Caution: Rudder Flutter

ED: These knowledgeable inputs through <Canard.Com> indicate need to examine our rudder systems for proper rudder spring tension and good stops. I used to think weak rudder return springs just increased the chance of a "rudder banging" incident while taxiing down wind. There seems to be more to it than that.

Verne "Catman" Simon (CA) - I test flew my Long-EZ after removing the lower winglets. Stall characteristics and roll rate and seemed unaffected by lower winglet removal. High speed was very different though.

The throttle was advanced incrementally and the airplane was checked for flutter by "bumping" the stick in ten knot increments starting at 140 kts. Nothing remarkable happened until I passed through 175 KIAS when the airplane vibrated violently(I assume it fluttered). The main wing demonstrated 1 ft excursions along with a torsional component. It was scary to say the least!

After landing I observed:
1. Left rudder stop was missing and rudder was not aligned properly
2. All aileron hinges pins were in place
3. Rudder springs- still attached
4. In flight, rudders appeared to extend slightly in response to turbulence.
5. Examination of the exterior of the airplane revealed nothing missing or out of place
6. During flight the airplane required left rudder to maintain a "ball centered" flight regime. This is consistent with the rudder misalignment.

I increased rudder spring tension and trimmed the left rudder so it was aligned properly. I repeated the same flight tests but, limited the speed to 170 KIAS at 4000 feet. This flight seemed smoother than the previous one. This time there were no surprises.

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Bob Sudderth (WA) - This event sounds like he ran up to a speed where rudder spring tension was insufficient to hold the rudder firmly against the stop and the rudder fluttered. That drove the wing into a "driven" flutter condition. If the wing had actually fluttered I don't believe he would have survived.

A wing flutter condition, as I understand it, can be detected at a lower speed as a slight oscillation that slowly dampens. At a higher speed it goes bonkers so fast you can't stop it. When you have a control surface break loose it goes divergent right now and continues until you regain control of the surface. Flutter that is driven by a control surface is limited in magnitude due to the limited energy produced by the control surface. If a wing flutters, the energy is almost unlimited. The airplane normally comes apart.

A similar thing happened on the X-21 in the sixties. During a high speed structural test an actuator attachment fitting on one aileron broke off, thereby freeing the aileron. The aileron was unbalanced, as our rudders are, and it fluttered. It drove the wing to a driven flutter mode that got worse as speed was reduced. This went on for a minute and a half. Then a partial failure of the support beam holding the engines on occurred that changed the natural frequency of the airplane and the flutter stopped. There was no further damage to the airplane. This was due to the aileron being able to impart only so much energy into the airplane. The wing tips were moving 5 to 6 feet at three cycles per second. Had the wing been the source of the flutter the energy would have been unlimited and continuously magnified until it failed.

I bet when the lower winglet was removed the bottom of the rudder was exposed to the airflow. That would also aid in unseating the rudder at high "q" *(dynamic pressure)* speeds. This probably would never be a problem at normal speeds, but at high speeds, the rudder could unseat, deflect the vertical and wing tip in some strange way and start a cycle going. What ever you do, never fly with an unsecured control surface. Tape it, nail it, use good springs, but never let it fly freely. At normal speed it is evidently OK, since the rudder can only move in one direction, but who knows at what speed it is not OK.

This should be a lesson to keep very good stops and strong rudder springs to keep this from happening. I have always flown without lower winglets and have tested to 195 KIAS during flutter test with no problems. However, the bottom of my rudders are not exposed to the air stream. A small fixed surface protects the rudders in case I drag a wing tip landing and would otherwise tear off a rudder.

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Ken Brimmer (VA) - I thought you guys would like to know what Nat Puffer found when he was testing the removal of the lower winglets. He is the only one to do extensive testing of them (on a Cozy III).

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Nat Puffer (AZ) - The fact he didn't notice any difference in stall characteristics, doesn't mean anything. You have to have the c.g. where you can induce a main wing stall. Then you find out that the main wing stalls ½" c.g. farther forward without lower winglets. We were the only ones in all of history to document this effect.

Price VGs Lower Approach Speeds

Larry Mohr (IL) - I finished VG installation and did my first test hops. What a difference in slow-speed handling! I installed exactly as Jim Price advised with 6 sets at 20 degrees, 1/1/2" apart at 9" centers on each side of the canard and 9 sets for the main wings each. Final approach speeds changed from 90+ to 80 with what felt like the same attitude and a 500 fpm rate of decent. Cruse penalty is about 2 kts. One big thrill. I finally managed to complete an approach without the speed brake trying to chop my arm off, and at 80 indicated the LEZ is rock solid with the brake out. I'm tickled pink, if you can't tell.

Fly Safely