

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR23FA208

MATERIALS LABORATORY

Factual Report 23-062

July 27, 2023

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A. ACCIDENT INFORMATION

Location: Tupelo, Mississippi
Date: June 3, 2023
Vehicle: Piper PA-31-325, N4077W
Investigator: Scott Johnson, ASI-WPR

B. COMPONENTS EXAMINED

Aileron balance cable, separated from end terminal.
Separated end terminal, attached to pulley and pulley bracket.

C. EXAMINATION PARTICIPANTS

Specialist Donald Kramer, Ph.D.
National Transportation Safety Board
Washington, DC

Engineering Technician Edward Komarnicki
National Transportation Safety Board
Washington, DC

D. DETAILS OF THE EXAMINATION

An aileron balance cable that had separated from its root end terminal fitting was submitted to the NTSB Materials Laboratory for examination, as shown in figure 1. As part of the original cable manufacturing process, the cable and end terminal are joined by swaging. The cable end is inserted fully into the terminal socket and the terminal is swaged (plastically deformed) around the cable, mechanically interlocking the two components. The cable was found separated from its terminal.

The free end of the cable exhibited grinding and cutting features. Figure 2a shows an overview image of the free end. Figure 2b shows a higher magnification image of the same end. Multiple regions exhibited superficial grinding marks. One region exhibited a U-shaped channel cut with grinding marks, metal burrs along one edge, and several cut wires. The cut and abraded surfaces had a shiny metallic appearance as opposed to the dark and oxidized appearance observed across the rest of the cable, terminal, and pulley assembly. The cable assembly length was approximately 142 inch, which was between 30 inch and 36 inch short of the nominal assembly length, according to the manufacturer's assembly drawing. The features and measurements were consistent with the cable having been cut.

The end terminal did not have any apparent cable fragments retained in the socket. Figure 3 shows an X-ray image of the terminal socket. The X-ray image of the

socket had a knurled appearance from the swaging operation used to join the cable to the terminal. The contrast between the socket and the wall of the terminal was consistent with an empty socket, with no remaining wires or wire fragments present.

Submitted by:

Donald Kramer, Ph.D.
Sr. Materials Engineer

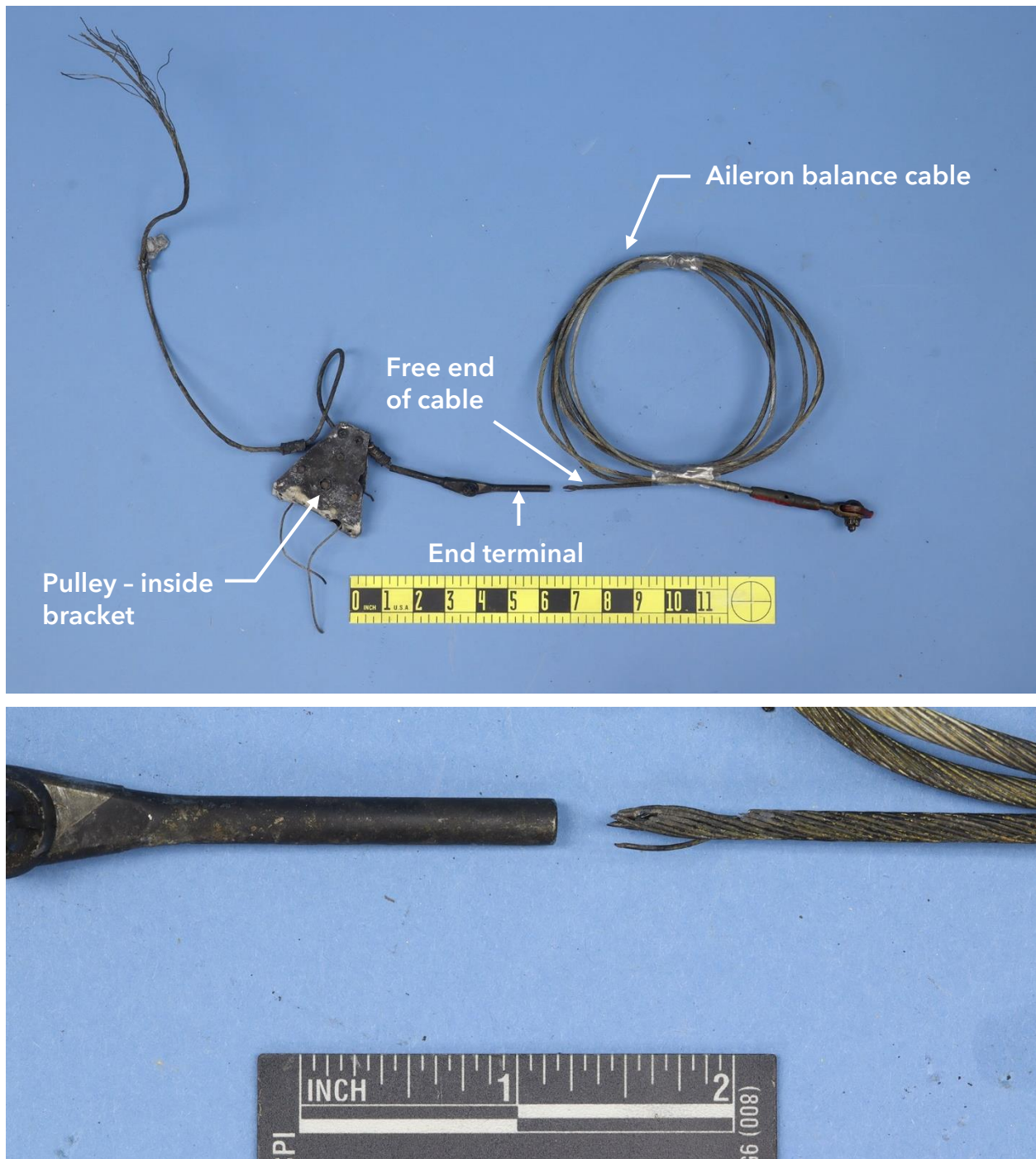


Figure 1. Top image: Aileron balance cable and end terminal as received. Bottom image: closer view of terminal end and free end of balance cable.

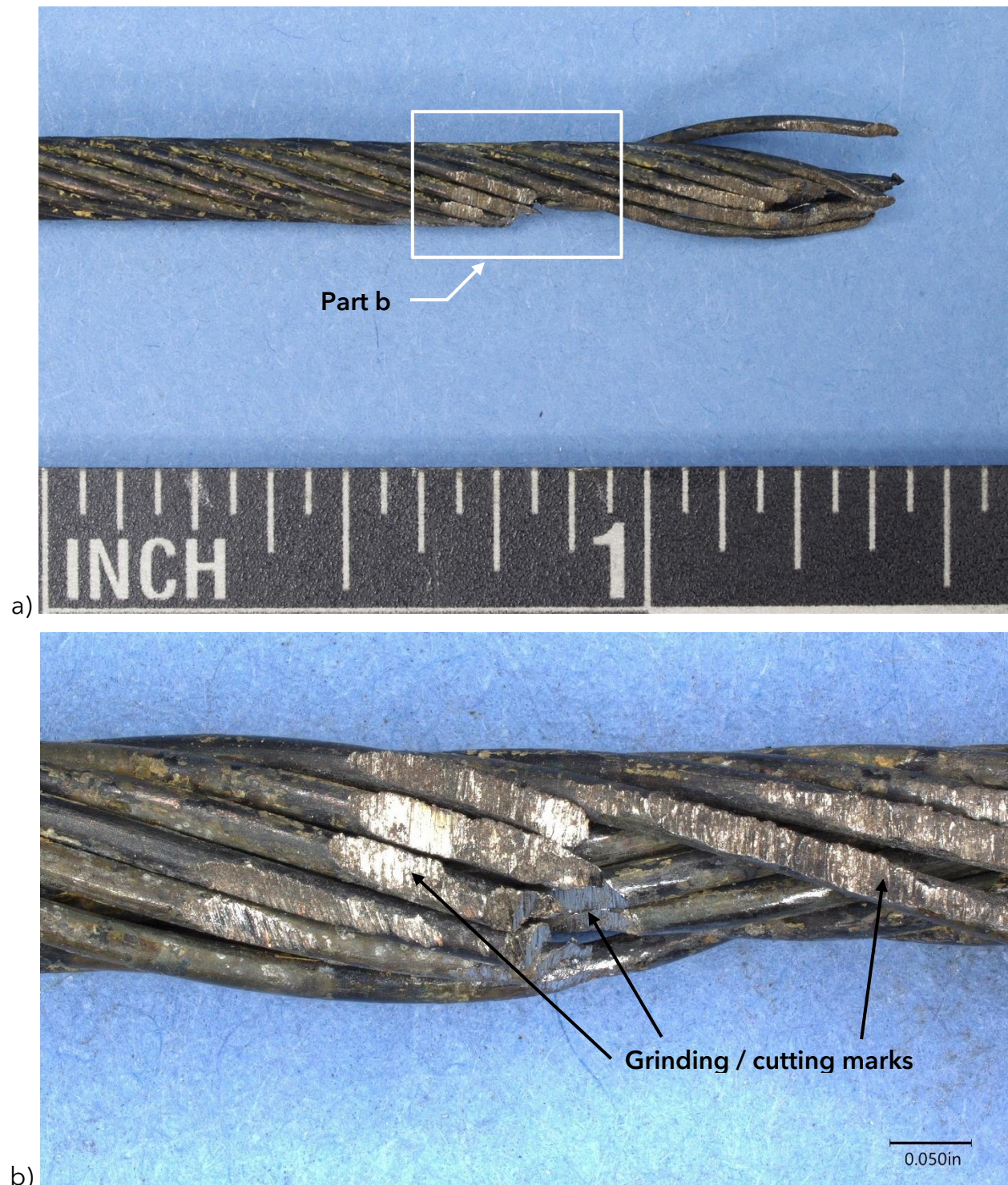
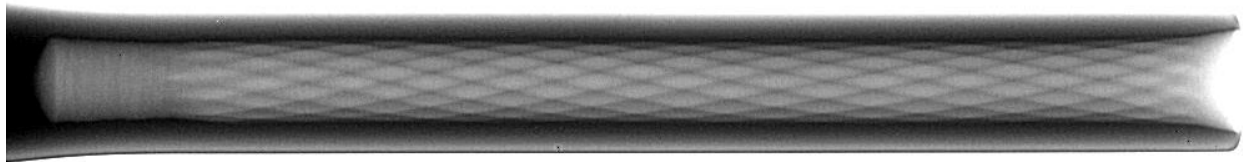


Figure 2. Images of the aileron balance cable's free end - a) Overview image showing orientation of cable and b) closer view of free end showing grinding and cutting marks.



5000 μm

100 kV 200 μA Z0

x-ray 01
User: ???

Figure 3. X-ray image of cable terminal. The inside surface of the socket appears knurled in the image, from being swaged onto the cable. There were no apparent cable fragments present inside the socket.