

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR23LA086

MATERIALS LABORATORY

Factual Report 23-025

March 15, 2023

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A. ACCIDENT INFORMATION

Location: Kent, Washington
Date: January 7, 2023
Vehicle: James C. Schindler Challenger II, N528J
Investigator: Andrew Swick, AS-WPR

B. COMPONENTS EXAMINED

Left and right aileron control cable sections and pulleys.

C. EXAMINATION PARTICIPANTS

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

D. DETAILS OF THE EXAMINATION

An overall view of the submitted components is shown in figure 1. The components included aileron cable pieces that were attached to the control stick at the forward cockpit position, a mating piece of the fractured right control cable, and forward pulleys from the aileron control system that had been removed from the left and right sides of the fuselage at the forward cockpit position. The turnbuckle on the left control cable was fractured, and an inset image shows a closer view of the fracture.

The turnbuckle for the right control cable was bent in the barrel and in the shanks of the eye fittings at each end of the barrel. The control cable was also bent adjacent to the cable fracture. The fractured end of the cable was splayed consistent with an overload fracture. Individual wire fractures were examined using an optical stereomicroscope, and necking deformation was observed at the fracture locations consistent with ductile overstress fracture.

The turnbuckle for the left control cable was fractured, and the shanks of the eye fittings at each end were bent. The turnbuckle fracture occurred through the safety wire through-hole in the middle of the barrel, and the safety wire remained intact. The fracture surfaces for the turnbuckle were rough and on slant angles relative to the longitudinal axis, features consistent with ductile overstress fracture. Deformation associated with the fracture was consistent with fracture from bending loads with relative orientation of the two sides as shown in the inset image in figure 1.

Cable contact marks were observed on the sides of the pulley grooves and on the cable bracket for the left pulley. Normally, the control cable contacts the pulley groove at the forward outboard quadrant of each pulley as the cable is routed

between the transverse direction at the forward side of the pulley and longitudinally aft at the outboard side of the pulley. As shown in figure 2, contact marks were observed on the upper inboard edge of the lower bracket forward of the pulley and on the upper inboard edge of the upper bracket aft of the pulley axis. Cable contact marks were also observed on the upper and lower sides of the pulley groove as shown in figure 3. The contact mark on the upper side of the groove corresponded to a bracket contact mark on the upper face as indicated in figure 3. When the bracket contact mark on the pulley upper face was aligned with the bracket edge, the cable contact marks on the upper side of the pulley coincided with the contact marks on the inboard edge of the upper bracket.

The left pulley was disassembled from the brackets. Scratches consistent with cable contact were observed on the interior surfaces of the brackets between the pulley outer diameter and the bracket attachment flange as shown in figure 4.

No abnormal cable contact marks or scratches were observed on the right pulley or the right pulley attachment brackets.

Submitted by:

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

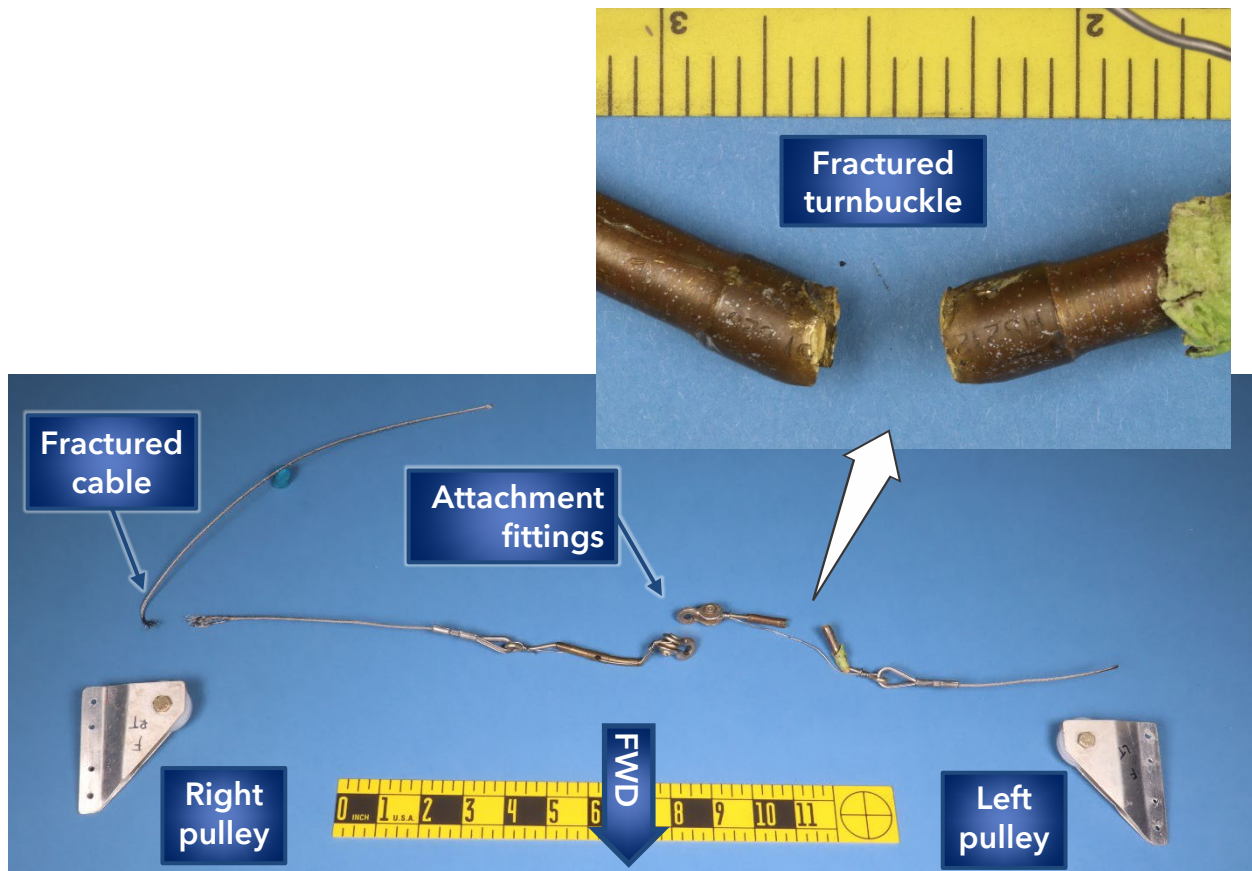


Figure 1. Overall view of the submitted components from the aileron control system at the forward cockpit position with a closer view of the fractured turnbuckle from the left cable assembly.

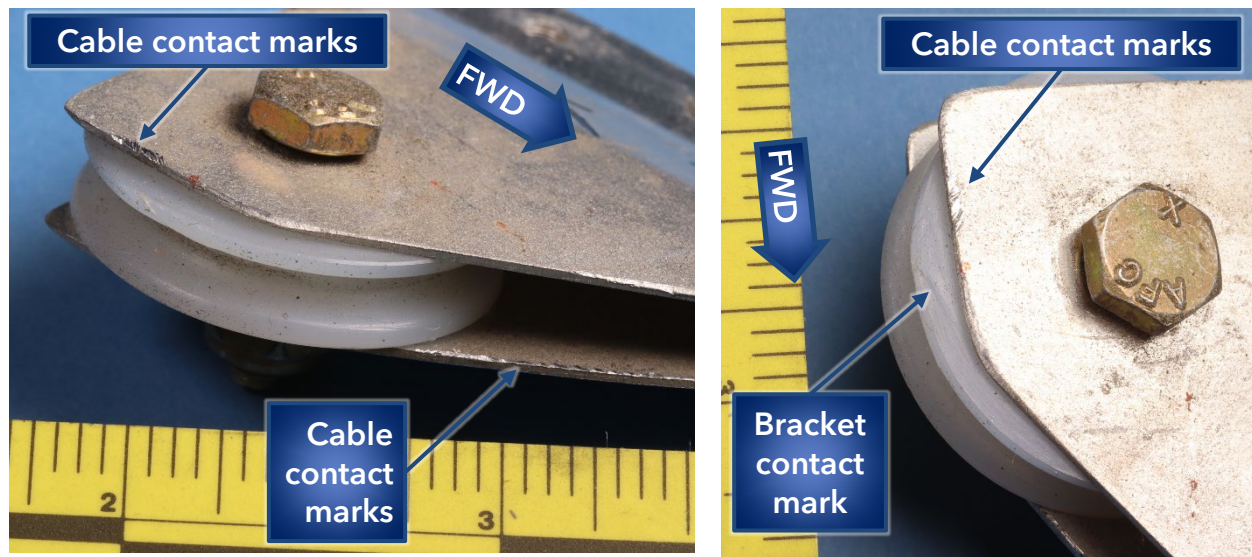


Figure 2. Close views of the upper inboard side of the left pulley showing areas of cable contact on the bracket edges and bracket contact on the upper face of the pulley.



Figure 3. Cable contact marks on the sides of the pulley groove and on the inboard edge of the upper bracket.

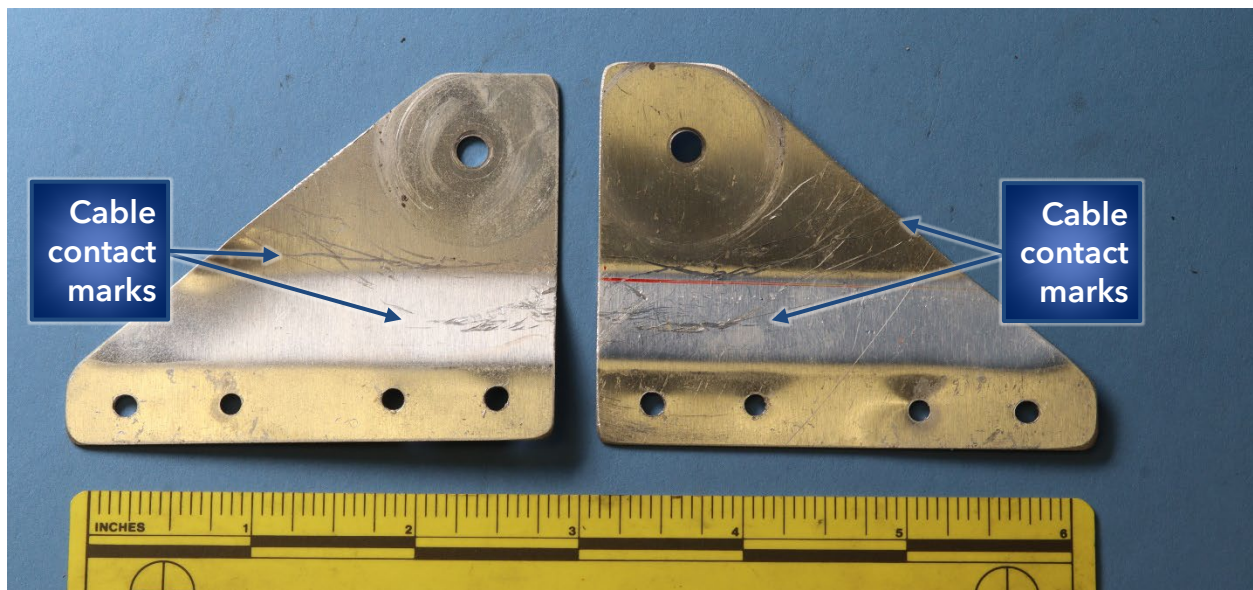


Figure 4. Cable contact marks on interior surfaces of the upper and lower brackets for the left pulley.