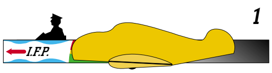
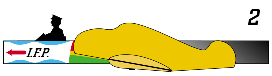
Angle of Attack is the difference between the wing's chord line and the flight path—not the ground. Relative wind, the direction of the airflow over a wing in flight, parallels the flight path.

Stall in Level Flight

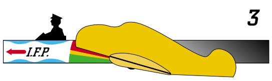
1. Hold the AlphaTrainer model to emulate level flight at normal cruise speed. Note that the Fuselage, Instantaneous Flight Path (IFP), and Pilot Viewing Attitude are all aligned with the horizon. The elevator is in its neutral position, and the angle of attack (AOA) is at the bottom of the green.



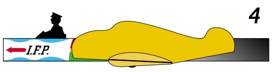
2. Simulate the deceleration that precedes a stall by **slowly** raising the model's nose until the angle of attack is in the yellow. Although the AOA has changed, the IFP and Pilot are still basically aligned with the horizon.



3. Slowly raise the model's nose until the AOA enters the red, which depicts the critical angle of attack—the AOA at which a wing will stall. Compare the elevator's position to the angle of attack and the wing's chord line to the IFP.



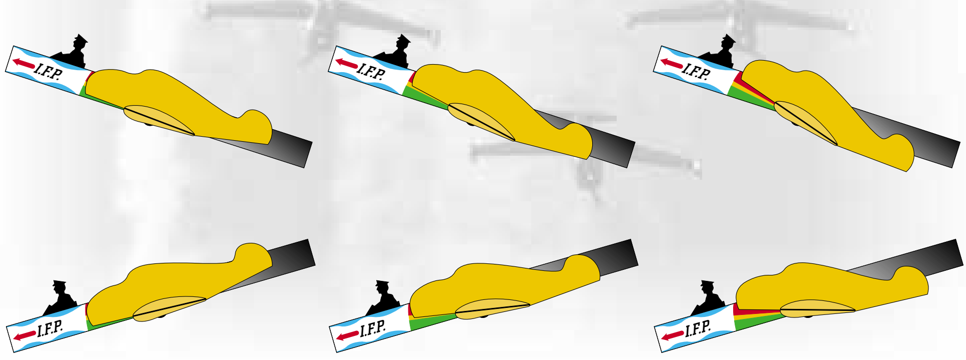
4. To recover from the stall, lower the model's nose until the AOA is in the green. Note the elevator position and its relationship to the angle of attack.



Press the above tabs if model becomes loose.

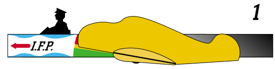
The message is clear:
To recover from a stall, lower the nose by reducing the up elevator deflection and return the AOA to the green.

To demonstrate that an airplane can reach its critical AOA—and stall—in any attitude, repeat steps 1-4 above, but align the flight path straight at the ground, like an airplane descending out of a loop. Step 3 represents the pilot attempting to complete the loop before the airplane has gained sufficient energy. As the illustrations below depict, you can use the AlphaTrainer to demonstrate that a wing can reach its critical AOA and stall in a climb or descent, just as it can in straight-and-level flight.

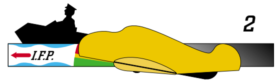


Accelerated G Maneuvers

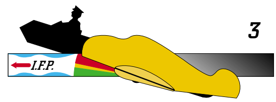
1. Hold the AlphaTrainer model to emulate level flight at reduced speed. The AOA should be in the yellow, which represents flight at approximately 20% above stall speed. The IFP and pilot's viewing attitude are aligned with the horizon.



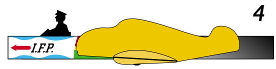
2. Since most pilots look where they expect the airplane to go, pivot the pilot's viewing attitude upward, in anticipation of a rapid climb. The IFP should remain aligned with the horizon because airplanes can't change their flight path as quickly as pilots change their viewing attitude.



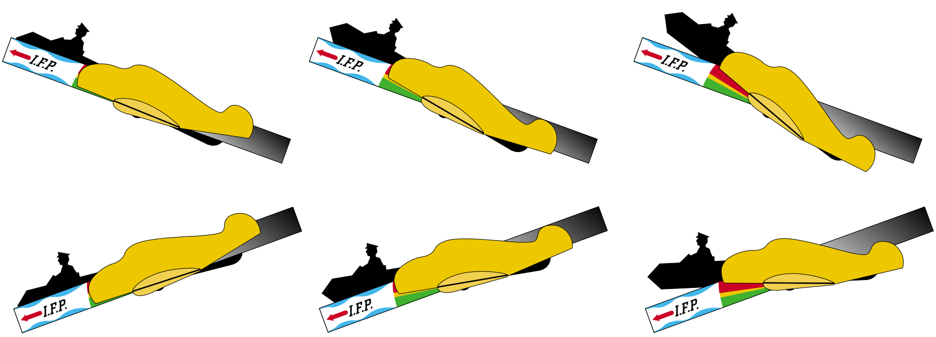
3. To make the airplane conform to the viewing attitude that anticipates a rapid climb, the pilot quickly applies up elevator. Pivot the fuselage up so it matches the viewing attitude, putting the AOA in the red—the critical angle of attack. The IFP remains in level flight, and the angle between it and the viewing attitude shows the difference between the anticipated and actual flight path. This represents the confusion pilots may experience when they try to maneuver aggressively at speeds above the normal "stalling speed," but not fast enough to accomplish the maneuver.



4. To recover from the stall, pivot the pilot's viewing attitude and fuselage back to the green zone. Notice that the elevator position returns to neutral, and the pilot and fuselage again become aligned with the flight path. In actual flight, this may require a gentle dive, increased power, or both.



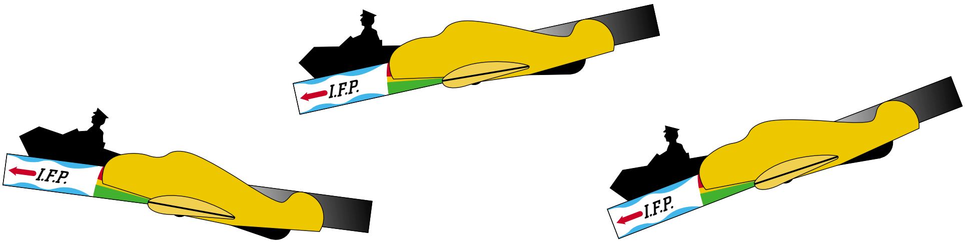
As the graphics below illustrate, an airplane can stall at any airspeed and any attitude. Excessive acceleration and a rapid increase in angle of attack, not the lack of the airspeed, cause the stall.



Wind Shear

Wind shear is a wind that moves in a different direction and velocity from the prevalent wind. A change in relative wind direction, wind shear disrupts the airflow moving over the wing. Wind shear can be horizontal or vertical, and each affects airplanes differently. Vertical shear changes the AOA. At low airspeeds—in takeoff, landing, and in the traffic pattern—this often results in a stall. Horizontal shear immediately changes the airplane's speed, which pilots can see on the airspeed indicator. If the horizontal shear gust reduces the airplane's speed by 20 percent, the airplane will sink, trading altitude for airspeed to maintain the AOA it was trimmed for.

The examples below depict horizontal wind shear in level, climbing, and descending flight at airport pattern speeds and show how pilots may not recognize a horizontal shear until it's too late. Usually, a gain and then a loss of airspeed is the first clue, and pilots may attribute this to "turbulence." A sink rate is the next clue. The AOA and pilot's viewing attitude remain the same, but the IFP changes—downward. The AlphaTrainer clearly shows how pilots can aggravate this situation by abruptly applying up elevator to arrest the sink rate—and stalling the airplane.



These are just a few of the scenarios your AlphaTrainer can show. It can simulate many other situations to help you become more familiar with how an airplane's wing behaves in flight. You can find more information on our website at www.alphatrainer.com. The site contains animated AlphaTrainer scenarios, ordering information, and current news and information from the author, Tom Shefchunas. If you have questions or comments, please e-mail Tom at tshef@alphatrainer.com.

To order, visit the secure order page at

www.alphatrainer.com

Or call toll free

877-542-1112.