Vari-Eze Spar Cap Failure

Andreas P. Christou *(CT)* - I noticed a small crack in the paint just below the right center section wing attach fitting (WA-2-5).

A friend put his finger over it while I moved the wing tip up and down. He felt it move! I looked at the top fitting while he moved the wing tip up and down and I saw the wing/center section gap move 1/16 in/out. Worse yet, the WA-2 plate was moving as well.

We removed the right wing and found a teaspoonful of bluish-white granular powder sitting between the WA-3 wing tongue and on top of WA-2-2 plate. The face of WA-5 spacer was corroded, as was the top surface of WA-2-2 in the area between the wing tongue.

I also noted that there was a gap between the top of WA-2 plate and the thick layer of micro above it. Given that the WA2/WA-2-2/WA-5 combination were moving, we felt that further nvestigation was needed. I ground off the micro above WA-2 for a small section in the middle, to avoid the strake lay-ups to the front and the cowling lip reinforcement to the rear.

I found large amounts of corrosion. I then exposed all the area above WA-2 and saw that the plate was slightly distorted, and there was a semi circular crack running in a curve around one of the eight AN509-428 R-14 screws. There was also a small gap inboard of WA-2, as evidence of movement.

I removed WA-2 plate, the WA-5 spacer and the eight screws and was then able to remove WA-2-2 WITH the BID pad and part of the spar cap still attached.

The bottom surface of WA-2 was severely corroded. About half the metal had been converted to a gray/white aky material.The spar cap had failed exactly on the inboard edge of WA-2 plate. The shear web had failed along the top front and top rear edge of WA-2.The bottom surface of WA-2-2 plate was also badly corroded as were all four faces of WA-5 spacer.

There was NOTHING holding the upper wing attach fitting to the center section spar, except a snug fit, and positive G.

My guess is that progressive movement and failure of the spar cap followed corrosion.

MY PLEA TO ALL OF YOU IS PLEASE!! CHECK your wing fittings thoroughly before next flight.

NOTE:
I had no external corrosion indication. Most corrosion was buried inside the structure. The failure of the upper center section spar cap was **TOTAL**.

During my last flight, I performed one roll followed by a loop, another roll, a half loop with half roll off the top, accelerating while falling to the 45 degree line, a pull to level and another roll and then local flying, all the time wondering why something just did not feel right.

The canard may be tested to 10 G, but was the wing attach fitting ever fatigue tested?

Andreas P. Christou
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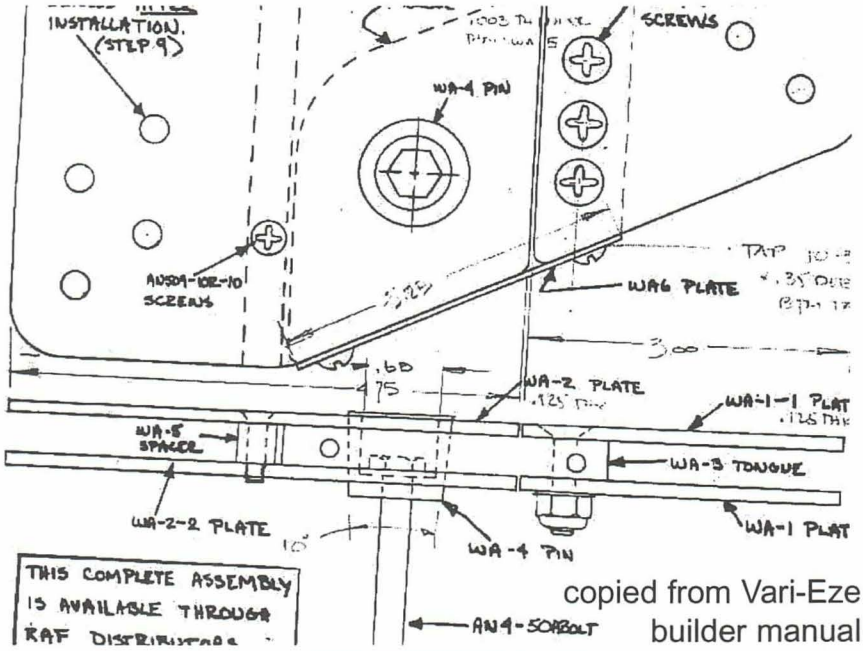
RAF Input

ED: I received the following e-mail CC from Burt Rutan, addressed to Andreas.

"Andreas.....no question you are luck to be alive. After looking at these photos it reminded me of the corrosion issues that prompted the inspections back in the 80s. Did your aircraft undergo these inspections? (I am attaching a Word doc. that summarizes Tonya's search of the CP newsletters)."

"On the assumption that there may be others out there with corrosion or failing caps, we must do a mandatory inspection recommendation immediately for all Vari-Eze types. Burt"



copied from Vari-Eze builder manual

Highly Edited CP Corrosion References. Refer to complete text in the Canard Pushers!

October 1983CP 38 page 4 Some builders live in highly corrosive environments. Rodie Rodewald - Hawaii has found exposed aluminum parts, not anodized, will corrode.

October 1987 CP 53 Page 4 carefully inspect wing attach fitting for inter-granular corrosion.

October 1987 CP 53 Page 7 CAUTION: CORROSION IN VARIEZE WING ATTACH FITTINGS East US

VariEze, not on the coast, had severe intergranular corrosion in wing attach fittings and two aluminum tubes between the top and bottom plates. All VariEze owners should make a very careful inspection of the aluminum wing attach fittings, especially under the glass that laps onto the aluminum plates. *ED-The notice details methods, sources, and procedures.*

April 1988 CP 55 page 8 Check wing attach fittings for corrosion. Remove both wings, clean and inspect the wing attach fittings on the wings and on the centersection spar.

April 1988 CP 55 page 5 We received a letter from a VariEze owner/pilot with corrosion in the WA-2-2 plate. This plate has one of the worst cases of intergranular corrosion we have seen. It is absolutely not safe to fly and must be replaced. Unfortunately, this is probably going to be very difficult, and we honestly do not have any simple fix for this. Just removing the WA-2-2 plate could do serious damage to the centersection spar. The UND wrap around the end of the centersection spar may have to be cut and removed. The foam under the WA-2-2 plate must be dug out, the 8 AN525 (or AN509) screws must be .

A replacement plate must be fabricated, duplicating exactly all of the holes in the plate. This is a difficult job and will require an expert machinist and a lot of patience. Brock will not be able to help you with this. Each case will have to be dealt with on an individual basis. The new piece should be alodined and then floxed and screwed back into place. If the UND wrap was damaged, it must be replaced, which requires cutting into the fuel tank.

This is major work, not anything that could not be done by a person who has built a VariEze, but very tedious, difficult work. It must be done right. There is no short cut, no easy way. If you find more than simple white powder surface corrosion, stuff you can easily polish off with 320 grit sandpaper, you must ground your VariEze and replace the corroded parts.A mandatory inspection is required before next flight for all VariEzes. Do not take this problem lightly, it could kill you and anyone who may be with you. Remove both wings. Clean all visible aluminum parts at the wing root and centersection spar. Look at the edges of all the WA plates on the centersection spar. Look for a thinner edge or a swollen appearance under the glass. Look in between these plates (where the WA-3 tongue slides in). A white powder appearance that can be completely removed and polished out with 320 grit is OK, but the plates should be very thoroughly cleaned and sprayed with zinc chromate. LPS or a good quality grease as used in marine applications should be generously applied everywhere before re-installing the wings. Check WA-4 pins and AN4 bolts and grease both thoroughly. Replace AN4 bolts if they show any sign of corrosion.

New construction VariEzes, or anyone replacing wing attach fittings with new ones, should clean all aluminum parts with Alumiprep 33 or Metal Prep #79 then alodine them with Alodine 1201. *ED-See CP for details*

When you inspect your VariEze, be very conscientious. Check very carefully, it is difficult to find, you may have to probe under the glass over the WA-2-2 plates. Look hard and long at it before you decide it is safe to fly. Keep the aluminum parts clean, grease them often and you will have no problems. People who live far from oceans may not see this problem but they must check for it just the same. This problem is confined to the VariEze. The Long-EZ wing attachment is completely different and this same problem should not occur. Of course, all metal parts must be protected from corrosion.

January 1991 CP 66, page 3 ALERT! Possible Corrosion in Elevator Torque Tubes in EZs. Ohio VariEze noticed small bumps rising up on top of each elevator along the aluminum torque tube. He could depress these bumps a little with his finger. He found "severe corrosion pits where each bump was located. There is no corrosion at all on the exposed ends of the elevator torque tubes.

ALL EZ, Defiant and Solitaire flyers should inspect the leading edges, the tops and bottoms of both elevators for bumps such as we have described here, before the next flight. If any evidence of bumps or corrosion is found, ground the airplane and remove foam and glass locally. Anyone living where there is much humidity should be concerned and check the area called out before each flight.

October 1996 CP 86 page 4 Corrosion Found in Brackets. Long-EZ pilot reported finding moderate to severe corrosion in the GU elevator hinge brackets.. Every EZ and Defiant owner should make frequent careful inspections of these brackets. Keep in mind that there was little or no evidence visible outside the canard. *ED: - The notice continues with procedures, materials and methods.*

January 1997CP 87, page 9 Ft. Myers, FL- VariEze sat under a flat metal shade with no walls. The hinge brackets started to corrode so replaced them with stainless steel ones.I now have a Long EZ and made its brackets out of stainless. However the canopy hinges on it started to corrode and I had to cut up the hinges to get the canopy off. I keep after the rudder and aileron hinges with WD-40 and have had no trouble with them.

January 2002 CP107 page 8 My EZ wing attachments are disintegrating, that is the aluminum is separating, that is flaking off. If so what was done, or can anything be done to stop this condition? Can the attachments be replaced or must I part my old bird?

Burt Rutan — This is a real tough one. As described in an early newsletter the aluminum components need corrosion protection for all but our dry desert environments. They are not easily replaced, since the units are jigged as a unit during construction. I have seen others resort to building new wings and center section to deal with wing attach corrosion. There may be a way to avoid this but RAF has never worked out or approved a repair procedure.