

National Transportation Safety Board

Office of Research and Engineering

Washington, DC 20594



ANC22FA047

MATERIALS LABORATORY

Factual Report 23-043

May 12, 2023

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A. ACCIDENT INFORMATION

Location: Clear, Alaska
Date: June 26, 2022
Vehicle: Bell UH-1B, N9970F
Investigator: Van McKenny, AS-40

B. COMPONENTS EXAMINED

Pieces of a flex frame from the KAflex coupling at the transmission end of the engine to main transmission drive interconnect.

C. EXAMINATION PARTICIPANTS

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

D. DETAILS OF THE EXAMINATION

An overall view of the submitted KAflex coupling pieces are shown in figure 1. The pieces were from the flex frame attached to the transmission end of the interconnect (drive shaft) between the engine and the main transmission. The fracture submitted for detailed examination was labeled X4A. For reference in this report, the mating sides of the fracture are labeled X4A1 and X4A2 as shown in figure 1.

The submitted pieces were partially covered with sooty deposits. To facilitate a closer examination of the fracture surfaces, the surfaces were cleaned with a soft-bristle brush dipped in a solution of Alconox detergent and water. The surfaces were then rinsed with water followed by ethanol. Closer views of the cleaned fracture area on opposite sides of the frame are shown in figure 2. Impact damage was observed at the fracture location on one side as indicated in the left image in figure 2, and the damage extended across the fracture plane. On the opposite side of the frame, tension cracks parallel to the fracture surface were observed adjacent to the fracture as indicated in the right image in figure 2.

An overall view of fracture surface X4A1 is shown in the upper image in figure 3. The fracture surface generally had rough features with radial marks and curving chevron marks consistent with overstress fracture. Unlabeled arrows in figure 3 indicate the general direction of fracture propagation from the upper left corner as viewed in the upper image. Closer views of the initiation area on fracture X4A1 and the mating surface on X4A2 are shown in figure 3 in the middle and lower images, respectively. The area of impact damage was observed on the lower side as viewed in figure 3, and a shear lip was observed at the opposite side of the fracture

surface. Tinting from oxidation and surface deposits was observed, but the patterns were different on the mating surfaces, consistent with post-fracture oxidation and deposition.

The frame piece with fracture surface X4A2 was sectioned near the fracture surface to facilitate examination using a scanning electron microscope (SEM). Fracture features were generally obscured by oxidation. The silvery smooth area near the upper right corner (as viewed in figure 3) had a dendritic appearance consistent with resolidified material. Analysis of the material using energy-dispersive x-ray spectroscopy (EDS) revealed a spectrum consistent with an aluminum alloy as noted in figure 3.

Submitted by:

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



Figure 1. Overall view of the submitted KAflex coupling pieces as received.

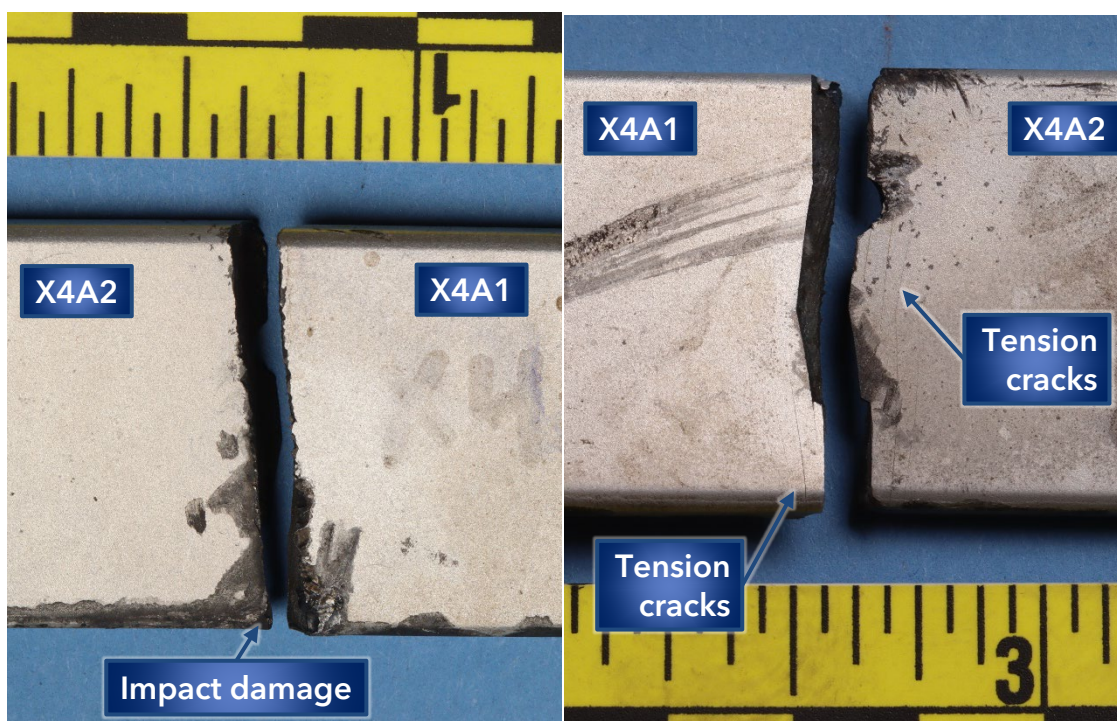


Figure 2. Closer views of the X4A fracture location after cleaning. Impact damage was noted on both sides of the fracture on one side of the frame (left image), and tension cracks were observed adjacent to the fracture on the opposite side (right image).

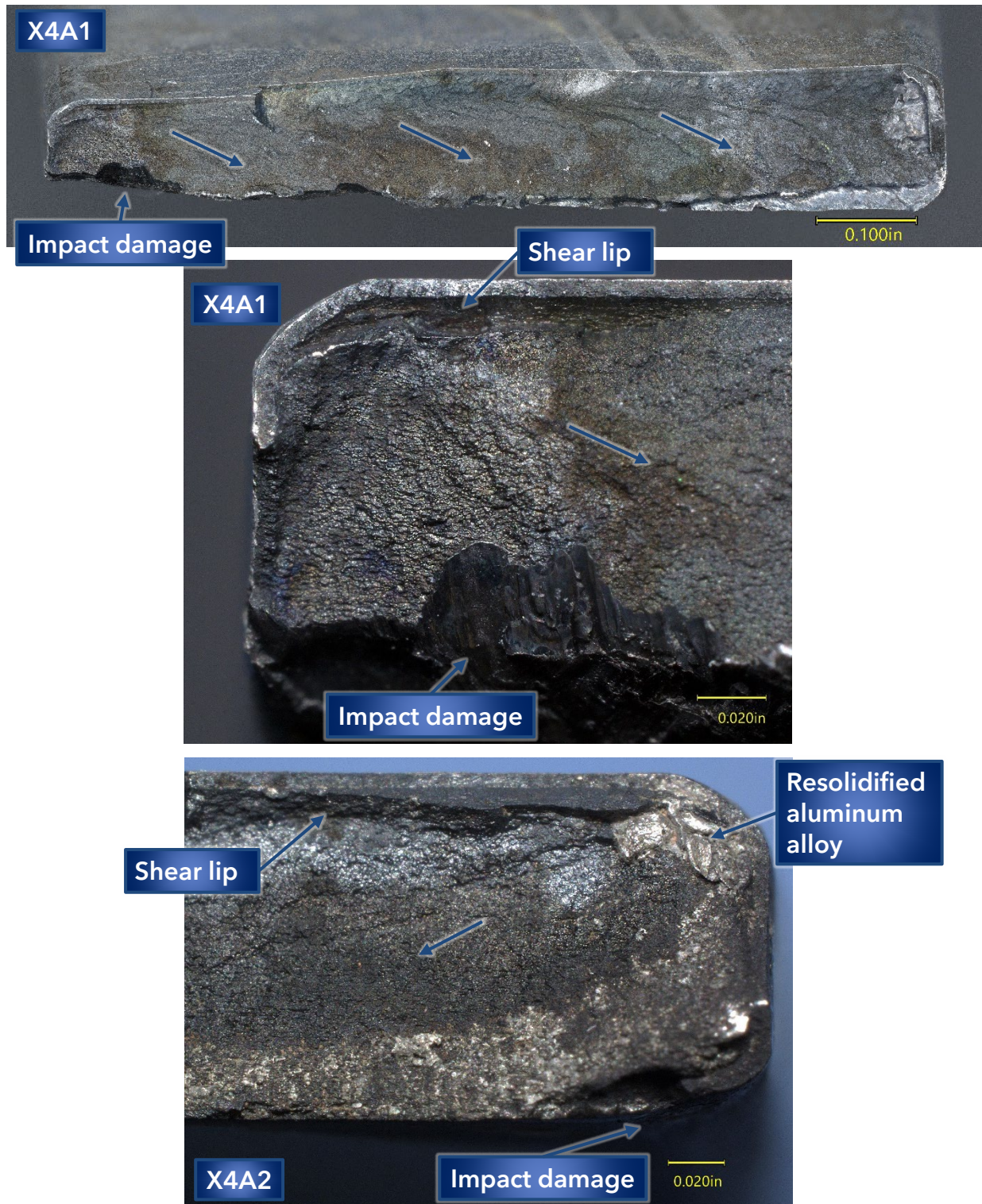


Figure 3. Overall image of fracture surface X4A1 (upper image) with a closer view of the fracture initiation on X4A1 (middle image) and the mating side (lower image). Unlabeled arrows indicate the general fracture propagation direction. The fracture initiation area on X4A1 showed tinting consistent with post-fracture oxidation. Similar oxidation patterns were not observed on the mating side of the fracture.