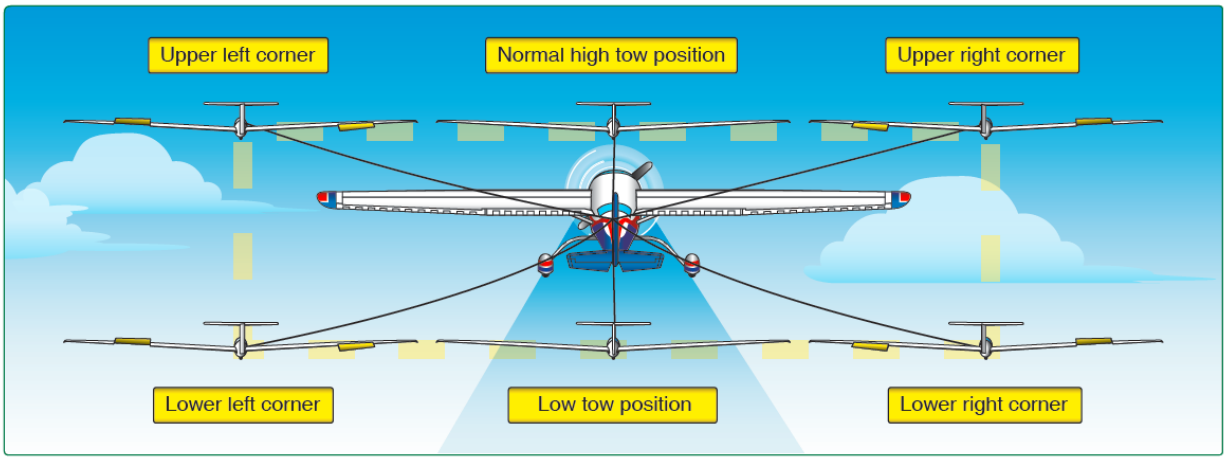
Boxing the Wake

In some of your first glider tow lessons you will learn to box the wake.

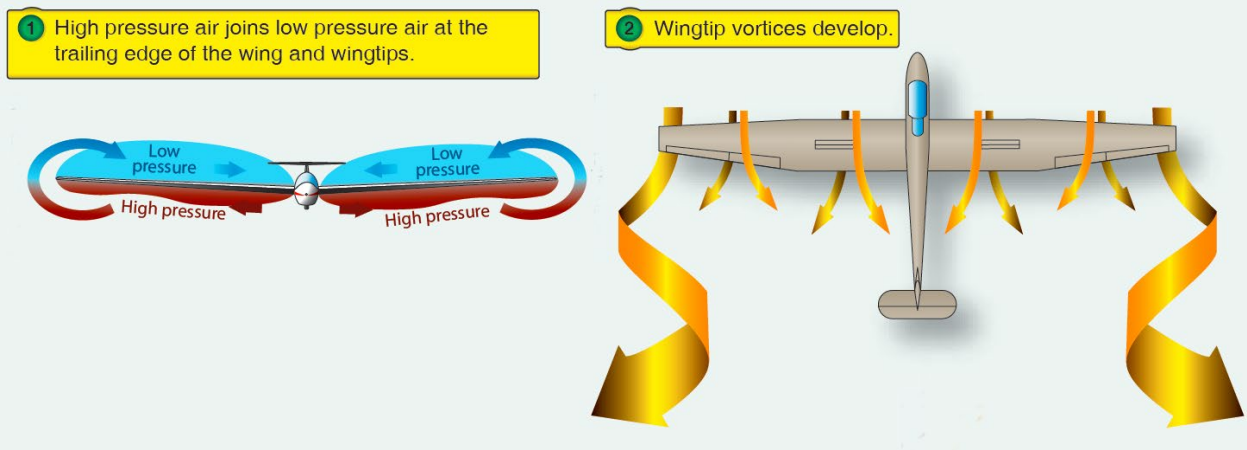
The maneuver consists of descending directly behind the towplane to a “low tow” position, then moving in a square pattern (usually counter clockwise) that flies on the outside of the towplane’s wake. At each position (low-tow, bottom left, top-left, top-right, bottom right, and low tow) the glider pilot pauses briefly to demonstrate control in that position.



Boxing the wake is not a maneuver that a pilot would perform on a typical soaring flight. It is instead a training maneuver that teaches control of the tow position with varying forces exerted from the tow rope. It is also a required maneuver on the checkride – so it’s work being able to perform it confidently.

When boxing the wake, the pilot also learns where it is safe to be in regards to the towplane’s wake turbulence in order to avoid it. While the towplane’s propwash is slightly turbulent it does not present any control issues. The wingtip vortices do present control issues and the rotational motion they induce may exceed the glider’s ability to counteract them with aileron control. Therefore it’s essential that the pilot knows where the wingtip vortices will be encountered and know how to avoid them.

The wingtip vortices are like little tornados that extend back and slightly downward from each wingtip. They are the result of the low pressure on top and high pressure on the bottom of the towplane’s wing. They are strongest when its weight and angle of attack are highest – therefore, heavy and slow. The vortex on each wingtip rotates top-inward. The left wing vortex rotates clockwise and the right counter-clockwise as seen from the glider.



Overall the maneuver requires smooth control inputs and precise positioning in relation to the towplane. Your instructor will point out the visual cues for the particular towplane in use.

As the maneuver progresses and the position of the glider changes in relation to the towplane, the tow rope will exert a force on the glider pulling it back toward the center.

Before beginning, ensure you are at least 1,000 – 1,500 feet above ground (as per local requirements), the towplane is on a straight course, and you are centered behind the towplane.

The maneuver starts at the normal “high tow” position. In this position the towplane is approximately on the horizon as seen from the glider. The glider should be centered with the towplane’s rudder precisely aligned down its fuselage. This ensures that only the propwash will be encountered as you descend and not either wingtip vortex.

The first part of the maneuver is to descent directly behind the towplane through the propwash –which will feel bumpy. Increasing amounts of forward stick input will be required as the glider descends since the rope will be pulling the nose of the glider up from a higher and higher angle. As the glider gets below the propwash the ride will smooth out significantly. This is the low-tow position and is often used for long-distance tows in level flight. Note the sight picture of the tow plane. Usually the towplane’s elevator will be aligned with its mirrors (low wing) or its wing (high wing).

Once established in the low tow position the pilot moves out to the side while keeping the low-tow vertical position. Your instructor will show you how far out you must go to be clear of the corresponding wingtip vortex – on a tailwheel equipped towplane this is usually when the tailwheel and opposite main wheel are aligned At this point in addition to the upward force encountered in the low-tow position, the rope also exerts a sideways force pulling the glider back towards the center. Wings should be nearly level, applying bank as needed to move the glider horizontally. Rudder is used to avoid the yawing forced from the rope and to keep the glider’s heading parallel to the towplane’s.

From the bottom corner the glider is maneuvered up to re-align the towplane with the horizon while maintaining the lateral position outside the wake. The upward force of the rope decreases, requiring less and less forward stick force as the glider ascends while maintaining the forces on the rudder and aileron to hold the lateral position.

From the left upper corner, the glider is maneuvered across to the opposite upper corner. At first, one need only release the rudder and aileron pressure and the tow rope will yaw the glider toward the center. However, that is short lived and the pilot must now fly the glider to the opposite upper corner. Once past the centerline more rudder and aileron input will be required as the force from the tow rope increases again.

From the upper right corner point a descent to the outer low-tow position is made. The rope's force increases with the descent and more forward stick is required to maneuver to the low-tow position aligning the vertical sight cues on the towplane while keeping the lateral position stable outside of the wake. Rudder and aileron input keeps the glider aligned straight ahead and approximately wings level.

The glider is then maneuvered at the low-tow height back directly behind the towplane so that its rudder is perfectly aligned with its fuselage. Now the glider can be brought back up through the propwash to finish in the starting high-tow position.

Initially the forward pressure on the stick only needs to be relaxed for the glider to climb, however, just about the time that the glider encounters the propwash the rope's upward force is insufficient to complete the climb and the pilot will need to apply stick input to continue climbing to the high-tow position.

Common errors:

- Not using smooth control movements or over controlling. Don't rush through it, it's not a race.
- Not being centered properly before descending or climbing through the propwash. Don't risk being caught by the wingtip vortices by not taking the time to properly center on the towplane first.
- If encountering the wake, not continuing to climb up to smooth air.
- Allowing the tow rope to pull the glider toward the center and thus encountering a wingtip vortex. Fly a nice square box pattern and avoid rounding the corners.
- Sloppy lateral control wandering too far out or too close in from the desired position
- When climbing from low-tow to high-tow, not positively controlling the glider's climb rate and pausing the climb in the propwash.
- Allowing unnecessary slack in the rope to develop – usually by position changes that are too rapid or beyond the desired position.

Applying your knowledge from boxing the wake.

Sooner or later you will find yourself displaced from the normal tow position. Boxing the wake taught you how to avoid the wake turbulence and resume the normal tow position. This can be done by first maneuvering to the low-tow position and climbing up the center or to the high tow position before moving laterally back to the center.

The upper left corner of the box is also the position where the glider-cannot-release signal would be given from in the event that the glider cannot release normally from tow.

You can apply your knowledge to the takeoff as well. Knowing that the wingtip vortices and propwash increase controllability issues when encountered, ensure that you maintain the proper alignment with the towplane during your initial climb. No one wants it to be any harder than it needs to be! Be sure to climb with the towplane as it starts its climb, and at the same time being very careful not to climb above the towplane where the glider is pulling up on the towplane's tail (kiting). That can result in a very dangerous situation for the tow pilot as the glider can easily overpower the towplane's pitch control.