correction angle in order to maintain the track over the ground

f. Preparing the pilot for the airport traffic pattern and subsequent landing practice

Lesson Details

The Basics

The aircraft should be flown parallel to, and at a uniform distance from, about 1/4 to 1/2 mile from the boundaries. Do not fly directly above the boundaries as that would not provide an adequate visual reference. All turns should be started when the aircraft is abeam the corner of the boundary. The closer the aircraft is to the boundary the steeper the turns will be required to make the corner, and turns should be limited to no more than 45° of bank.

To maintain a course parallel to and of equal distance from the bondaries, wind must be taken into account. Whenever there is crosswind the aircraft will need to be flown in a crab. The amount of bank in a turn will also vary with the amount of wind. The faster the groundspeed (created by a tailwind) the steeper the bank required to make the turn, and a slower groundspeed (headwind) will require a less steep bank. During turns the altitude must be maintaind which will required some amount of control back pressure. Airspeed is maintained by increasing or decreasing power as needed.

This maneuver requires that attention be divided between the distance, making turns, maintaining altitude, and maintaining airspeed. This requires that the pilot plan ahead. Poor planning will end up with poor results.

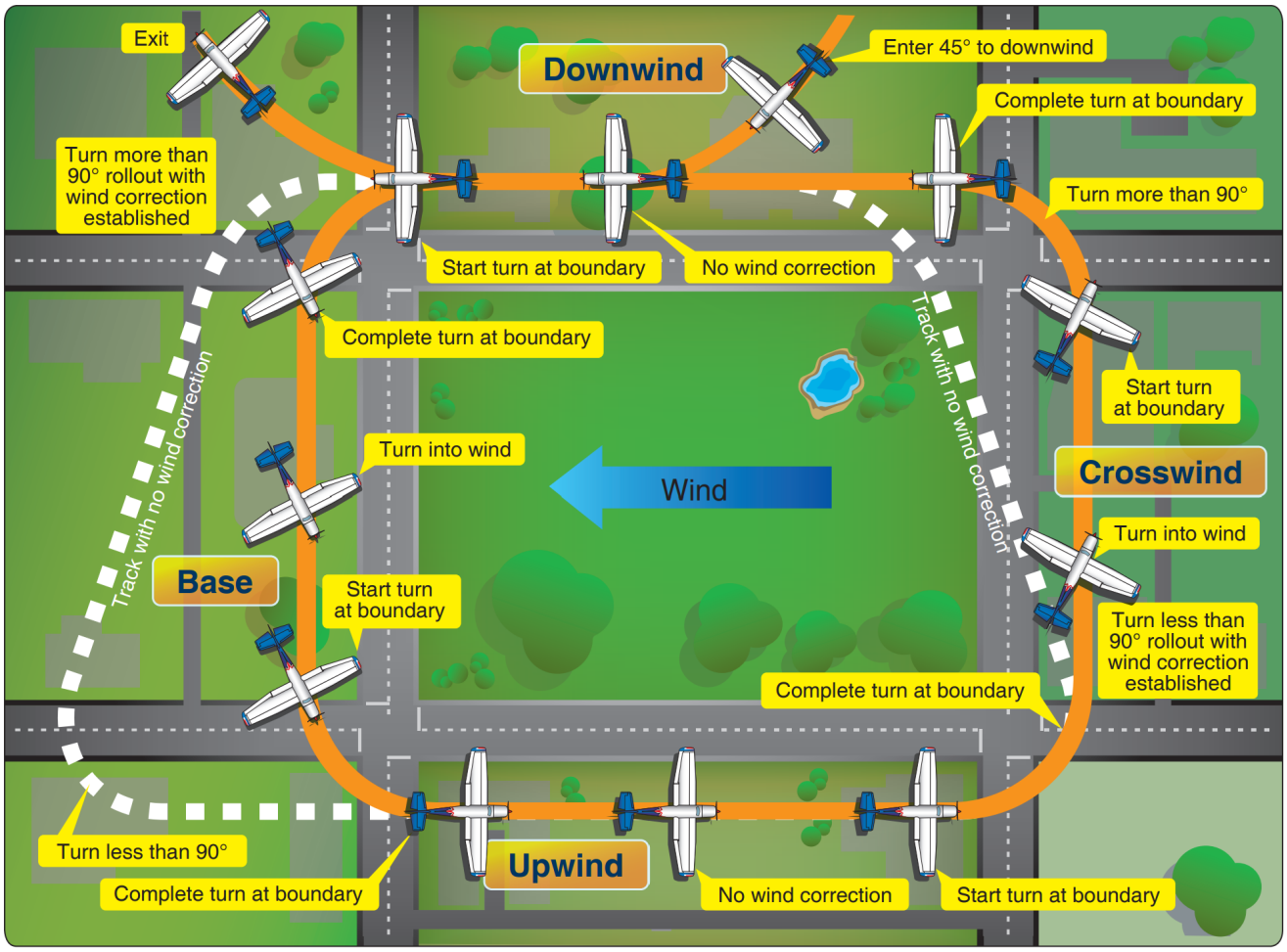

Figure 6-4. *Rectangular course.*

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 points
    a. A square or rectangular field or area bounded on four sides by section lines or roads are ideal. Sides should be approximately 1 mile in length. 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 Rectangular Course

1. Entry is made at a 45° angle to the downwind leg (as would be done entering the traffic pattern).
2. Upon reaching the 1/2 to 1/4 mile point from the field turn to a downwind heading parallel to the field

Downwind Leg

1. Since the airplane has (theoretically) a direct tailwind no wind correction is required
2. Observe the next boundary (or reference point) and plan for the turn. The tailwind results in a higher groundspeed thus the turn to the next leg is entered with a fast rate of roll-in and a relatively (compared to other turns) steep bank. As the turn progresses bank is reduced slowly since the tailwind (and thus the groundspeed) are reducing.

Base Leg

1. On the base leg the wind will tend to drive the aircraft away from the field
    a. To compensate for the drift the turn to base will have to be greater than 90°, and a crab will have to be established. When rolling out onto this leg the aircraft will be turned slightly toward the field and into the wind.
2. Maintain the same distance from the field boundary, at the same altitude, for the length of the leg.
3. Continue the leg until the upwind leg boundary is being approached.
4. Since drift correction was maintained on the base leg, the turn to the upwind will be less than 90°. Start the turn with a medium bank and decrease the bank as the crosswind becomes a headwind. The rollout should be timed such that the aircraft is parallel to the boundary as the wings roll level.

Upwind Leg

1. On the upwind leg no wind correction will be needed since the aircraft is headed directly into the wind.
2. Maintain distance from the field, and maintain altitude. Use visual references to maintain distance, and cross check with the instruments.
3. Observe the next boundary as it is being approached in order to plan the turn to the crosswind
    a. Due to the headwind (slowest groundspeed) the turn to the crosswind leg will begin with a shallow bank.
    b. Because of the crosswind the aircraft will tend to drive toward the field. To compensate for this drift the turn will need to be stopped before the 90° point and a crab away from the field and into the wind will need to be established.

Crosswind Leg

1. While on the crosswind leg the wind correction angle should be adjusted to maintain a consistent distance from the field.
2. Observe the next boundary point and begin to plan for the turn to downwind.
    - Since the wind correction angle is being held into the wind the turn to downwind will be greater than 90°, and the crosswind will become a tailwind. So the bank is initially medium and will increase through the turn. Plan accordingly.

Anomalies

In a perfect scenario, drift is not encountered on the upwind/downwind legs.

- It may be difficult to find a situation where the wind is blowing exactly parallel to the boundaries
- Therefore, slight wind correction may be necessary on all the legs

Coordination

The airplane should remain coordinated at all times. Do not use the rudder to correct for wind drift, but turn the plane with coordinated controls to crap instead. Also, don't use the rudder to encourage a turn as that can result in a dangerous cross-controlled situation.

Common Errors

- Poor planning, orientation, division of attention
- Uncoordinated flight control application
- Improper correction for wind drift
- Failure to maintain selected altitude or airspeed
- Selection of a ground reference without a suitable emergency landing area within gliding distance

Conclusion

It is important to anticipate turns to correct for GS, drift, and turning radius. When wind is with the plane, turns must be steeper; when it's against, turns must be slow/shallow. The same techniques apply in traffic patterns.

ACS Requirements

CFI PTS Standard

To determine that the applicant

1. Exhibits instructional knowledge of the elements of a rectangular course by describing:
    a. How to select a suitable altitude.
    b. How to select a suitable ground reference with consideration given to emergency landing areas.
    c. Orientation, division of attention, and planning.
    d. Configuration and airspeed prior to entry.
    e. Relationship of a rectangular course to an airport traffic pattern.
    f. Wind drifts correction.
    g. How to maintain desired altitude, airspeed, and distance from ground reference boundaries.
    h. Timing of turn entries and rollouts.
    i. Coordination of flight controls.
2. Exhibits instructional knowledge of common errors related to a rectangular course by describing:
    a. Poor planning, orientation, or division of attention.
    b. Uncoordinated use of flight controls.
    c. Improper correction for wind drift.
    d. Failure to maintain selected altitude or airspeed.
    e. Selection of a ground reference where there is no suitable emergency landing area within gliding distance.
3. Demonstrates and simultaneously explains a rectangular course from an instructional standpoint.
4. Analyzes and corrects simulated common errors related to a rectangular course.

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: Rectangular course: enter a left or right pattern, 600 to 1,000 feet above ground level (AGL) at an appropriate distance from the selected reference area, 45° to the downwind leg
4. 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.
5. Divide attention between airplane control, traffic avoidance and the ground track while maintaining coordinated flight.

6. Maintain altitude ±100 feet; maintain airspeed ±10 knots.