

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR22LA093

MATERIALS LABORATORY

Factual Report 23-001

January 06, 2023

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A. ACCIDENT INFORMATION

Location: Chemehuevi Valley, California
Date: 02/07/2022
Vehicle: Cessna 152 (N6496L)
Investigator: Elliot Simpson

B. COMPONENTS EXAMINED

1. Portions of left rudder cable (nominally 1/8 inch diameter, 7 by 19 steel construction) and pully
2. Portion of right rudder cable (nominally 1/8 inch diameter, 7 by 19 steel construction) and pully

C. EXAMINATION PARTICIPANTS

Specialist Michael Budinski
NTSB
Washington, DC

Specialist Frank Zakar
NTSB
Washington, DC

D. DETAILS OF THE EXAMINATION

The submitted items are shown in Figure 1.

Examination of the portion of right rudder cable revealed wire wear as documented in Figure 2. Wires that had worn through were observed. The right rudder cable piece had an average diameter of 0.132 inch. In the worn region the typical diameter ranged from 0.105 inch to 0.117 inch. An Olympus Vanta X-ray fluorescence (XRF) portable alloy analyzer identified the material of the right cable as grade 304 stainless steel.

Examination of the portions of left rudder cable revealed that the cable fully fractured in a region exhibiting wear as documented in Figures 3 through 7. Figure 3 shows close images of the aft fractured piece. Wear of individual wires was observed.

The fractured ends of the left rudder cable were ultrasonic cleaned with Alconox, a commercial detergent. This cleaning procedure removed dry grease from the general area of the fracture. The forward piece of the left rudder cable had been raveled (at the Materials Laboratory) in a manner whereby each strand was separated and arbitrarily identified with labels A through G (see Figure 1). The fractured wire

ends in each strand were imaged using a digital microscope as documented in Figures 4 through 7. Approximately 52% of the wires exhibited wear with about 43% of the wires exhibiting material loss through the full diameter of the wire due to wear. The balance of the wires fractured in overstress across the full wire diameter.

A visual inspection of right and left pulleys was performed. The grooves in the pulleys exhibited deposits and remnants of dried or degraded grease. No fresh grease was present.

Submitted by:

Michael K. Budinski
Chief, Materials Laboratory

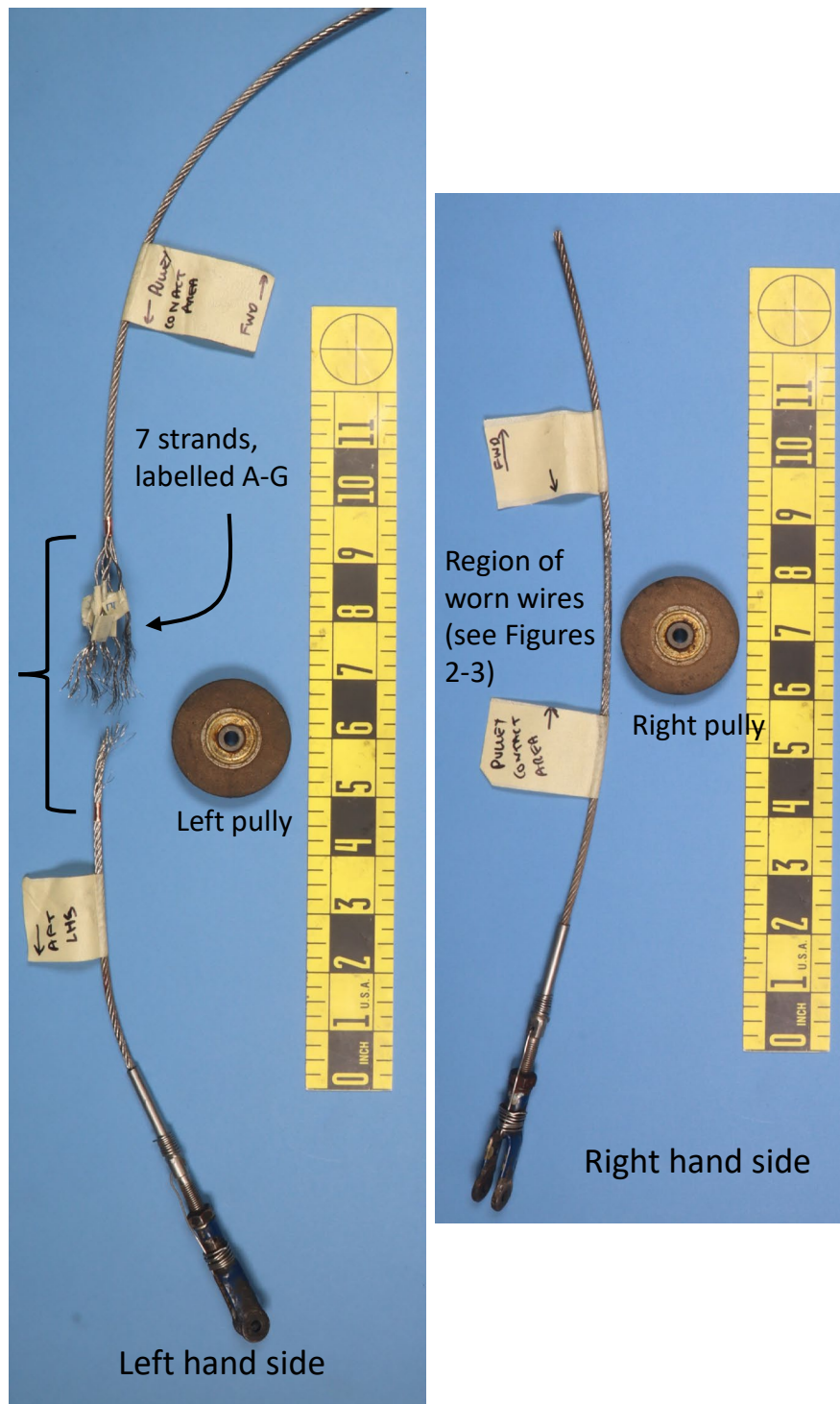


Figure 1. Image of the submitted items. The rudder cables showed evidence of wear in the area that corresponded to their respective pulleys.

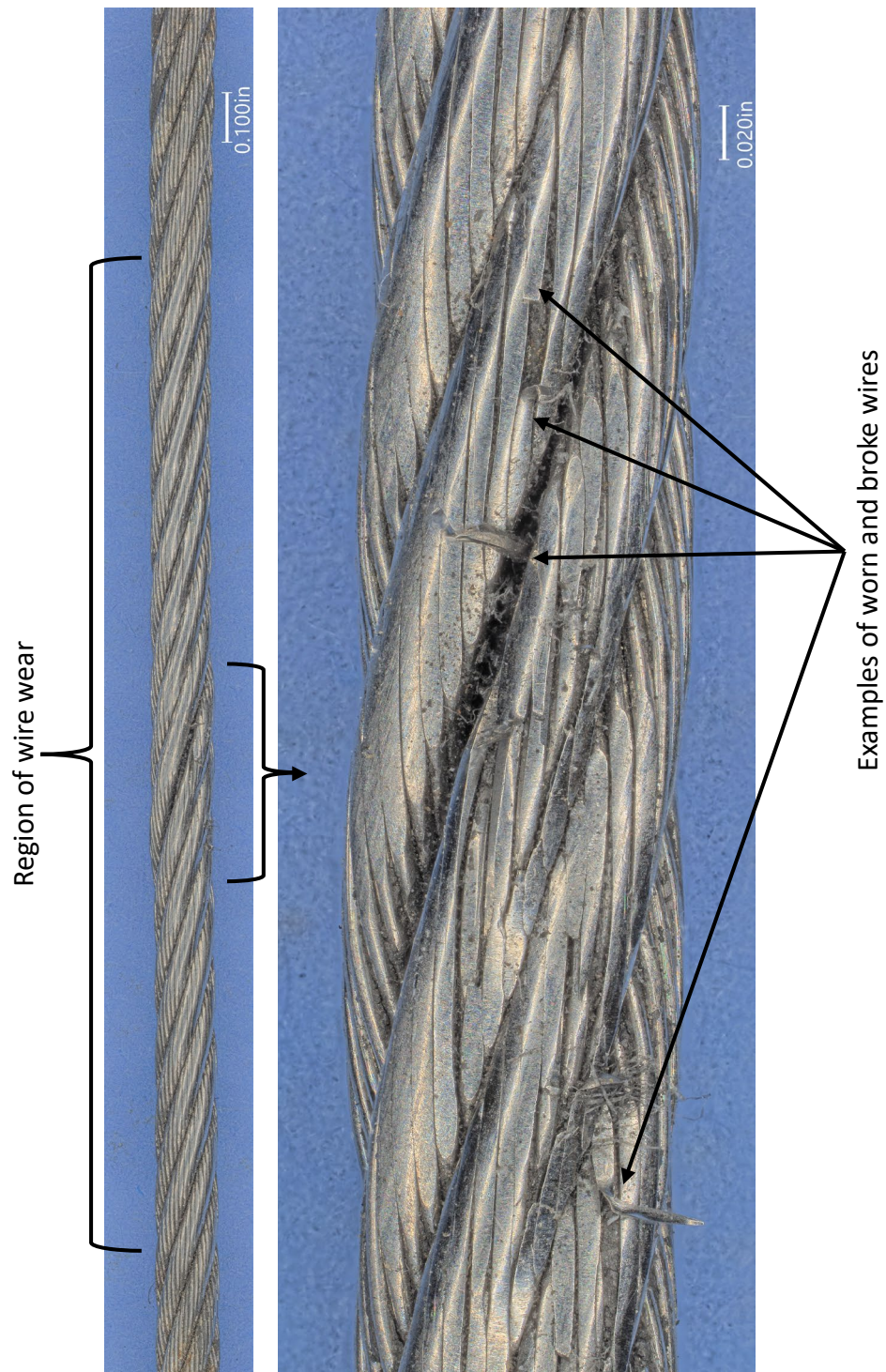


Figure 2. Digital microscope images of the worn area on the right rudder cable piece.

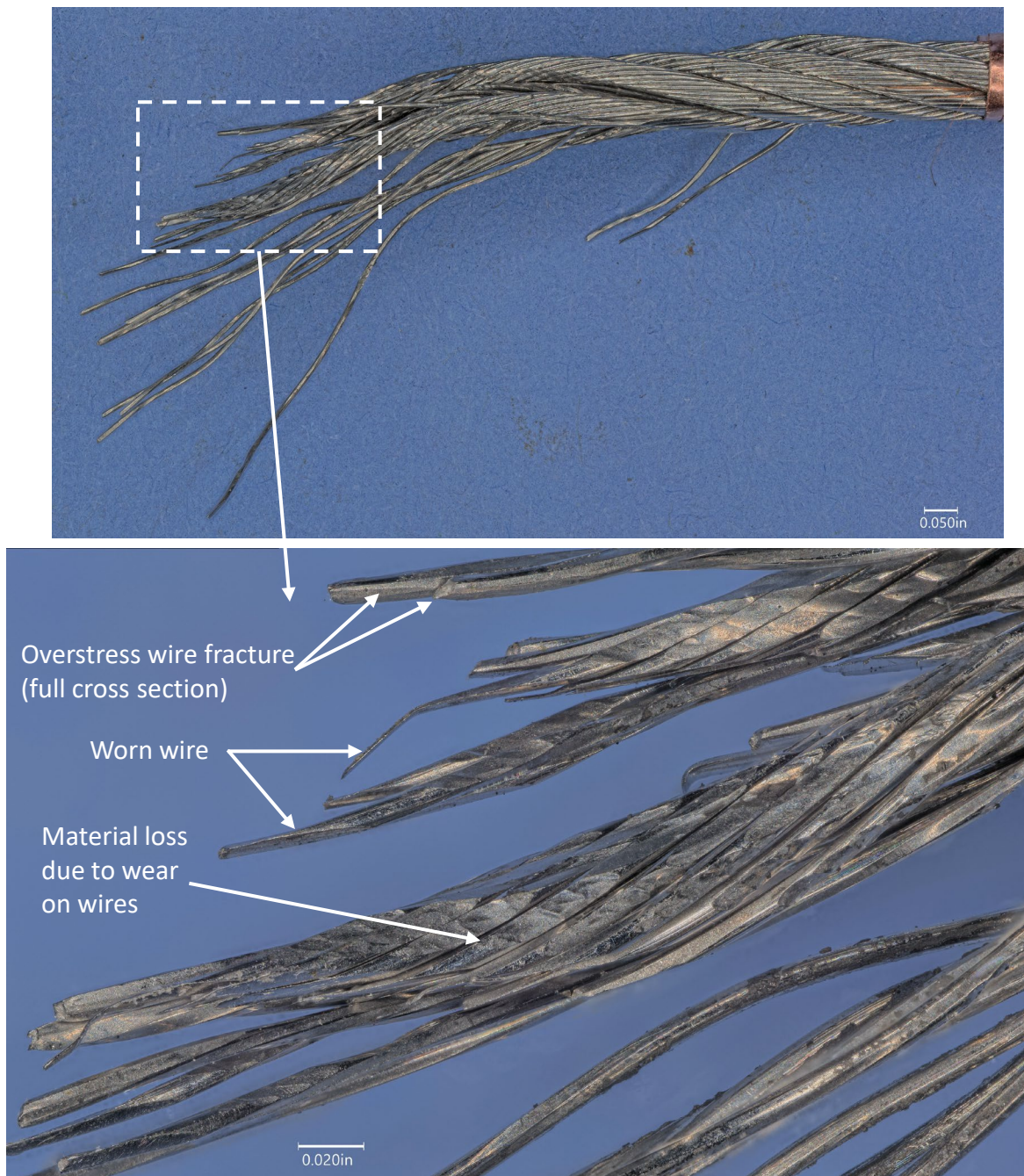


Figure 3. Digital microscope images of the worn area on the aft pieces of left rudder cable portion.

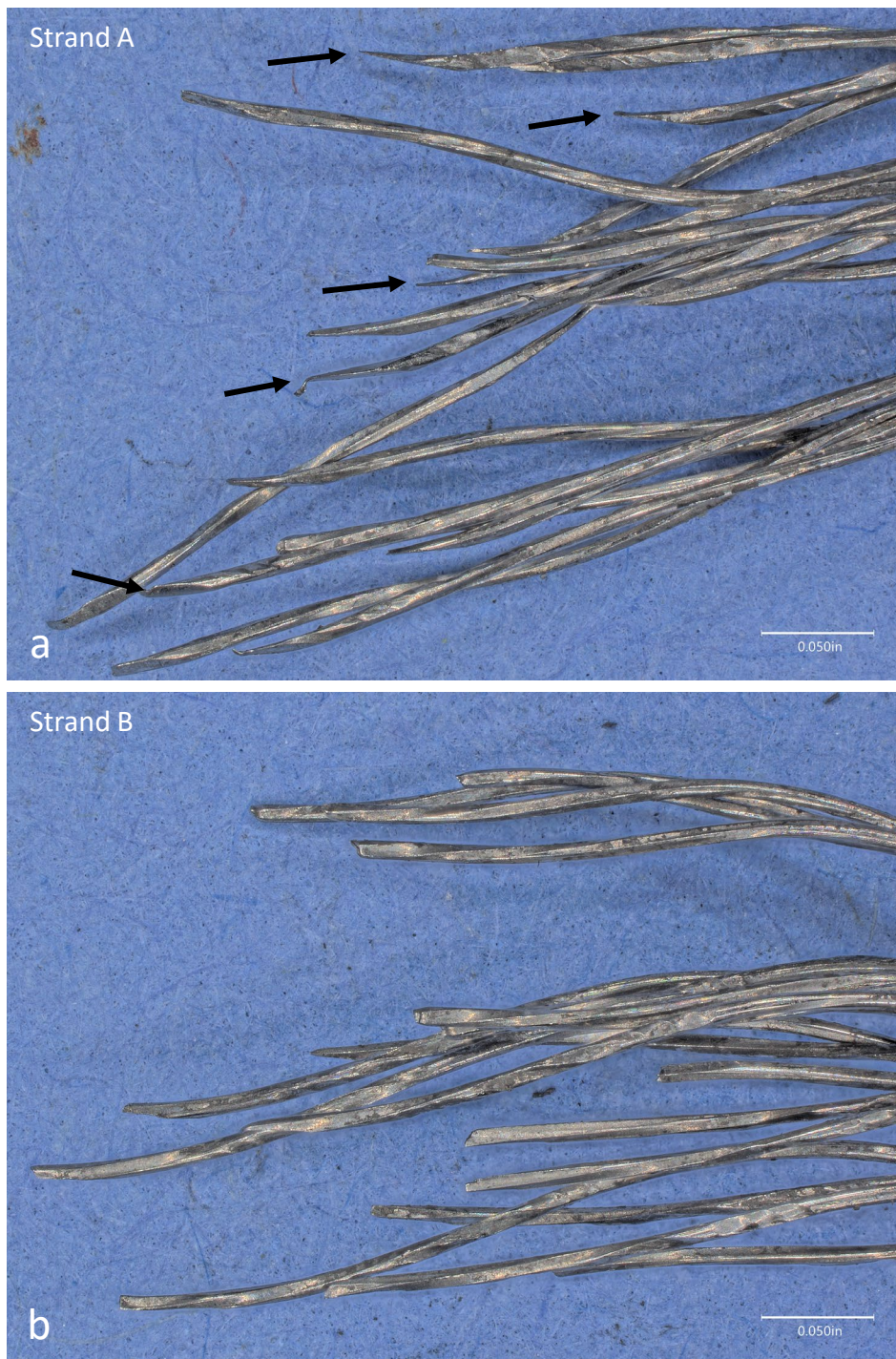


Figure 4. Digital microscope images of the left side forward rudder cable piece (see Figure 1). View a shows the fractured wire ends in strand A. Wear reduced the ends of the wire to a knife edge, indicated by arrows. View b shows the fractured wire ends in strand B.

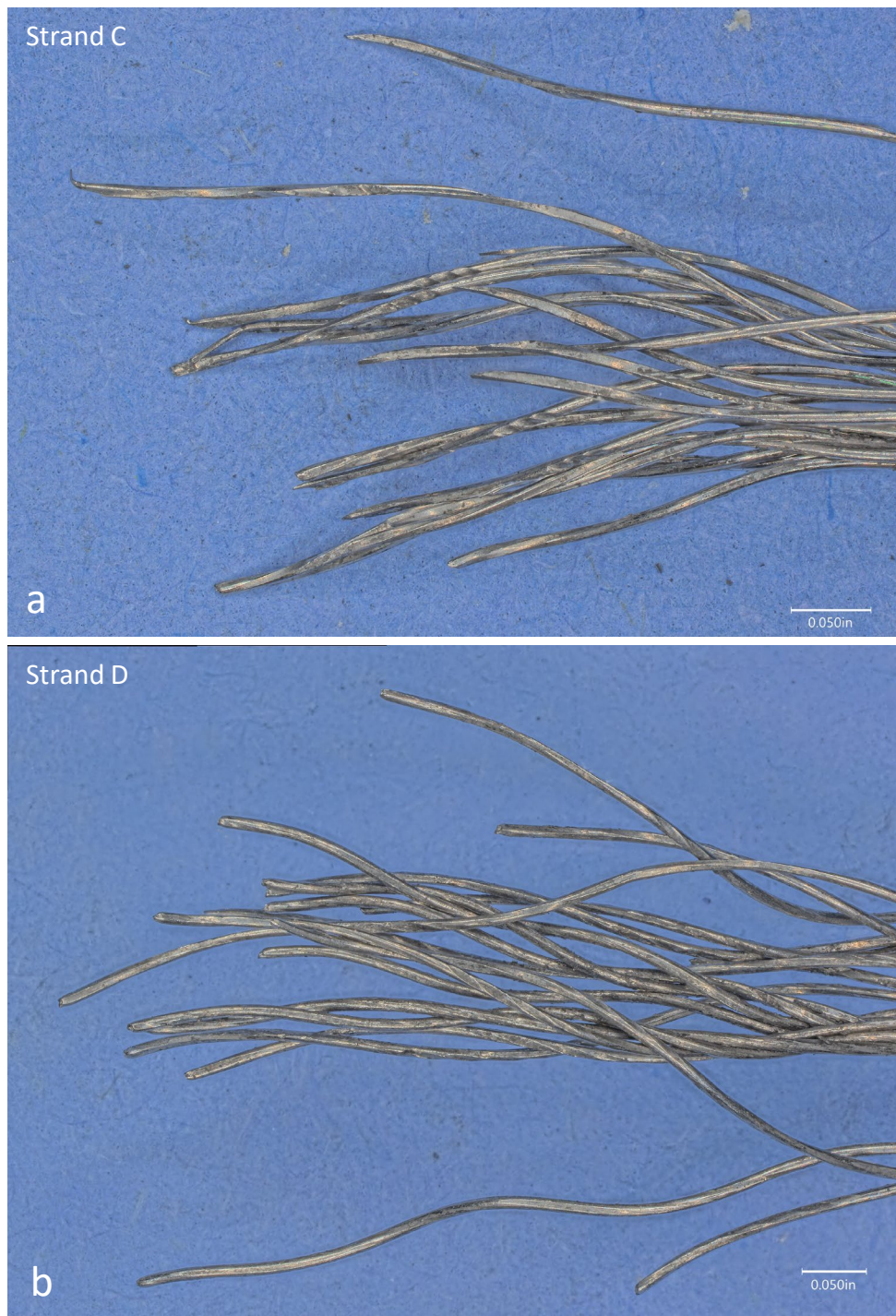


Figure 5. Digital microscope images of the left side forward rudder cable piece (see Figure 1). View a shows the fractured wire ends in strand C. View b shows the fractured wire ends in strand D.

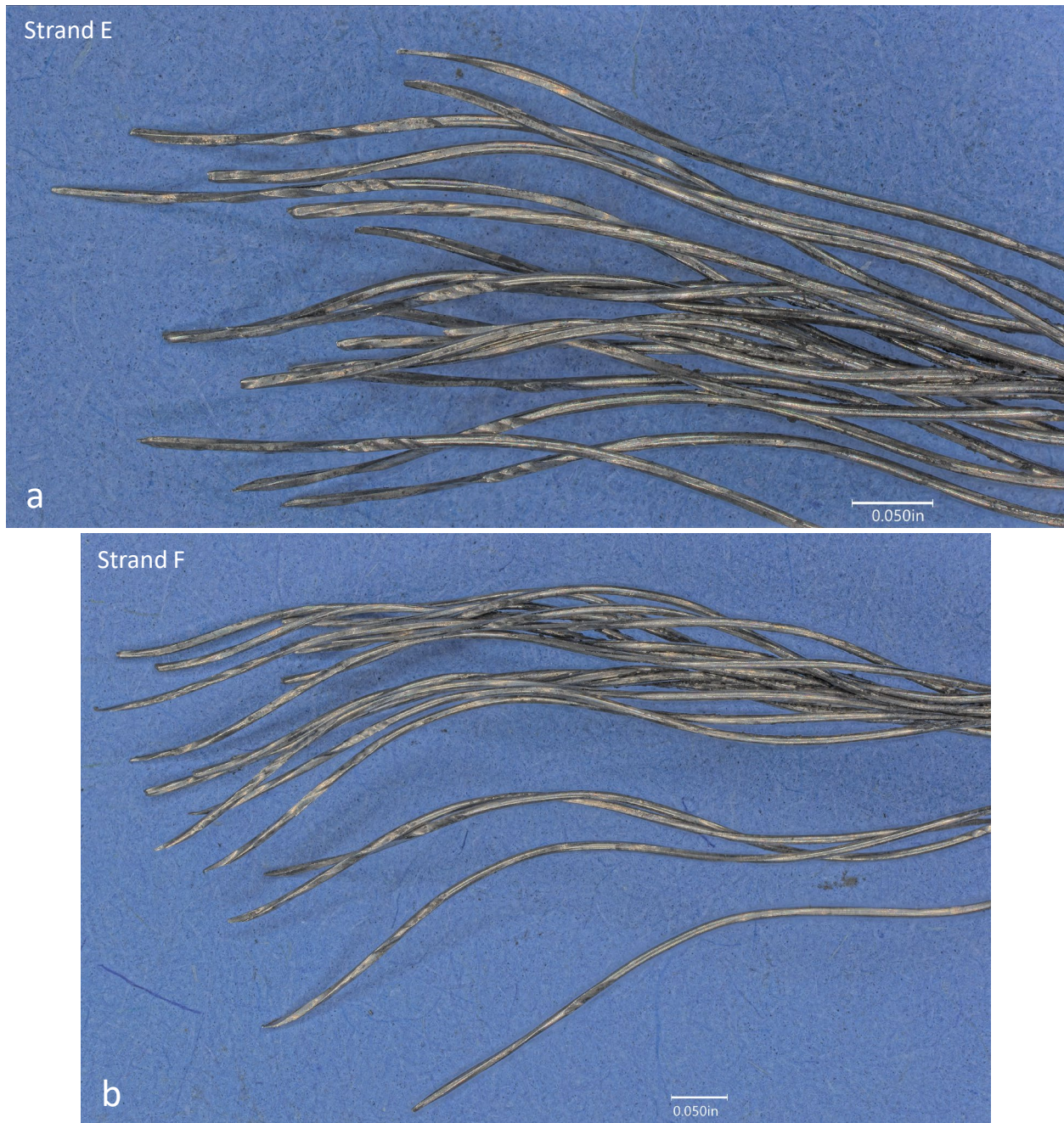


Figure 6. Digital microscope images of the left side forward rudder cable piece (see Figure 1). View a shows the fractured wire ends in strand E. View b shows the fractured wire ends in strand F.



Figure 7. Digital microscope image of the left side forward rudder cable piece (see Figure 1) showing the fractured wire ends in strand G.