

# THE PHYSICS OF FLIGHT

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## Chapter VI - Stalls

One of the most crucial concepts to understand about flying is how stalls occur and when to anticipate them. There are many kinds of stalls, any of which can be fatal to your R/C aircraft. Just ask any full-scale pilot and they will go on and on about takeoff stalls, departure stalls, approach stalls, landing stalls – until you wish you never had asked! If you have the opportunity, you should take a ride in a full-scale airplane and experience stalls firsthand. Once you see how quickly the stability of the airplane decays, you will fly your R/C plane with renewed vigilance.

How much lift a wing has to produce depends on the wing loading, imposed G forces, and the speed it is moving through the air. Wings have a limit as to how hard they can work, and this is called the critical angle of attack. Stalls occur when the angle of attack of the wing exceeds a critical angle with the relative wind. When the critical angle is exceeded, either due to too much flight load or not enough airspeed, the air over the wing becomes turbulent and results in a loss of lift. Steep turns can impose significant G loads, with a sixty degree bank doubling the normal wing loading.

Wings can be in a fully stalled or partially stalled condition. There are those who will tell you that a spin is a maneuver in which one wing is stalled and the other is not. Actually, one wing is more fully stalled than the other, but both are in a stalled configuration. Many aerobatic maneuvers count on the ability to stall each wing to a different degree.

Stalls can happen in most any airspeed and attitude. Some dive-bombers descended in a nearly vertical attitude with a very high airspeed. After dropping their load, the pilots had to gently change the pitch attitude of the airplane in order to not impose a high wing loading which could cause a stall condition. But for the most part, stalls will occur in low airspeed situations where the wing is at a fairly high angle of attack. This situation is most prevalent in takeoffs, landings, and flying the approach pattern. Unfortunately, this is when the airplane is in close proximity to the ground, leaving little room for recovery.

How do you avoid having your plane become a statistic? You need to practice stalls at higher altitudes to learn how your airplane behaves at the onset of a stall, and what it takes to recover from a full stall. With the onset of a stall, it will seem that the effectiveness of control surfaces is greatly reduced. Depending on your airplane, this may be very subtle or pronounced. Some airplanes have a wide latitude between the onset and full stall, while others give little margin for recognition and recovery.

Need some convincing that you need to practice stalls? Let's take a look at full-scale aviation for some interesting numbers. The 1996 NALL REPORT by the AOPA Air Safety Foundation reports that 47% of the accidents in 1995 were during the takeoff and landing phases of flying. The report points out that fatal accidents during takeoff and climb were caused mostly by loss of control or stalls. Eight of twenty fatal VFR (visual flight rules) approach and landing accidents were due to steep turns and resultant stalls with a loss of control. Roughly 60% of the fatal maneuvering accidents were due to low, slow flight.

Stalls are an integral part of flying, so you need to spend some time practicing – at a safe altitude! You should learn how your airplane stalls in level flight and in banked turns, and become proficient at recognizing the signs of an impending stall and how to regain full control. After

becoming comfortable with stalls at altitude, you won't hesitate to make the correct recovery when an impending stall shows up on that low and slow landing approach.