

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



May 2, 2018

MATERIALS LABORATORY FACTUAL REPORT

Report No. 18-035

A. ACCIDENT INFORMATION

Place : Pomeroy, Washington
Date : January 27, 2018
Vehicle : Hughes 369D
NTSB No. : WPR18FA074
Investigator : Samantha Link

B. COMPONENTS EXAMINED

Portion of the tail rotor blade and skin portion that fractured from the tip, net weight, a cut-out piece of the tail boom, and an annunciator panel.

C. DETAILS OF THE EXAMINATION

Figure 1 shows a photograph of the as-received parts from the helicopter. Visual examination of the tail rotor blade revealed a skin portion fractured from the outer tip, and the mating fractured skin piece is displayed next to the blade. The other end was cut to facilitate transportation and handling. The submitted net weight was intact and was attached to a rope. The skin portion from the tail boom was cut-out onsite to facilitate transportation and handling and the outer face contained several gouge marks.

Tail Rotor

The leading edge of the tail rotor blade contained an erosion strip that was bonded to the blade. A dent was located at the leading edge near the tip end, and this dent contained gouge marks, see figure 2. The fracture at the outer tip of the blade intersected the dent.

Bench binocular microscope examination of the tail rotor blade revealed the fracture faces exhibited a rough texture and on a slant plane consistent with overstress separation, with no evidence of a pre-existing crack. The dent was cut from the tail rotor at the NTSB Materials Laboratory to facilitate examination. Scanning electron microscope examination of the dent revealed gouge marks and evidence of metal transfer on the outer surface. Energy dispersive spectroscopy (EDS) analysis of the erosion strip at the saw-cut portion (representing the base metal) produced a spectrum that contained major elemental peaks of nickel and a minor elemental peak of carbon, see Appendix 1. The gouge marks and metal transfer areas produced a spectrum that contained major

elemental peaks of iron, nickel and chromium, and minor elemental peaks of silicon, aluminum, and manganese, see Appendix 2.

Net Weight

The surface of the net weight contained a tinted area on one side midway between the ends that was slightly darker compared to the other areas. EDS analysis of the outer surface produced an EDS spectrum that contained major elemental peaks of iron, nickel and chromium, consistent with stainless steel, and minor elemental peaks of carbon, silicon, aluminum, sulfur, and manganese, see Appendix 3. The net weight was weakly attracted to a magnet consistent with a ferrous alloy. The area that exhibited a dark tint produced a spectrum that contained major elemental peaks of aluminum and silicon and minor elemental peaks of iron, carbon, chromium, nickel, titanium and oxygen, see Appendix 4.

Tail Boom

The outer face of the cut-out skin piece from the tail boom contained several gouge marks that penetrated and exposed bare metal. EDS spectrum from the saw cut area (base metal) contained a major elemental peak of aluminum and minor elemental peaks of magnesium, manganese, iron, copper, carbon, and oxygen, see Appendix 5. EDS spectrum of exposed metal from an area where paint was intentionally peeled at the NTSB materials laboratory to expose the bare metal outer face contained a major elemental peak of aluminum and minor elemental peaks of iron, chromium, titanium, and carbon, see Appendix 6. EDS spectrum of exposed metal within the largest gouge mark contained a major elemental peak of aluminum and minor elemental peaks of iron, chromium, titanium, chromium, sodium, carbon, and oxygen, see Appendix 7.

Annunciator Panel

The annunciator panel contained buttons that were labelled from left to right ENGINE OUT, XMSN OIL PRESS, XMSN OIL TEMP, GEN OUT, ENGINE CHIPS, MR XMSN CHIPS, T/R XMSN CHIPS, FUEL LOW, FUEL FILTER, AND PRESS TO TEST. Four light bulbs were located behind the face plate of each button, with exception of the button PRESS TO TEST that contained two bulbs and two dummy bulbs (bulbs that contained a metal base with no glass envelope and no filaments). The bulbs were disassembled from the panel. Bench binocular microscope examination of the disassembled bulbs revealed the filament in each bulb was intact with no evidence of stretching, with exception a filament in one bulb from the FUEL LOW button that was fractured and showed no evidence of stretching.

Frank Zakar
Senior Metallurgist

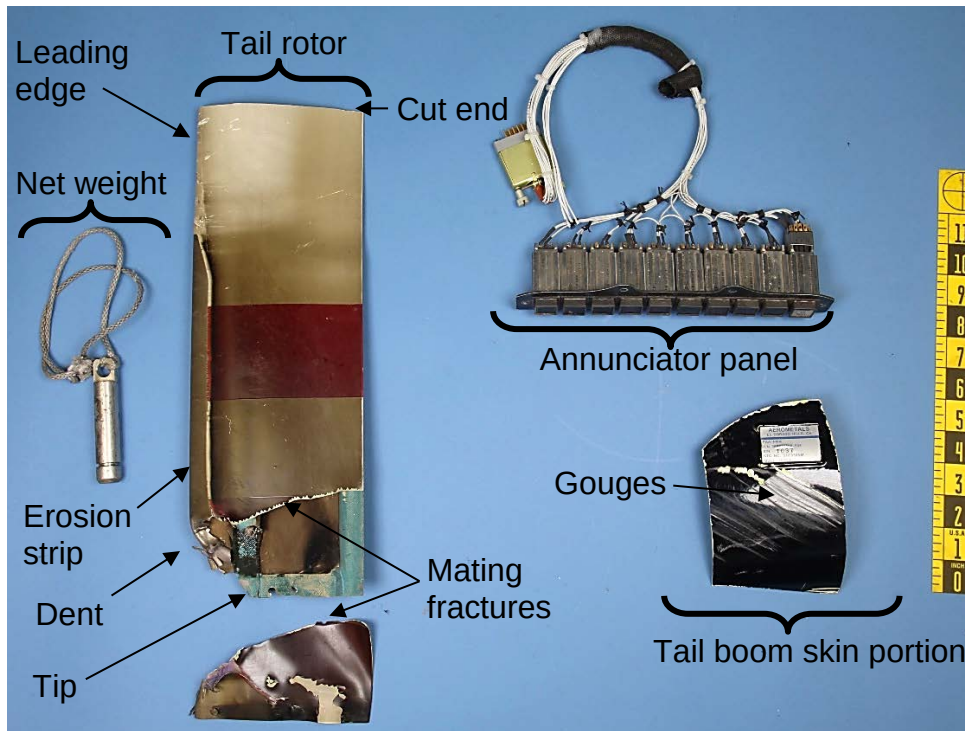


Figure 1. Photograph of the as-received a portion of the tail rotor blade, torn skin portion from the tip end of the tail rotor blade, net weight, cut-out piece of the tail boom, and annunciator panel.

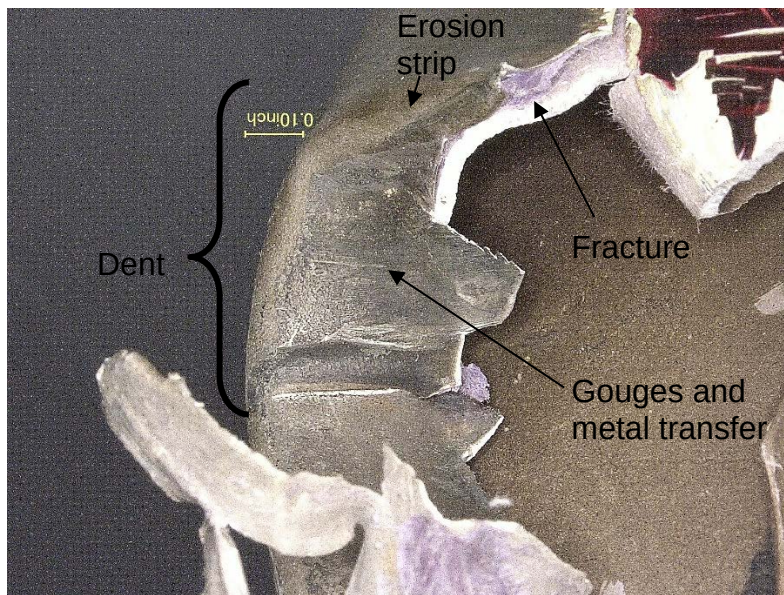
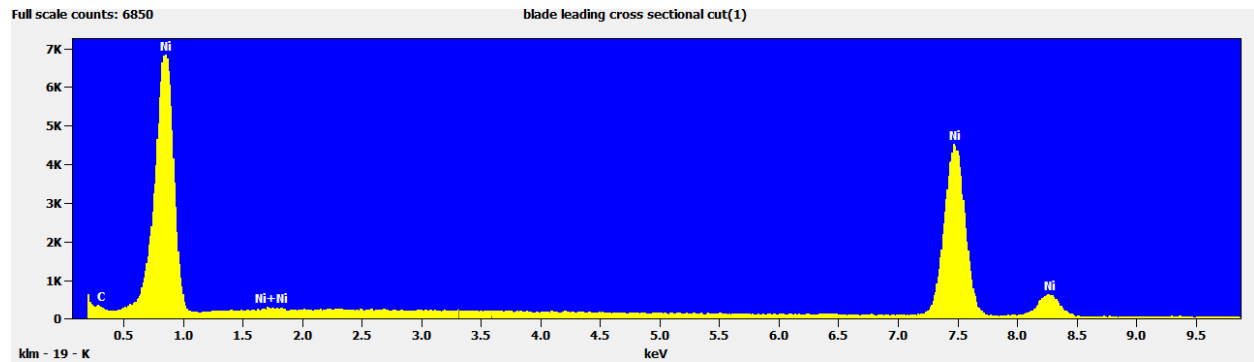
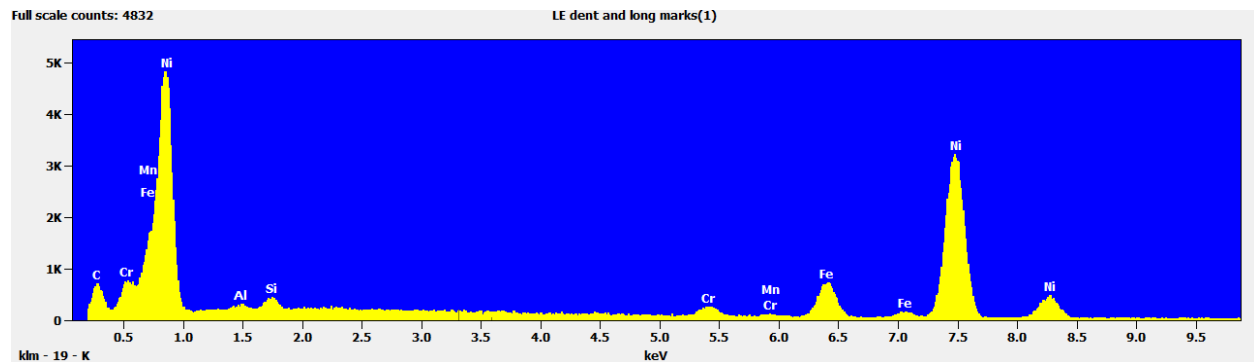


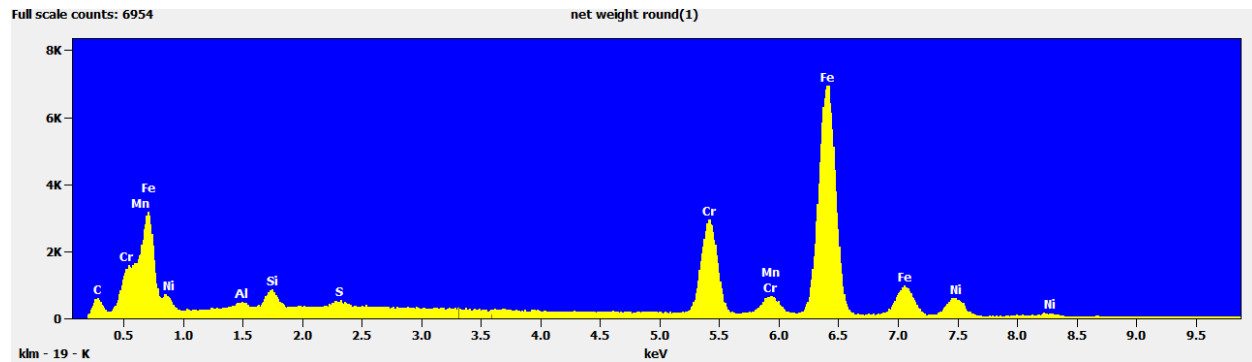
Figure 2. Close-up photograph of a portion of the erosion strip at the leading edge of the tail rotor blade in the area of the dent showing a gouges and metal transfer on the outer face.



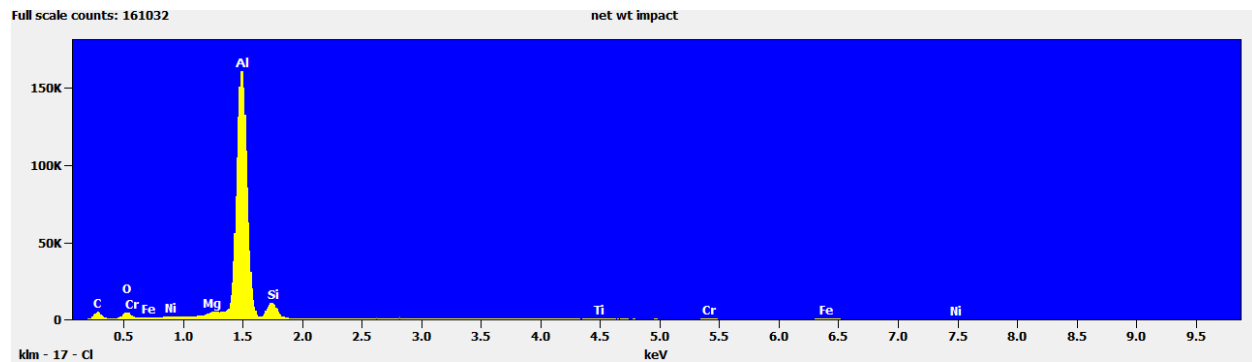
Appendix 1. EDS spectrum of the erosion strip base metal (saw cut area that exposed the base metal) showing major elemental peaks of nickel and a minor elemental peak of carbon.



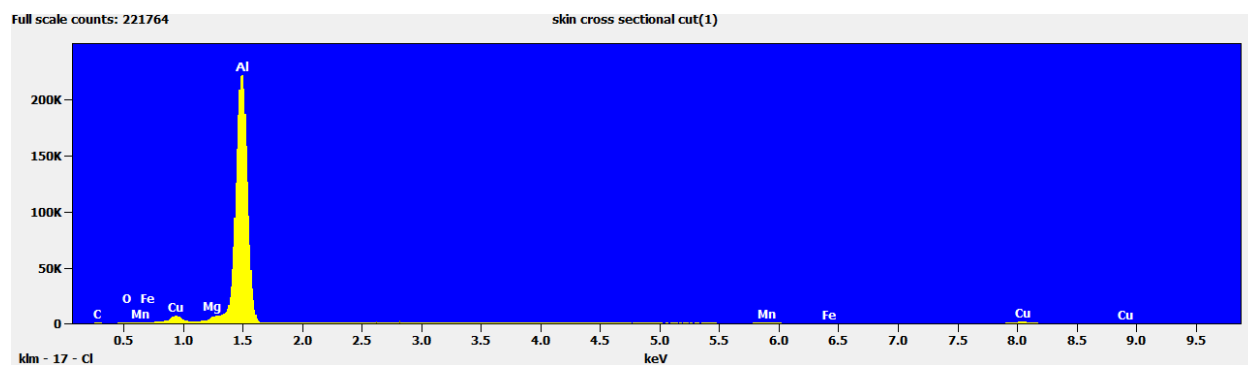
Appendix 2. EDS spectrum of gouge marks and metal transfer found in the dent of the tail rotor blade showing major elemental peaks of iron, nickel and chromium, and minor elemental peaks of silicon, aluminum, and manganese.



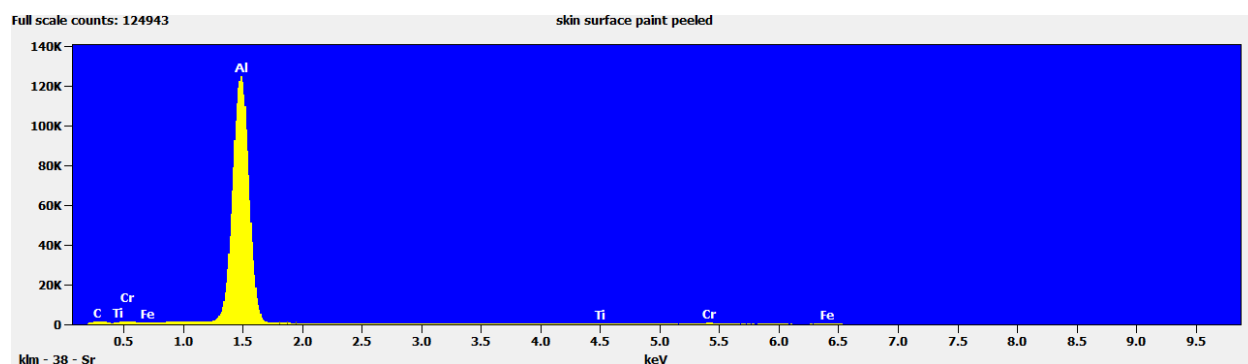
Appendix 3. EDS spectrum of the net weight showing major elemental peaks of iron, nickel and chromium, and minor elemental peaks of carbon, silicon, aluminum, sulfur, and manganese.



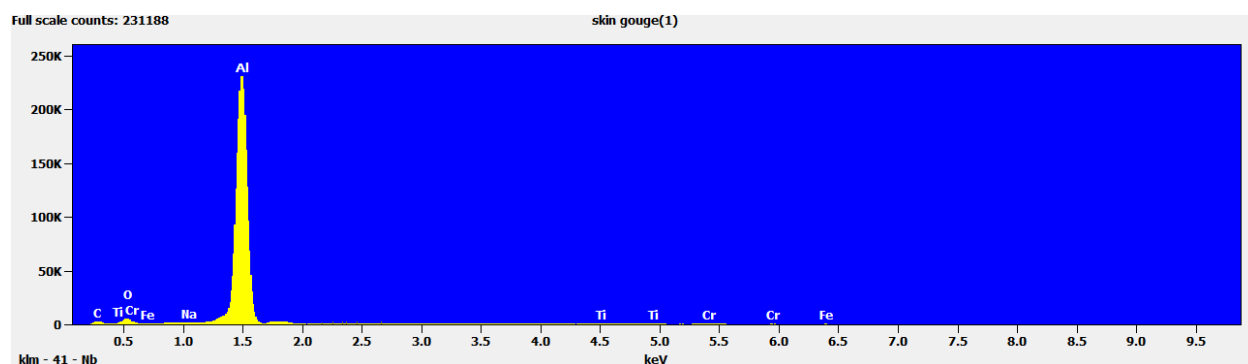
Appendix 4. EDS spectrum of the net weight in the area that exhibited a darker tint relative to other areas showing a major elemental peak of aluminum and silicon and minor elemental peaks of iron, carbon, chromium, nickel, titanium and oxygen.



Appendix 5. EDS spectrum of the tail boom outer surface in the saw cut area (base metal) showing a major elemental peak of aluminum and minor elemental peaks of magnesium, manganese, iron, copper, carbon, and oxygen.



Appendix 6. EDS spectrum of the tail boom from an area where paint was intentionally peeled at the NTSB materials laboratory to expose the bare metal outer face showing a major elemental peak of aluminum and minor elemental peaks of iron, chromium, titanium, and carbon.



Appendix 7. EDS spectrum of the tail boom at the gouge mark showing a major elemental peak of aluminum and minor elemental peaks of iron, chromium, titanium, chromium, sodium, carbon, and oxygen.