

NATIONAL TRANSPORTATION SAFETY BOARD

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



April 13, 2022

MATERIALS LABORATORY FACTUAL REPORT

Report No. 22-024

A. ACCIDENT INFORMATION

Place : St. Augustine, Florida
Date : June 29, 2021
Vehicle : Cessna 152, N25513
NTSB No. : ERA21FA274
Investigator : Peter Wentz, ASI – ERA

B. COMPONENTS EXAMINED

Section of rudder control cable.

C. DETAILS OF THE EXAMINATION

A section of a rudder control cable was submitted to the NTSB Materials Laboratory for examination as shown in figure 1. The cable consisted of seven (7) strands and each strand consisted of 19 wires. As seen in figures 2a and 2b, three of the strands had separated and four were intact. The intact strands exhibited some regions of wear on their outward facing wires, one such region being indicated by the yellow rectangle in figure 2b.

The three separated strands were examined with the aid of a stereomicroscope and all three strands exhibited features consistent with wear at the point of separation, with some individual wires exhibiting fracture features. The three separated strands, numbered arbitrarily as 1 – 3, are shown in figures 3 – 5, respectively. Strand 1 exhibited necking separation for two wires, consistent with overstress, with the remainder exhibiting a beveled appearance that was consistent with wear. All wires on strand 2 exhibited a beveled appearance that was consistent with wear. Finally, strand 3 contained seven fractured wires with the remainder displaying the same beveled appearance. Of the seven fractured wires, two exhibited necking separations consistent with overstress; two exhibited a flat appearance on one side and bending deformation on the other that was consistent with fatigue progression followed by overstress separation; and three were corroded and the fracture mode was undetermined.

Donald Kramer, Ph.D.
Sr. Materials Engineer

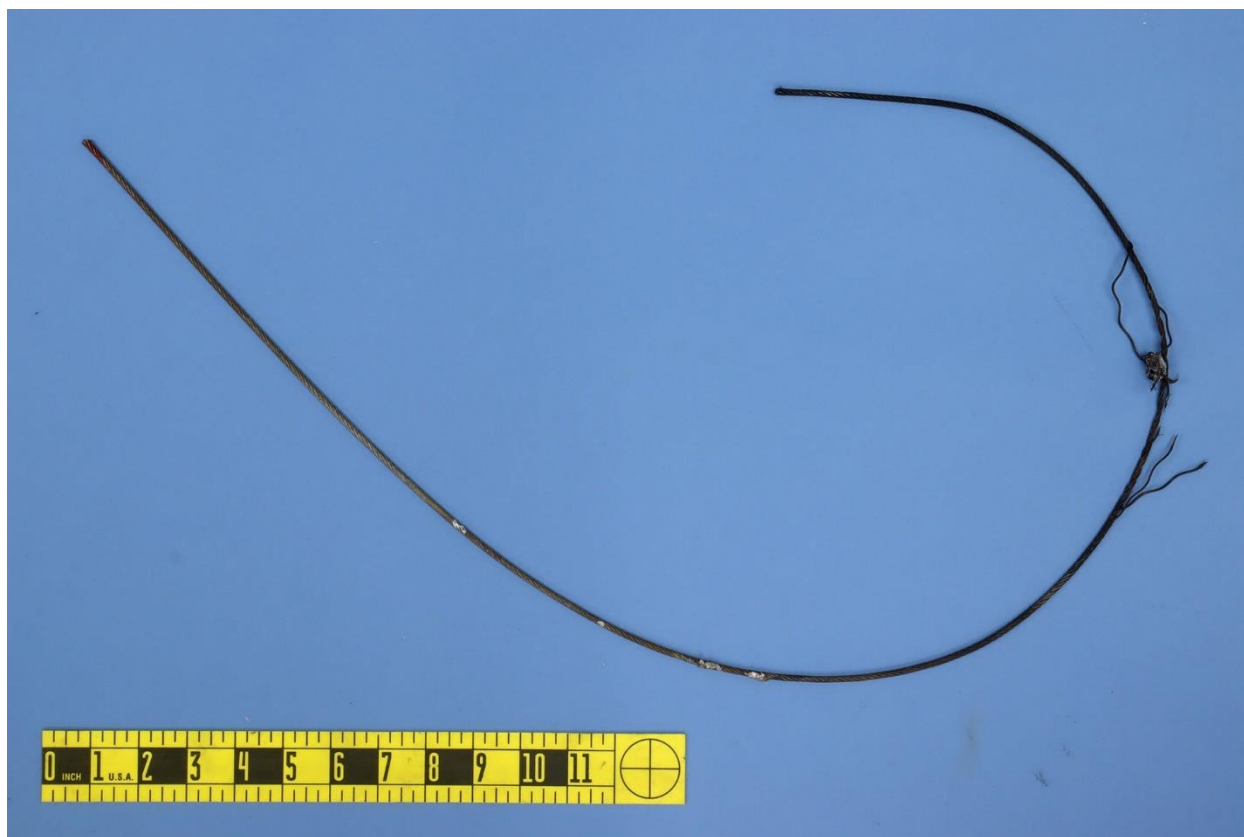


Figure 1: The section of rudder cable as received.



Figure 2: a) and b) higher magnification images of the cable at the point of strand separation. A yellow box in part b) highlights a region exhibiting wear of outward-facing wires on an intact strand.



Figure 3: Strand 1 separated end. Two wires exhibited features consistent with overstress (white circles). The remainder were beveled, consistent with wear.



Figure 4: Strand 2 separated end. All wires were beveled, consistent with wear.

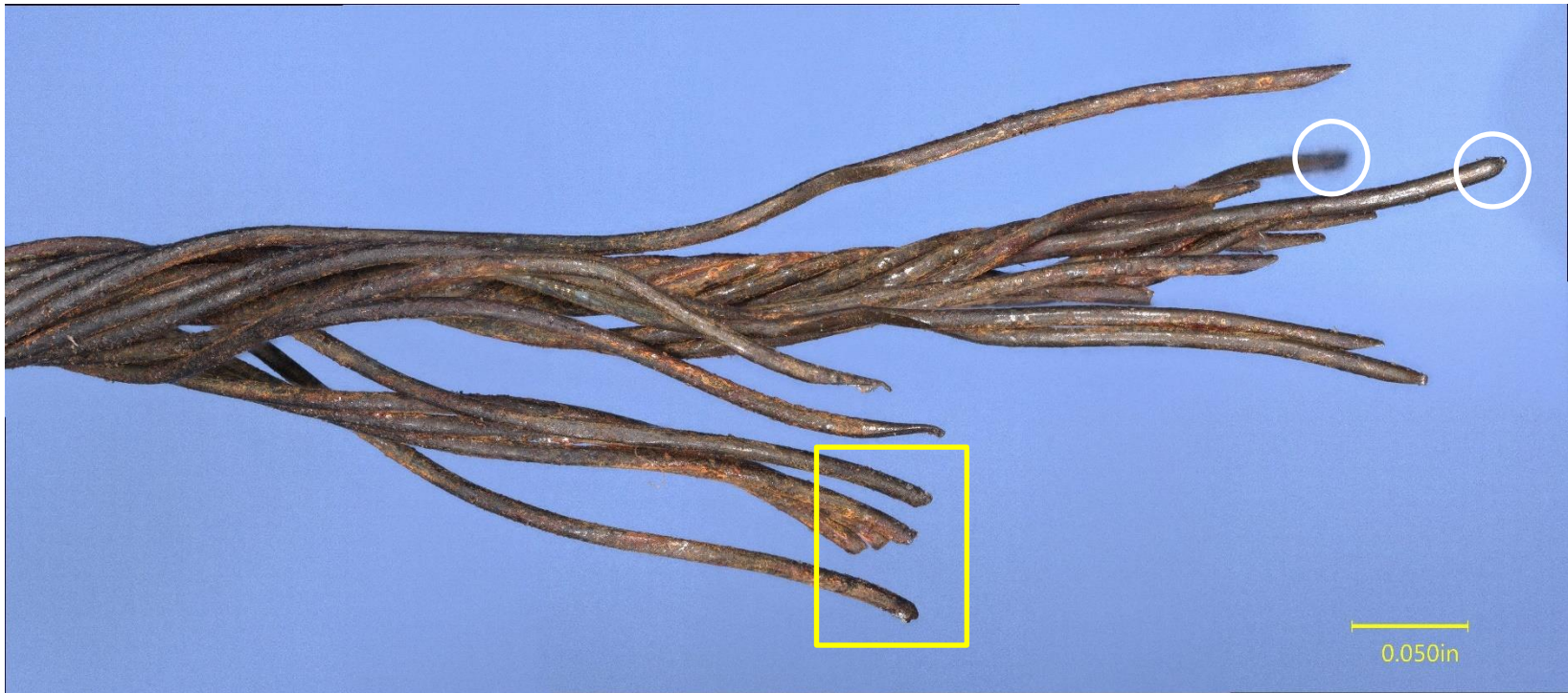


Figure 5: Strand 3 separated end. Two wires exhibit features consistent with overstress (white circles), two exhibited features consistent with fatigue initiation followed by overstress, and three could not be determined (fatigue and undetermined indicated together by the yellow rectangle). The remainder were beveled, consistent with wear.