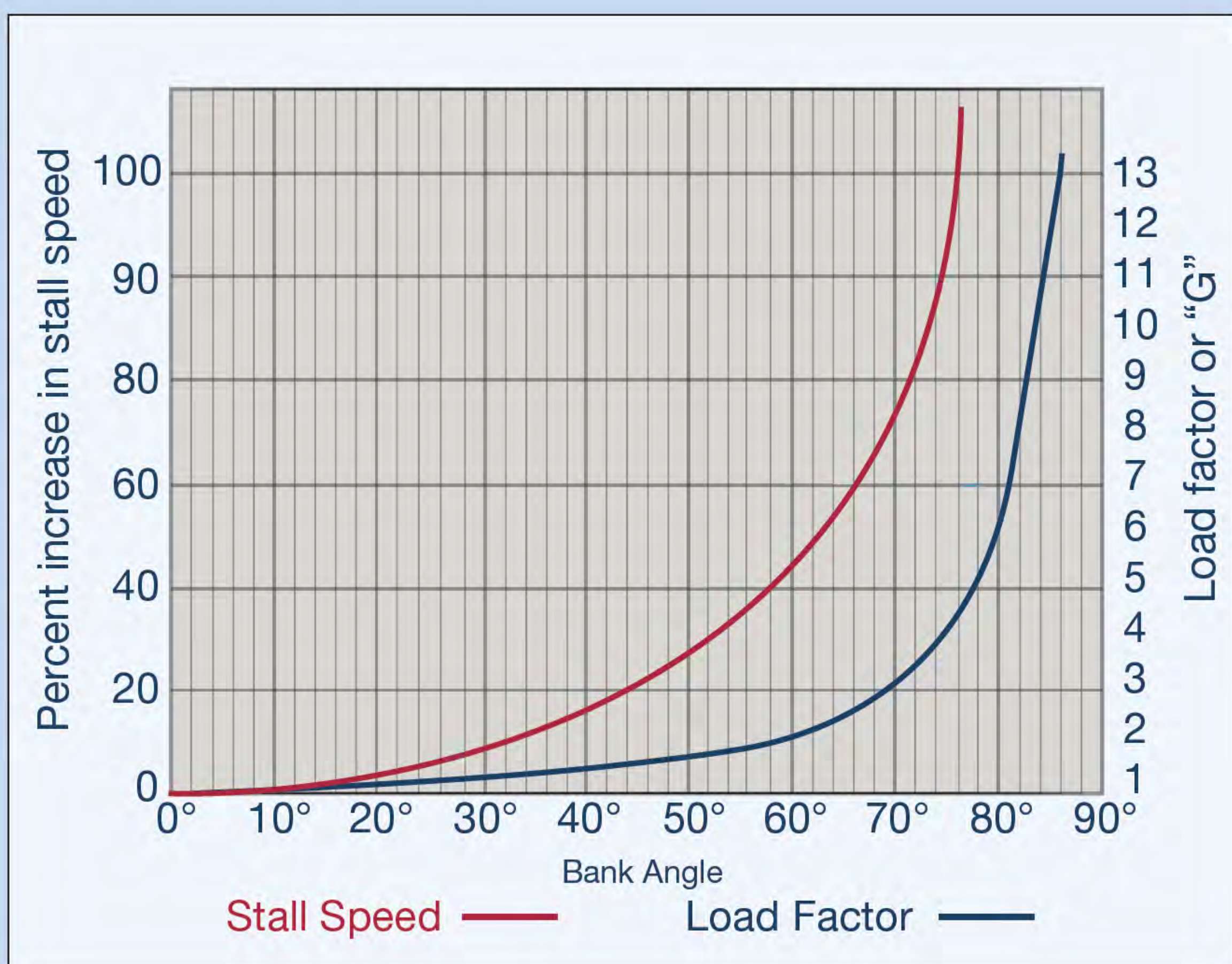


Of Angles And Margins

While correlating a wing's AoA to speed is an imprecise means to determine when an airplane will stall, it's usually all we have in the way of instrumentation allowing us to determine how close we are to the airplane's stalling speed unless it's equipped with an AoA indicator. One problem with this measurement is the airspeed indicator's markings only consider the airplane's stalling speed in level, unaccelerated (i.e., 1g) flight. When will the airplane's wing stall in a turn, or when pulling out of a dive? We can use the airspeed indicator for that, too, though doing so perpetuates the imprecision.



Flaps	Bank Angle, Degrees							
	0		30		45		60	
	IAS	CAS	IAS	CAS	IAS	CAS	IAS	CAS
Cruise	42	52	47	56	55	62	68	73
T/O	40	48	44	51	52	57	65	68
LDG	34	44	39	47	46	52	58	62

The graph at upper right is one you should have seen before, which correlates the banked stalling speed to the angle of bank and wing loading. The table below it is taken from a Diamond DA20-C1 airplane flight manual and presents the airplane's new stalling speed in calibrated and indicated airspeeds as determined by the bank angle.

As this article's main text explains, the lift required to maintain level flight in the turn equals the weight of the aircraft plus whatever additional lift we must generate to match the centrifugal force produced. The total wing loading can be expressed as $L = nW$, where L = lift, n = load factor and W = weight of the aircraft.

Since the airplane basically weighs more in the banked turn, we must generate additional lift to maintain altitude. In a conventional airplane, the way we do that is to increase the wing's AoA by adding back pressure. In doing so, we reduce the difference between the wing's critical AoA by flying at a new, higher AoA. Given that the stall always occurs at the same critical angle of attack, by increasing the AoA, we've closed the gap between the two. The wing's critical AoA will be reached with the airspeed well above the normal stall speed.