

# Load Factors and Stalling Speeds

Given the fact that we continue to experience one fatal stall/spin accident per week in the United States, it would seem reasonable that a good many of us could benefit from a refresher course on the variability of stalls and resultant spins.



The sad but likely true problem is that few private pilots are given anything more than a rudimentary understanding of stalls. Their hapless instructors take them out to the practice area to learn about stalls. The airplane is slowed (after clearing turns, of course), the nose is allowed to pitch up until the stall warning horn sounds, then the CFI pushes the nose over and recovers the airplane.

*"See, Mary, that was a stall,"* says the CFI proudly before turning the controls over to the student.

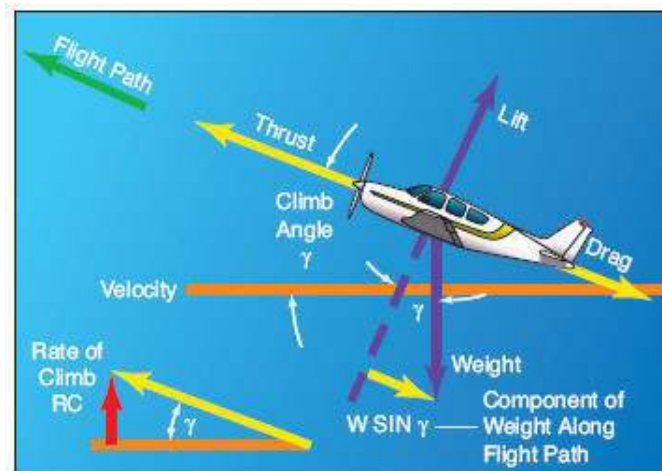
Mary then dutifully repeats the exercise all by herself as the CFI observes. She slows the airplane, pitches up until the stall horn sounds, then she pitches the nose over and smiles. *"I did it,"* she says. Her CFI is proud.

That's it . . . a couple of anemic incipient stall entries. It is little wonder why we continue to experience fatal stall/spin accidents each week!

## The truth about stalls

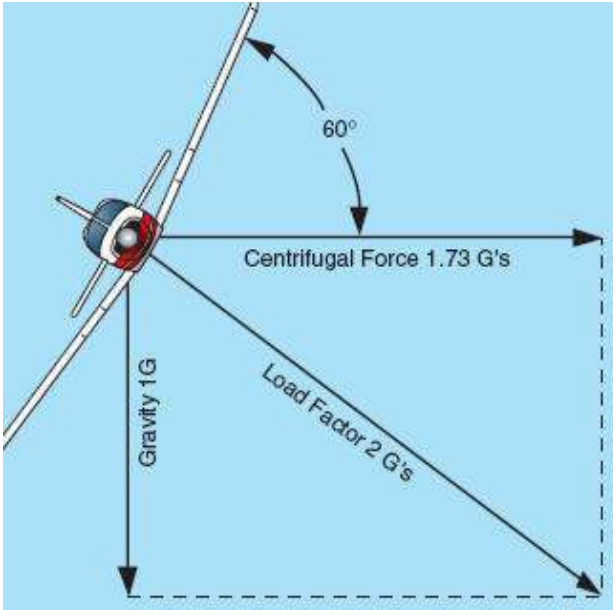
There are two basic truths about stalls that every pilot should know. These are:

1. An aircraft can stall at ANY airspeed within the limits of its structure.
2. Stall speed increases in proportion to the square root of the load factor.



Exceeding the wings critical angle of attack, which results in a stall, can occur at any airspeed. In a high speed dive, for example, a sudden pull up can easily exceed the wing's critical angle of attack.

When a sufficiently high angle of attack is imposed, the smooth flow of air over an airfoil breaks up and separates, producing an abrupt change of flight characteristics and a sudden loss of lift, which results in a stall.



A more insidious form of stall occurs when the aircraft is banking. As it banks, its weight and the weight of its payload increases due to the combined effect of gravity and centrifugal force. For example, the load factor for any airplane in a 60° bank, is 2 G's. The load factor in an 80° bank is 5.76 G's.

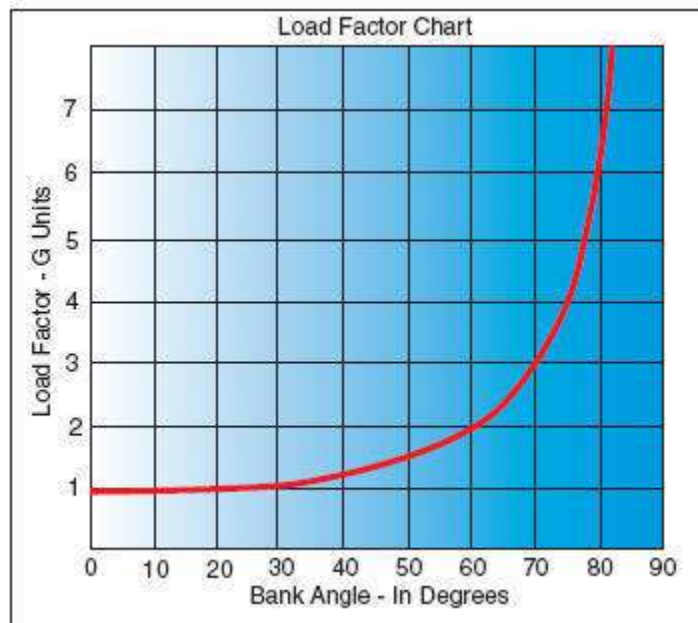
This means that an airplane with a normal unaccelerated stalling speed of 50 knots can be stalled at 100 knots by inducing a load factor of 4 G's. If it were possible for this airplane to withstand a load factor of 9, it

could be stalled at a speed of 150 knots.

Let's look at another example. If we bank an airplane to just beyond 72° in a steep turn, the resultant load factor is 3. If this turn is made in an airplane with a normal unaccelerated stalling speed of 45 knots, the airspeed must be kept above 75 knots to prevent inducing a stall.

## ***Here is the lethal scenario***

Later, after receiving her private pilot certificate, Mary finds herself in a steep bank while turning from the left base leg to the final while landing at her home airport. With the resulting doubling of her load factor, her stall speed increases substantially. She is not aware of this!



Mary allows her airspeed to drop to 60 knots in the turn as she pitches up to regain lost altitude. Her outboard wing (right wing) experiences more induced drag (from lift) and parasitic drag (from the lowered right aileron).

Wham! Her right wing instantly drops out from under her . . . and that's the end of Mary.

## ***What happened?***



Mary apparently assumed that her 60 knot airspeed was well above the 45 knot stall speed she had encountered the day she practiced stalls with her instructor. What she failed to consider was the 2 G load factor bearing down on her airplane and its effect on stall speed. She also failed to consider the additional drag impacting her outboard (right) wing in the turn.

None of this was ever actually demonstrated (at a safe altitude) in Mary's primary training! Hence, Mary, along with some 50 other poorly trained pilots that year lost their lives in stall/spin accidents that could have been easily avoided.

## ***Who is to blame here?***

Who's to blame? Is it Mary? Of course not. The culprit in this scenario is clearly Mary's CFI and the designated pilot examiner (DPE) who permitted her to slip through the cracks. Will they ever be held accountable? Legally, not likely. Morally, that's another story.

What about the rest of us? Do we really understand what is going on here? Have we practiced accelerated, turning, or cross-controlled stalls at a safe altitude with a qualified, experienced flight instructor on board?



If not, we could easily become another fatal stall/spin victim.