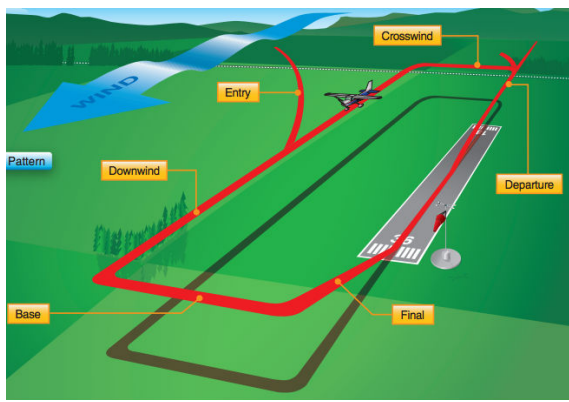


## Rectangular Course Maneuver

<b>Objective</b>	
<p>To ensure the applicant learns the purpose of and can exhibit a clear understanding of the rectangular course maneuver and how to perform the maneuver properly.</p>	
<b>Purpose</b> <p>The rectangular course maneuver is intended to simulate the pattern that we will fly when landing at an airport. It introduces the concept of the airport traffic pattern, traffic pattern entry, and demonstrates the effect of wind on the airplane's ground track, as well as corrections necessary to counteract the wind.</p>	
<b>Schedule</b>	<b>Equipment</b>
<ul style="list-style-type: none"> <li>● <b>Ground Lesson:</b> 15 minutes</li> <li>● Initial <ul style="list-style-type: none"> <li>■ <b>Flight 1:</b> 40 minutes - <i>Introduction to Maneuver</i></li> <li>■ <b>Flight 2:</b> 40 minutes - <i>Improve Proficiency (Dual)</i></li> </ul> </li> <li>● Solo <ul style="list-style-type: none"> <li>■ <b>Flight 3:</b> 20 minutes - <i>Improve Proficiency</i></li> </ul> </li> <li>● Pre-Checkride <ul style="list-style-type: none"> <li>■ <b>Flight 4:</b> 20 minutes - <i>Demonstrate Proficiency</i></li> </ul> </li> <li>● <b>Debrief:</b> 10 minutes (<i>per flight</i>)</li> </ul>	<ul style="list-style-type: none"> <li>● n/a</li> </ul>
<b>Student Actions</b>	<b>Instructor Actions</b>
<ul style="list-style-type: none"> <li>● Ask any questions, receive study material for the next lesson.</li> <li>● Watch linked video.</li> <li>● Review listed references.</li> </ul>	<ul style="list-style-type: none"> <li>● Deliver the ground lesson (below).</li> <li>● Demonstrate the maneuver in flight.</li> <li>● Debrief after each flight.</li> </ul>
<b>Completion Standards</b>	
<ul style="list-style-type: none"> <li>● <b>Ground:</b> Student can explain the purpose of the maneuver and how to execute it properly.</li> <li>● <b>Flight:</b> Student can perform the maneuver to the applicable ACS standards. <ul style="list-style-type: none"> <li>● See expanded Completion Standards below.</li> </ul> </li> </ul>	

## References

- ERAUSpecialVFR - "Traffic Patterns"
  - YouTube - [https://www.youtube.com/watch?v=w\\_Bbs4K7L5U](https://www.youtube.com/watch?v=w_Bbs4K7L5U)
- AIM - Page 187-189 [Traffic Patterns, Entry]
- FAA-H-8083-3B (Airplane Flying Handbook) - Chapter 6, Page 6-8 [Maneuver Description]
- FAA-S-ACS-6B (Private Pilot ACS) - Area V Task B Skill 3a
- FAA-S-8081-6D (CFI PTS) - Area X Task A

## Ground Lesson Outline

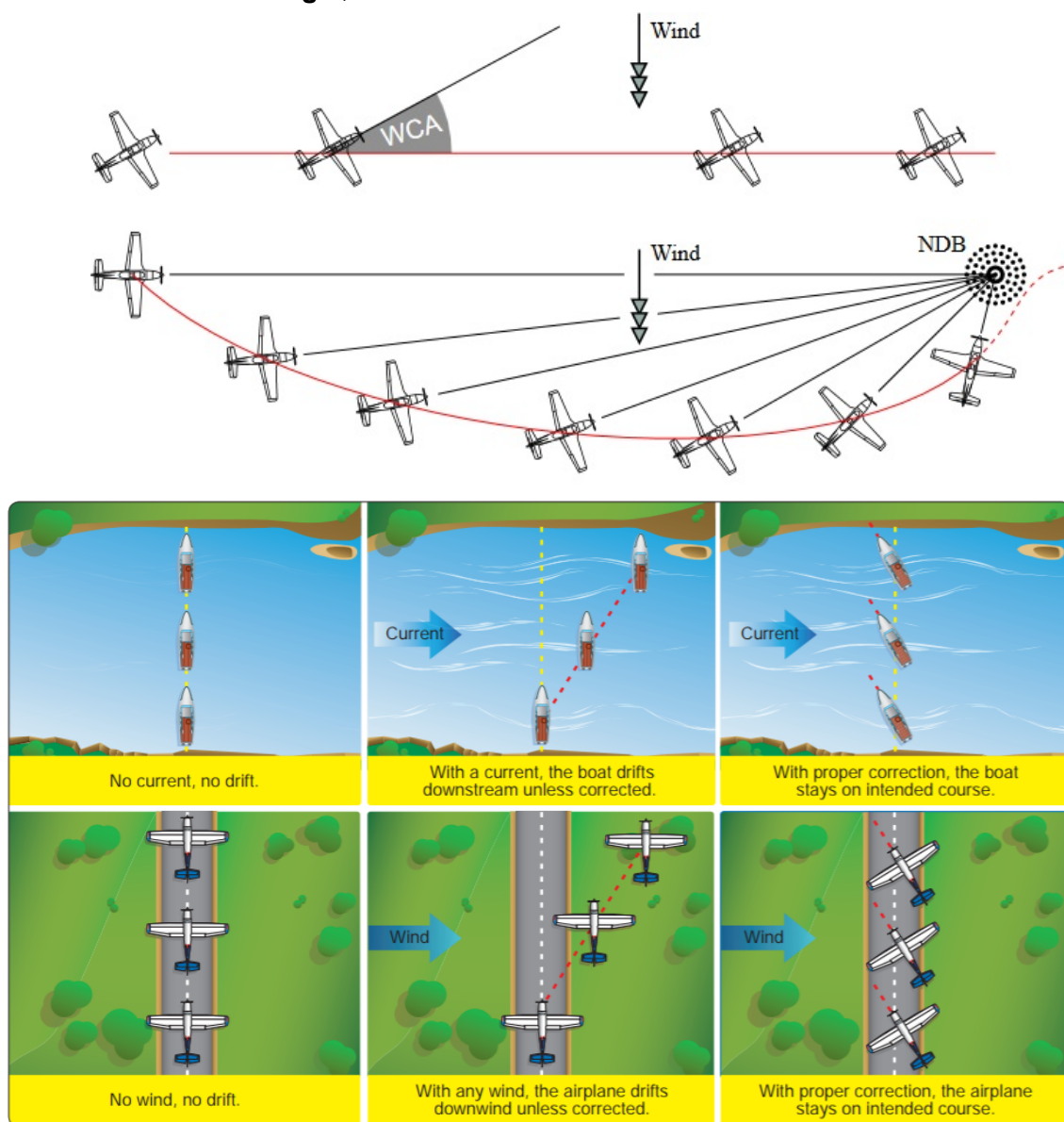
- The Rectangular Course
  - Heading vs. Course
  - Wind Correction Angle
- Airport Traffic Patterns
  - Upwind, Crosswind, Downwind, Base, Final
- Ground Reference Maneuvers
  - Selecting an area
- Wind Correction
- Coordination
- Safety considerations
  - Use of checklists
  - Emergency Landing Area
  - Visual traffic scanning
- Maneuver Description - step-by-step
  - Entry position, airspeed, etc.
- Expanded Completion Standards

## Common Errors

- Failure to adequately clear the area above, below, and on either side of the airplane for safety hazards, initially and throughout the maneuver.
- Selection of a ground reference where there is no suitable emergency landing area within gliding distance.
- **Failure to properly assess wind direction.**
- Failure to establish a constant, level altitude prior to entering the maneuver.
- **Failure to maintain altitude or airspeed during the maneuver.**
- Failure to manipulate the flight controls in a smooth and continuous manner.
- **Failure to properly divide attention between controlling the airplane and maintaining proper orientation with the ground references.**
- Failure to execute turns with accurate timing.
- **Uncoordinated use of flight controls.**
- **Improper correction for wind drift.**

## Ground Lesson Content

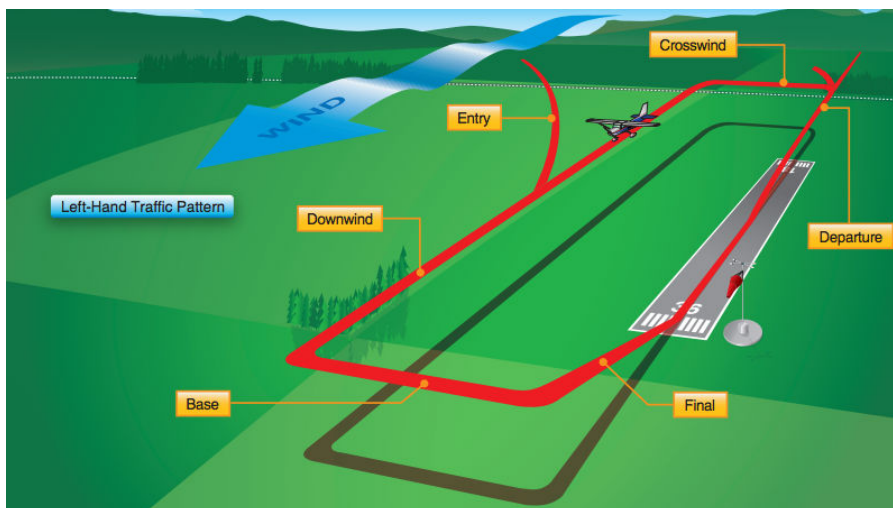
- The Rectangular Course** - The rectangular course ground reference maneuver is a basic building block of a pilot's skillset. It is nothing more than it sounds: flying a rectangular course over the ground. The challenge of this maneuver, however, is that airplanes fly within the air, which is nearly always moving. Simply pointing at a ground landmark and flying 'towards' it will result in the airplane flying a longer, curved path. As an airplane flies through the air, in order to track a straight line, called a *course* line, they must fly at an angle relative to the line which counteracts the effects of the wind. This is called a **wind correction angle**, or WCA.



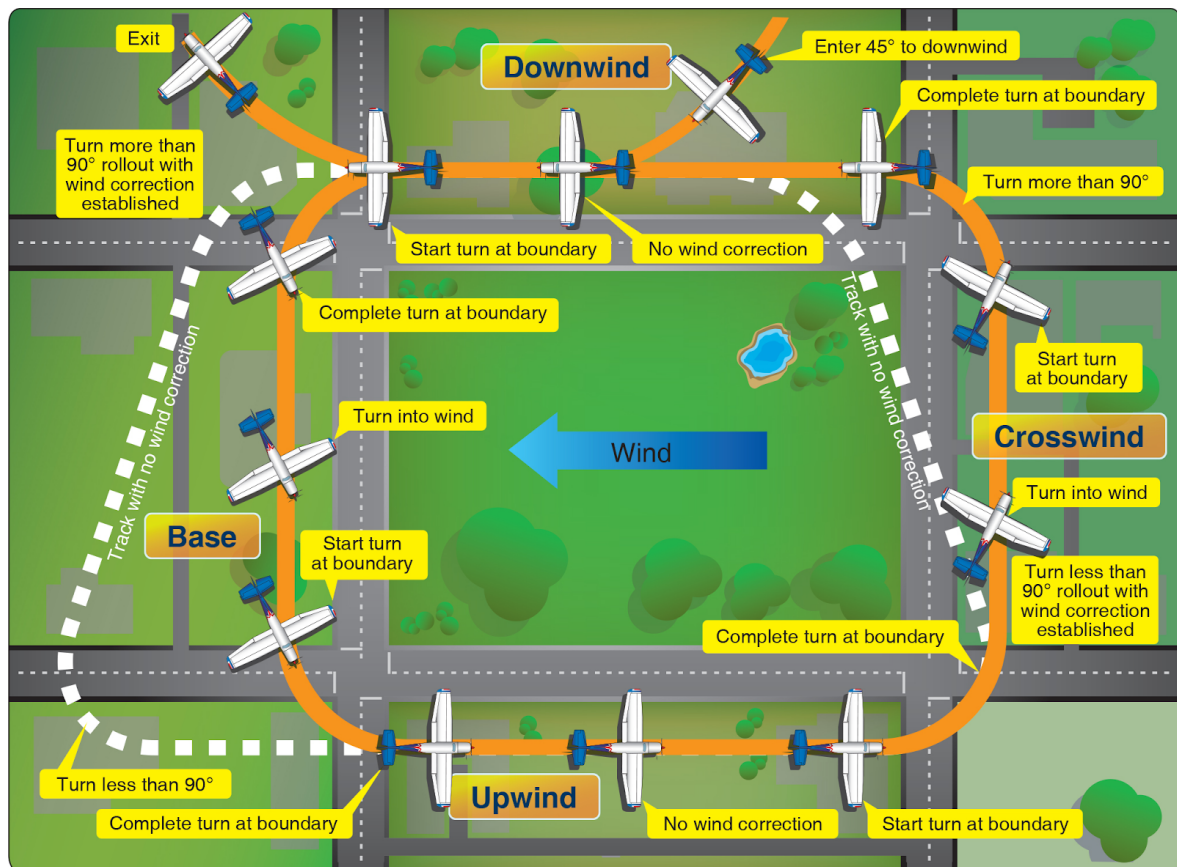
- Every time an airplane lands, you can see this at work... the aircraft below must fly at an angle in order to fly directly down the runway:



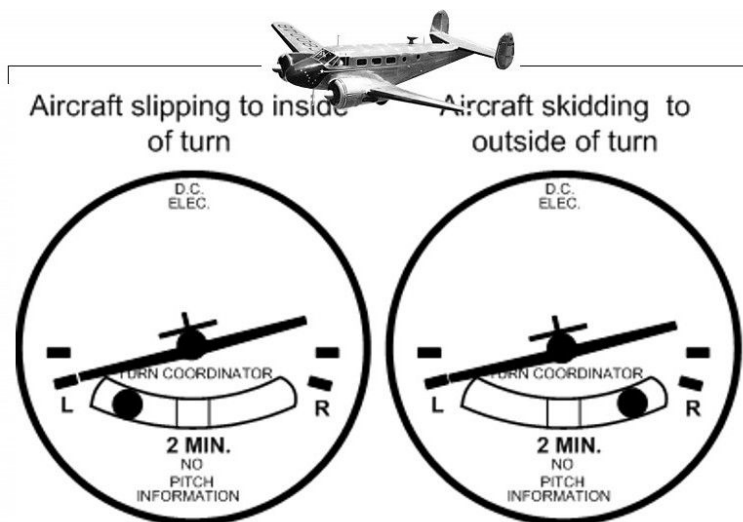
- **Airport Traffic Patterns** - The rectangular course maneuver is related to takeoff and landing. It aims to simulate the shape of something called an **airport traffic pattern**. An airport traffic pattern is simply a rectangle, with one of the long segments aligned with the runway. Imagine an airplane that would take off from a runway, and 'circle back' to land again on the same runway. Doing so would be called 'flying a pattern'. A traffic pattern is used to organize the flow of traffic taking off and landing on the same runway, and has 5 'legs':
  - **Upwind/Departure** - As the airplane takes off, the first portion of the flight, in the same direction as the runway, is called the 'upwind' or 'departure' leg. It is called this because normally airplanes choose to take off on a runway which faces into the wind.
  - **Crosswind** - As the airplane climbs, usually once it has reached 700 ft above the ground, it turns left. This is called 'crosswind', as the leg is *across* the wind.
  - **Downwind** - As the airplane continues in the pattern, it turns left again, now facing opposite of how it began. This is usually *with* the wind, meaning the wind is blowing from behind, and this is called 'downwind'.
  - **Base** - As the airplane prepares to land, it begins to descend and turns left again, once it is far enough from the landing runway. This is called the 'base' leg, because this leg is the basis for, and determines how the next, final approach leg, will be started.
  - **Final** - The airplane turns left once more to align with the runway. This is essentially the same as the 'Upwind' leg, but the airplane is landing instead of taking off.



- Because the rectangular course maneuver is flown without descending, *the Upwind and Final legs can be considered the same*. The maneuver is generally flown as a simplified form of practice for flying actual traffic patterns for takeoff and landing at an airport.
- As a simulation for an airport traffic pattern, this maneuver should be flown in a configuration similar to how one would normally fly the 'downwind' leg of a pattern: in a clean configuration, and at a moderate airspeed, usually less than cruise.
- **Ground Reference Maneuvers** - The maneuver is a **ground reference maneuver**, meaning it is performed by reference to a prominent feature on the ground. In the case of this maneuver, this can be any large, rectangular area, in a suitable location, away from populated areas and within gliding distance of an emergency landing site.
- The maneuver is flown with the airplane remaining  $\frac{1}{2}$  to  $\frac{3}{4}$  miles *outside* of the rectangular area. The turns should be timed so that they can be completed without flying beyond the desired rectangle course.



- **Wind Correction** - The main challenge of this maneuver is determining the wind correction angle. This takes some practice, but the main task is determining the direction of the wind itself (look for smoke, flags, etc), and then visually estimating how different wind correction angles affect the ground track of the airplane by trial and error.
- **Coordination** - Because this maneuver is flown close to the ground and involves turning, it is important to pay close attention to flying with proper coordination. As the airplane rolls into and out of turns, the rudder must be used to keep 'the ball' in the center. This avoids *slips* and *skids*, which create the risk of a stall or spin. The turn coordinate is shown below:



- **Safety Considerations**

- **Checklists** - Pilots should complete a pre-maneuver checklist before beginning the maneuver.
- **Emergency Landing Area** - Due to the risks involved with maneuvering at low altitude, pilots should select a suitable emergency landing area.
- **Visual Traffic Scanning** - Pilots must remember to keep up their traffic scan throughout the maneuver.

## Maneuver Description

- **Selecting a Ground Reference** - Select a prominent rectangular area, which is ideally at least  $\frac{1}{2}$  mile wide and 1 mile long, and is easy to identify. It should be in an unpopulated area and clear of hazards on the ground. Rectangular fields which are easy to distinguish, or bounded by roads on all sides are ideal. Do not choose things like houses or other structures as references, as this could cause a nuisance. The goal is to replicate an airport traffic pattern, and so the rectangular course should be large enough to realistically simulate this. *Because this maneuver is performed so close to the ground (below 1,000ft AGL), make sure that the chosen ground references are near a suitable emergency landing area, as gliding distance will be almost zero.*
- **Entry Position and Heading** - First, the wind direction should be identified. Look for smoke, flags, or other signs of surface wind direction. If none are available, the ATIS or METAR of a local airport can be used to estimate. Plan to enter the *downwind* leg at a 45 degree angle, and when  $\frac{1}{2}$  to  $\frac{3}{4}$  of a mile from the field boundary marking the downwind, turn to join the leg.
- **Altitude** - This maneuver should be performed at **600 to 1,000ft AGL**.
- **Bank** - Since this maneuver simulates an airport traffic pattern and involves maneuvering at low altitude, the bank angle should be *less than 30 degrees*.
- **Course** - Apply wind-drift correction and track the rectangular area, **remaining  $\frac{1}{2}$  to  $\frac{3}{4}$  of a mile outside the field boundary**.

- **Airspeed** - The maneuver must be started at less than **V<sub>a</sub>** (maneuvering speed). Choose a normal level cruise flight airspeed and power setting, at least 5-10 knots below **V<sub>a</sub>**. Ideally, perform this at a normal traffic pattern airspeed.
- **Coordination** - The entire maneuver should be flown in coordinated flight. Attention should be given to proper rudder input during turns.
- **Recovery** - Recover to straight and level flight after making one full circuit of the rectangular area, unless specified by the instructor.
- **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 references. *In particular, this is a very low altitude maneuver. Keep a careful watch for obstructions or other ground hazards.*

## Expanded Completion Standards

- The pilot can explain the purpose of the Rectangular Course ground reference 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, performs a pre-maneuver checklist, establishes a speed *below V<sub>a</sub>*, and selects an appropriate altitude for maneuver entry, **between 600 and 1,000 feet AGL**.
  - Pilot selects a suitable ground reference area, with landmarks approximating a rectangular area.
  - Pilot enters the maneuver on a 45 degree segment to the downwind leg.
  - Pilot applies proper wind correction to maintain straight legs and flies a rectangular pattern around the ground references.
  - Pilot divides attention between accurate, *coordinated airplane control* and outside visual references.