



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

TAIL ROTOR BLADE EXAMINATION

ERA22LA340

A. ACCIDENT

Location: Hollywood, Florida
Date: July 27, 2022
Aircraft: Robinson R22 Mariner, N42WC

B. EXAMINATION PARTICIPANTS:

Thom Webster
Robinson Helicopter Company

Elliott Simpson
Senior Aviation Accident Investigator
National Transportation Safety Board

C. DETAILS OF THE INVESTIGATION

Examination of the tail rotor blades were conducted at the facilities of Robinson Helicopter Company on October 5, 2022

1.0 Examination

Both tail rotor blades remained attached to the hub assembly and output shaft. Both tail rotor pitch links were still connected to their respective pitch control arms. The tail rotor gearbox drive shaft and pinion gear remained attached to the output shaft but had detached from the gearbox.

Brown corrosion was present on all exposed nut and bolt heads along with the surface of the output drive shaft (figures 1, 2, 3).

Examination of the gearbox casing and drive assembly revealed torn metal, and hazy fracture surface features consistent with overload failure. The threads joining the gearbox to the tail assembly were intact, and there was no evidence of fretting to the mating surfaces. The input shaft rotated freely at the gearbox. No damage was observed to the input or output pinion gears, and there was no bluing or scoring on any of the bearings.

SN: 7433

The blade was twisted about 20 degrees and torn 5 inches from the outboard tail rotor attachment bolts (figure 4).

The outboard 8 inches of the leading-edge skin showed pitting and paint removal. The tip cap had been refinished with red paint, and bubbling corrosion-like formations were at the intersection of the cap with the blade skin (figure 5).

Thinning of the leading-edge skin surface was evident at the leading edge join with the tip cap (figure 14). The drain hole appeared to be free of blockage.

A “tap” test at the interface between the tip and skin indicated the likely presence of voids.

Using a chisel, the trailing edge bond joint was opened, and the skins were peeled apart. Cohesive adhesion was observed throughout the entire length, with trails of adhesive failure at the tip edge contact junction (figure 6).

White corrosion-like deposits were observed to the inner surface of the tip cap (figure 7).

A water puddle mark was present on the inner surface of the leading-edge skin (figure 8).

SN 7434

The blade exhibited a 10-degree progressive curve along its entire length (figure 15). The outboard 8 inches of the leading-edge skin exhibited paint removal and pitting. The tip cap was missing. On the inner and outer portions of inboard skin, bubbling red paint was observed at the tip edge (figure 9).

Using a chisel, the trailing edge bond joint was opened, and the skins were opened. On the inside of the outboard skin, smooth dark green adhesive was observed along its entire length, consistent with adhesive failure (figure 10).

On the inside of the inboard skin, a white powdery corrosion-like substance was present to about 85% of the surface length from the leading edge aft (figure 11). The last 15% of the surface exhibited smooth dark green adhesive consistent with adhesive failure (figure 11).

Areas of cohesive (overload) separation were observed at the trailing edge where the skins joined. Black deposits were present on the inner surface of the leading edge.

The leading-edge skin had thinned to a knife-edge (nominal thickness should have been 0.63mm) and was torn at the intersection with the tip cap (figure 12).

Under microscope examination, fluid oozed from yellow patches (figure 13) when pressed.



Figure 1 – Corrosion to hardware



Figure 2 – Corrosion to hardware



Figure 3- Corrosion to output shaft



Figure 4 – Twisted blade 7433



Figure 5 – Corrosion at tip cap



Figure 6 – Tip and contacting skin



Figure 7 – Tip cap inner surface

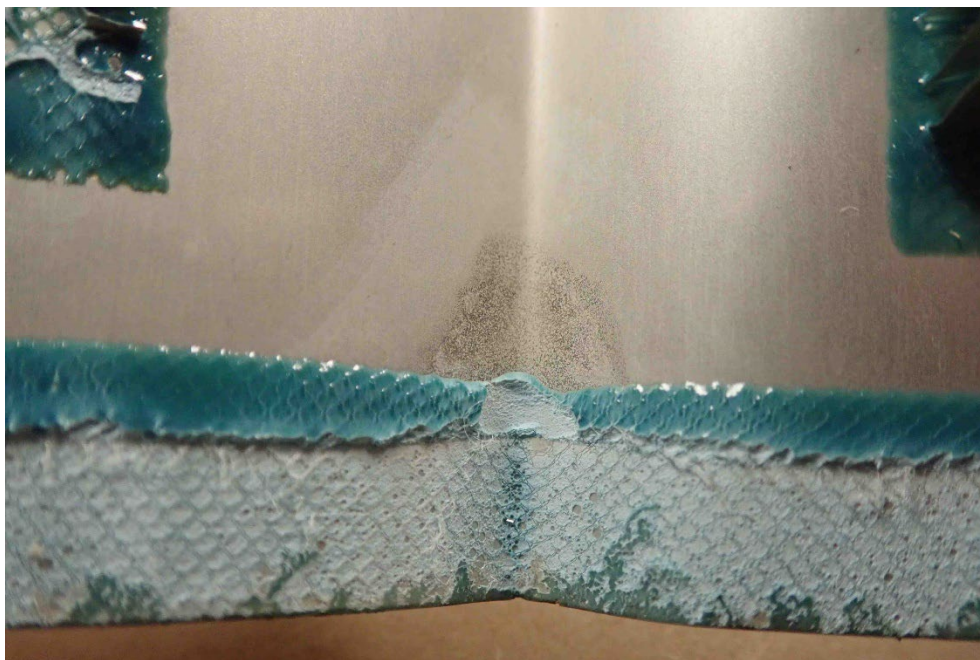


Figure 8 – Water puddling marks



Figure 9 – Corrosion and paint bubbles

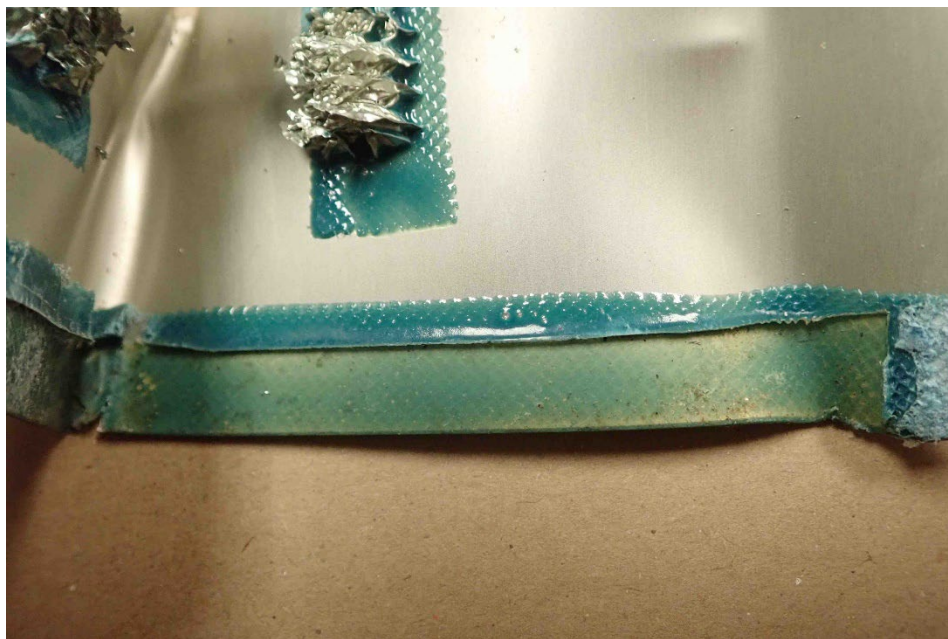


Figure 10 - Smooth dark green adhesive

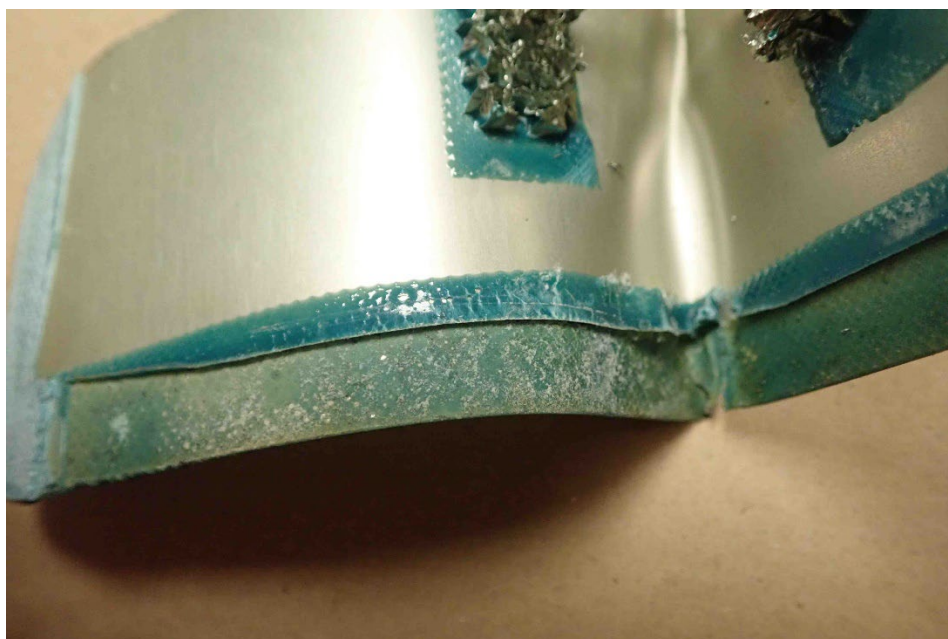


Figure 11 – White corrosion deposits



Figure 12 – Leading edge tip crack/tear

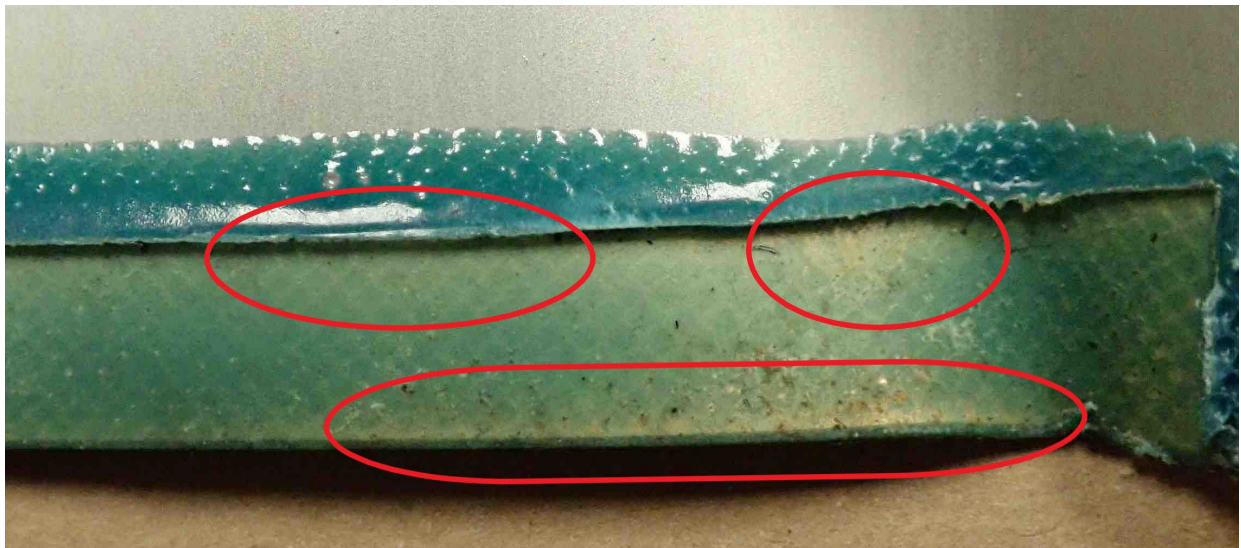


Figure 13 - Yellow patches under adhesive



Figure 14 – Tip cap leading edge skin thinning



Figure 15 – Blade 7434

Submitted by: Elliott Simpson