

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



WPR23LA130

MATERIALS LABORATORY

Factual Report 23-053

July 10, 2023

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A. ACCIDENT INFORMATION

Location: Gordonville, Texas
Date: March 18, 2023
Vehicle: Aero Commander 100-180 (N4064X)
Investigator: Stephen Stein

B. COMPONENTS EXAMINED

Items from the nose landing gear

1. Upper and lower scissors link (torque link) assembly fractured into two pieces.

C. EXAMINATION PARTICIPANTS

Specialist Michael Budinski
NTSB
Washington, DC

Electron microscopy Edward Komarnicki
NTSB
Washington, DC

D. DETAILS OF THE EXAMINATION

Images of the submitted pieces of the nose landing gear scissors link assembly are shown in Figure 1. The center ears on the upper link are separated by fracture as annotated in Figure 1a. A close view of the fractured ears still assembled to the lower link is shown in Figure 2. A fatigue fracture origin is identified on the fracture surface of the left ear from the upper link.

As depicted in Figure 3, the left and right ear fragments from the upper link were removed for closer examination. As fabricated, the ears are integral to the rest of the upper link via a single piece of steel sheet. Weld overlay is applied to the ears, increasing their thickness. As noted in the figure, post-weld cracks occurred adjacent to the weld or in the heat affected zone. Closer views of the fracture surfaces in profile are shown in Figures 4 and 5.

The mating fracture surfaces on the upper link piece are shown in Figure 6. Key features are annotated in the figure including a region of fatigue cracking.

Figure 7 shows higher magnification digital microscope images of the fracture surface of the left fractured ear from the upper link. A fatigue fracture region is identified in Figure 7a. A closer view of the fatigue fracture region is shown in Figure 7b. Significant mechanical batter is present on the fracture face in the fatigue fracture region. A scanning electron microscope was used to image the fatigue fracture

region close to the origin. Fine striation features were observed in this region as shown in Figure 8 (see Figure 7b for the specific location).

Submitted by:

Michael K. Budinski
Chief, Materials Laboratory

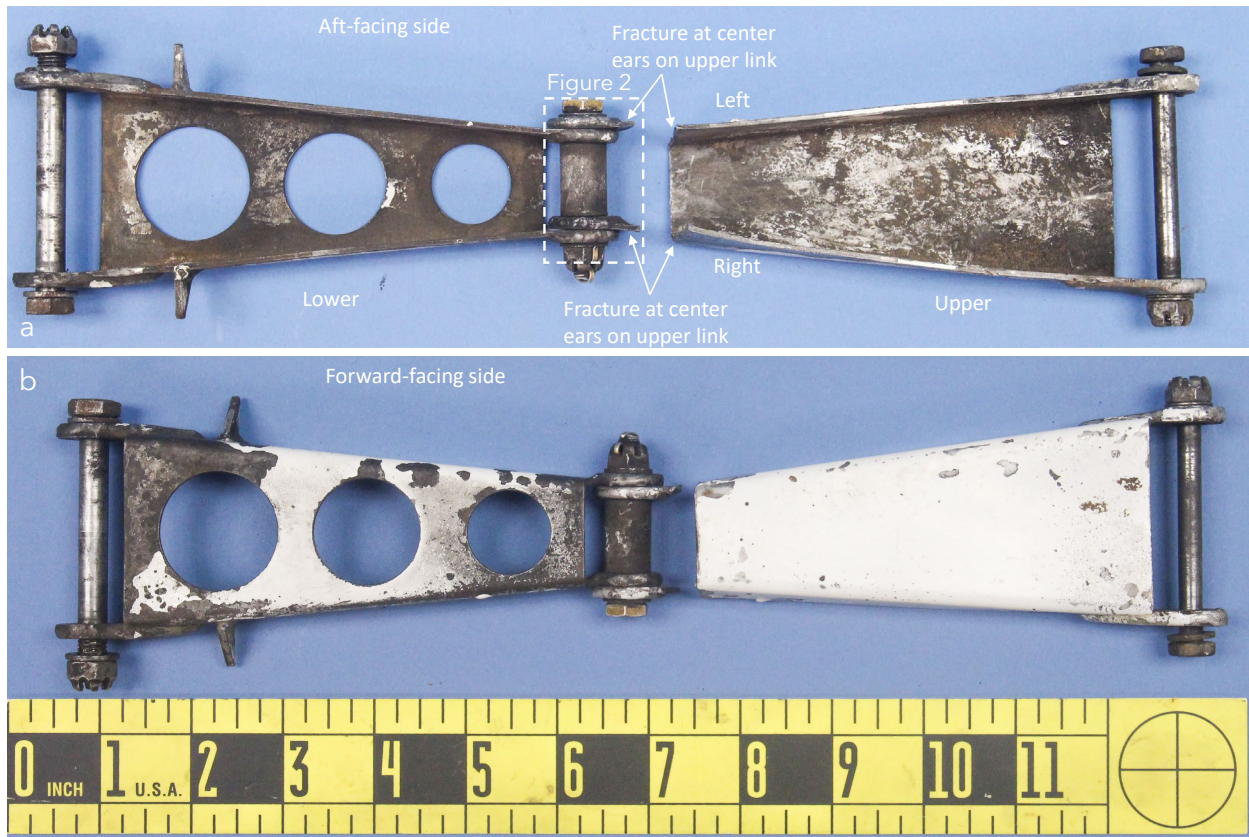


Figure 1. Images of the upper and lower scissors link with orientations annotated.

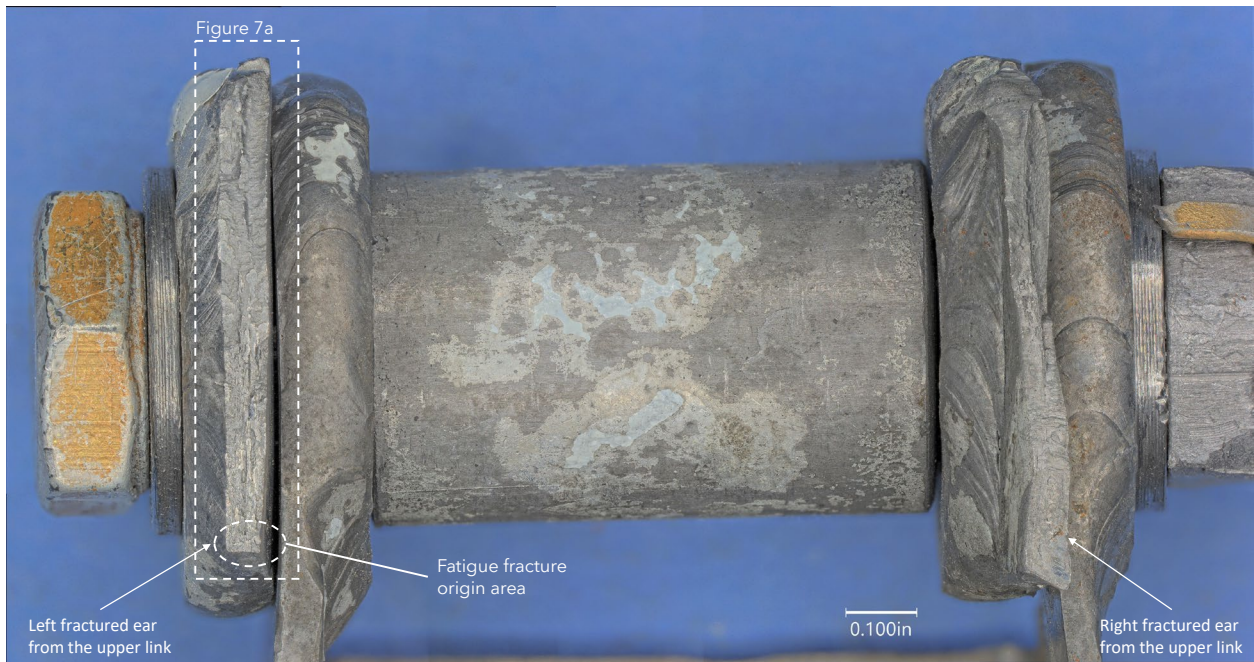


Figure 2. Close view digital microscope image of the fractured ears still assembled to the lower link.

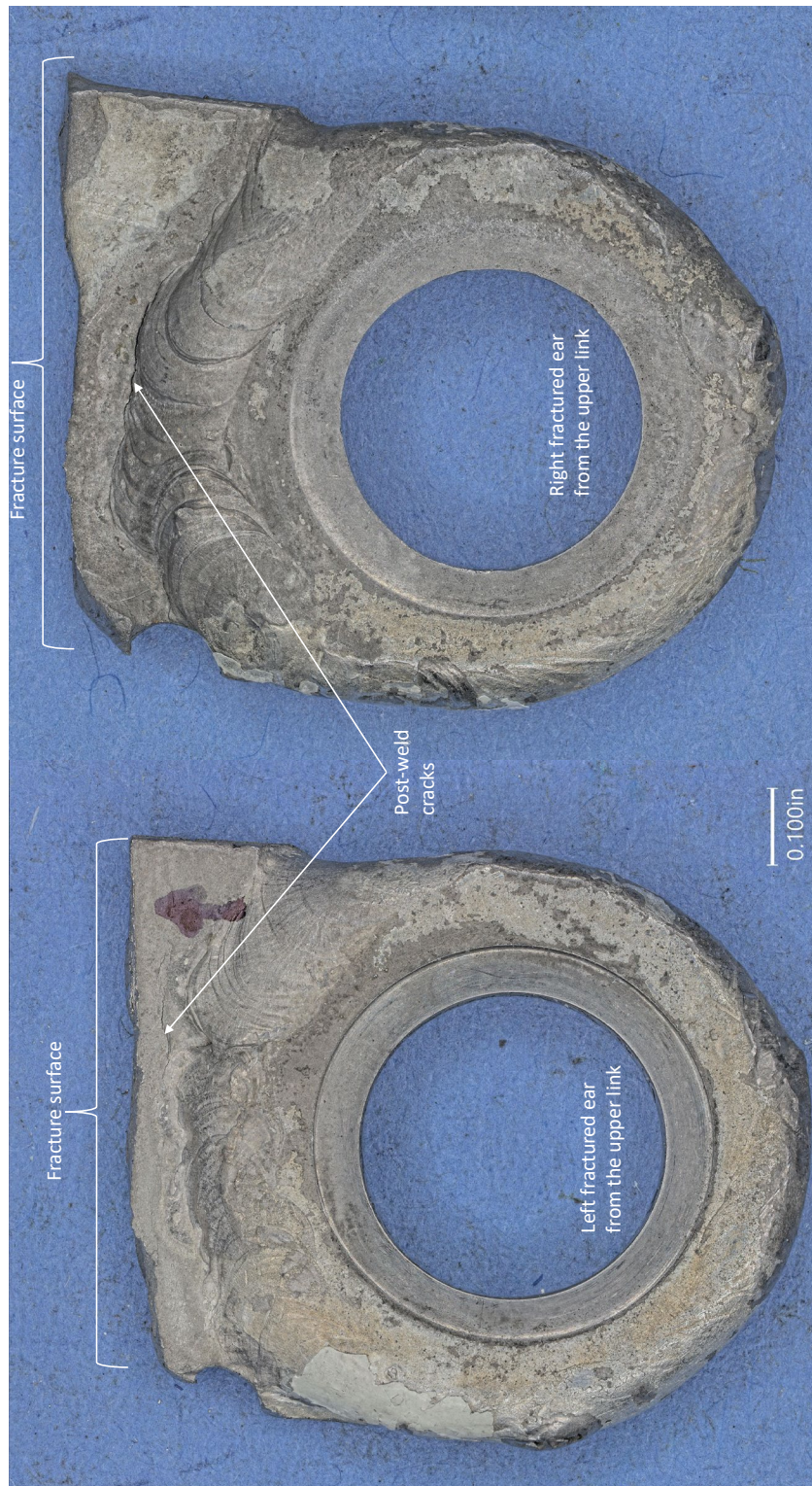


Figure 3. Digital microscope images of the left and right ear fragments from the upper link were removed for closer examination. The fracture surfaces are annotated and post-weld cracks are identified.

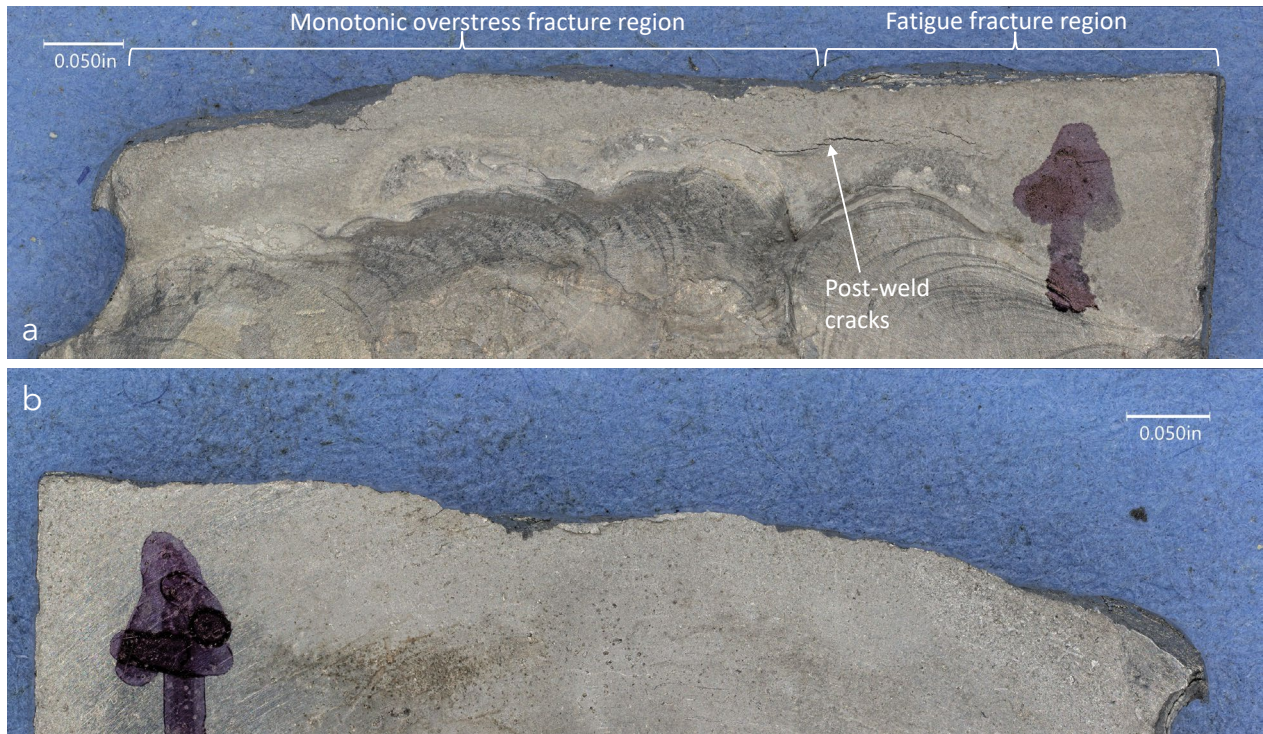


Figure 4. Closer digital microscope images of the left ear fracture surface in profile.



Figure 5. Closer digital microscope images of the right ear fracture surface in profile.

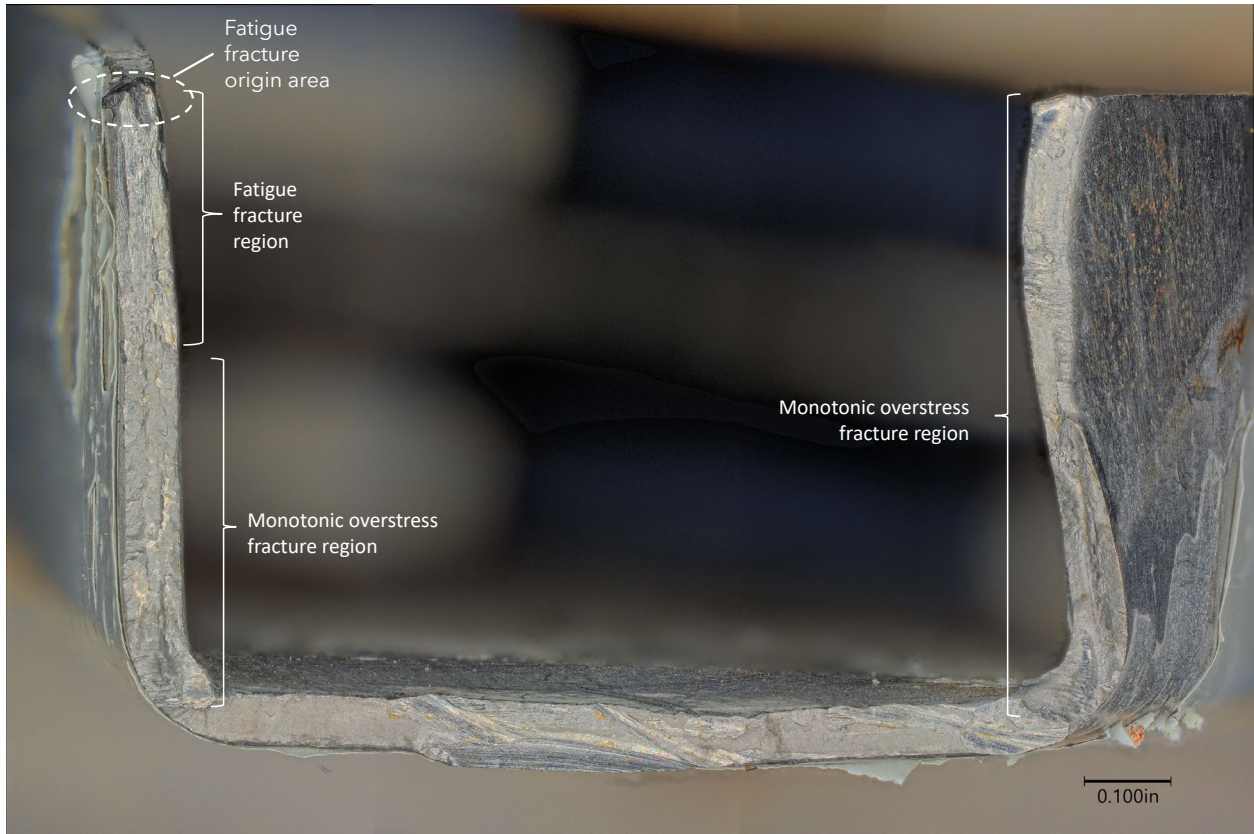


Figure 6. Digital microscope image showing the mating fracture surfaces on the upper link piece. Key features are annotated in the figure including a region of fatigue cracking.



Figure 7. Digital microscope images of the fracture surface of the left fractured ear from the upper link. A fatigue fracture region is identified in Figure 7a. A closer view of the fatigue fracture region is shown in Figure 7b. Significant mechanical batter is present on the fracture face in the fatigue fracture region.

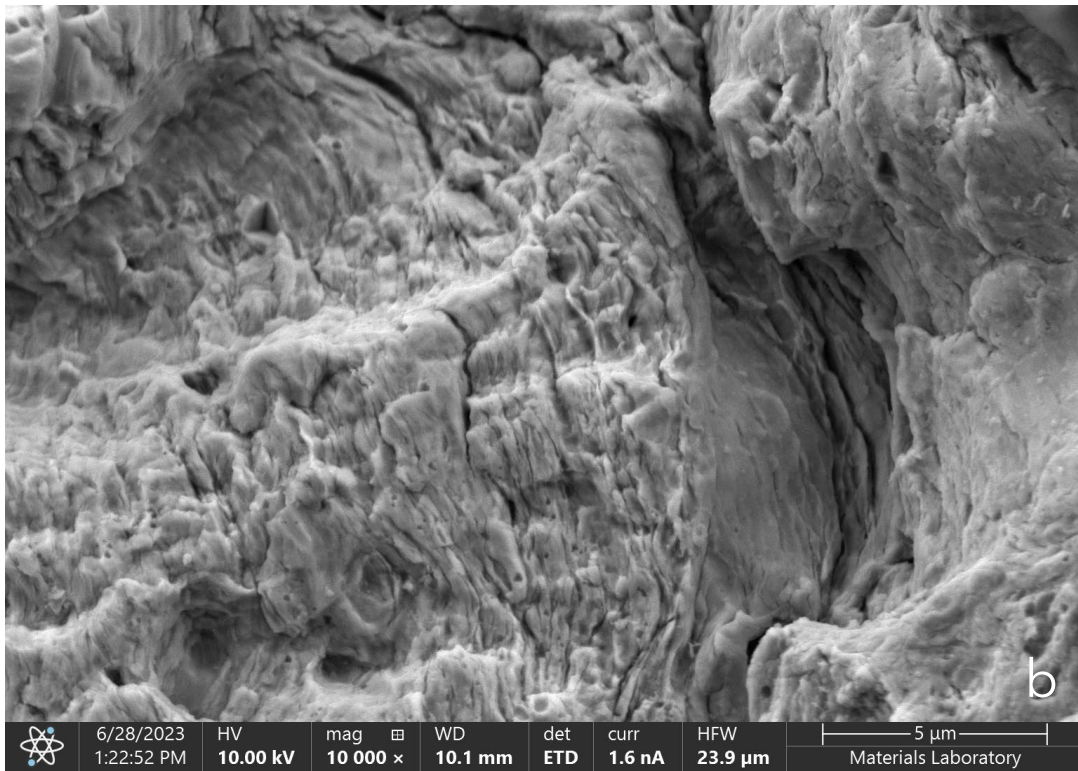
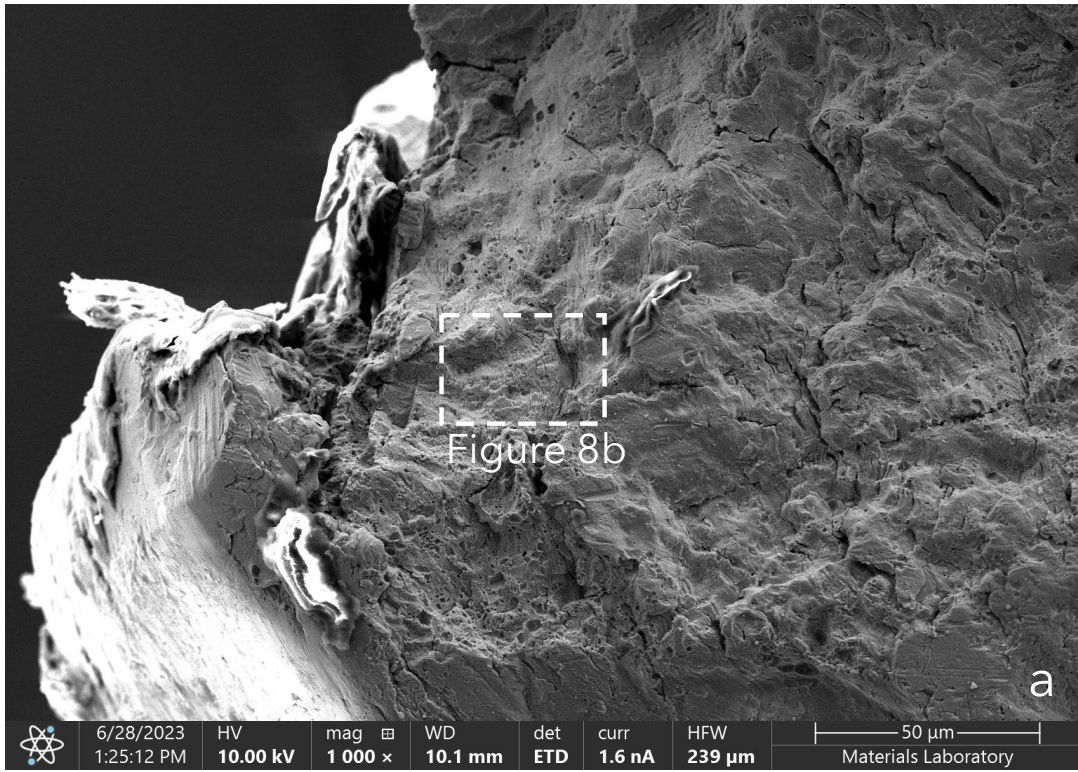


Figure 8. Secondary electron scanning electron fractograph of the fatigue fracture region close to the origin on the left ear piece. Fine striation features were observed in this region as shown in view b (see Figure 7b for the specific location).