

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



CEN24FA220

MATERIALS LABORATORY

Factual Report 25-038

June 2, 2025

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A. ACCIDENT INFORMATION

Location: Broseley, Missouri
Date: June 14, 2024
Vehicle: Air Tractor Inc. AT-602, N115AA
Investigator: Timothy Sorensen, AS-CEN

B. COMPONENTS EXAMINED

Portions of the right aileron bellcrank (fractured), right and left aileron pushrods (fractured), and right flap pushrod (fractured)

C. EXAMINATION PARTICIPANTS

Specialist Michael Meadows
National Transportation Safety Board
Washington, District of Columbia

D. DETAILS OF THE EXAMINATION

Portions of the aileron and flap control systems from the accident aircraft were disassembled and/or cut from the wreckage prior to being submitted to the NTSB materials laboratory for examination. Figure 1 shows a view of the components as received.

The right aileron bellcrank was fractured but is generally comprised of two opposed parallel c-shaped beams with plates welded along the central third of the inboard and outboard beam flanges. A transverse lug with bearings was positioned at the approximate center of the bellcrank. The upper portion of the fractured bellcrank retained a bent section of the pushrod which led to the torque tube at the control column in the cockpit. The lower portion of the fractured bellcrank retained a section of the main aileron push rod assembly. Evidence of a yellow paint coating was present but the overall appearance of the bellcrank was covered by rust and blackened, bubbled, and flaked areas of coating, consistent with post impact fire damage.

The free ends of the c-shaped beams, above and below the welded plates were deformed/twisted aft as shown in figure 2 from the perspective of looking outboard. The deformation patterns were consistent with side loads or torsional loads imparted by the attached pushrods.

The bellcrank fractured along both c-shaped beams just below the welded plates. Figures 3 and 4 show normal and oblique views, respectively, of mating sides of the bellcrank fracture surface with the upper portion on the left and the lower

portion on the right. The bellcrank fractures were examined more closely using a 4x - 80x stereomicroscope. The fracture surfaces were covered with reddish-brown rust and were oriented along a slanted plane relative to the axes of the beams, consistent with shear lip features as a result of overstress separation. A reversal in the fracture surface orientation was observed along the aft c-shaped beam as indicated by yellow arrows, consistent with a sudden change in the load path. The degree of deformation observed was greater on the lower portion of the bellcrank outside of the regions attached to the welded plates.

Figure 5 shows a closer view of the forward c-shaped beam from the lower portion of the fractured bellcrank. The outboard flange was bent forward toward the base of the c-shaped beam for approximately 3 inches from the lower end of the bellcrank and the cavity formed was impacted with debris consistent with soil. The forward side of the section of the main aileron pushrod near the rod end exhibited chipped paint, gouges, smeared metal, and flattened/smeared regions on the safety wire as shown more closely in figure 6.

The two right and one left aileron drooping push rod fractures were examined more closely using a 4x - 80x stereomicroscope and are shown in figures 7 - 9. Rust and smearing damage was observed, but all fractures exhibited a relatively rough fracture morphology and a cup-and-cone type appearance. The rods all fractured near the aft rod end in the threaded region within approximately two or three threads from the end of the jam nut. Bending deformation of the rods was observed at the fracture locations. The aileron push rods fractured in a manner consistent with tensile/bending overstress.

The right flap push rod was examined more closely using a 4x - 80x stereomicroscope and is shown in figure 10. Rust was observed covering the fracture surface, but the fracture surface exhibited a slanted orientation relative to the axis of the rod. The fracture surface was cleaned using a diluted solution of water and Evapo-Rust® and reexamined. Upon cleaning, parallel smear lines were observed along the slanted plane that were consistent with shear overstress separation.

Submitted by:

Michael Meadows
Materials Engineer

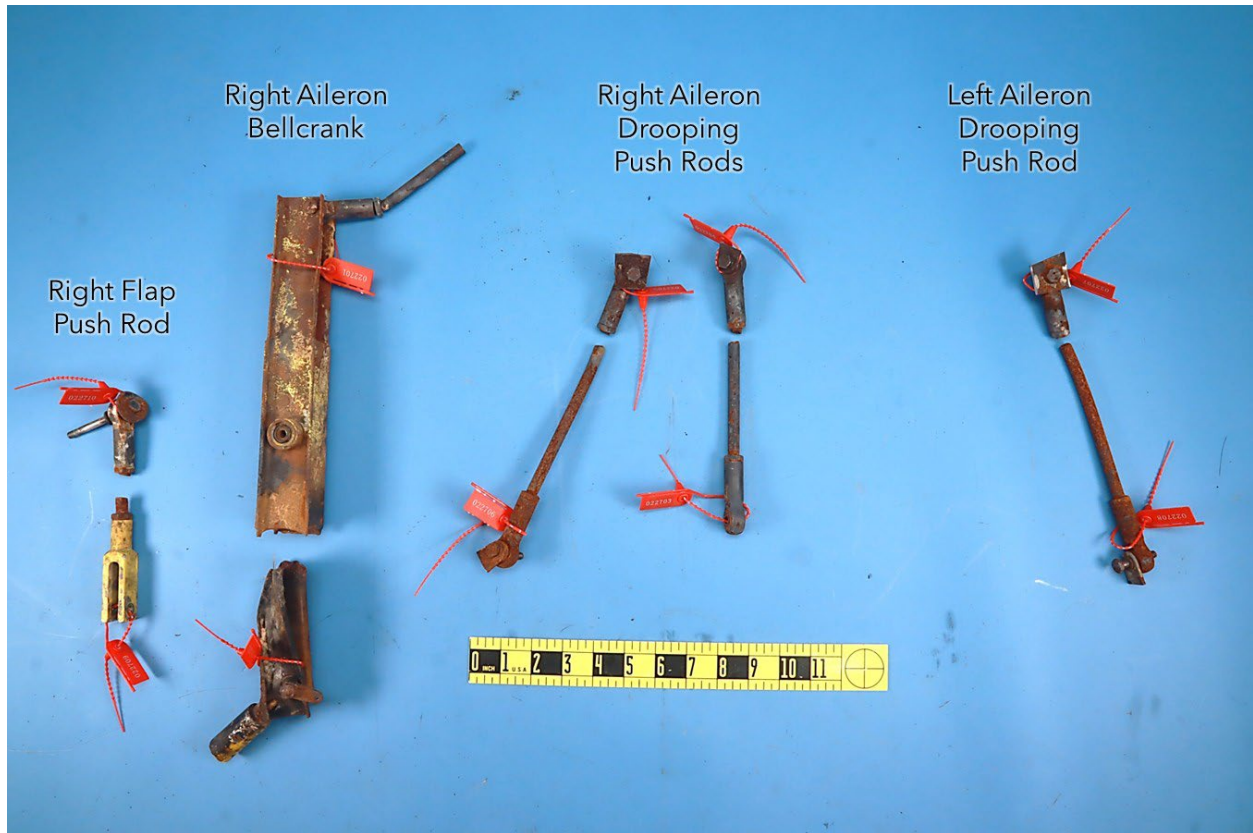


Figure 1. Photograph of the fractured components as received.



Figure 2. Photograph of the fractured right aileron bellcrank viewed looking outboard.

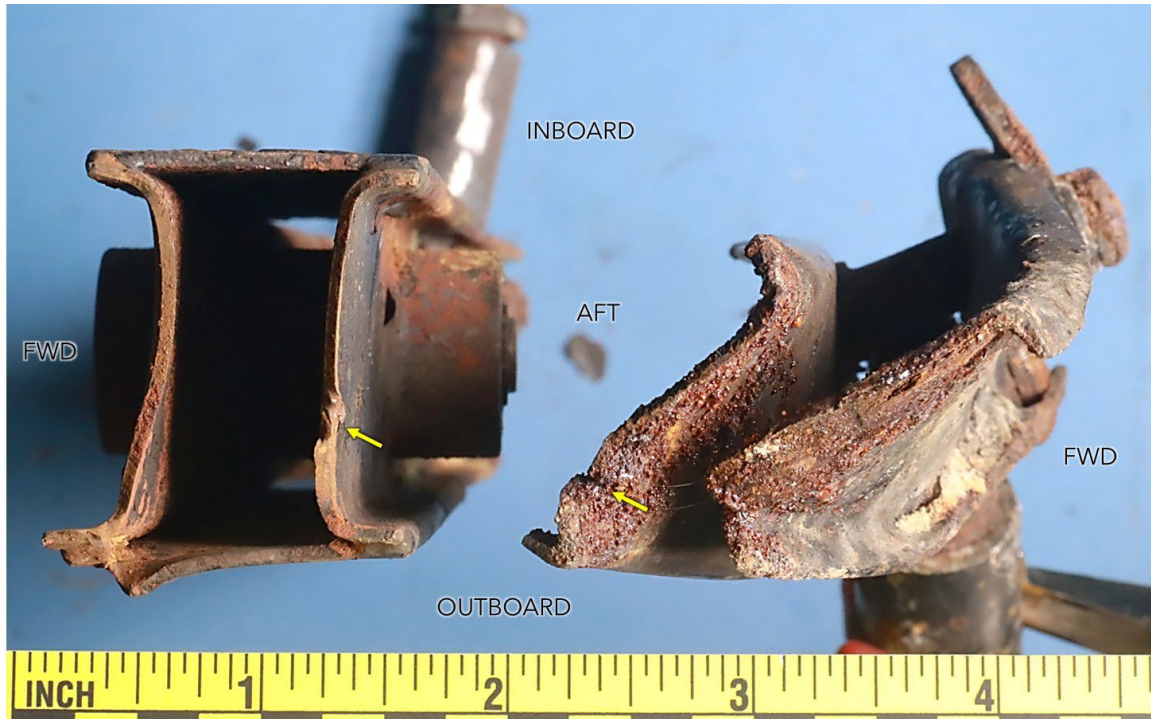


Figure 3. Photograph of mating sides of the fractured right aileron bellcrank with the upper portion on the left and the lower portion on the right. A shift in the fracture surface orientation is indicated by yellow arrows.



Figure 4. Similar photograph as figure 3 taken from a more oblique angle. A shift in the fracture surface orientation is indicated by yellow arrows.



Figure 5. Photograph of the forward side of the lower portion of the fractured right aileron bellcrank showing the bent outboard flange at the lower end.



Figure 6. Closer photograph of the forward side of the section of main aileron pushrod retained by the lower portion of the fractured bellcrank showing chipped paint, gouges, and smeared metal.



Figure 7. Photograph of the fractured right aileron drooping push rod (longer rod).



Figure 8. Photograph of the fractured right aileron drooping push rod (shorter rod).



Figure 9. Photograph of the fractured left aileron drooping push rod.



Figure 10. Photograph of the fractured right flap push rod.