

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



April 19, 2022

MATERIALS LABORATORY FACTUAL REPORT

Report No. 22-027

A. ACCIDENT INFORMATION

Place : Yulee, Florida
Date : June 18, 2021
Vehicle : Cessna 150L, N1300Q
NTSB No. : ERA21FA258
Investigator : Ralph Hicks (AS-ERA)

B. COMPONENTS EXAMINED

Elevator bellcrank, rudder, and a portion of tail cone

C. DETAILS OF THE EXAMINATION

The subject Cessna 150L crashed into the St. Mary's River in a nose-down configuration, according to witnesses. After recovery from the river, initial examination determined all structural components were present and internal engine continuity was confirmed. The elevator bellcrank, rudder, and a portion of tail cone were submitted to the NTSB Materials Laboratory for further examination.

Figure 1 shows the submitted components positioned as though assembled. Close-up photos of the elevator bellcrank are shown in Figure 2. The elevator bellcrank had been assembled to the tail cone via a bolted joint; however, a portion of the connection thru-hole in the bellcrank had separated, as shown in Figure 3. The separated portion consisted of roughly one-half of the thru-hole circumference, which allowed the bellcrank to separate from the mating bolt. Wear and deformation were observed around the remaining circumference of the thru-hole, and the upper portion of the remaining thru-hole had thinning of its width compared to the lower portion.

Figures 4 and 5 show digital images of the fracture surfaces on the upper and lower portions, respectively, of the bellcrank thru-hole circumference. Both fracture surfaces had rub damage that obscured large areas. The undamaged areas on the fracture surfaces had features consistent with overstress.

Figure 6 shows the rudder horn still assembled to the rudder. Close-up photos of the bumpers on the rudder horn are shown in Figure 7. Both bumpers had damage from contact with the mating rudder stop bolts assembled in the tail cone. The rudder stop bolts are shown still assembled to the tail cone in Figures 8–10. The heads of the bolts had rub damage consistent with contact with the rudder horn bumpers. Neither bolt had a nut

assembled on the inner side, but both had safety wire attached. The safety wire on the left side bolt was intact and the bolt was still sitting inside the nutplate, which was snug against the tail cone skin, as shown in Figure 9. The safety wire on the right side bolt was missing at the top nutplate hole, and the top rivet head had sheared off. The right side bolt was still assembled within the nutplate, but the nutplate was no longer assembled against the tail cone skin, as shown in Figure 10.

According to FAA Airworthiness Directive (AD) 2009-10-09 all Cessna 150 model aircraft should have either a placard prohibiting spins and other aerobatic maneuvers or service kit part number SK152-25 installed. SK152-25 replaces the rudder stop, rudder stop bumpers, and the attachment hardware with new duplicate parts and includes the addition of a doubler. The service kit also replaces the safety wire with jamnuts. Diagrams of the service kit hardware taken from a Textron Aviation document outlining the replacement of the parts is shown in Figure 11. Neither stop bolt on the accident aircraft had a doubler nor a nut and washer assembled on the inside surface of the tail cone skin, which indicated that a service kit was not installed.

Adrienne V. Lamm
Materials Engineer

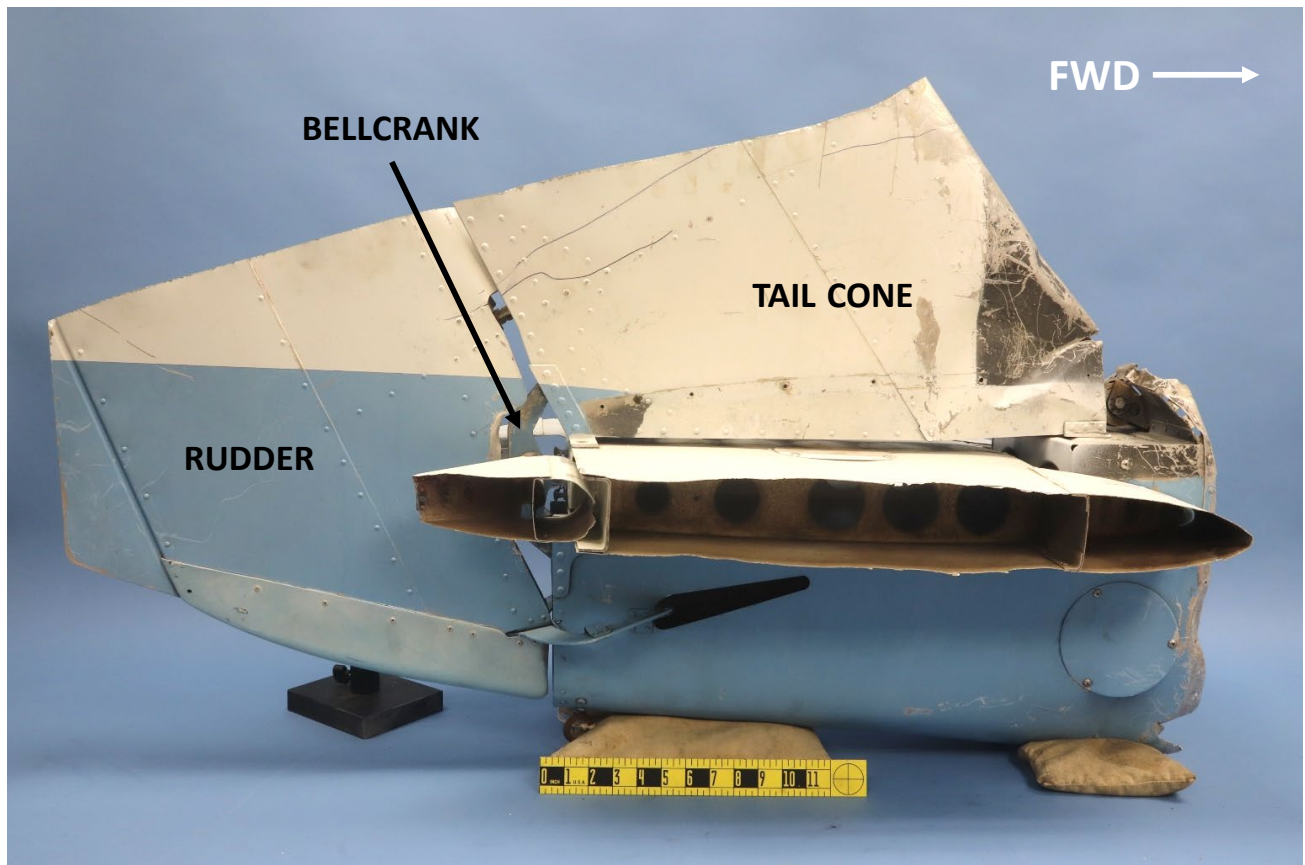


Figure 1: Overall photo showing the submitted elevator bellcrank, rudder, and a portion of tail cone as though assembled.

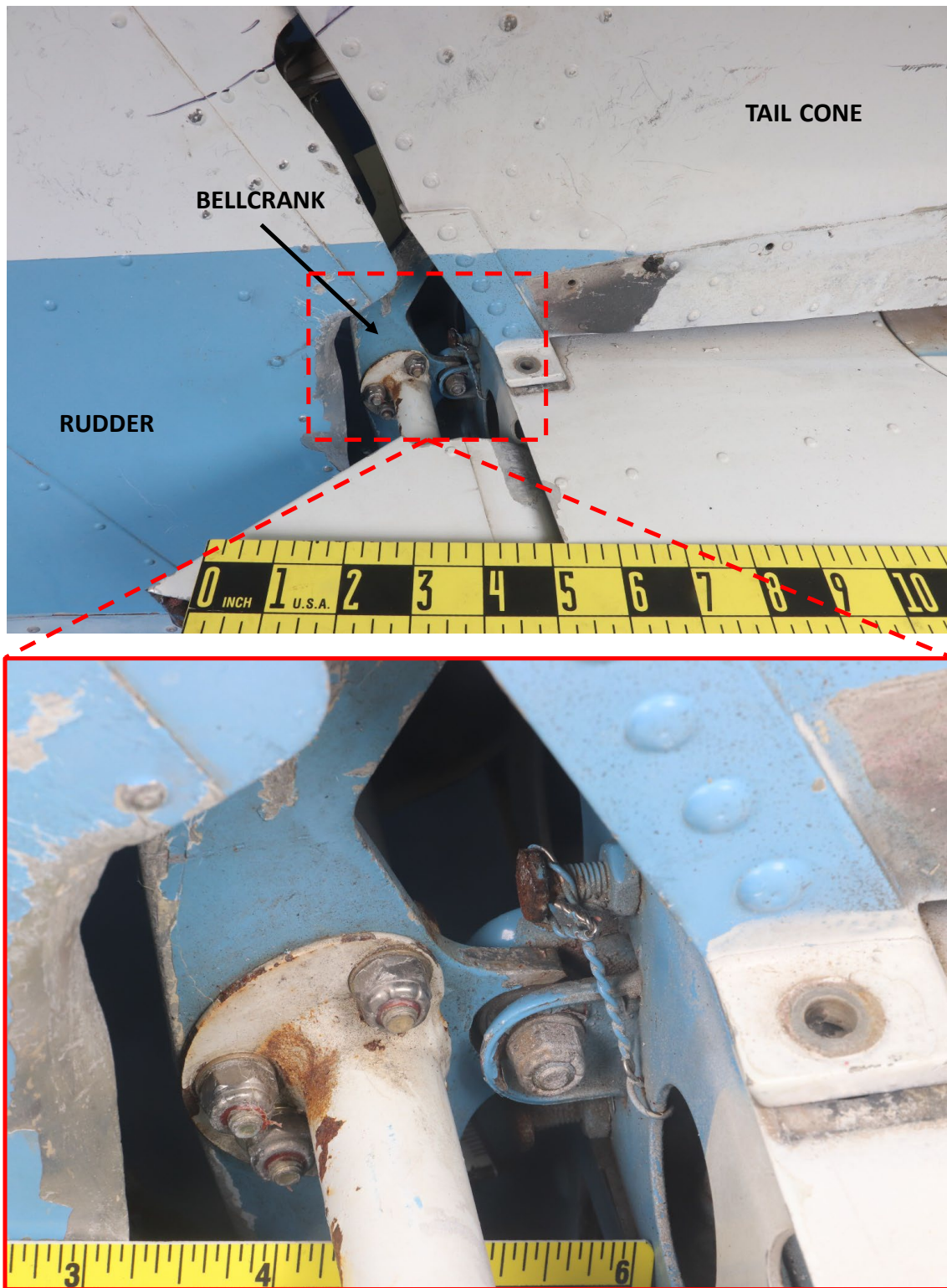


Figure 2: Close-up photos of the bolted connection between the elevator bellcrank and the mating tail cone.

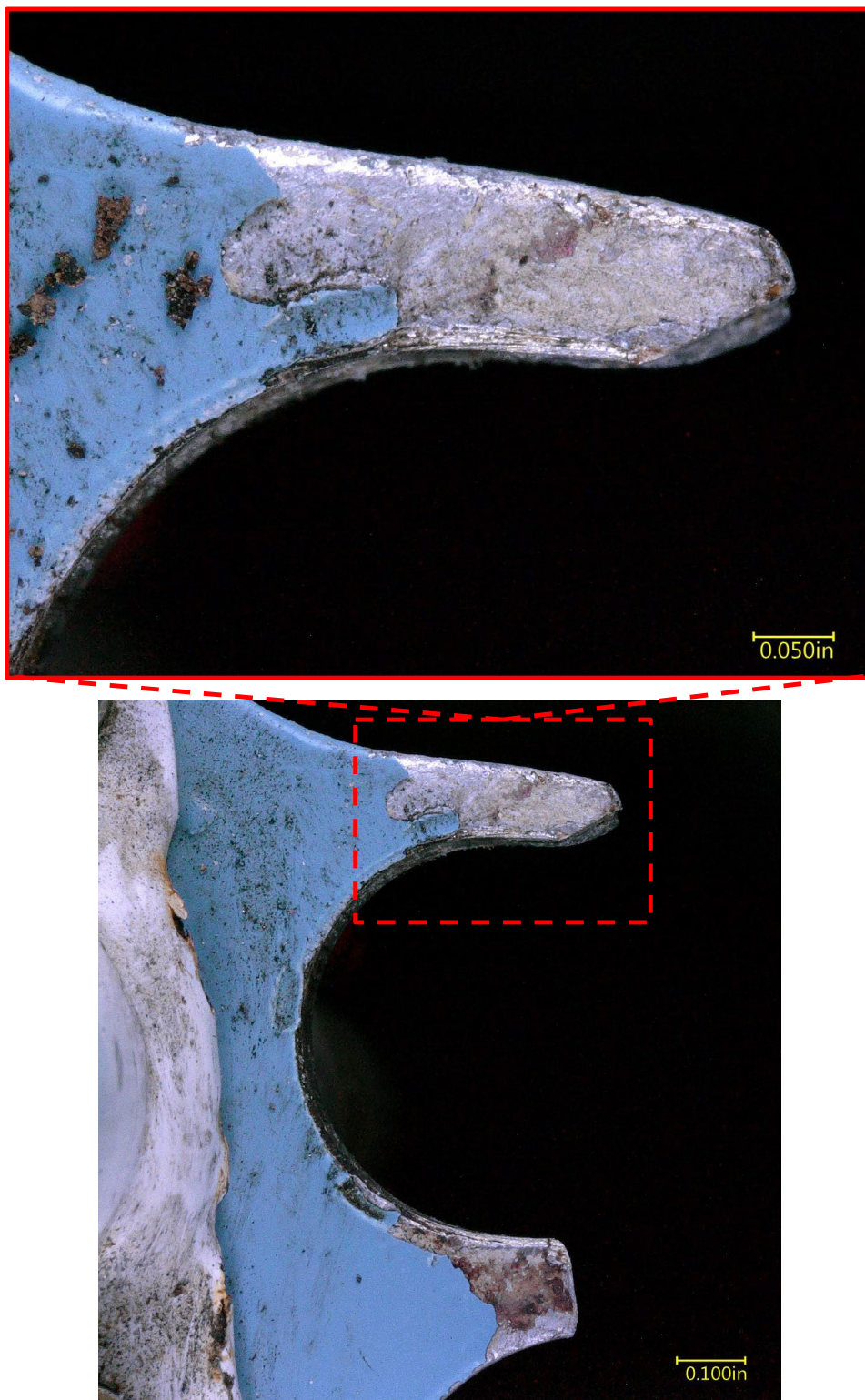


Figure 3: Digital microscope images of the elevator bellcrank connection thru-hole.

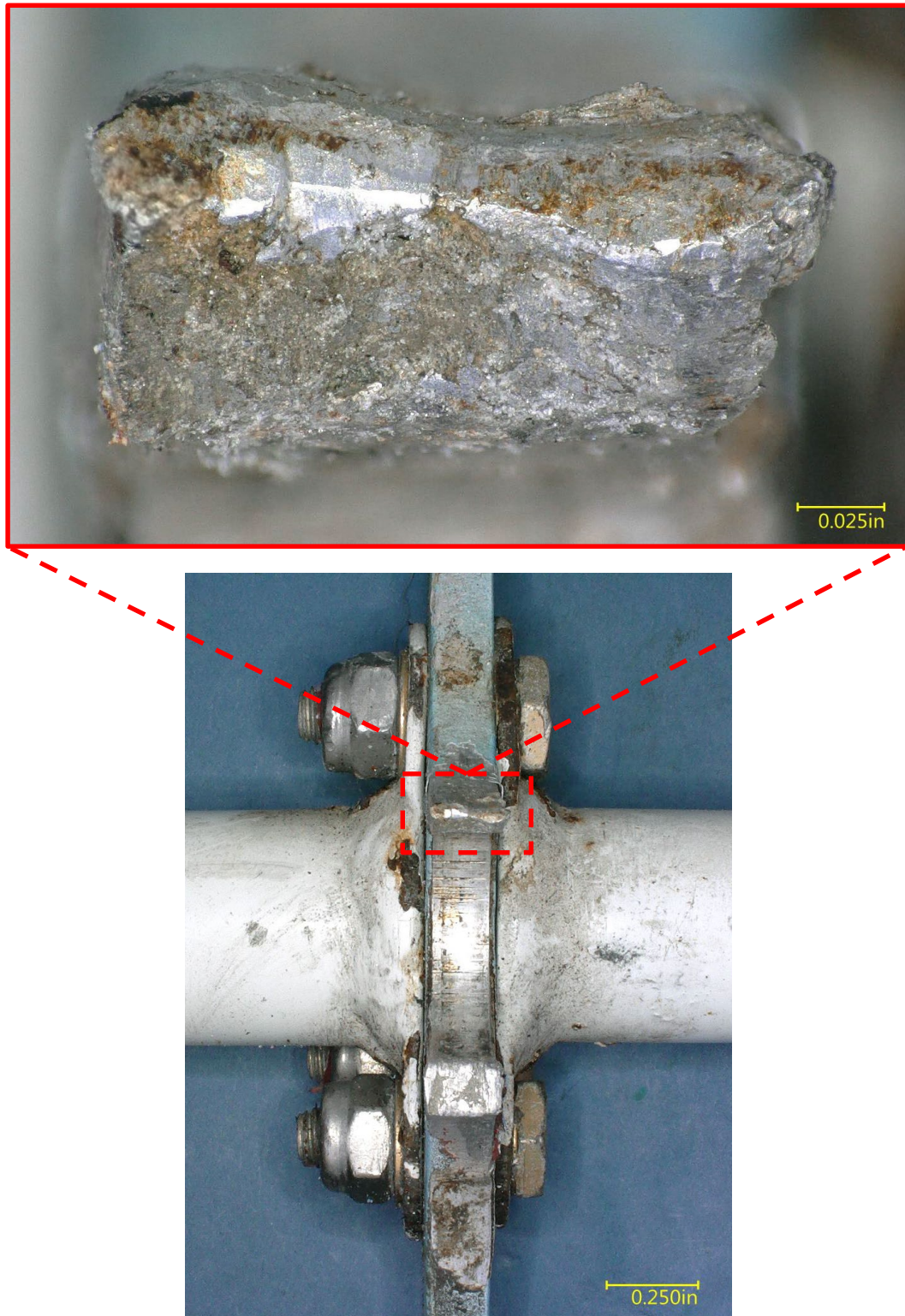


Figure 4: Close-up photo (bottom) and digital microscope image (top) of the fracture surface of the upper bellcrank thru-hole circumference.

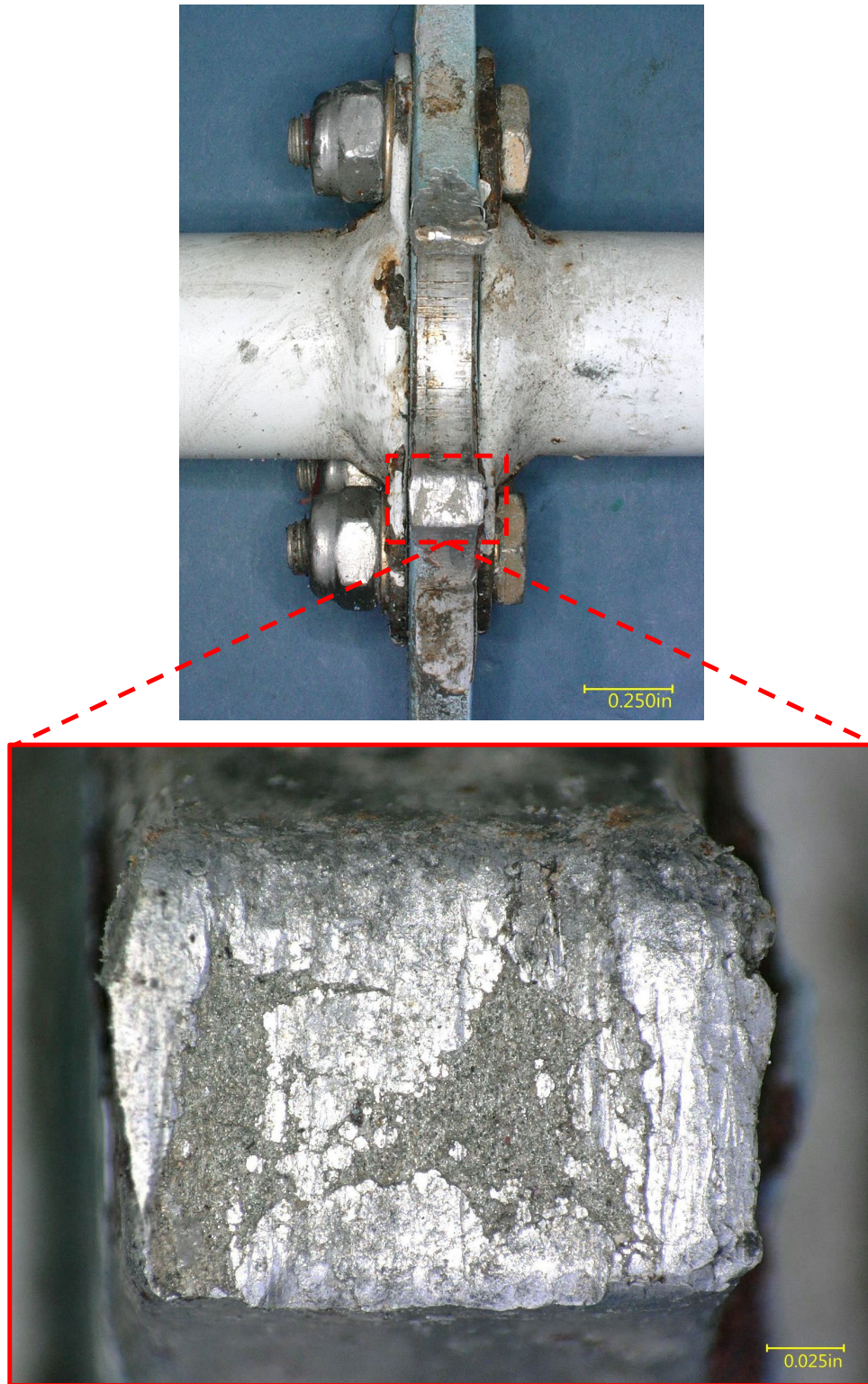


Figure 5: Close-up photo (bottom) and digital microscope image (top) of the fracture surface of the lower bellcrank thru-hole circumference.

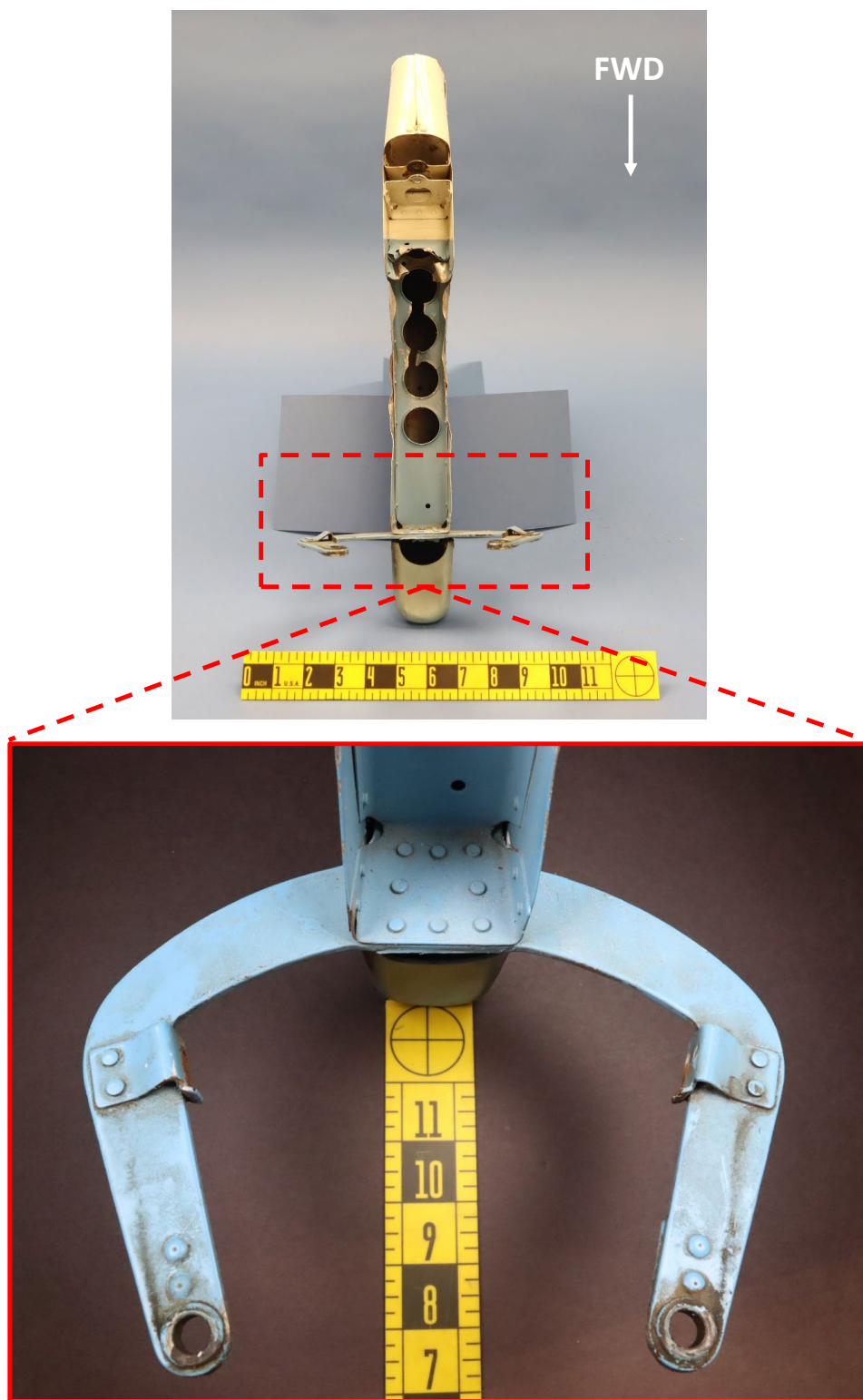


Figure 6: (Top) Overall photo of the rudder and assembled rudder horn.
(Bottom) The rudder horn as viewed from the top.

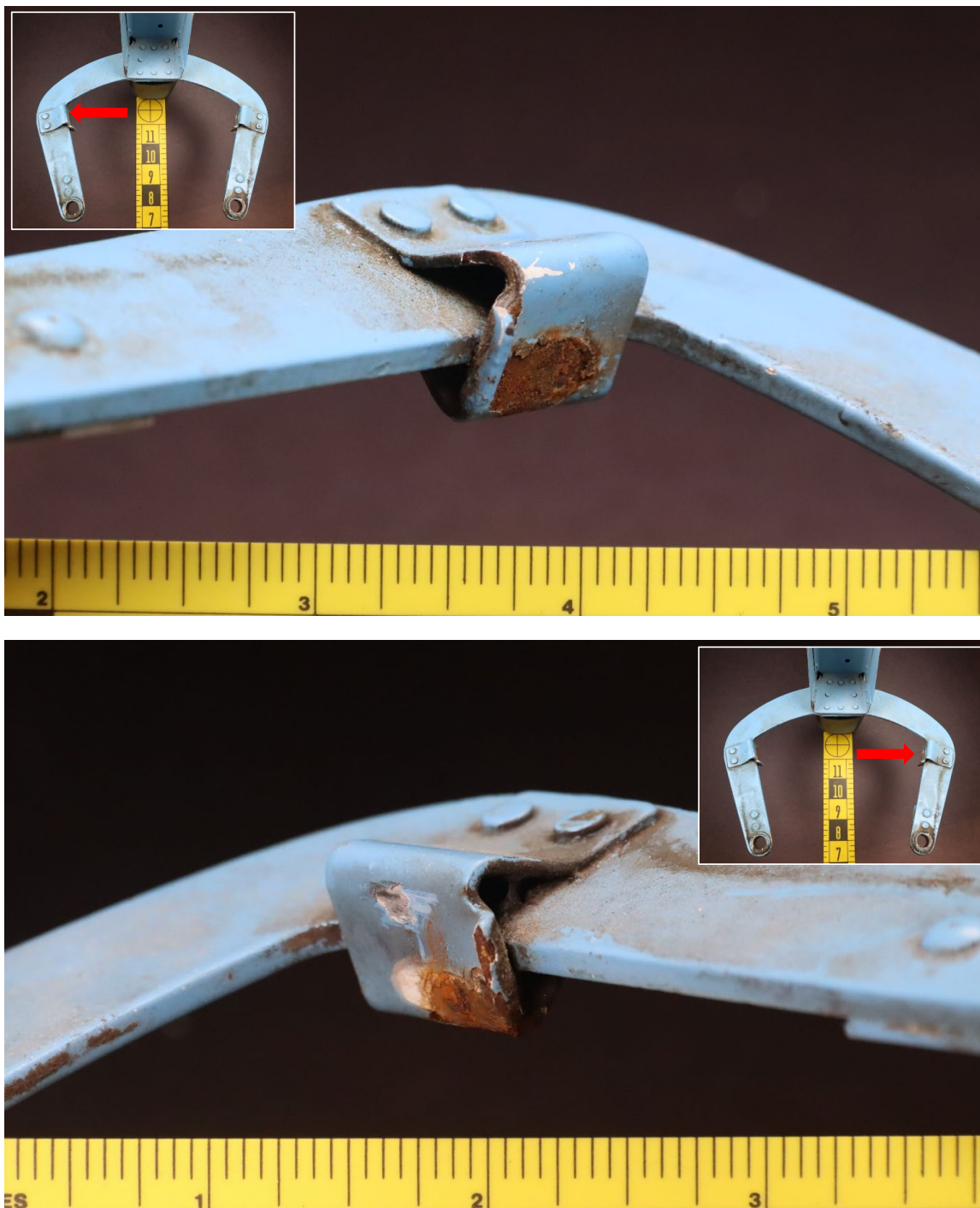


Figure 7: Close-up photos of the bumpers on the rudder horn.

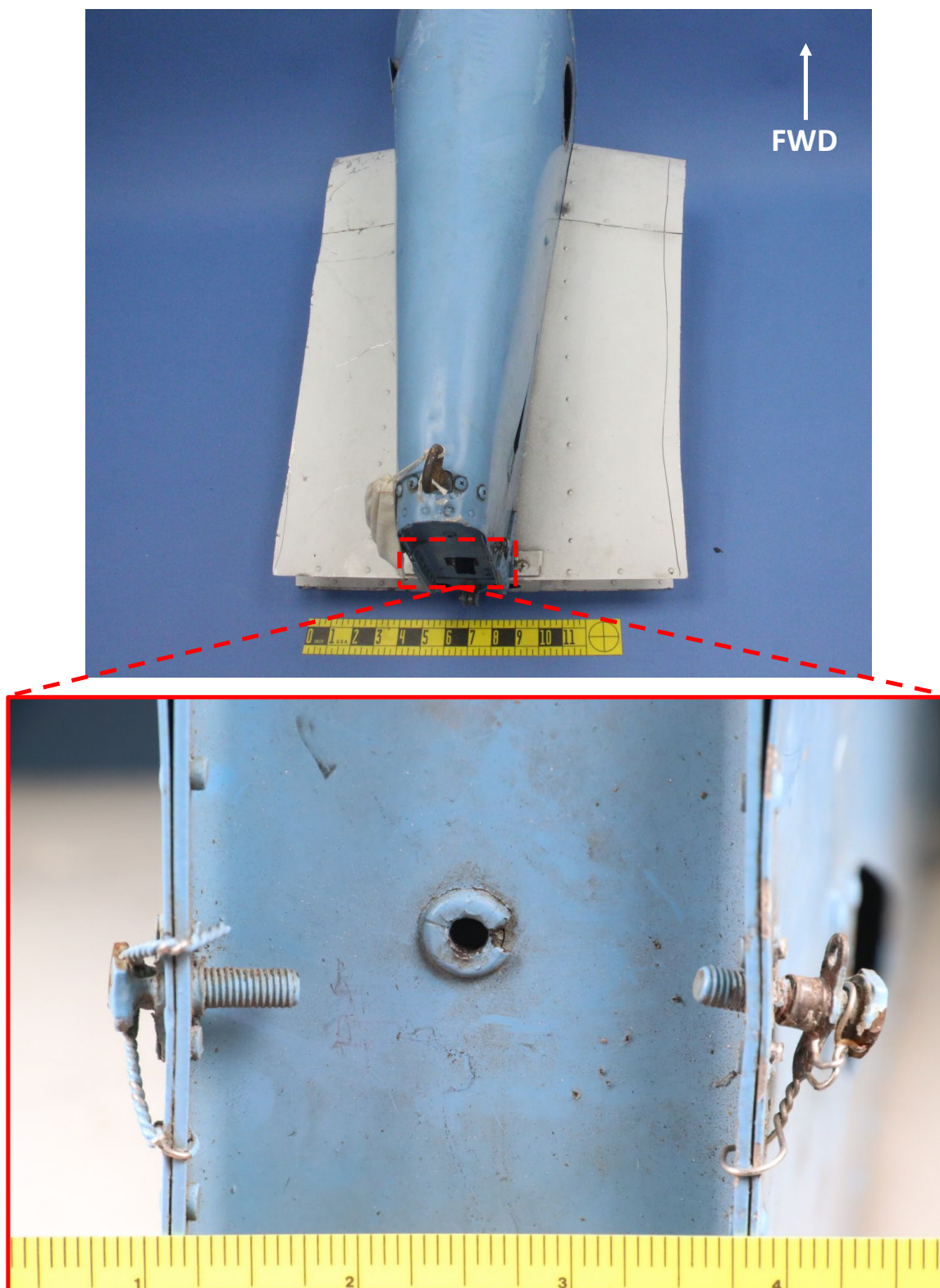


Figure 8: Overall (top) and close-up (bottom) photos of the rudder stop bolts still assembled to the tail cone.

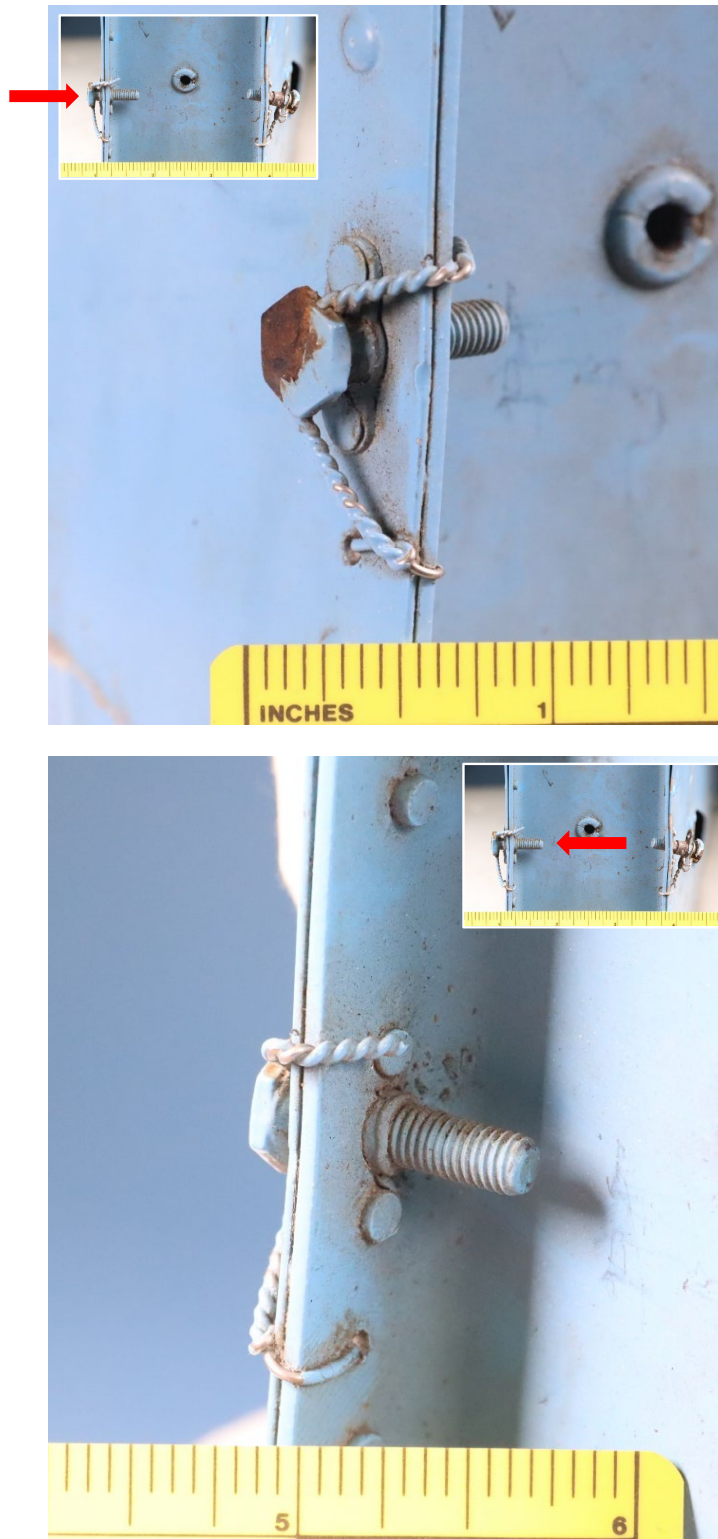


Figure 9: Close-up photos of the left rudder stop bolt.

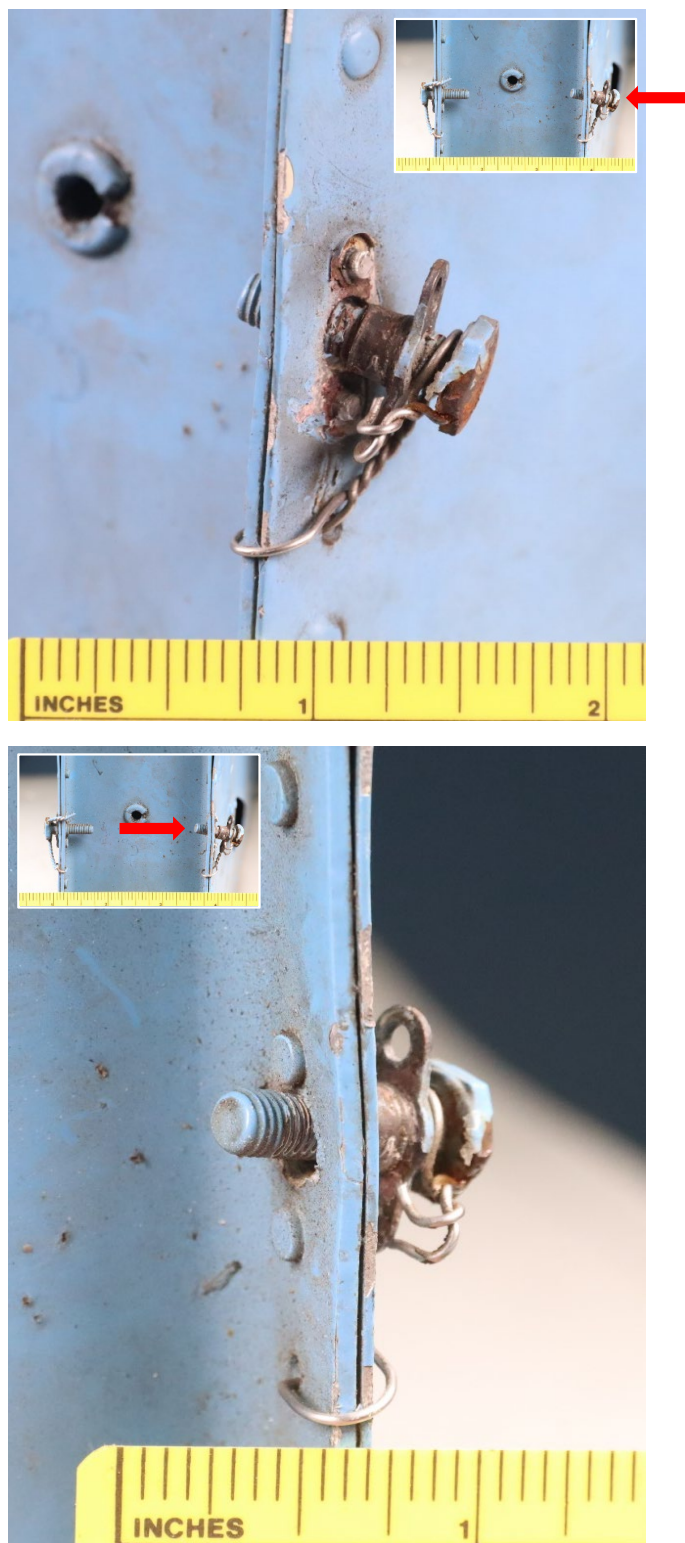


Figure 10: Close-up photos of the right rudder stop bolt.

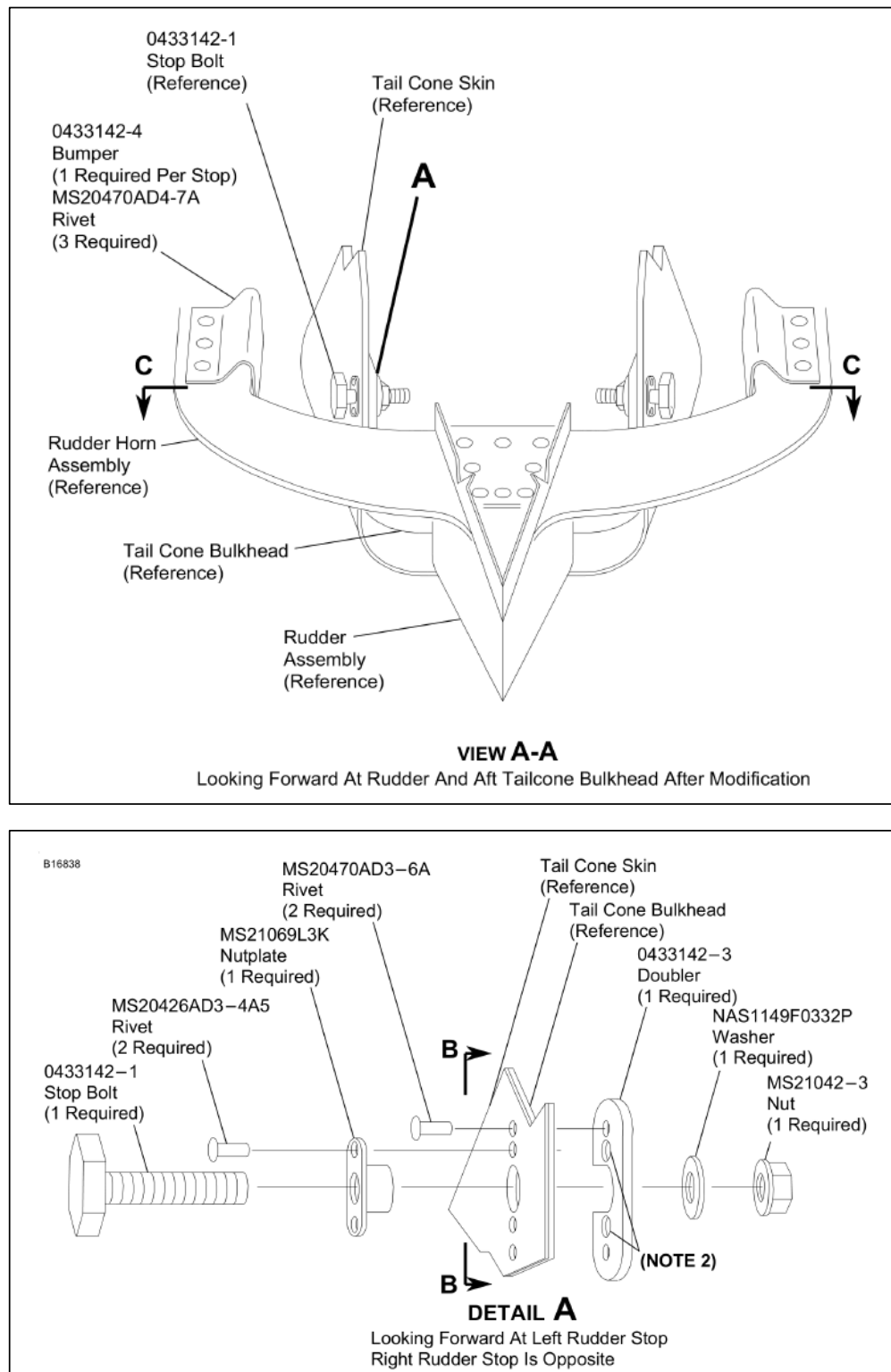


Figure 11: Diagrams of the service kit hardware taken from a Textron Aviation document outlining the replacement of the parts on the rudder stop bolts.