

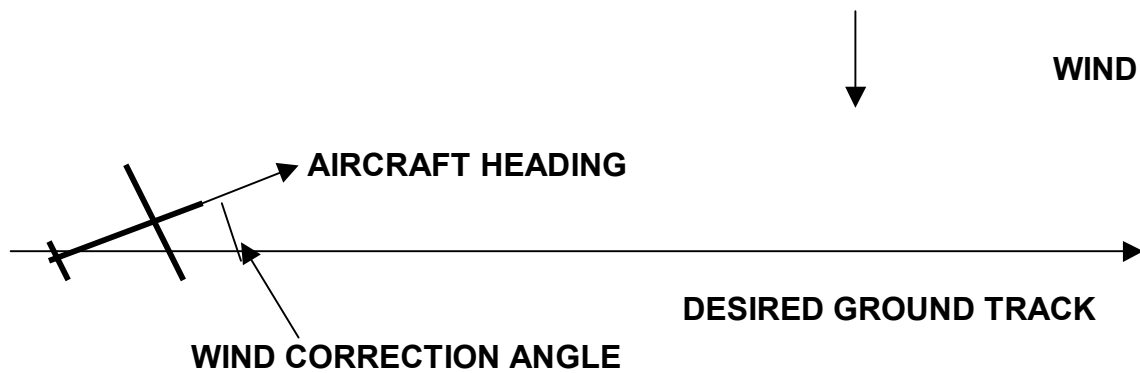
Ground Reference Maneuvers

Ground Reference Maneuvers: Now we will go on to what we call ground reference maneuvers. Like the name says, they are maneuvers that are done in reference to the ground. These maneuvers are performed between 500 and 1,000 AGL. We have to watch out for the third minimum safe altitude. This FAR says that you have to be more than 500 feet above personal property. This is why we practice above 500 AGL.

We perform these maneuvers to get you used to flying the aircraft at low altitudes and using the ground and the horizon as references. At the same time, you will have to cross-check the altimeter and the airspeed indicator to make sure the aircraft is doing what you want it to. The main references will be the horizon for pitch and airspeed control, and the ground for ground track.

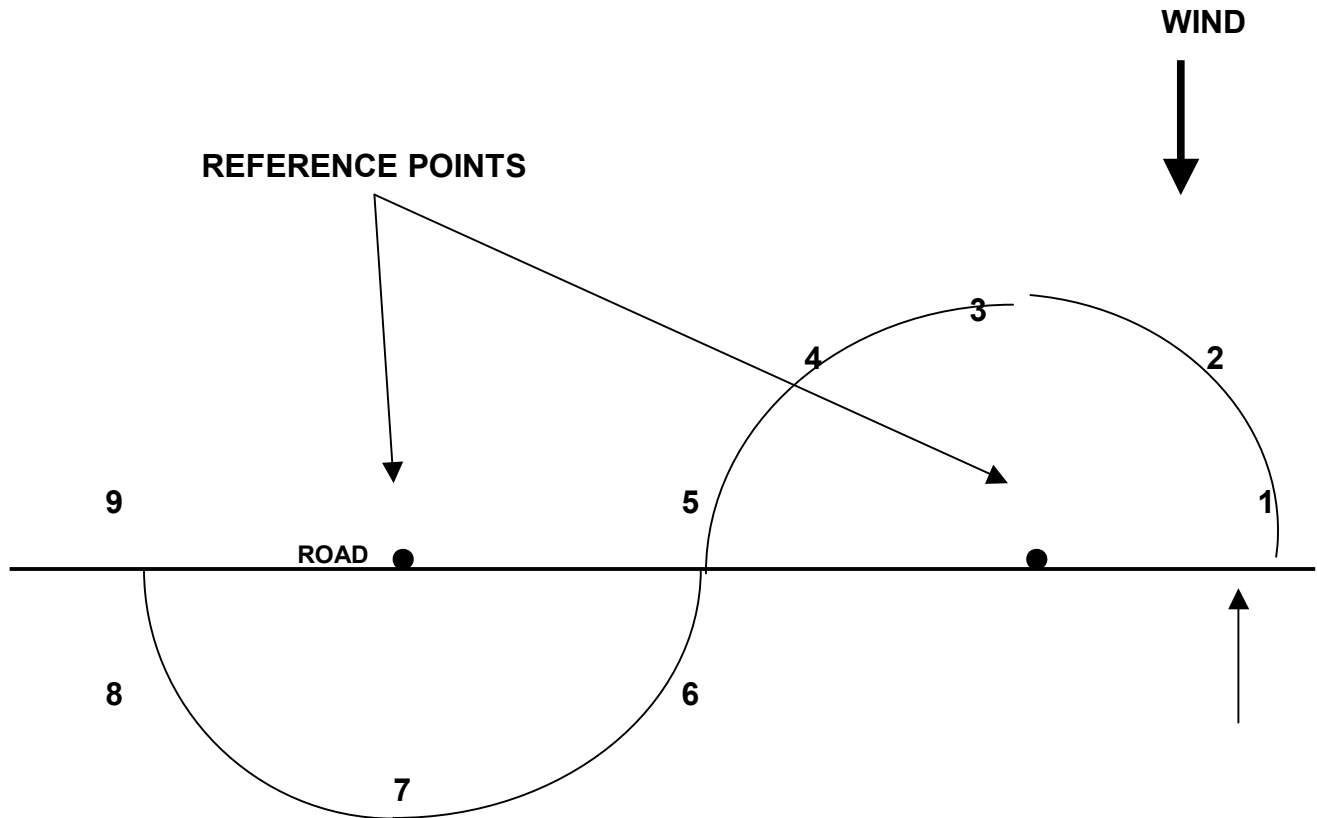
Ground Track: Ground track is the path the aircraft would make if it had a large pencil hanging from the bottom, dragging along the ground. In the case of the ground reference maneuvers and future lessons, you will want a desired ground track. As you know from some of your lessons, you cannot just fly in a straight line toward something without correcting for the wind. For example, if the wind is coming from the top of the page, blowing toward the bottom, the wind will want to blow the aircraft toward the bottom of the page. In order to make a straight ground track; we must correct the heading of the aircraft toward the top of the page in order to make a straight line

Distance: If you saw the aircraft moving to the left or the right, you were instructed to correct your heading in the opposite direction until the point didn't move. This is the same thing. You wanted to have a desired ground track from the point you were at, to the reference point. When you see the aircraft moving, the aircraft is going off the desired ground track. When the aircraft is turned into the wind enough to counter the wind, the reference point will stop moving. At this point, the aircraft heading is corrected enough into the wind so the wind does not blow the aircraft off course. I have made a diagram below to help you see what is going on.



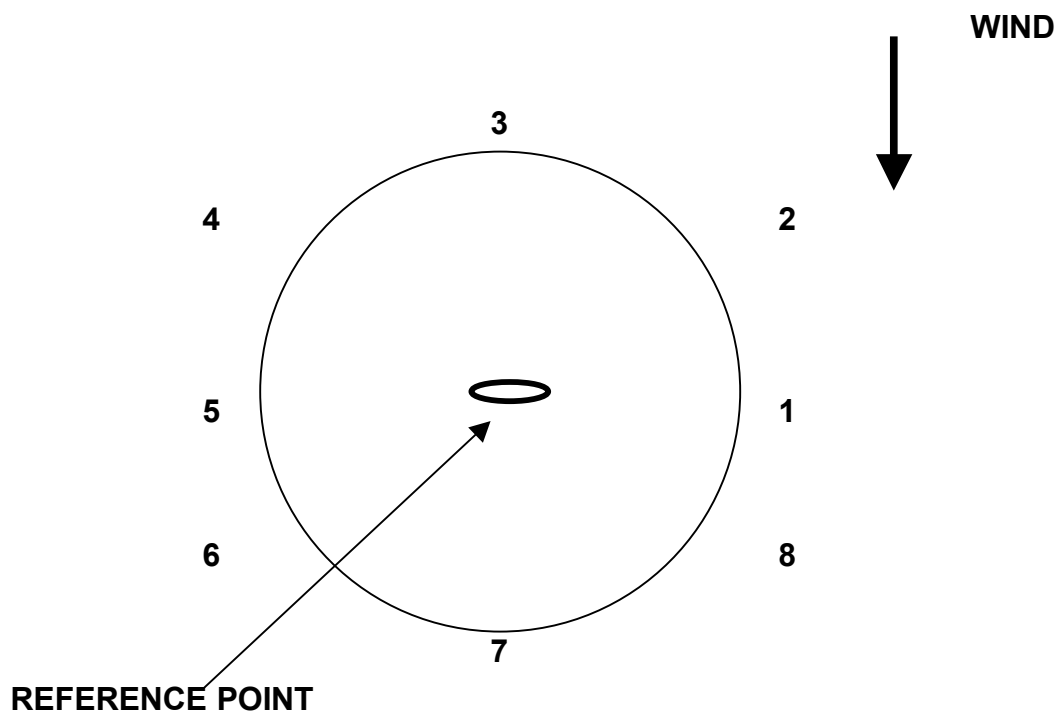
In the drawing above, you'll notice that if you see your point moving to the left, you will need to turn to the left until the point stops moving. Once your point stops moving, then you have the correct wind correction angle. Remember that you want to look outside the airplane, but now you also want to cross-check your instruments. Don't stare inside the aircraft, though. If you hold nose-level attitude, you will hold level flight.

S-Turns across a Road: The s-turn uses the same principals as the turn around a point. The only difference is the fact that each semicircle is in the opposite direction than the one that precedes it.



1. The aircraft initially starts the maneuver wings level with the wind behind it. The instant the aircraft crosses the reference road, begin banking to the left.
2. Continue a shallow bank to the left. Remember that you are flying into the wind. You are trying to keep an equal distance from the reference point in the center of the semicircle.
3. Maintain a shallow bank to keep on the ground track.
4. The wind is behind the aircraft at this point. The bank angle needs to increase as the groundspeed increases.
5. At this point, the aircraft must be wings level. The highest groundspeed is at this point.
6. The bank angle is increasing more in order to maintain the ground track.
7. The steepest bank angle is at this point. Remember that the aircraft is turning to the right, and the wind is perpendicular to the aircraft on the right side.
8. Groundspeed decreases at this point, and the bank angle is constantly decreasing.
9. The wings are level, and the groundspeed is at its slowest.

Turns Around a Point: The next maneuver we will discuss is the turn around a point. This maneuver is a little different than the rectangular course. Performing the turn around a point requires constant changes in bank angle while maintaining altitude, airspeed, and a constant ground track. In a no-wind condition, the aircraft would be in a constant bank throughout the maneuver. In a wind, the maneuver becomes more difficult.

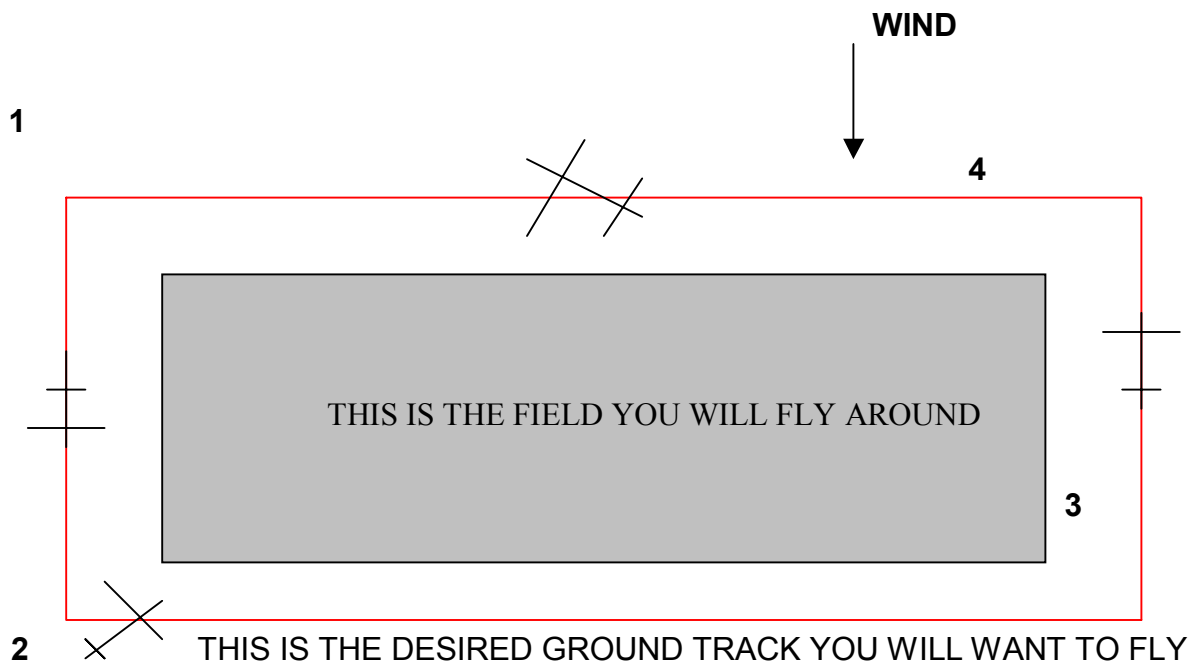


1. Begin maneuver. The aircraft is directly into the wind at this point. Start a shallow bank, and keep the desired ground track.
2. The aircraft is still in a shallow bank at this time. Remember that the aircraft is moving into the wind, so a shallower bank is required to keep the desired ground track.
3. At this point, the aircraft is perpendicular to the wind. If you had already completed one turn, this would be the shallowest bank angle in the maneuver.
4. The ground speed is beginning to increase. The bank angle must begin to increase so that the wind doesn't blow you in too close to the reference point.
5. You are halfway through the maneuver. Bank angle is still increasing as the ground speed increases.
6. Bank angle and ground speed still increase. If the aircraft is moving outside the desired ground track, increase the bank angle. If the aircraft is moving inside the desired ground track, decrease the bank angle to let the aircraft drift back onto course.
7. The three-quarter point has the steepest bank angle because the wind is perpendicular to the aircraft on the side of the turn. A simple way to think of this is to just say, "If you are turning left, the steepest

bank angle will be when the wind is perpendicular to the aircraft on the left.” The same will apply if you are performing the maneuver to the right.

8. Now that you have just passed the steepest point in the maneuver, the bank angle will begin to decrease again.

Rectangular Pattern: The rectangular pattern is the simplest maneuver. This ground reference maneuver will transition you into the traffic pattern. The wind corrections are identical to what I told you above. For the pattern shown below, the wind is directly perpendicular to the desired ground track. In many cases, you will not be able to find a rectangle that is in perfect position with the wind.



1. Enter the rectangular course with the wind behind the aircraft. At this point, the aircraft will have the greatest groundspeed.
2. Turn to the second leg of the pattern. At this point, find a reference point far out beyond the course to be flown. Once a point is found, fly directly toward it. If the point is not moving, then you have correctly compensated for the wind.
3. The third leg is directly into the wind. The ground speed will be the slowest at this point.
4. Turn the final leg of the pattern. At this point, the aircraft will not have to be turned a full 90 degrees because the wind is coming from the right side of the aircraft. You are turning left on my diagram.