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REPORT ABOUT FINDINGS - LOOSE BRACKETS

FOR TAIL WING IN JORA UA2 1995 – BUILD no. 008

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Problem description:

During checks in spring 2010, a certain play was discovered in the Tail wing of LN-YOY Jora UA2. It was possible to move the left side of the tail wing up and down a couple of millimeters, while there was a remarkable "tick" sound inside the tail wing bracket area. The tail wing on a Jora is connected with a 6mm stainless steel cross bolt, and one 6mm bolt at the rear edge.

The play which was discovered was not in the bolt/bracket fixture, but appeared to be loose brackets inside the wing itself. From external checks it appeared that only the left side had developed some play (approximately 0.5 mm) but after opening for inspection the problem was apparent on both sides.

The wooden central beam had expanded during seasons of cold and wet, and made the bolt nuts work themselves into the wood a little. This then led to be loose brackets which in turn led to play in the fixture of the tail wing.

How the repair was done:

Openings for inspection was made in the cover material from underneath. This was as agreed with the factory as the best procedure. To reinforce these holes, a rip stop ring was glued and sealed. One inspection hole for each side was made.

On the opposite side of the wooden central beam, hidden inside a D-formed torsion case, were the nuts used to connect brackets to the tail wing. The wing is made from a central plywood beam with a D-shaped fiberglass leading edge. This is a construction which does not allow the nuts to be accessed without cutting a hole.

Access holes for inspecting the bracket bolts were cut, one each side. The bolts are still rather difficult to reach but the wooden center part of the wing cannot be opened, hence the holes are cut offset.

In order to access the nuts for the bolts inside the torsion box, holes needed to be cut through the fiberglass from either the top or the bottom in front of the central beam.

It was decided that holes on the top, where there was compression forces instead of underneath where there is stretch forces, was better.

The above picture was agreed with the factory to be a good way to get inside for repair. The holes were first drilled 22 millimeters, but increased to 42 for access with tools.

The repair is easier to get stronger on the compression force side, compared to the underneath where stretch forces are a play.

Bolts and nuts was dismantled, and the brackets were pulled out from inside into the wing. This is a cumbersome job, since the front of the tail wing has access into the 6x12x12 cm boxes through the described 42 millimeter holes only. It is a bit of work, but not impossible if one is a bit creative, patient and create tools which will fit inside the rather tiny and small areas.

View of the inside fastening of the brackets before disassembly. There is no trace of glue, and the bolts are rather loose due to the plywood beam have expanded with temp. and seasonal changes.

Apart from the fact that the brackets are loose, everything else looks good. Wood and glue have a good quality and there are no traces of damages. It appears with certainty that the bolts have worked loose due to vibration and seasonal changes, and not from a structural damage or overload.

First two holes of 4 millimeters were drilled. A piece of piano wire were used to probe through these holes in order to determine that there would be no structural damage on hidden objects when a larger 22 millimeter hole was drilled. Afterward a new check, and two larger 42 mm holes were drilled which did make it possible to use tools to remove the nuts inside.

To avoid opening new holes if the bolts works loose again, two nut holder racks were manufactured which will hold the six M4 all-metal lock nuts.

New M4 8.8 grade bolts, stainless steel all-metal lock nuts, and a stainless steel racks were fabricated and test mounted before gluing.

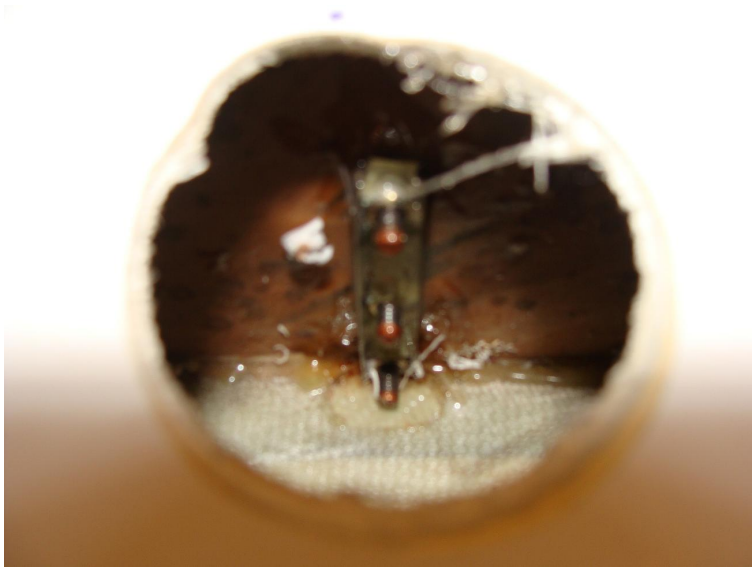
The racks are made from 1.4 millimeter stainless steel, as a tray which can hold the 7mm nuts rather tight. The nuts were glued into the rack with cyanacrolate glue, before T-88 epoxy was used to fill all space between the nuts.

The racks were after gluing test fitted with brackets and bolts to ensure a good fit inside the tail wing.

Racks and brackets were glued to the wooden beam when they were mounted with T-88. The nut did get a thin layer of copper paste to avoid bolts rusting or being glued to the nut. It also will make it possible to tighten the bolts if necessary at a later stage.

Rather extensive work was done to avoid getting glue on the bolts in the wooden beam, even if there might be a small amount which did get to the bolts. The goal was to avoid gluing the bolts, and I do think this mostly was achieved.

Observe there is very little space on the bottom side towards the fiberglass, so the racks cannot be much longer than the nut itself on that side. (The picture show here where the nut is mounted all the way to the edge of the racks on one side)



Assembly is relatively simple. The main concern is lack of space. The racks are glued to the wooden beam so they cannot work loose again. This makes it possible to replace or re-tightening the bolts later.

The picture show the copper paste which were smeared into the nuts on the end of the bolt. Picture is taken from the top of the tail wing and downwards.

After the brackets where mounted back in the tail wing, every layer of fibers in the D torsion box were sanded stepwise . This to get a strong repair using 4 layer of fiberglass laminated with T-88.

The picture shows the holes after the sanding. Every layer of the D box has been revealed. Since there is no possibility to glue from beneath, a layer of glue was smeared on the underside of the holes, and the first ply of fiberglass were pushed 1 millimeter into the hole so the lamination was in contact with it.

A total of 4 layers were epoxied, where the direction in the fibers were rotated.

The Lamination was a little thicker than the original. This is not always better, but the 1mm lower glued fiberglass did make the first laminated layer a little thicker.

After all the layers were laminated and glued they were sanded smooth with the top of the tail wing. Surface protection of the wing was decided not to be painted, but to be covered with 3M ControlTac 180 white film.

Paint would demand a full sanding of the tail wing, and extra weight and work. The film can later be peeled off using a heat gun , enabling an easier inspection of the repair.

A complete repair can be seen on the picture to the left..

3M ControlTac can be delivered in a range of colors, and is a strong film used as decor film on cars, durable for many years even if the cars are taken through car washers.

The inspection holes on the underneath were created using rip stop rings from AircraftSpruce. This makes it possible to inspect and do maintenance at a later stage.

The rip stop rings were covered with a transparent lid of plastic, and covered with transparent 3M ControlTac 180 film. A visual inspection of the brackets can now be done without opening the tail wing again.