Tech' Desk

TEST-FLIGHT CARD, POWER-OFF STALLS

I now have a good degree of comfort in flying my aircraft. With each hour of flight time and especially when going through my programmed Test Cards, my confidence level in my home-crafted aeroplane increases, as does my confidence in my own ability to fly and handle it. And because of this confidence level, I'm now ready to expand the flight test envelope into the edges of flight, and now want to explore the straight forward power-off stall.

There are a number of information packets and procedural outlines available for this test-flight. An excellent reference is FAA AC90-89A. (Google FAA AC 90-89A, and go to 'Advisory Circular' to download a copy.) Play it safe. Check out the information regarding the safe way to approach and to conduct this test. Go from the known to the unknown slowly and follow your flight-test plan. If you are at all uncomfortable with the inherent risk of a spin resulting from this flight-test, consider having an experienced test pilot perform it for you.

Methodology:

We want to establish a number of data for different flight conditions. To start, and manage risk, we will fly an aircraft loaded to a slightly forward (from the centre) of our C of G envelope. Next we will ensure that the aircraft loading is well below its maximum takeoff weight. We will stall the aircraft in a 'wings-level, straight ahead' flight path. And we will stall it with power off, first with flaps up, then with flaps at take-off position, and finally with full flaps as in a normal landing.

C of G and Weight Issues:

Before flight, a calculation gives us a CG position of 81.28" from our datum. Our CG range is from a forward position of 77.95" to an aft of 84.84". If we take the centre of these numbers as 81.40", we can see that our loading for this test is just slightly ahead of the centre position. In addition, our weight of 1685 lbs is well below our allowable take-off weight of 1750 lbs.

Desirable Stall Characteristics:

Our RV-9A is equipped with an Angle of Attack (AOA) instrument. This unit provides a series of LED lights starting with two green, then three amber and finally three red indicators as the aircraft transitions from level flight to slow flight and then finally to the stall condition. In addition, an audio signal is transmitted to the earphones as the stall is approached. We want this instrument to warn us prior to the stall.

In addition, we would like to have the stall occur in a straight-ahead manner with no tendency to roll to either side. And then we would also like to experience a definite buffet announcing the oncoming stall.

Flight-test Card:

A simple flight-test card is prepared to enable quick data entries. In order to develop accurate data, we will run three stall tests and average the findings. We will repeat the same procedure for each of the three flap positions.

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TEST-FLIGHT CARD, POWER-OFF STALLS

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STALL - POWER-OFF, WINGS LEVEL					
Flap Position	Run #	Stall Warning IAS (MPH)	Buffet	Roll Tendancy Deg. L/R)	Stall IAS (MPH)
	1				
	2				
	3				

curred prior to allowing the aircraft to fly out of it. In the stall the nose dropped straight ahead and we felt little, if any, tendency for either wing to drop.

We repeated this 'flaps up' stall test two additional times, and the results were very nearly identical. (See results in the following Flight-test Card.)

Flight Data:

The flights were flown giving remarkably similar data. The day was clear and calm, and with little wind. Some reference materials suggest alternating directions 180 degrees for each subsequent test, but since we are only recording ***indicated*** airspeed, I see no reason for this additional test requirement.

We conducted our tests at about 3000 ft. AGL. Since we are familiar with the stall characteristics of this aircraft we felt comfortable at this altitude. In an unfamiliar aircraft I would suggest following AC 90-89A's recommended 6000 AGL test flight level.

Stall Flight-test, Flaps Up:

The first test (flaps up) gave us no measurable buffet but a nose drop of about 20 degrees. Our stall warning occurred at 17 mph above the actual stall. Recovery followed as soon as the control stick was moved ahead, and we lost about 100 ft. of altitude before recovery. Recovery could have been quicker with less altitude loss, with a quicker response on the control stick. However, we wanted to ensure a definite stall had oc-

Stall flight-test, Take-off Flaps:

The same tests were repeated with flaps in the 'take-off' position. The results were similar, but the pre-stall buffet was more pronounced, the stall itself was deeper, occurring at a lower airspeed. There was a tendency for the aircraft to roll slightly to the left in the stall. Recovery again was immediate upon the forward movement of the control stick. The indicated airspeed at the stall was at the bottom of the instrument's scale, and so only an approximation could be made. Recovery showed a lesser loss of altitude, somewhere around 75 feet. Stall warning occurred at about 20 MPH before the stall.

Stall Flight-test, Full Flaps:

Finally, we again repeated the tests, this time with the flaps fully deployed. The stall was still deeper, in that the nose dropped to a lower level before recovery. The IAS was entirely off the instrument's range, and recovery was immediate. With the application of power together with the forward movement of the stick, the aircraft flew out of the stall immediately with little altitude loss.

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TEST-FLIGHT CARD, POWER-OFF STALLS

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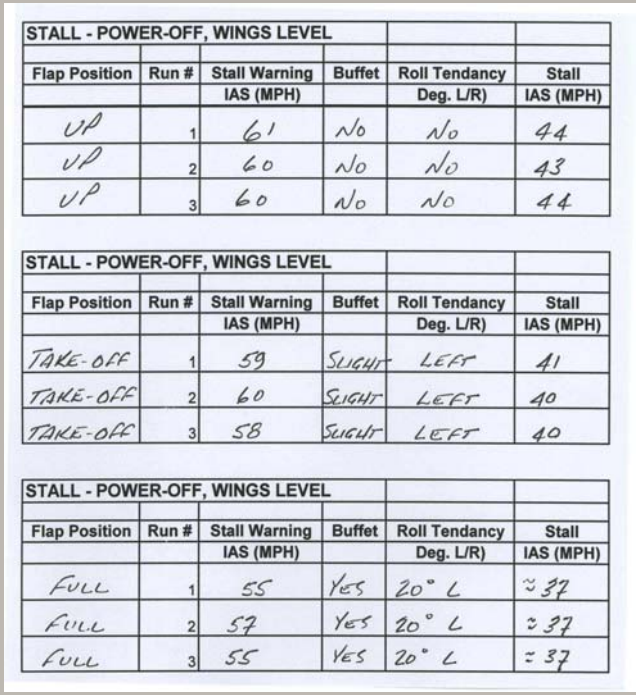
Again, the stall warning occurred well before the stall.

Now however, under the conditions of the full-flaps stall, there was a definite tendency for the aircraft to roll to the left, dropping the left wing. This was not a sharp movement, but it was definite and easily corrected with the application of full right rudder.



STALL - POWER-OFF, WINGS LEVEL

Flap Position	Run #	Stall Warning IAS (MPH)	Buffet	Roll Tendancy Deg. L/R)	Stall IAS (MPH)
UP	1	61	No	No	44
UP	2	60	No	No	43
UP	3	60	No	No	44

STALL - POWER-OFF, WINGS LEVEL

Flap Position	Run #	Stall Warning IAS (MPH)	Buffet	Roll Tendancy Deg. L/R)	Stall IAS (MPH)
TAKE-OFF	1	59	SLIGHT	LEFT	41
TAKE-OFF	2	60	SLIGHT	LEFT	40
TAKE-OFF	3	58	SLIGHT	LEFT	40

STALL - POWER-OFF, WINGS LEVEL

Flap Position	Run #	Stall Warning IAS (MPH)	Buffet	Roll Tendancy Deg. L/R)	Stall IAS (MPH)
FULL	1	55	YES	20° L	≈ 37
FULL	2	57	YES	20° L	≈ 37
FULL	3	55	YES	20° L	≈ 37

Conclusion:

These test runs have shown an aircraft that is benign and docile in the condition (CG and take-off weight) that the tests were conducted, although some adjustments should be made. The actual results can be summarized as:

Power-off, Flaps Up:

Stall warning at 17 MPH before stall

Little or no buffet before stall

No roll tendency in stall

Stall occurs at 44 MPH IAS

Power-off, Take-off Flaps:

Stall warning at 20 MPH before stall

Slight buffet before stall

Slight tendency to roll left during stall

Stall occurs at 40 MPH IAS

Power-off, Full Flaps:

Stall Warning at 19 MPH before stall

Measurable Buffet before stall

Definite roll to left during stall

Stall occurs at an estimated 37 MPH IAS

These summarized results will be entered into our Pilot Operating Handbook (POH). Additional action that should be taken includes:

- Reprogramming the AOA instrument to warn at a 'closer to stall' airspeed. ie. somewhere around 7 to 10 MPH IAS.

- Check to see if asymmetrical flap deployment is causing the roll to the left in a flaps-down stall, and

additional tests conducted at full take-off weight and also at maximum aft CG loading, and then modifying the above results accordingly.

After the additional action has been taken, checked and recorded, we will explore power-on stalls with the same flap deployment positions.

Jack Dueck, EAAHAC