

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN22LA427

MATERIALS LABORATORY

Factual Report 23-014

March 15, 2023

(This page intentionally left blank)

A. ACCIDENT INFORMATION

Location: Canby, Minnesota
Date: September 11, 2022
Vehicle: Cessna A188A, N2122U
Investigator: Mitchell Gallo, AS-CEN

B. COMPONENTS EXAMINED

Tailwheel strut support tube, washers, and bushings.

C. EXAMINATION PARTICIPANTS

Specialist Matthew R. Fox, Ph.D.
NTSB
Washington, DC

D. DETAILS OF THE EXAMINATION

An overall view of the submitted components is shown in figure 1. The tube was received cut in two locations and had a polished appearance with circumferentially-oriented fine grinding marks on the exterior surface. Superficial-appearing orange and dark red oxides were also observed, mostly on the lower half of the tube exterior surface.

As installed on the airplane, the support tube provides a structural connection between the tailwheel spring attach fitting and the fuselage structure. The support tube is inserted through a tailwheel attach fitting at the middle portion of the tube and flanged elastomer bushings at each end. The elastomer bushings are located within lugs attached to the fuselage with washers inserted between the bushing flange and the corresponding fuselage lug.

A view of the aft bulkhead on the accident airplane before the support tube was removed is shown in figure 2. No portion of the support tube is visible, but the right end of the attach fitting was displaced upward relative to the right attachment lug on the fuselage. The support tube was reportedly cut from the assembly using a handheld reciprocating saw, producing the pieces shown in figure 1.

The pieces of the support tube that were retained within the bushings were removed and cleaned using a soft-bristle brush dipped in a solution of Alconox detergent and warm water. After cleaning, the pieces were rinsed with water followed by alcohol and then dried with compressed air. Additional cuts were made with a table-top water-cooled abrasive saw through the middle piece to facilitate hardness testing. The support tube is shown in figure 3 with cut pieces in their respective positions following the disassembly, cleaning, and sectioning.

The locations of field cuts are shown in figure 3. The location of the field cuts corresponded to the joints between the attachment fitting and the fuselage lugs. In addition to

the transverse cut through the cross-section at each location, evidence of additional partial cuts adjacent to the through-section cut were observed. No evidence of any fracture features were observed at either of the cut locations on the tube. The tube wall at the location of the right joint was flattened and substantially deformed consistent with ductile overstress deformation of tube, and the deformation corresponded to the upward displacement of the attach fitting right end relative to the adjacent fuselage lug. The piece of the tube that had been retained within the lug was ovalized, also consistent with overstress deformation associated with the relative displacement. The left end of the support tube was slightly flattened but appeared to be intact aside from the field cut.

The chemical composition of the support tube was analyzed using an Olympus Vanta x-ray fluorescence (XRF) alloy analyzer, and the material was identified as alloy 4130 steel, consistent with the specified material for the part. The dimensions of the tube were measured on the lab-cut piece from the middle of the tube. The tube had an outside diameter of 0.873 inch and a wall thickness of 0.0481 inch. According to an engineering drawing for the tube at the time of airplane manufacture in 1970, the specified tube had a nominal outside diameter of 0.875 inch and a wall thickness of 0.049 inch. In 1985, the wall thickness of replacement parts (the airplane model was no longer in manufacture) was changed to 0.120 inch.

One end of the lab-cut piece was polished for Rockwell superficial hardness tests, but the overall wall thickness was deemed too thin for reliable results. Instead, Rockwell superficial hardness was measured on the outside diameter of the lab-cut piece. Measured hardness, adjusted for surface curvature, was 44.3 HR30N, consistent with expected values for the specified material.

Submitted by:

Matthew R. Fox, Ph.D.
Chief Technical Advisor - Materials



Figure 1. Support tube, washers, and bushings as received.

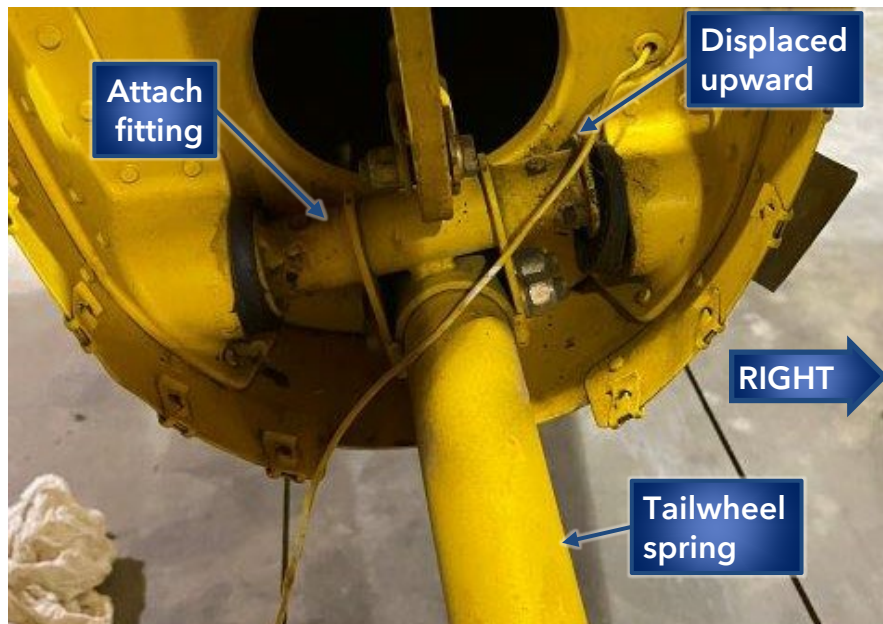


Figure 2. Aft bulkhead on the accident airplane before the support tube was removed.

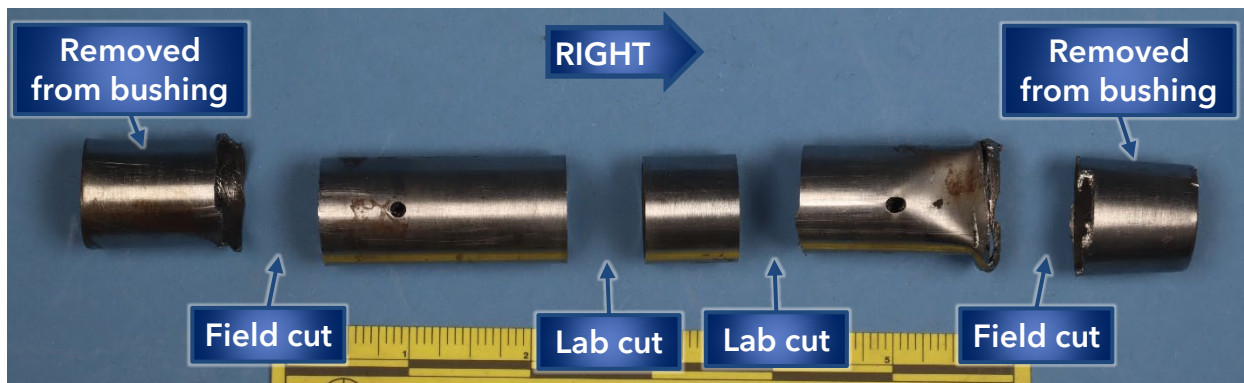


Figure 3. Support tube assembled in relative positions after end pieces were removed from the bushings and lab cuts were made in the middle piece.