

Comanche Tail Problems and Cures

As our Comanche fleet ages our maintenance requirements will continue to change. We're only one year away from Comanches having their 50th birthday. The newest Comanche C is already 35 years old. Aging aircraft require a constantly evolving inspection program if we hope to find structural problems before they find us. With proper maintenance and inspections our birds still have many years of service left.

Having specialized in Comanche maintenance since the first deliveries in 1958 I've witnessed a slow but steady decline in the efforts necessary to keep our airplanes in pristine airworthy condition. A new problem has recently come to light that effects the safety of our fleet.

In recent years we've been removing, dismantling and inspecting tail assemblies for wear, corrosion and cracking during annual and 100 hour inspections. The focal point of these inspections is the stabilator torque tube, torque tube horn and associated components. A proper stabilator torque tube inspection cannot be accomplished without complete removal and disassembly.

Stabilator torque tubes were the subject of a recent FAA investigation in which maintenance personnel were asked to weigh in on the air worthiness of these units during annual inspections. The [Comanche Flyer](#) ran several articles on the subject. Following this investigation Piper issued a Service Bulletin No. 1160 in December 2005.

Service Bulletin No. 1160 requires inspection of the stabilator torque tube assembly (includes bolts, hardware and attached fittings) within the next one hundred (100) hours of operation or at the next scheduled inspection, whichever occurs first. Thereafter, the inspection is required every 10 years, or until superseded by requirements added to the Service Manual.

As always, Piper considers Service Bulletin compliance mandatory, however FAA rules only require mandatory compliance from commercial operators. Unfortunately, most Comanches won't fall under the mandatory compliance rule and this very important inspection can be legally avoided.

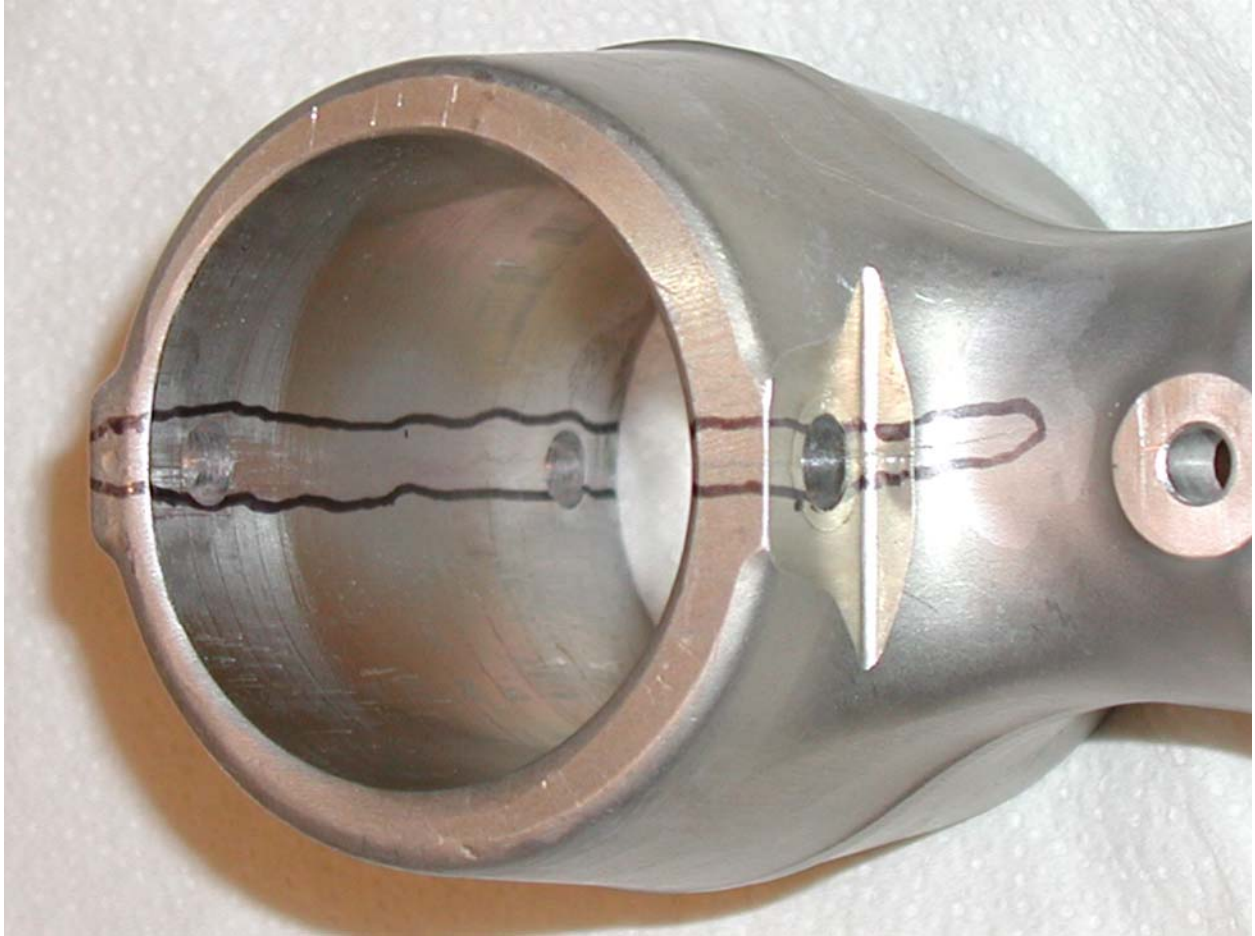
My shop is in Southern California where the climate is dry and corrosion is minimal. We are finding a high percentage of rust pitted stabilator torque tubes and cracked torque tube horns. I don't recall any cracked horns being reported during the comments period. I don't know if this indicates there were no cracked horns found, they were overlooked, or they were not the subject of the inspection and therefore omitted from the report.

In 2006 we completed a thorough torque tube inspection on six Comanches. Two required torque tube replacement due to pitting from rust. Three had cracked horns (the aluminum forging in the center of the torque tube that attaches the balance arm). Consequently 50% of the horns we inspected this year were cracked and 33% of the stabilator torque tubes we inspected were pitted from rust and were scrapped.

When Piper Service Bulletin No. 1160 was issued the main focal point was the stabilator torque tube. In addition to the stabilator torque tube the Service Bulletin states: "Check condition of balance weight tube attachment fittings and control horn." Unfortunately no mention is made of the fact that the horn can't be properly inspected without removal from the torque tube.

In 2006 Piper sold 36 new stabilator torque tubes but no horns. New horns haven't been available for over 20 years. I fear that many of the original horns may have been removed and reinstalled on the new tubes without a dye penetrant or other approved inspection for cracks.

The horn we removed from a 1958 Comanche 250 with 3540 hours was approximately 80% cracked.



View #1 1958 Comanche 250, 3540 hours. Crack visible from outside.



View #2 1958 Comanche 250 3540 hours. Crack visible from outside

To understand the importance of this, had the crack continued to 100% the horn would have separated into two halves, neither of which would have remained on the job. (The crack was centered through the horn's six bolt holes.) The stabilator balance arm would become detached from the stabilator torque tube resulting in total loss of pitch control from the control yoke. The stabilator would be free to travel up and down from stop to stop without any pilot input. Having lost the counter balance the stabilator would become tail heavy resulting in an airplane pitch down condition. Some control would remain through the trim system; however, if the out of balance condition were to cause flutter followed by stabilator separation, loss of the aircraft would most assuredly follow.

During your next flight control check on the ground, notice how easily the control yoke moves the stabilator from stop to stop through the pitch axis. During a 200 mph descent notice how much pilot force is needed on the control yoke to make a pitch change? All that force is transmitted to the stabilator torque tube through the subject horn.

All six Comanche stabilator torque tubes we removed for inspection in 2006 had never been removed since manufacture. The two large ball bearings that support the torque tube are sealed and cannot be properly lubricated with grease during annual inspections. There are no grease fittings. To lubricate them requires removal and disassembly. The original grease was still in these six bearing pairs since manufacture dating 43 to 49 years ago. The bearings were contaminated with dirt and debris and would not rotate with hand pressure. The Piper Service Manual does not address lubricating these bearings during annual or any other service check. I guess Mr. Piper never anticipated these birds still flying 50 years later.

Comanche 180's, 250's & 260's share the same stabilator torque tube. The 400, PA30 & 39 have a thicker torque tube but all torque tubes have the same outside diameter. All Comanches, both singles and twins, share the same stabilator horn, PN 20397-00. The stabilator torque tube horn looks like a large aluminum pipe tee. It connects two steel tubes at a right angle. Had the horn been made of steel I would probably not be writing this article. The stabilator horn, fittings and bearings are pressed over the torque tube with a close tolerance interference fit. The balance arm tube is likewise pressed into the horn. Close tolerance bolts then secure all the tubes and fittings. Disassembly and assembly require special fixtures and a press to prevent damaging any of the components.

Our procedure is as follows: Removal of the left and right stabilators. Removal of the complete stabilator torque tube assembly. Disassembly of all items attached to the torque tube including extraction of the balance arm tube from the horn. A press is needed for proper disassembly. The use of heat is not recommended. In most cases paint and rust must be removed from the torque tube to allow removal of the close tolerance horn and fittings without damaging them.

Once disassembled, we remove any paint and foreign material from all parts followed by inspection of the torque tube for cracks, rust, corrosion pitting and any discrepancies. If the tube passes inspection it is sent out for cad plating. Dye penetrant inspection is performed on the aluminum horn checking for cracks. Bearings are disassembled, cleaned and inspected. Many bearings are reusable. Bearings are replaced or repacked with suitable grease and resealed. All attaching hardware is discarded and replaced with new.

After assembly, we paint the entire assembly exterior with epoxy primer and a polyurethane top coat out to the inboard stabilator attach fitting location for protection from exterior rust and pitting.

Then the torque tube is sealed on one end and both tubes are filled with epoxy anti rust primer. The primer is then poured out leaving all the steel hardware and the inside of both steel tubes coated with protection from rust and corrosion. Unless previously treated, your torque tube once had factory Peralketone inside for protection, however, this was ineffective against rust. Most tubes we inspect are raw steel on the inside with light rust.



Stabilator Torque Tube Assembly after overhaul and paint

While the stabilators and torque tube are removed, the aft bulkhead and all four bearing support fittings in the empennage are inspected for condition and loose rivets. These attach fittings were the subject of AD 75-27-08 & 94-13-10 that required removal of the factory rivets and replacement with #6 structural screws or an inspection every 100 hours. Why wait for these bearing support fittings to become loose? Installation of the #6 structural screws in advance of problems makes a lot more sense. About half of the Comanches we inspect still have the problem rivets installed.

Additionally, we disassemble the trim spool and jack screw system and

overhaul the trim spool assembly and linkage removing the vertical play that allows trim tab flutter common to most Comanches. Wiggle your trim tab up and down. If you have free play most of it will be your trim spool and jack screw moving up and down inside the trim spool cage due to a worn spool and bushings.

Our inspection is more in depth than the requirements of Piper Service Bulletin No. 1160; however, the number of unairworthy parts we are finding certainly seems to justify the closer look.

Following reassembly of the tail the stabilator group is re-balanced.

A 1964 Comanche we recently inspected had a rusted and pitted torque tube and a cracked horn. The attach fitting AD had never been complied with. We knew this because the most forward two rivet holes in one of the attach fittings (the first ones you see when you look inside) were empty. The factory had neglected to put two rivets in this most critical fitting and no one had noticed for 42 years. You guessed it. The aircraft log had been signed off as being inspected every 100 hours since 1975.

This same 1964 Comanche had never had the rudder AD 72-22-05 complied with, requiring those funny looking counter weights attached to the top of the rudder. The choices were: install the Piper counter weight kit #760-705 or lower the VNE to 188 MPH. Neither was done. The log book endorsement stated this serial number was not affected. Not true. All Comanche serial numbers are affected.

Additionally, this same aircraft had never had the aileron nose rib AD 79-20-10 complied with. The choices were: install Piper kit #763-893 or remove the ailerons every 100 hours for inspection. The kit was not installed and the ailerons had never been removed. This was easy to determine because both aileron control rod ends were rusted solid to their attaching bolts and required several hours' labor for removal. The log book stated: "All AD's complied with".

There is a message here. Don't take it for granted that all your AD's and Service Bulletins are complied with just because the log book says so. One bad signoff can be followed by 20 years of follow up signoffs that didn't include inspections. Every IA I know can tell you stories about AD's not complied with that were signed off. Ask yours sometime.

What can be done? During your next annual inspection, schedule a complete AD and Service Bulletin review that includes a physical inspection for compliance. Follow with a tail section inspection that exceeds compliance

with Piper Service Bulletin No. 1160 with special attention to the horn. As mentioned earlier, this cannot be accomplished without complete removal and disassembly.

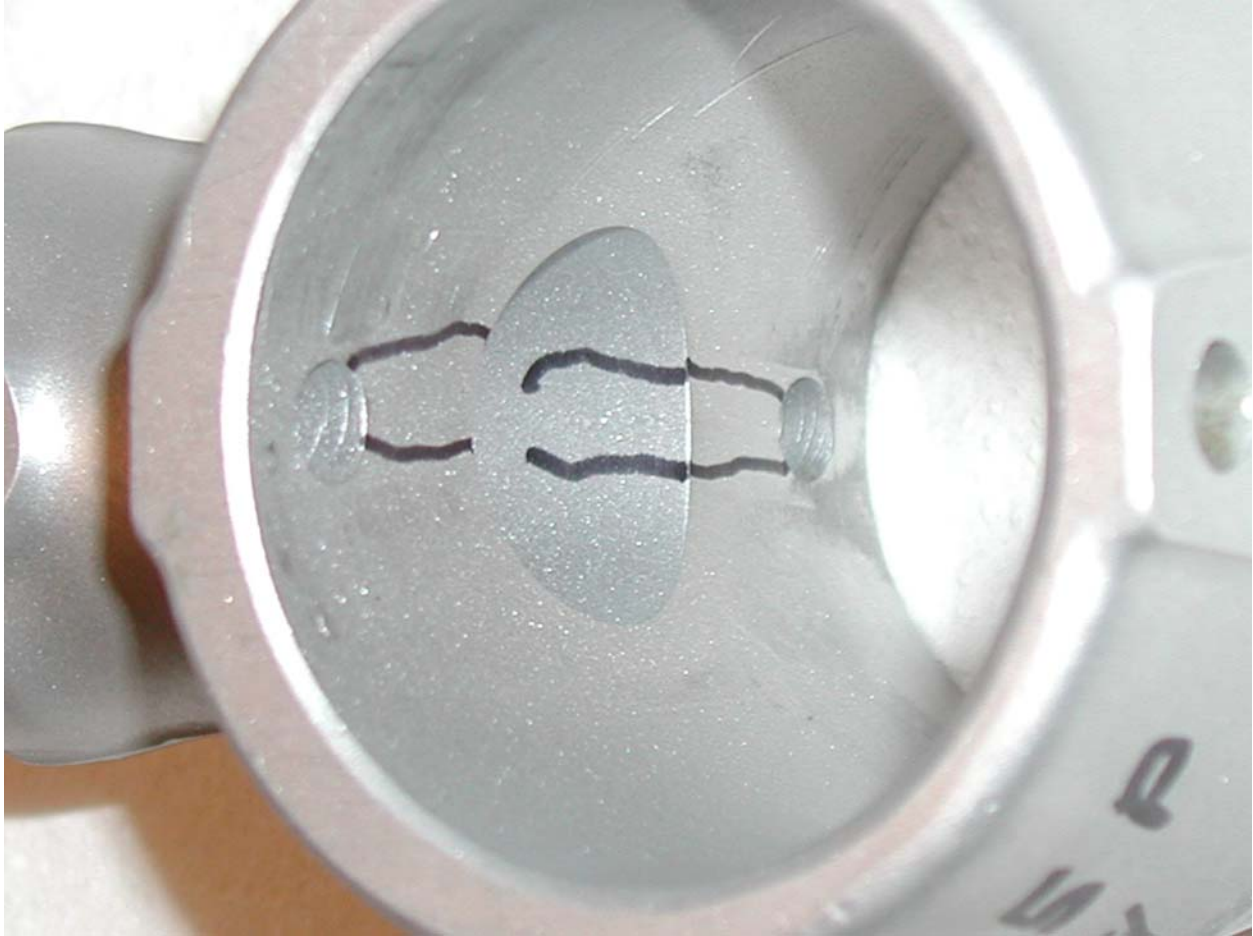
Only one of the three cracked horns we found in 2006 had cracks visible on the outside. All three had cracks in the inside corners of the intersection where the two bores meet. In all three cracked horns the cracks were in alignment with the bolt holes. It should be noted that all three cracked horns we found in 2006 were from mid time airframes. A 1958 with 3540 hours, a 1962 with 3800 hours and a 1964 with 4800 hours. The lowest time airframe of the three with 3540 hours had the most severely cracked horn (approx. 80%).



1962 Comanche 250, 3800 hours. Crack not visible from outside.



Three cracked horns out of six checked in 2006
Only one crack visible from outside



1964 Comanche 180, 4800 hours. Crack not visible from outside.

Don't ignore Service Bulletin No. 1160 just because compliance may not be mandatory in your case. Go beyond the service bulletin language that says: "Check condition of balance weight tube attachment fitting and control horn." Condition can't be checked without complete disassembly.

There is no point in inspecting only. While it's apart, overhaul everything associated with the torque tube. The disassembly process requires a press and removal of fittings riveted to the torque tube. Most of the bolts and hardware used are close tolerance parts that will be corroded and are not reusable. Reassemble with a serviceable re-plated or new tube, all new bolts and fasteners with serviced and overhauled components.

Caution: In 2006 we received two new stabilator torque tubes from Piper that had been drilled incorrectly. The bolt holes drilled for the horn were not in proper alignment. Piper wasn't aware of the problem until we brought it to their attention. Piper then discovered that all their new tubes in inventory were also drilled incorrectly and they scrapped them. When the horn is

placed on a correctly drilled torque tube the four bolt holes should line up perfectly. When the horn was placed on the bad tubes, after aligning the first hole, the other three were not in alignment. Drilling or reaming to fit would have ruined the horn and the tube by changing round close tolerance bolt holes into sloppy oval shaped holes. If the bolt holes don't align perfectly, reject the tube. I worry that some or all of those 36 tubes sold by Piper in 2006 may also have incorrectly drilled holes since they were made by the same production staff that wasn't aware of the error.

What cost can you anticipate? We currently charge a flat fee of \$1800 for the complete process mentioned earlier including the trim spool overhaul assuming your tube, horn and bearings are reusable. Hopefully your shop can accomplish the process in that ballpark. We have an additional charge for replacing the problem rivets in the bearing support fittings: AD 75-27-08 & 94-13-10.

We also supply overhauled stabilator torque tube assemblies for installation elsewhere on an exchange basis.

Piper has new Stabilator Torque Tube Kits available. The price recently jumped from \$218 to \$453. The kit includes a new sleeve attached; however the old sleeve is normally reusable. New tubes without the sleeve are still available from Piper for about \$280. Prior to the price jump, Piper was selling the tube with sleeve for \$60 less than the tube without the sleeve. Figure that one out. Since horns are not available new, salvage yards are the only source. I spoke with Piper about the possibility of producing new horns but they haven't made any commitment.

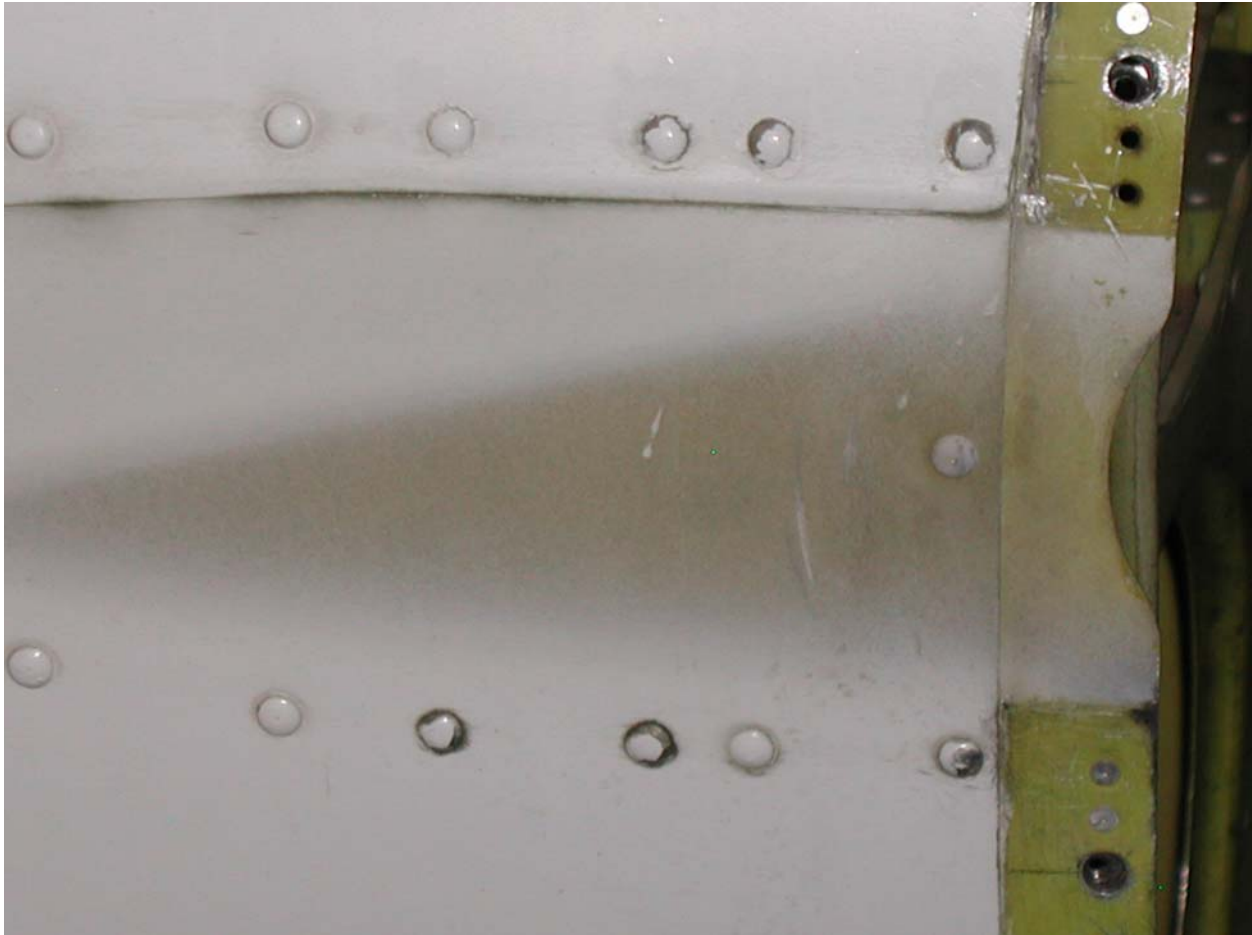
Piper AD 75-27-08 & 94-13-10

The Stabilator Torque Tube Bearing Support Attach Fitting AD

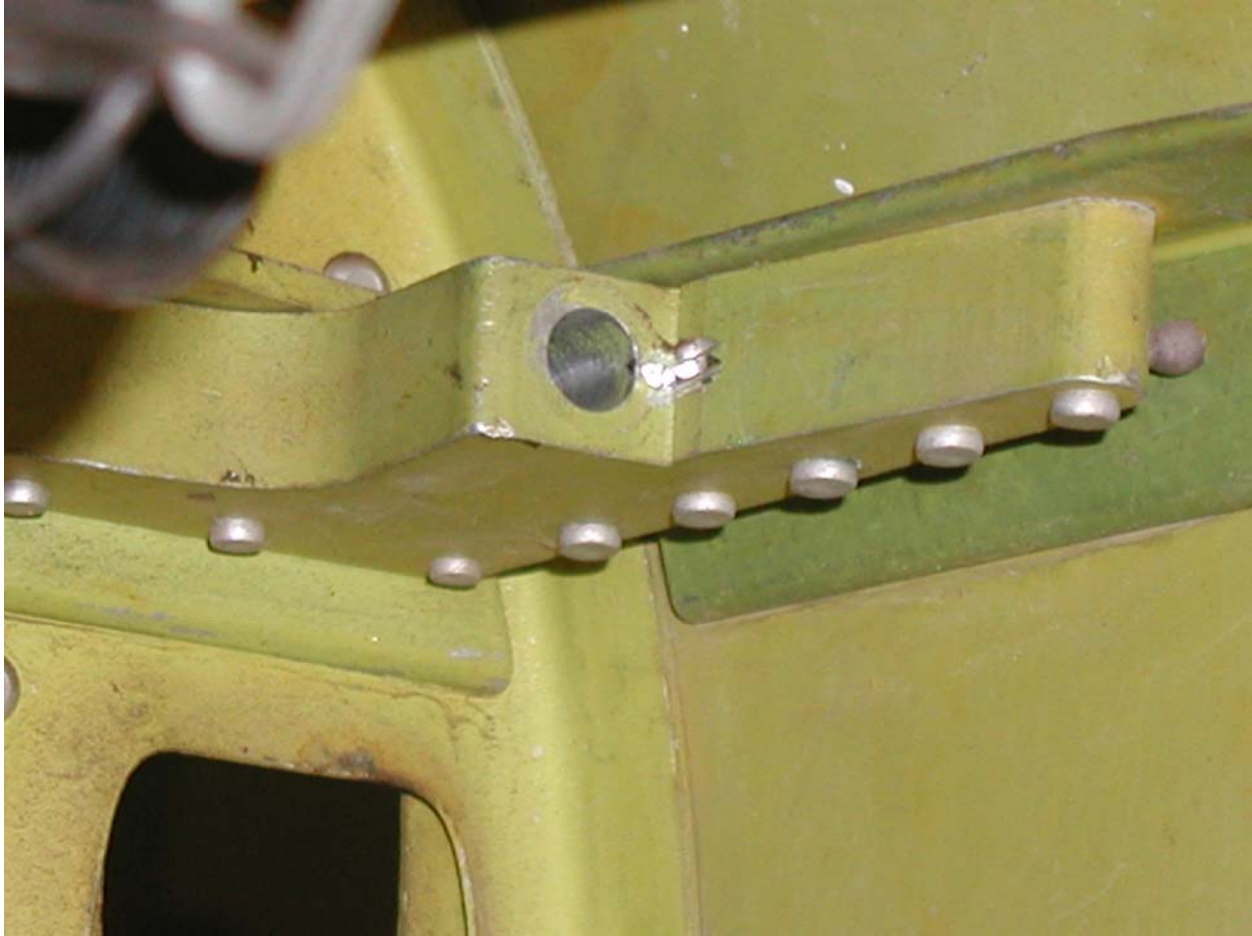
Piper AD 75-27-08 & 94-13-10 began life over 30 years ago. The choices were: Inspect the stabilator torque tube bearing support attach fittings every 100 hours for loose rivets or replace the problem rivets with #6 structural screws.

The following photo shows evidence of working (loose) rivets attaching the outer skin to the interior angles that hold the subject attach fittings. The (problem) rivets inside become loose causing movement in the attach fittings. Since the attach fittings are riveted to these angles their movement causes the angles to move resulting in working (loose) rivets through the skin visible on the exterior. If you have chipped paint around these exterior

rivets it's a pretty sure bet the attach fitting rivets inside are also working (loose).



Chipped paint around rivets serves as a working (loose) rivet indicator. These rivets hold angles on the inside upon which the stabilator torque tube bearing support fittings are attached with the (problem) rivets.



Stabilator torque tube bearing support fitting attached to angle with factory (problem) rivets that are the subject of AD's 75-27-08 & 94-13-10. The rivets with chipped paint on the exterior are located behind this fitting. One rivet is visible to the right of the fitting.



Replacement of problem rivets with structural screws per AD 75-27-08 & 94-13-10.

Following attach fitting rivet replacement with structural screws, the loose outer skin rivets are replaced with structural Cherry Max blind rivets.

As time marches on our aging Comanche fleet will require more and different inspections and fixes to remain safe. Sharing information through forums like [The Comanche Flyer](#) is essential. Maintaining a Comanche properly is complex and expensive. If Piper still made new Comanches they would surely sell in excess of \$400,000. Protect your investment. Don't compromise safety. Stay the course.

Working together we can facilitate inspections and repairs to keep our fleet safe well into the future. Please report your inspection results through [The Comanche Flyer](#) so we can all share the data and measure the need for any further action.

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About the author:

Denny Haskins has operated an aircraft maintenance facility at Redlands Airport, L12 since 1955. He has maintained Comanches since becoming a Piper dealer in 1958. Denny holds an IA certificate, has worked on hundreds of Comanches, has owned several and is a private pilot.