

X.A. Rectangular Course

Objectives	The student should develop knowledge of the elements related to rectangular courses and the proper elements involved in maintaining a proper ground track as in the traffic pattern. The student should have the ability to perform the maneuver as required in the necessary ACS.
Key Elements	<ul style="list-style-type: none">✈ Plan ahead✈ Wind corrections✈ Coordination
Elements	<ul style="list-style-type: none">✈ Selecting a suitable altitude✈ Selecting a suitable reference line✈ The basics✈ Prior to entry✈ The maneuver✈ Coordination
Schedule	<ol style="list-style-type: none">1. Discuss objectives2. Review material3. Development4. Conclusion
Equipment	<ul style="list-style-type: none">✈ White board✈ Markers✈ References
Instructor's Actions	<ol style="list-style-type: none">1. Discuss lesson objectives2. Present lecture3. Questions4. Homework
Student's Actions	Participate in discussion Take notes
Completion Standards	The student understands the effects of wind on the airplane's ground track and can make the necessary corrections to maintain a uniform ground track while in the traffic pattern.
References	FAA-H-8083-3B, <i>Airplane Flying Handbook</i> (Chapter 6)

Instructor Notes

Introduction

Overview—review objectives and key ideas.

What—ground track of airplane is equidistant from all sides of a selected rectangular area on the ground.

Why—to simulate the conditions encountered in a traffic pattern and prepare the student for traffic pattern work. It assists in improving the practical application of the turns, the division of attention between flight path, ground objects, and airplane handling, the timing of the start of the turn and the recovery from the turn to maintain a ground track, and the establishing of a ground track and determining the appropriate crab angle.

Selecting a suitable altitude

Entry altitude should be 600-1000' AGL.

Maneuver restrictions are $\pm 100'$. At 600' AGL, there is no room for error below, and at 1,000' AGL, there is no room for error above—800' AGL is a good altitude for the maneuver.

Selecting a suitable reference point

Ideally, choose a square or rectangular field; an area bounded by four sides by section lines or roads, approximately 1 mile in length. Stay clear of populated areas, obstructions, or anything that could pose a hazard. Estimate wind direction and try to align one leg parallel with the wind.

CE—Selection of a ground reference without a suitable emergency landing area within gliding distance.

- ✦ Always be prepared for emergencies.
- ✦ Select a reference field that would allow you to do an emergency landing.

The basics

Fly the plane parallel to the boundaries at a uniform distance ($\sim 1/4$ to $1/2$ mile distance).

Start turns when abeam the corner of the boundaries, turn at $\sim 45^\circ$.

- ✦ Flying closer to the boundary requires steeper banks.
- ✦ Amount of bank varies with groundspeed. Faster groundspeed = steeper bank.
- ✦ May need to increase back pressure to maintain altitude.

Correct for the wind to maintain a parallel equidistant course.

- ✦ Crab into the wind whenever there is crosswind.

CE—improper correction for wind drift.

- ✦ Either from not understanding the effects of wind or from not dividing attention.

Keep airspeed constant by adjusting power as necessary.

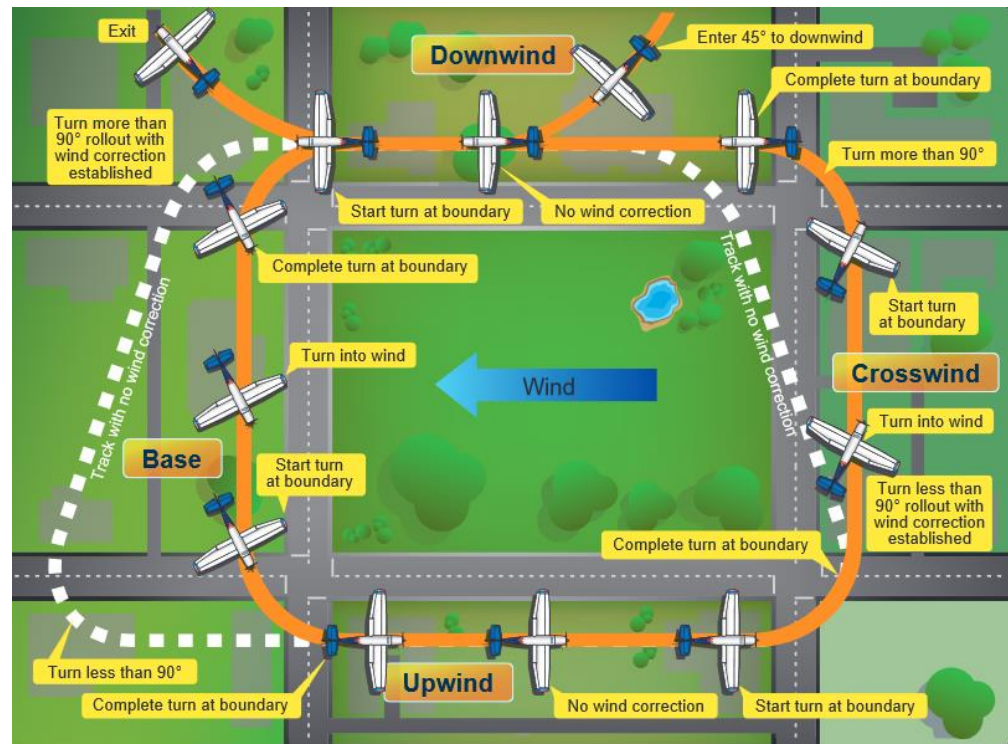
CE—failure to maintain selected altitude or airspeed.

- ✦ Due to poor division of attention and/or lack of proper pitch awareness.
- ✦ Not exceeding 45° of bank should help maintain airspeed.

Divide attention between distance, turns, altitude, and airspeed. Plan ahead and do not fixate on one part of the maneuver.

CE—poor planning, orientation, division of attention.

- ✦ This can result in not beginning/ending the turns properly and not establishing crosswind correction.
- ✦ Hinders altitude, airspeed, and ground track.



Prior to entry

- ✦ Pre-maneuver checklist: Lights ON; Fuel Pump ON; Mixture FULL RICH; Gauges GREEN
- ✦ Clearing turns
- ✦ Airspeed: trim for hands of level flight at 95 knots prior to entry

Entry procedure

Determine the direction of the wind by observing smoke or water, interpolating between the surface wind and forecast winds aloft, or flying a wind drift circle—a constant rate turn while watching a point, noting the movement of the airplane in relation to it.

- ✦ Position the aircraft to enter at a 45° to the downwind.
- ✦ Clearing turns.
- ✦ Airspeed: 95 knots and trimmed for hands off, level flight.

Flying the maneuver

Make entry 45° to downwind. Upon reaching ¼ to ½ mile from the field, turn to a downwind heading parallel to the field.

Downwind: no wind correction needed—direct tailwind. Plan the turn—tailwind results in increased groundspeed, so enter at a relatively steep bank and reduce the bank as the turn progresses and the tailwind and groundspeed are decreasing.

Base: the wind will tend to drift the airplane away from the field during and after the turn into the leg, so turn more than 90° and establish a crab into the wind. When rolling out, turn the airplane slightly toward the field/into the wind. Maintain a constant distance from the field. Turn less than 90° for upwind, starting with a medium bank and reducing it to a shallow bank as groundspeed is decreasing. Time the rollout to parallel the boundary as wings come level.

Upwind: plane headed into wind so no correction needed—maintain distance and altitude. Turn to crosswind will be slow with a shallow bank, because the groundspeed is reduced. The wind will drift the plane toward the field. Decreasing headwind increases groundspeed, so bank must be gradually increased—stop the turn before reaching 90° and crab the airplane into the wind.

Crosswind: Adjust wind correction angle to maintain distance, and plan turn to downwind. Turn will be more than 90°—crosswind becomes a tailwind, so bank starts out as medium and is increased. Time rollout so that wings are level when aligned with the crosswind corner.

If you can't find wind blowing parallel to boundaries, a slight correction may be necessary on all legs.

Coordination

Maintain coordination at all times. Don't use rudder to correct for wind drift or encourage a turn; rather turn the plane with coordinated controls.

CE—uncoordinated flight control application.

✦ Normally occurs when fixating on the boundaries and attempt to use rudder to correct drift.

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

Brief review of main points.
Anticipate turns to correct for groundspeed, drift, and turning radius.
Tailwind = steeper turns, headwind = shallower turn.
Apply the same technique to traffic patterns!

CFI PTS

Objective: 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 line 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 and airspeed from ground reference boundaries.
 - h. Coordination of flight controls.

2. Exhibits instructional knowledge of common errors related to 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 line 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.

PPL ACS

Objective: To determine that the applicant:

1. Demonstrates understanding of:
 - a. Purpose of ground reference maneuvers.
 - b. Effects of wind on ground track and relation to a ground reference point.
 - c. Effects of bank angle and groundspeed on rate and radius of turn.
 - d. Relationship of rectangular course to airport pattern.

2. Demonstrates the ability to:
 - a. Clear the area.
 - b. Selects a suitable ground reference area, line, or point as appropriate.
 - c. Plans the maneuver so as to enter a left or right pattern, 600 to 1,000 feet AGL, at an appropriate distance from the selected reference area, 45° to the downwind leg.
 - d. 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.
 - e. Divide attention between airplane control and the ground track while maintaining coordinated flight.
 - f. Maintains altitude, ± 100 feet; maintains airspeed, ± 10 knots.