Vari-Eze Mandatory Ground

Inspect for Corrosion and limit flight operations before next flight.

IMPORTANT STRUCTURAL NOTICE
VARIEZE WING SPAR AND WING ATTACH STRUCTURE

A Vari-Eze wing center-section spar cap has failed. This compression cap totally failed just inboard of the right wing attach fitting. The failure appears to be caused by high flight loads; however, the failure was discovered on the ground and did not result in an accident. This is the first known failure of a Vari-Eze fiberglass primary structural component.

Tests conducted at RAF have shown that the compression cap was joggled on installation and samples from the other wing show serious weakness. It is possible that other Vari-ezes also have weak spar caps and, thus, RAF is recommending that all Vari-ezes immediately be subjected to significant flight restrictions.

RAF is in the process of attempting to develop an acceptable spar cap repair procedure in order to allow Vari-ezes to operate safely. Due to the way the Vari-Eze wing attach aluminum parts are jigged and installed during the wing fabrication process, it is not feasible to merely replace affected components. It may be necessary to modify the wing structure in a way that will not allow wing removal.

Following the discovery of this failed spar cap and during the disassembly the builder discovered very serious corrosion in the aluminum parts of the top right wing fitting. The corrosion would also have resulted in wing failure if it had not been discovered.

The corrosion problem and inspection requirements have been covered in directives in the Canard Pusher newsletter on six previous occasions: CP 53 Oct ’87; CP 55 Apr ’88; CP 66 Jan ’91; CP 86 Oct ’96; CP 87 Jan ’97; and CP 107 Jan ’02. (These notices are repeated later in this newsletter).

In spite of these notices we continue to see occasional examples of severe corrosion, the extent of which is likely to cause wing failure.

Based on the data we have seen to date there is a high likelihood that an EZ will lose a wing resulting in a fatal accident unless builders ground their aircraft and carefully inspect them. Builders of experimental aircraft are, in general, careful to do inspections and check all newsletter notices. Those who operate, but did not build their aircraft are generally at a much greater risk since they often ignore notices or are not experienced at inspection and repair. If you have built an experimental but are no longer operating it, do take the responsibility to notify and assist the new owner so he can fly safely.

Details from the spar cap failure incident follow:

After discovery of the failed spar cap (a “loose feeling” when moving the wingtip) the aircraft was grounded.

During the teardown to find out what had happened, considerable corrosion was found in the top WA-2 aluminum plate. The owner of this aircraft promptly contacted RAF, and offered to send the corroded and failed pieces to us for our evaluation. He later also sent additional pieces of his center section spar box so we could conduct some structural tests.

We have carefully examined all of these materials and parts, and have also conducted compression tests on the unidirectional E-glass spar caps from both the left and right sides of this center section spar. The corrosion found in the WA-2, WA-2-2 plates and the WA-5 spacer from the top right side wing attach fitting, is inter-granular corrosion in the WA-2 plate particularly, and thus cause for concern for anyone operating a Vari-Eze.

For now at least, we feel that this incident is comprised of two separate and different problems. The severe corrosion of the aluminum wing attach plates is one and the failure of the glass spar cap is the other, and there does not appear to be any connection between the two.

Such severe corrosion in this wing attach fitting, in a Vari-Eze that has been flying for 20 years means that it is possible that many other Vari-ezes out there could also be affected. This

particular Vari-Eze was built in North Andover, Maine, and was based at and flown from the Lawrence, MA (KLWM) airport. It was purchased by Andreas Christou in June of 1992, and moved to the Waterbury/Oxford (KOXC) airport. It was subsequently moved to the Sky Acres (44N) airport in 1997. All of these locations are on or near the North East Coast. It has been parked outside on the ramp in a marine environment all of its life except when brought home for the winter for maintenance.

This Vari-Eze was built before the recommendation came out to Alodine all aluminum parts. For some reason not understood, only the right upper wing fitting was affected by this corrosion. The lower right, and both upper and lower left wing attach fittings on the center section spar are essentially corrosion free. In this case the owner had installed cover plates over the normally visible, wing attach aluminum plates. These consisted of thin aluminum covers that were fitted over the wing fittings, and held in place using silicone as an adhesive. This made it impossible to inspect the actual WA-2 wing attach plates during a normal pre-flight walk around. Had it been possible to easily look at the top surface of the WA-2 plates, there were indeed indications of corrosion at the inboard edges of this WA-2 plate that should have been noted during a pre-flight inspection.

If you own a Vari-Eze which has had any kind of cover installed such that you can not closely inspect the normally visible WA-2 wing attach plates, remove them before next flight, and do not re-install them. It is possible that these covers actually allowed moisture to become trapped in the void under this cover, and exacerbated the corrosion problem.

Before next flight, remove both wings and carefully inspect the top of each wing attach fitting, the WA-2 aluminum plates on the center section spar box. Carefully check both left and right and top and bottom plates. Look for little gray lines indicating possible corrosion, extending from under the composite lay-up/micro fairing inboard of these fittings. Examine with special care between the plates and look closely at the visible face of the WA-5 spacer. See page 6-17 in Section 1 of the Vari-Eze plans to be sure you completely understand this important paragraph.

In the case of the Vari-Eze involved in this incident, the corrosion was obvious using the described inspection above. If you see any signs of corrosion, you must ground your aircraft, and conduct a much more thorough examination, which will include actually cutting into structure, and removing the WA-2 plates.

In the subject Vari-Eze, the top right WA-2 plate was so severely corroded that the corrosion had worked its way completely through this 1/8” thick plate, reducing the physical qualities of this plate to the point that this alone would have caused a wing attach failure. The WA-2-2 plate and the WA-5 spacer also are heavily corroded, particularly in the area of the void between the “ears” or tabs of the WA-3 tongue, which is part of the wing fitting on the wing itself. See the top view on page 6-17, the WA-3 tongue and the WA-5 spacer, are outlined using a dashed line. Please report any findings of corrosion to raf@antelecom.net, or by snail mail to RAF, 1654 Flight line, Mojave, CA 93501.

Center section glass spar cap failure.

The failure of the actual unidirectional glass top spar cap, just inboard of the right WA-2 wing attach plate was likely caused by an in-flight overload, and occurred right at this location due in part to glass fibers that were not straight, and also what appears to be a rather poor quality laminate. We have carefully removed a section of the glass spar cap inboard from this fracture point, and upon close examination, have found what looks like a rather dry, resin-starved lay-up. We made up 8 test coupons, cutting up the spar cap inboard of this dry-looking local area, and we have failed each of these in compression using an Instron Lab testing machine. The average compression failures occurred at only 68% of the expected stress.

In addition to this test we also conducted a compression test of the left upper wing attach/spar cap. The left compression spar did not fail in flight, and on close inspection, there did not appear to be any damage to the spar cap. It is of course possible that there may have been some compression damage that was not detectable. There was no corrosion visible in the aluminum wing attach plates in this area, nor in the bottom fittings of both wings. The section of spar cap immediately adjacent to the WA-2 aluminum plate, failed in this compression test, at a stress

level of only 25% of the predicted maximum stress. This indicates a serious weakness, however the test method may have induced some side-loading of the cap.

This is extremely serious, because it seems likely that since this has occurred in this one example of a Vari-Eze, that there may be other Vari-ezes out there in the field that have similar weaknesses. There is no way, short of a load test to failure, to determine that any particular Vari-Eze has a similar problem. Such a test would of course render the aircraft un-flyable, and even if tested to a lower "G" value, there is a good chance that undetectable damage would occur during such a test, making the subject aircraft unsafe to fly.

During the testing described above, all of the samples failed without the normal "cracking" sound we have come to expect. They simply failed in what seemed to be a "soft", soundless failure. Certainly not what we normally see when conducting compression tests on composite laminates.

We are worried that there may be more of these weaknesses out there. There is no easy way to determine if your particular Vari-Eze has the same problem, and there is no simple fix for this problem. For these reasons RAF believes that all Vari-ezes must be grounded upon receipt of this information, and a carefully conducted examination of the wing attach fittings must be completed before next flight. In addition, no Vari-Eze should be flown to a load factor above 2.5 "G"s. Also, you must avoid flying in greater than light turbulence, and of course, do not fly over the 1110-lb gross weight limit.

RAF will be attempting to contact all known Vari-Eze builders/fliers, through the RAF web site, Sport Aviation, the Canard Pusher, the Central States Newsletter, and all other sources available to us. We would also ask you as a Vari-Eze owner, to pass this information on to any one you know of who is flying a Vari-Eze.

DETAILED CORROSION INSPECTION

Before next flight, all Vari-ezes must under-go the following:

If your Vari-Eze has any kind of cover installed such that you can not closely inspect the normally visible WA-2 wing attach plates, remove them and do not re-install them. It is possible that these covers can actually allow moisture to become trapped in the void under this cover, and actually cause a corrosion problem.

Open your Section 1 of the Vari-Eze plans, and turn to page 6-17. Study the drawing of the Brock manufactured wing attach assembly, and keep this page handy so that you will clearly understand the following instructions.

Using a flashlight, closely inspect the visible part of each WA-2 aluminum plate on the top of the aircraft, and each of the WA-2-5 aluminum plates visible on the underside of the plane. Pay particular attention to the inboard edge of these aluminum plates. Look for little gray corroded lines extending from under the composite lay-up/micro fairing inboard of these fittings. Also look for any gap that may be building between the composite structure and these aluminum plates.

Now remove both wings, and place them on padded sawhorses such that you can easily inspect all areas of the aluminum wing attach fittings, on the wings as well as on the ends of the center section spar. Remove each aileron from the wings, and set them aside.

On the center section, use your flashlight to examine between the aluminum plates where the WA-3 tongue normally fits. Look for any signs of corrosion on the inner surfaces of these plates, as well as on the visible face of the WA-5 spacer.

On the wings conduct the same careful examination, paying particular attention to the inside edges of the "ears" of the WA-3 tongues, but look at every surface, on top and underneath the wings. You are looking for little "wiggly" gray lines of corrosion, or any pitting on any surface indicating corrosion.

Any indication of corrosion in any of these areas is cause to ground your Vari-Eze, and to conduct a much more in depth examination. This may include actually cutting into structure to get a better look. Report any discovery of corrosion to RAF. raf@antelecom.net is the email address, or via snail mail, RAF, 1654 Flight line, Mojave, CA 93501

If you find absolutely no indication at all of any corrosion in your wing attach fittings, you may return your Vari-Eze to flight status with the following limitation: Never exceed 2.5 "g" positive, or 1.5 "G" negative in flight. Install a placard in plain sight on the instrument panel, with these words

clearly shown. Also change all reference to flight at more than 2.5 ”G” in your owner’s manual, to read 2.5 ”G” maximum allowable in-flight loads.

Vari-Eze Ailerons Corrosion Inspection

There has been a report of corrosion of the A1 aluminum tube, in the inboard end of the ailerons on an older Vari-Eze, necessitating replacement of this tube. Therefore you must check yours at this time.

Before re-installing your ailerons, carefully examine the hinge areas of both ailerons. Look for any paint cracking around the hinges, or any signs of swelling around the aluminum tube A1 that is floxed into the foam core under the A2 aluminum bracket. The inboard hinge is mounted to the A1 tube and A2 bracket and the outboard hinge is attached to the aileron using Avex or Cherry rivets. See page 13-4 of Section 1 (Second edition) for detailed cross section drawings. Remove some glass, inspect and repair the glass per plans repair procedures.

Long-EZ and Defiant Mandatory Ground

Inspect for corrosion per this newsletter before next flight.

There has been a report of severe corrosion of the A10 aluminum tube floxed into the inboard end of the foam core of the Long-EZ ailerons. The hinges are mounted to the aileron using Avex or Cherry pop rivets. These rivets pass through the hinge, through the glass skin of the aileron, and through the A2 (or A5) brackets. See page 19-14 for detailed cross section drawings of these areas. If moisture is able to find its way into the A10 tube it is possible that this tube and perhaps even the A2 and A5 brackets could become corroded. The fix is to cut the bad sections out of the aileron, and replace them with new parts, using the standard repair criteria of lapping 1” per ply onto well sanded existing known to be good structure. Be certain to treat all aluminum parts with Alodine just prior to installing them. This surface preparation will prevent any re-occurrence of corrosion.

Since the Defiant aileron is essentially identical to the Long-EZ, please follow all of the above instructions.