The Risks of Maneuvering Speed Myths – Part 1

This article was in Avweb recently:

"It turns out that our early training on maneuvering speed was badly over-simplified. The truth is that you can't move all the controls to the stop and it isn't the same as gust penetration speed. Here's the unvarnished truth about V_A."

Having owned a Decathlon and operated it online at a flying school for over 10 years I was certainly aware of the need for pilots to know about this and strictly adhere to these limitations. I recall when Decathlons first arrived in Australia that many believed them to be as robust as a Pitts and suitable up to Advanced category. Unfortunately that wasn't the case as the owners soon discovered that the wing was a long way short of the strength of a Pitts wing. A friend who also owned a Decathlon once told me that it cost him $3,000 every time that some-one did a snap roll in it!

Let's just hit the highlights of that Avweb article.

Has Something Changed?

No, it is just that the simplifications that are commonly applied in pilot theory and the brevity of flight manuals (especially older ones that come with a typical aerobatic trainer) were inadequate.

You may have been told something like the definition quoted in Avweb's article:
"The maximum speed at which the limit load can be imposed (either by gusts or full deflection of the control surfaces) without causing structural damage."

Another one that I have seen is:
"Maneuvering Speed is the maximum speed at which you may use abrupt control travel."

Aerobatic pilots may also be familiar with the definition provided by CASA in their CAAP 155-1, Aerobatics, which states:
"Manoeuvring speed (V_A) is the speed above which full deflection of the elevator control will exceed aircraft structural limitations. Below V_A the aircraft will stall before structural limits can be exceeded."

All are woefully inadequate definitions of V_A and it is particularly disappointing to see that CASA's advice to aerobatic pilots is also inadequate.

Say It Ain't So

Avweb stated it very clearly:
"Surprisingly, to nearly every pilot, V_A is **not** a speed which at or below the pilot is allowed full unrestricted control surface movement without the danger of structural damage or failure. Another big surprise is that it should never be considered a gust penetration speed. The old Flight Training Handbook only hinted about this little bit of very important information: "Regardless of speed held, there may be gusts that can produce loads which exceed the load limits."

"The actual truth is significant and two-fold: Only when V_A equals V_S times the square root of the load factor will the aircraft stall in a nose up pitching maneuver at or near its load limit factor. Moreover, any time the value of V_A is greater than the value of V_S times the square root of the load factor, as is often the case, the loads imposed by the maneuver or gust need to remain along a single rotational axis, otherwise the aircraft's load limits will be exceeded."

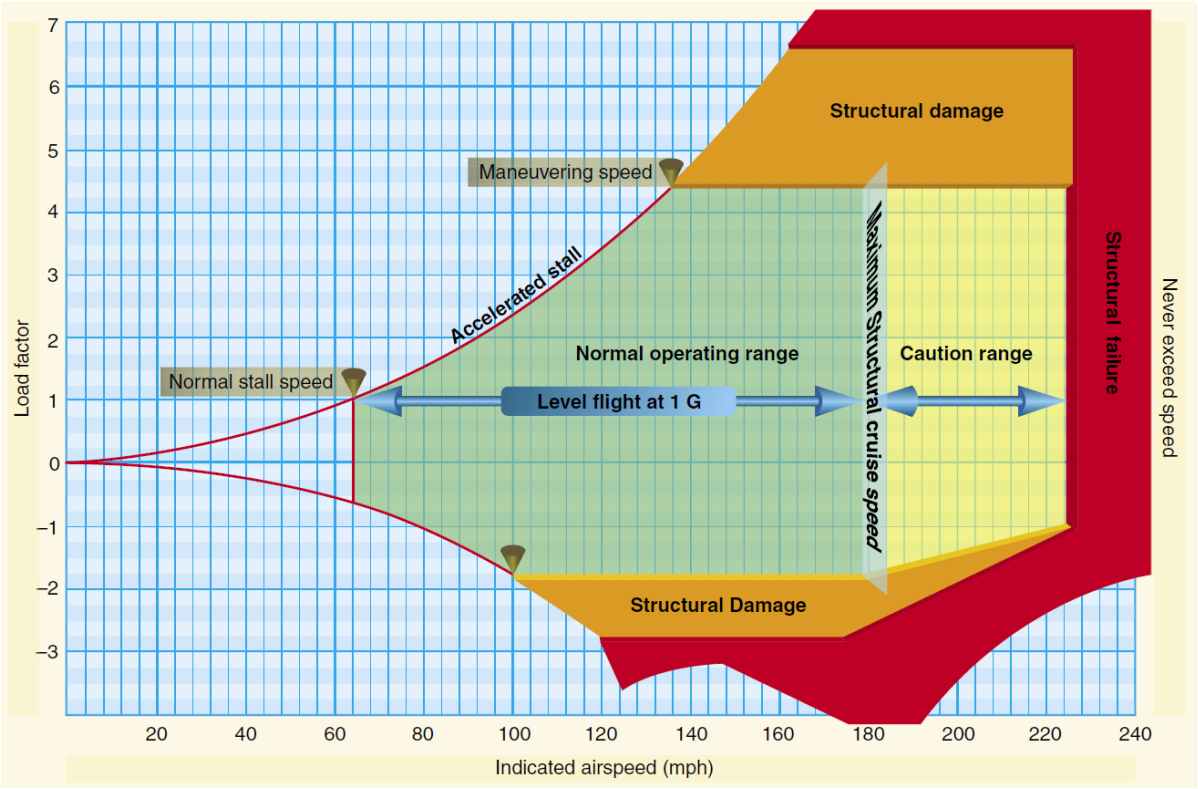
How many pilots believe that V_A equals Vs times the square root of the load factor for all aerobatic aircraft?

Part 23 Regulations

The airworthiness design regulations certainly require an aircraft to be strong enough to cater for the application of full control deflection up to V_A but NOT:

- Full control deflection followed by full opposite control deflection, NOR
- Full deflection of two or more controls

This diagram from the USA FAA's Handbook of Aeronautical Knowledge shows a "standard" flight envelope. Have you looked at the actual flight envelope for the aircraft that you fly? Unfortunately, they are rarely provided so even more reason for aerobatic pilots to have a good working knowledge of flight envelope limitations. For example, are you permitted to move the stick full forward abruptly at V_A?



Part 2 continues with more of the Avweb article and the full, correct definition of V_A.

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