

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ANC24LA036

MATERIALS LABORATORY

Factual Report 25-034

May 6, 2025

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A. ACCIDENT INFORMATION

Location: San Luis Obispo, California
Date: May 17, 2024
Vehicle: Cessna 190, N1500D
Investigator: Mitchell Rasmussen, AS-ANC

B. COMPONENTS EXAMINED

Right main landing gear axle, tapered shim, attachment bolt

C. EXAMINATION PARTICIPANTS

Specialist Michael Meadows
National Transportation Safety Board
Washington, District of Columbia

D. DETAILS OF THE EXAMINATION

The right main landing gear axle, a tapered shim, and a countersunk attachment bolt from the accident aircraft, shown in figure 1, were submitted to the materials laboratory for examination. The axle component consisted of a variable diameter shaft region with an integrated collar where it attached to the landing gear spring with three attachment bolts. Two of the bolts at the lower end inserted from the landing gear spring side and engaged with the threaded collar; the countersunk bolt at the upper end inserted from the axle side and was secured with a nut on the landing gear spring side. The tapered shim was sandwiched between the axle and landing gear spring with the thicker side oriented upward.

Figure 2 shows a view of the mating faces of the axle and tapered shim. The two fractured lower bolt shafts were retained in the axle, shown more closely in figure 3. The tapered shim was bent and buckled outboard, downward, and slightly aft. Two curved witness marks were observed near the lower edge of the tapered shim as indicated by the black arrows in figure 2. These witness marks were aligned with the hole features on the mating axle collar surface, also indicated by black arrows.

The fractured bolt shafts retained in the axle exhibited a relatively rough, matte gray fracture surface morphology. Magnified images are shown in figure 4. The fracture surfaces were cleaned using soapy water and a soft bristled brush followed by a water rinse and subsequent solvent cleaning with acetone. Radial features were observed emanating from a thread root at the upper edge of both bolts over a relatively flat fracture surface through approximately

40% of the bolt cross section at which point the fracture continued downward along an outboard and slightly aft slanted plane through the remainder of the bolt. The relatively flat fracture surface at the top of the bolt was consistent with overstress fracture from a downward bending load prior to final fracture in downward and slightly aft bending.

Figure 5 shows images of the tapered shim aligned with the axle at the lower attachment holes, left, and the upper attachment hole, right. A curved witness mark of scraped primer along the face of the axle collar aligned with the corner of the tapered shim in the deformed and rotated condition.

Figure 6 shows the orientation of the countersunk bolt with the upper attachment hole for the axle. Two diametrically opposite witness marks on the white painted region of the countersink in the axle aligned with the slot of the fastener head. Corresponding witness marks were observed on the bearing surface of the fastener head where an area of chipped paint was observed on the axle as indicated by the black arrows in Figure 6. With the bolt oriented in this position, a downward bend was observed along the bolt axis. Portions of metal, consistent with the presence of a nut were retained in two of the thread roots of the bolt as indicated by yellow arrows. The thread profile along the upper surface of the bolt was smeared and flattened.

Submitted by:

Michael Meadows
Materials Engineer



Figure 1. Photograph of the axle (right), tapered shim (left), and countersunk bolt (above) as received.



Figure 2. Photograph of the mating surfaces of the tapered shim (left) and axle (right). Corresponding witness marks are indicated by black arrows.

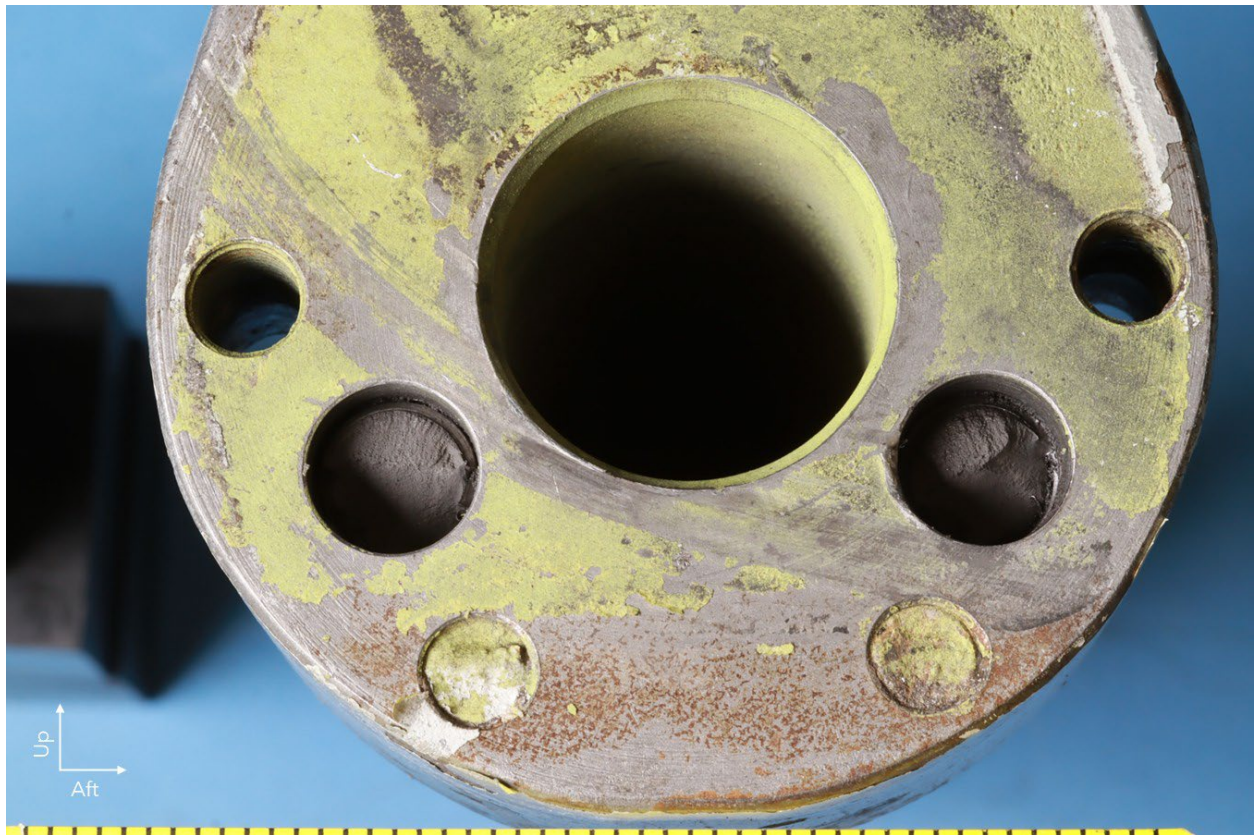


Figure 3. Photograph showing the fractured bolt shafts retained in the axle.

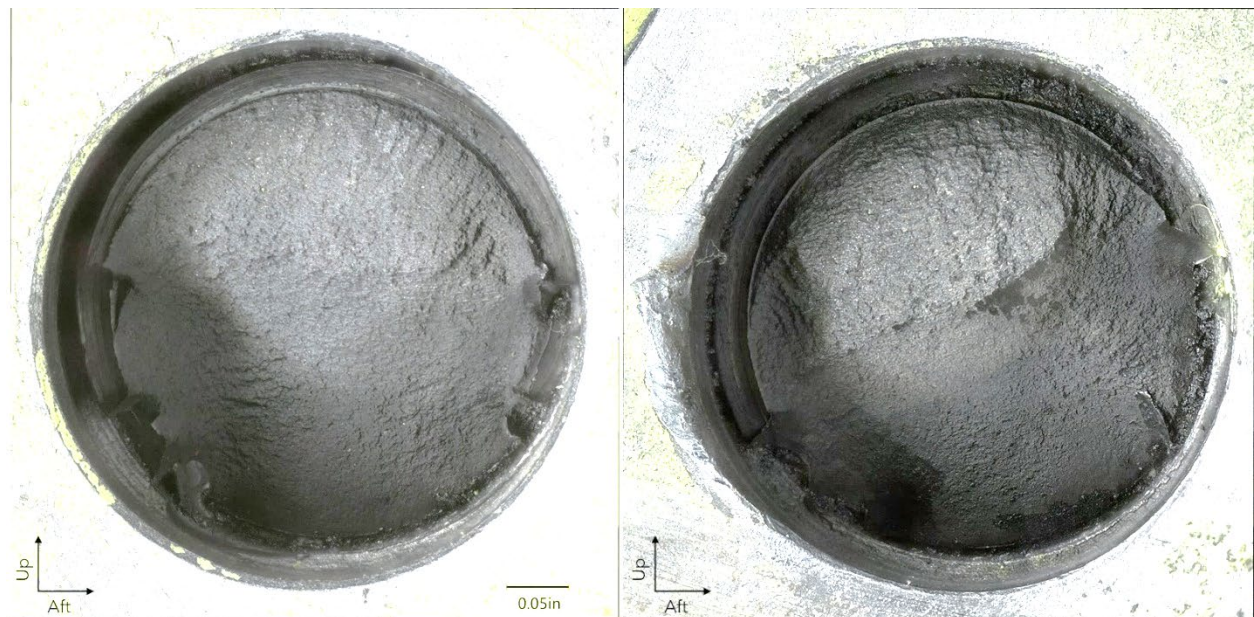


Figure 4. Digital microscope images of the fractured bolt shafts retained in the axle. Radial fracture features emanated from the top of the fasteners over a relatively flat plane which transitioned to a slanted fracture path.



Figure 5. Photographs of the tapered shim aligned with the bottom fastener holes (left) and the top fastener hole (right) relative to a curved witness mark where the primer had been scraped away.



Figure 6. Photograph of the countersunk attachment bolt relative to the countersink in the axle. Witness marks on the fastener aligned with chipped paint on the axle. Fragments of metal were retained in the fastener threads as indicated by yellow arrows.