

## FLIGHT TEST - to Failure

One of our goals at Kolb is to ensure that our designs are thoroughly flight tested so that our customers do not unknowingly become "test pilots." One phase of flight testing involved substantiating the G-load rating. There are several methods of testing ultralights for this, most of them, in our opinion, are inadequate in their duplication of actual in-flight conditions. For our own purposes, we feel that actual in-flight testing is the best method, as results are not dependent on guess work or assumptions.

The UltraStar was the immediate predecessor of the FireStar, the two ultralights share the same wing. The only difference is that the drag strut is positioned in the FireStar at a more favorable angle, making it a little stronger than the UltraStar wing in resisting drag loads. Since the wing of the FireStar is at least as strong as the UltraStar, the flight test to substantiate the G-load rating for the UltraStar is valid for the FireStar as well. The test UltraStar was equipped with two recording G-meters for measuring the G-load rating.

The first phase of testing involved exploring the maneuvering speed limit. Full and abrupt movements of each of three control axis was performed at speeds up to 65 mph. This corresponding to the top speed of the aircraft, makes this test more stringent than required. Full back and right stick combined with full right rudder at this speed produces a very tidy snap roll.

The second phase of testing consisted of performing basic aerobatic maneuvers. The UltraStar was tested extensively doing hundreds of loops, snap rolls, and spins. Whip stalls were performed at angles up to and including the vertical (bordering on a tail slide). Typical entry speed for a loop was 70-75 mph (shallow dive with full power) which produced an average G-load of 4-1/4 G's at the bottom when exiting the loop. Thus the limit load of 4 G's was easily substantiated.

Not satisfied by just substantiating our claims, we wanted to determine how strong the UltraStar really was, and also to determine what speeds would be required to achieve the higher G-loads. Even having done many loops in the 70-75 mph range, it was a little exciting to achieve the 80 mph+ speeds needed to push the G-meter up to 5 G's, (the perceived effect of increasing speed is not a linear function). To obtain 5-1/2 G's required a full power dive at approximately a 40 degree angle below the horizon. The 5-1/2 G's was of much longer duration than typical loops performed at 4 to 4-1/2 G's. Incidentally, this 90 mph dive and the 5-1/2 G pullout was an exciting ride even for one accustomed to performing ultralight aerobatics.

At this point, we felt that the UltraStar had been well proven to be as strong as anything in its class would ever be required to be. There is just no way that any pilot would ever accidentally get into such a high speed dive situation (to which would have to be added an abrupt pull out) to get into such a high G-loading situation. But it was decided to do one more test to 95 mph. An abrupt and sustained pullout at this speed resulted in structural failure of the left wing; the drag strut failed and the wing folded back alongside the fuselage.

The parachute was deployed, and the plane and pilot were brought down safely. A very gentle (but exciting) landing in a tree resulted in minimal additional damage to the airplane. The only in-flight damage to the UltraStar was the left wing which had remained neatly in its folded position during the descent into the tree. The left wing has since been replaced and the UltraStar is once more happily looping and rolling its way through the sky.

The failure showed that the weakest link in the wing to be the drag strut. In the last extreme high-G maneuver it appears that the wing rib in the area of the center of the drag strut deformed slightly, enough to push the drag strut out of column, which resulted in a buckling of the drag strut. A steel brace has since been added to reinforce the wing rib in this area, (This is now included as standard in the UltraStar, FireStar and TwinStar). Since the UltraStar had proven to be as strong as necessary, we did not feel it necessary to test beyond that point to see what additional strength the reinforcement would provide.

In conclusion, we learned greatly from this testing. We have more confidence in the structural integrity of the UltraStar than ever before. We feel that the UltraStar is abundantly strong, and we cannot imagine how one in normal day-to-day flying could accidentally exceed even a momentary 4 G-load. This method is certainly not the safest way to test an ultralight, but we feel that it just might possibly be the only way to be 100% sure that all factors have been adequately considered.

Incidentally, we are not making claims that the UltraStar is an aerobatic ultralight. All of the above mentioned maneuvers have been performed in a built-to-plans UltraStar. We do not recommend nor condone aerobatics in the UltraStar. Such maneuvers always entail increased risks and dangers to the pilot.

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