

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ERA22LA358

MATERIALS LABORATORY

Factual Report 22-097

December 13, 2022

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A. ACCIDENT INFORMATION

Location: Dillingham, Alaska
Date: July 27, 2022
Vehicle: Cessna 207A, N6908M
Investigator: Lynn Spencer, AS-ERA

B. COMPONENTS EXAMINED

Left rudder control cable, left and right pulleys from the rudder control system.

C. EXAMINATION PARTICIPANTS

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

D. DETAILS OF THE EXAMINATION

Overall views of the submitted rudder control cable assembly and pulleys are shown in figures 1 and 2. The rudder cable was fractured at a location approximately 94 inches from the turnbuckle terminal end and 152 inches from the center of the attachment holes in the clevis at the other end of the fractured cable.

The bearings at the centers of the pulleys moved freely in both submitted pulleys. However, the outer rim of the left pulley was rubbed as indicated in figure 2, obscuring most of the part marking information. A view of the cable grooves for the two pulleys are also shown in figure 2. The groove for the left pulley was mostly covered with orange deposits, and the groove contact surface was rubbed around much of the circumference. No oxide deposits were observed on the right pulley, but the contact pattern in the pulley was offset from the groove centerline as indicated in the lower image in figure 2.

A closer view of the cable fracture is shown in figure 3. The fractured ends showed limited splaying of the strands adjacent to the fracture. Orange oxides were present on the cable locally near the fractured ends as shown in figure 3. The fracture on the left side of the image in figure 3 was selected for closer examination and imaging, and the remaining images in this report were all obtained using a Keyence VHX 7000 microscope operated in depth mode.

A magnified view of the selected side of the fracture is shown in figure 4. The surfaces of the cable near the fracture oxidized and worn. Individual wires were mostly worn to a tapered end with no discernable fracture features. To facilitate a closer examination of wires on each strand, the strands were separated by unraveling the strands from around the core. The six outer strands were then sequentially

numbered within one lay starting with the strand that was unraveled furthest from the fracture. Each of the six wrapping strands and the core strand were then imaged as shown in figures 5 through 7. In each image, unlabeled arrows point to fractured wires visible in each image with substantial wear though most or all of the wire cross-section, leaving ends tapered to a chisel-like point in most cases. Approximately 6 wires in the core strand showed limited wear as indicated in figure 7 and had necking deformation consistent with ductile overstress fracture.

Submitted by:

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

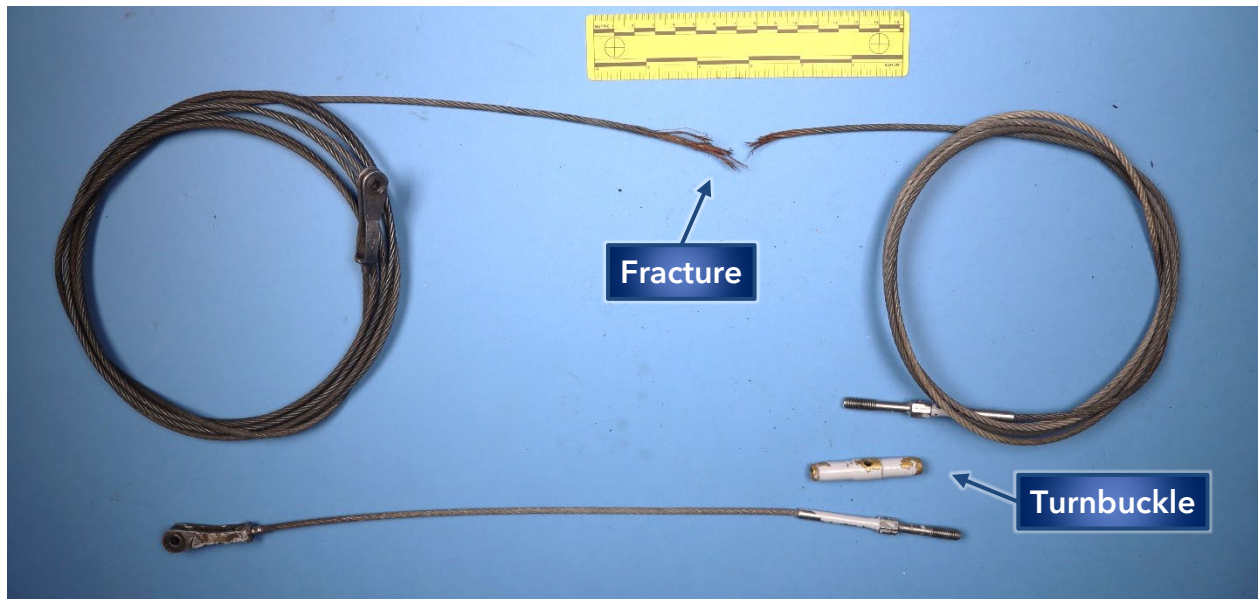


Figure 1. Overall view of the submitted control cable assembly.

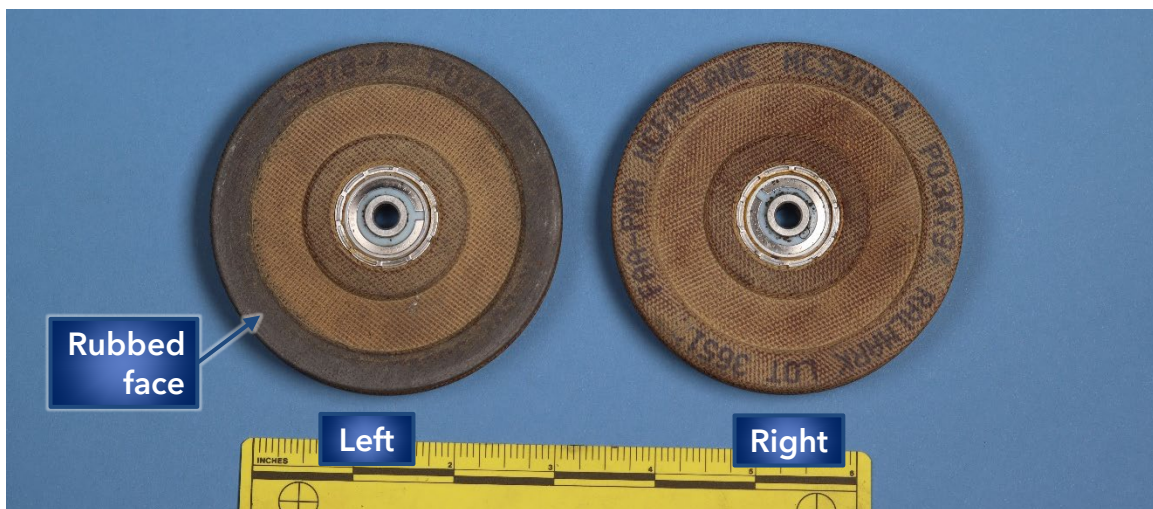


Figure 2. Left and right pulleys from the rudder control system showing the faces with identification markings (upper image) and the cable grooves (lower image).



Figure 3. Closer view of the cable fracture indicated in figure 1.



Figure 4. Magnified view of the fracture side shown on the left side of the image in the previous figure.



Figure 5. Fractured end of strand 1. Unlabeled arrows indicate worn and fractured wires visible in this view.

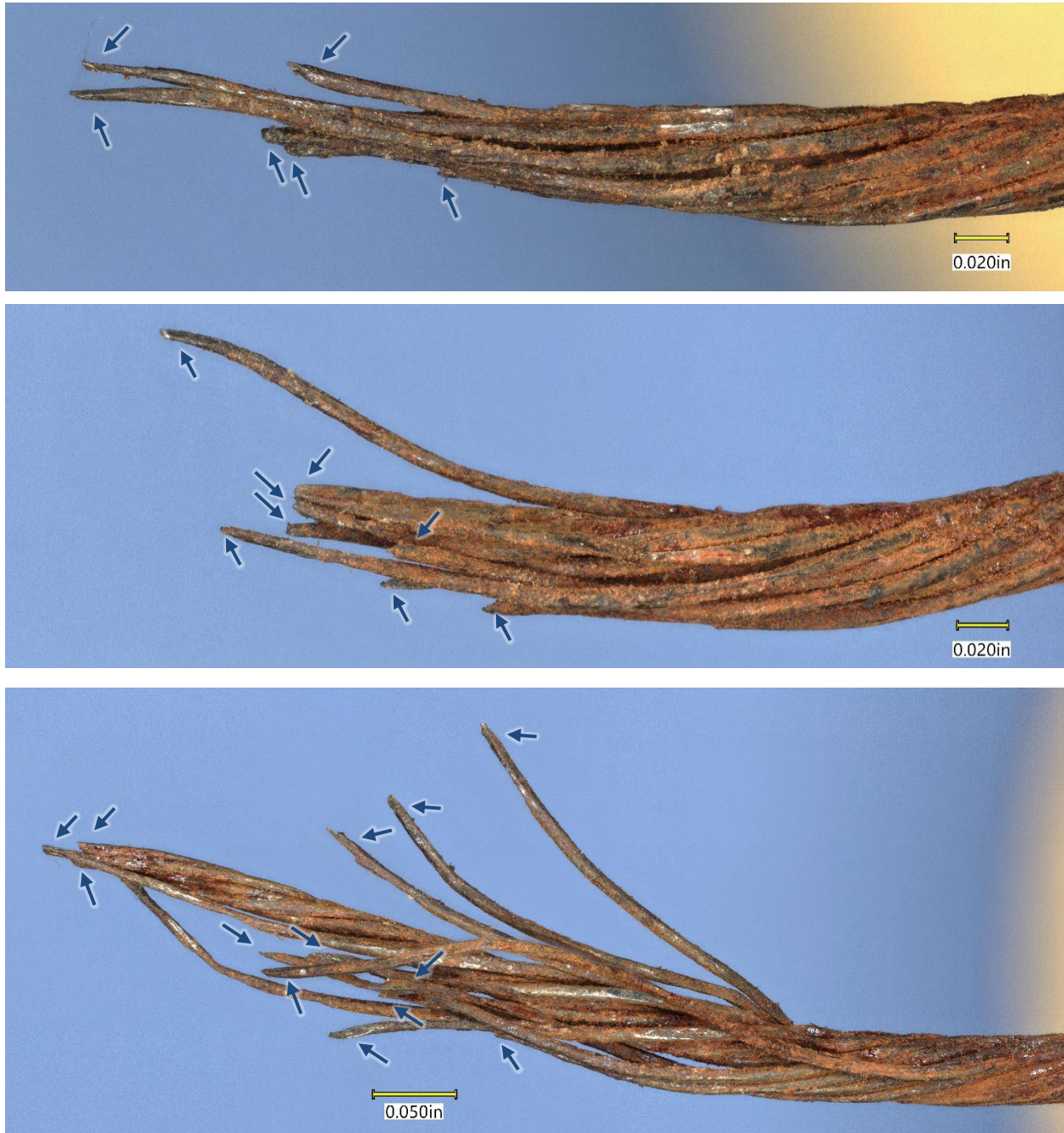


Figure 6. Fractured ends of strands 2 (upper image), 3 (middle image), and 4 (lower image). Unlabeled arrows indicate worn and fractured wires visible in these views.



Figure 7. Fractured ends of strands 5 (upper image) and 6 (middle image) and the core strand (lower image). Unlabeled arrows indicate worn and fractured wires visible in these views.