# How Do Gliders Fly?

By Whitney Arana, eHow Contributor

How Do Gliders Fly?

1. With no engines, gliders move through the sky in much the same way as eagles or vultures--by balancing the forces of gravity (downward force), lift (upward force), drag (retarding force) and thrust (forward momentum).

   Generating Thrust

2. Thrust is the force that propels the glider forward, working in direct opposition to drag. Because it has no engine, it needs help to acquire thrust initially. Otherwise, it will not go very far. Thrust is generated when the glider is launched into the air. The most common practice for launching gliders is called "tug," which means that an aircraft with an engine tows the glider for some distance. When the glider has acquired enough momentum, the connection is severed and the glider continues to fly on its own.

   Generating Lift

3. While overcoming drag is important for covering long distances, what really keeps gliders aloft is conquering gravity. If the air is still, the glider will always sink. But if the pilot can find rising air--lift--the glider can defeat gravity and prolong its flight. Lift is generated in a few ways: by the wings' design; the angle of attack; and the use of naturally rising air, such as thermals.

   Design

4. Glider wings are curved on top and flat underneath. For this reason, the air passing over the wing moves faster than the air passing along its bottom, resulting in higher pressure underneath the wing, which pushes the plane up. This difference is only slight, however, which is why, although it slows the fall down, design alone is not enough to keep a glider in the air for too long.

   Angle of Attack

5. If you draw a line representing the wind's path as it hits the wing and another line along the wing itself, you can see the angle of attack. A bigger angle of attack means more air is hitting the bottom of the wing, while a smaller angle means air is hitting the front of the wing, running about evenly over and under it. If more air is hitting the bottom of the wing directly, more lift is generated. However, if the angle of attack is too big, the plan will be pushed backward. It will simultaneously lose lift and thrust, and will fall out of the sky.

### Thermal Lift

6. In addition to minimizing the loss of lift, gliders can actually gain elevation by catching naturally rising air. The most common form of rising air that gliders can ride is known as a thermal. Thermals are formed as air that touches warm ground becomes heated while air that touches nearby colder ground remains cool--for example, the difference between air touching hot pavement and shaded grass. The hot air expands and rises, forming a sort of bubble, while the cooler air stays low. The rising hot air can push a glider upward. However, as the hot air rises it cools down, so thermals don't last forever. This is why the weather is so important in deciding how high a thermal will rise before it dissipates. To capitalize on these thermals, glider pilots will circle in them to gain as much height as possible before continuing on their journeys.

### Hill or Ridge Lift

7. A less common but still useful way to generate lift is to take advantage of ridge lift. When wind hits the face of a mountain or cliff, it is forced upward so it can pass over the obstacle and continue moving horizontally. A glider pilot can utilize the air's upward movement to generate lift by flying along the ridge. This type of lift is available year-round, but it is obviously possible only in specific landscapes.

### Wave Lift

8. A less common but extremely effective way to generate lift is to ride wave lift. In a situation where strong wind is running smoothly over a range of hills, the air flows up and over the hill (as with ridge lift), then bounces back up off the valley to form another upward-flowing "wave" of air. Gliders don't even need to travel too close to the landscape in order to utilize this type of lift, as a series of waves are formed.

### Detecting Lift

9. Pilots can detect lift in a couple of ways. First, he can do so by simple observation. The pilot can look for indications such as the landscape (does the ground rise sharply?), clouds (for example, cigar-shaped "lenticular" clouds mean wave lift is available) and environmental factors like wind and temperature. Bird activity can also help a glider pilot as birds use the same methods for staying airborne as gliders, with the intention of saving energy. For instance, if a group of birds is circling, that usually means it is capitalizing on a thermal.
10. The glider's variometer is also very helpful in detecting lift. This device measures the rate of altitude change by detecting static pressure. Air pressure decreases as aircraft climb higher, so if static pressure suddenly drops (as if the glider runs into a thermal), the variometer will immediately notify the pilot. The pilot can then utilize the available lift.