



IT'S NEVER TOO LATE TO STOP SMOKING...

...FASTENERS

Recently, Red Man Aviation in Tulsa, Oklahoma, had the opportunity to perform some fastener replacement and doubler installations on several clients' aircraft. These planes exhibited some common aging aircraft issues that we thought would interest the Aerostar Owners Association.





Of the several aircraft inducted for repairs and modification, the underlying discrepancies that appear to be increasing in frequency and severity, are loose and or failed CherryMAX/Huck fasteners on the upper and lower spar cap flanges on both the forward and aft spars from WS #28.5 to WS #58 (wing stations). In addition to the fasteners, skin cracks fore and aft emanating at the outboard edges of the main gear cutouts were present on both aircraft. These issues are well known and documented, with repairs available and excellent technical data references provided by the helpful individuals at Aerostar Aircraft.

None of the issues are unexpected or insurmountable. As the fleet ages and the cycles increase,

these issues will concern most of our Aerostars. This article aims to illustrate to owners what to look for and step through the repairs and modifications process.

The picture above and the following page is an excellent exemplar of the visual indications of what one might see on their aircraft, possibly indicating that fasteners are beginning to “work.” Further investigation on the two aircraft we observed suggested that the fasteners were loose and could be “spun” in place. This led to some very trying times when attempting to cut the Cherry or Huck locking collars and drilling the fasteners out during the removal process. The loose fasteners found were limited to the spar caps and the aft, intercostal, and trailing edges.

This page

Example of the visual indications of what one might see on their aircraft possibly indicating that fasteners are beginning to “work.”

Opposite

Illustrates crack forward of right main gear trunnion. This particular area had a small doubler of unknown origin installed in the past that appeared have little effect on the crack propagation as evidenced by the doubler and the skin underneath.

The photo to the right is of the underside of the right wing between the respective wing stations illustrates the possibility of fasteners working. A better assessment of the condition of the fastener can be gained by pressing on the fastener or the adjacent skin to visually check for movement. In several instances, we were able to get the movement of the skin. Still, we could physically “wiggle” the fastener in position.

The repair process began with some research and consultation with the fine folks at Aerostar Aircraft. John Jurkovich at Aerostar was more than helpful in supplying all the technical data, drawings, parts, and some tradecraft for tackling the repairs. We sent pictures and a description of the aircraft to see what we were dealing with; they were familiar with the status of our plane.



Top
Underside of the right wing between the respective wing stations illustrates the possibility of fasteners working.



Bottom
Replacing fasteners



This page

Preparation includes a thorough review all the notes and drawings. Drawings were provided by Aerostar Aircraft.

Opposite

Each & every individual hole has to be measured and checked for each and every fastener.

After thoroughly reviewing all the notes and drawings, the next step was to get organized with the proper replacement fasteners and tools to begin the careful removal of the suspect fasteners. In any process like this, the first and foremost objective is to not create new problems. Having the right tools to cut, drill, and precision ream (if required) for the proper interference fit (depending on the type of fastener) of the replacement fastener is a must. The types of fasteners we refer to are the Hi-Lok and CherryMAX series. The Hi-Lok series fastener is inserted with an interference fit. A collar is installed on the threaded end to shear at a predeter-

mined torque. The CherryMAX series is a blind fastener pulled with Cherry Pneumatic Rivet Tool. Depending on their intended application, these fasteners must be on hand in multiple lengths and diameters. Since we are attempting to address OEM fasteners that have been working or failed, each hole in the parent material must be properly examined.

In some cases, the fastener hole is “out of round” due to a previous working fastener. It must be reamed to the first or second oversized dimension. This required each individual hole to be measured and checked for each fastener. In addition to the proper diameter of each hole, we ob-





Top

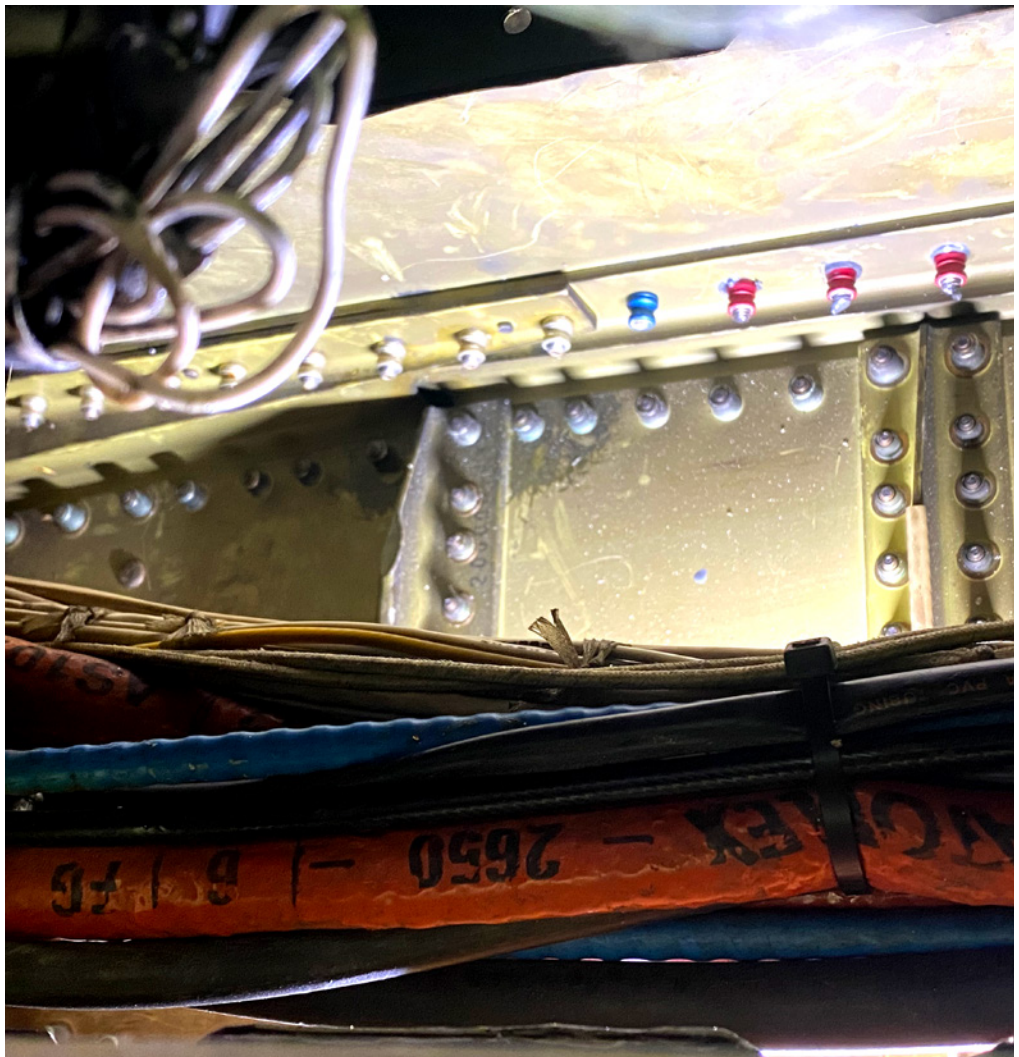
Trailing edge of wing looking forward illustrating typical doubler position underside of left wing. Doubler aft of gear trunnions must extend to include at least two fastener rows past any cracks in original skin.

Bottom

Shows the cut out in the forward intercostal that is performed to gain access to the forward spar flange.

Opposite

“Mapping” required to track the appropriate sized fasteners by length and diameter required.





served the smaller diameter countersunk head of the OEM fastener had almost pulled through. They would require countersinking to a bigger head Hi-Lok with the same shank diameter.

The Hi-Lok and CherryMAX series fasteners are installed utilizing GO-NO-GO gauges. This quality assurance measure ensures each fastener is installed per the manufacturer's specifications. Prepping for the placement of the doubler requires the installation of CSK shims in the countersink holes in the OEM skin. These again require measuring for proper size according to the appropriate fastener to be placed. Once the fasteners are installed, shims prevent the replacement fastener on top of the doubler (P/N 200114-505) from "dimpling" the doubler. They provide a sturdy foundation for the doubler.

The doubler is then attached to the aircraft utilizing Clecos to hold it in place. The holes are then carefully drilled, reamed, and countersunk. Then the new doubler is removed and de-burred before the fasteners are installed. Taking extra care that each fastener is placed according to the design specifications from the manufacturer is an absolute requirement to achieve the strength necessary for the intended repair. In addition, the holes are prepped by priming them with an epoxy primer and then "shot wet" with BMS 1422 sealant.

The picture with red hose on bottom shows the cutout in the forward intercostal for gaining access to the forward spar flange. This access point is later reinforced around the perimeter, and an inspection plate is installed. This picture also illustrates the Hi-Lok's installed in the upper

flange. Note the different colored collars denoting the size of the Hi-Lok utilized (i.e., standard, first-oversize, or second-oversize). After insertion, the GO-NO-GO protrusion gauges are placed by Hi-Lok to check for proper length before torquing the collar and then again after. The picture on the previous page illustrates some of the "mapping" required to track the appropriately sized fasteners by length and diameter. After all the fasteners have been installed and the final quality assurance inspection is performed, it is time to do some cosmetic work. The doublers are sealed with BMS 1422, and engine to wing nacelles are reattached. A thin bead of flexible, paintable seam sealer is used around the edges of the nacelle fairings. Lightweight filler is used as required in areas over the spar caps (where missing) to restore aerody-

Priming and painting complete the repair.



dynamic contour. Priming and painting to finish is the last step in the process.

The final step in the process is the return to service paperwork. Proper logbook/FAA Form 337 documentation with references to approved technical data and the Instructions for Continued Airworthiness will aid AMTs down the road when they inspect your aircraft.

As our aircraft age, just like our bodies, every now and then, they require some re-work. These repairs, if done correctly, should provide for many years and cycles of operation and prevent the start of any skin cracks or the propagation of cracks in the skin if they already exist. The Hi-Lok/CherryMAX replacement of fasteners should give owners renewed confidence in the structural integrity of their aircraft. They also provide peace of mind and many safe flying adventures.

Shannon Hankins

About the Author

Shannon Hankins is an A&P/IA based at KRVS in Tulsa, Oklahoma. He is an aircraft maintainer and owns and operates two award-winning planes – a 1966 Piper PA-30B and a Sorrell Hiper-Bipe. Shannon is a former USAF C-130 pilot and Maintenance Officer. He currently works for a major Airline and is type rated in the B727, B737, B757, B767, B777, and A320.

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