



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

March 21, 2019

TAIL ROTOR BLADE EXAMINATION

WPR19LA028

A. ACCIDENT

Location: Kailua, HI
Date: October 27, 2018
Aircraft: Bell 430, Registration Number: N430ST
NTSB IIC: Albert Nixon

B. EXAMINATION PARTICIPANT:

Albert Nixon
Senior Aviation Accident Investigator
National Transportation Safety Board
Federal Way, WA

Mark Stuntzner
Air Safety Investigator
Bell Helicopters
Fort Worth, TX

Van McKenny
Aerospace Engineer
National Transportation Safety Board
Washington, DC

Jordan McCall
Engineer-Field Investigations Laboratory
Bell Helicopters
Fort Worth, TX

Todd Alfstad
Engineering Specialist-Rotor Systems
Bell Helicopter
Fort Worth, TX

C. SUMMARY

Examination of the helicopter's tail rotor hub and blades was conducted on March 21, 2019, at the Bell Helicopter facilities in Fort Worth, Texas.

D. DETAILS OF THE INVESTIGATION

1.0 Tail Rotor Blade Examination

Maintenance Record Information

Tail Rotor Hub Assembly	PN: 222-012-701-147	SN: A-613
Tail Rotor Blade (missing balance weights)	PN: 222-016-001-139	SN: A-2354
Tail Rotor Blade (leading edge indentation)	PN: 222-016-001-139	SN: A-2398

Blade A2354 Manufactured:
4/21/2008

8/25/2008	Comp hrs: 27.06	Removed for dent in spar
8/21/2014	Comp hrs: 27.6	Installed on 49071
1/26/2017	Comp hrs: 1606.6	Worn bearings
2/02/2017	Comp hrs: 1606.0	Repaired delamination at spar closure. Installed on 49071
11/14/2018	Comp hrs: 1813.0	Removed after blade weight separation.

Visual examination of one of the suspect blades revealed that the root enclosure assembly (associated weights and attachment bolts) had separated from inboard edge of the rotor blade while inflight. Further, the second blade was observed to have about a 6-inch leading edge rectangular indentation about mid-span. The other blade's damage was consistent with impact damage from contact with the separated root enclosure.

A review of the maintenance records revealed that about 200 hours before the accident, the subject tail rotor blade was removed from service due to a partial delamination of the root closure at the root block. A repair was made where the blade's root closure is bonded to the root block. Scratches were observed around the edge of the repair area, consistent with surface preparation for the repair. However, while the surface preparation with the scratches created an appropriate bonding surface, the remaining area where the adhesive was in contact with the blade surface was corroded and the adhesive did not properly bond in this area.

There was no additional adhesive or evidence of surface preparation observed in the gap between the root closure and root block. Green-gray adhesive remnant material in the honeycomb was observed the entire length of the root closure. About 30% of the adhesive remained in the root area. No sections of the root closure remained attached to the rotor blade. On the area opposite the root closure, on the leading edge of the blade, paint work was noticed that would be consistent with the root closure being clamped to the root block during the repair.

The surface of the root block to where the tang enclosure was bonded was corroded with paths of oxidation extending outboard. These oxidation paths would be consistent with moisture between the adhesive and the blade enclosure.

A void was observed into the honeycomb beneath the captured nut plate of the outboard position. Black debris was observed beneath the captured inboard nut plate.



Figure 1: Tail rotor blade (1) as received, with root enclosure and attached weights intact.



Figure 2: Tail rotor blade (1) as received, with dent near mid-span of leading edge.



Figure 3: Tail rotor blade (2) as received, with root enclosure and attached weights separated.

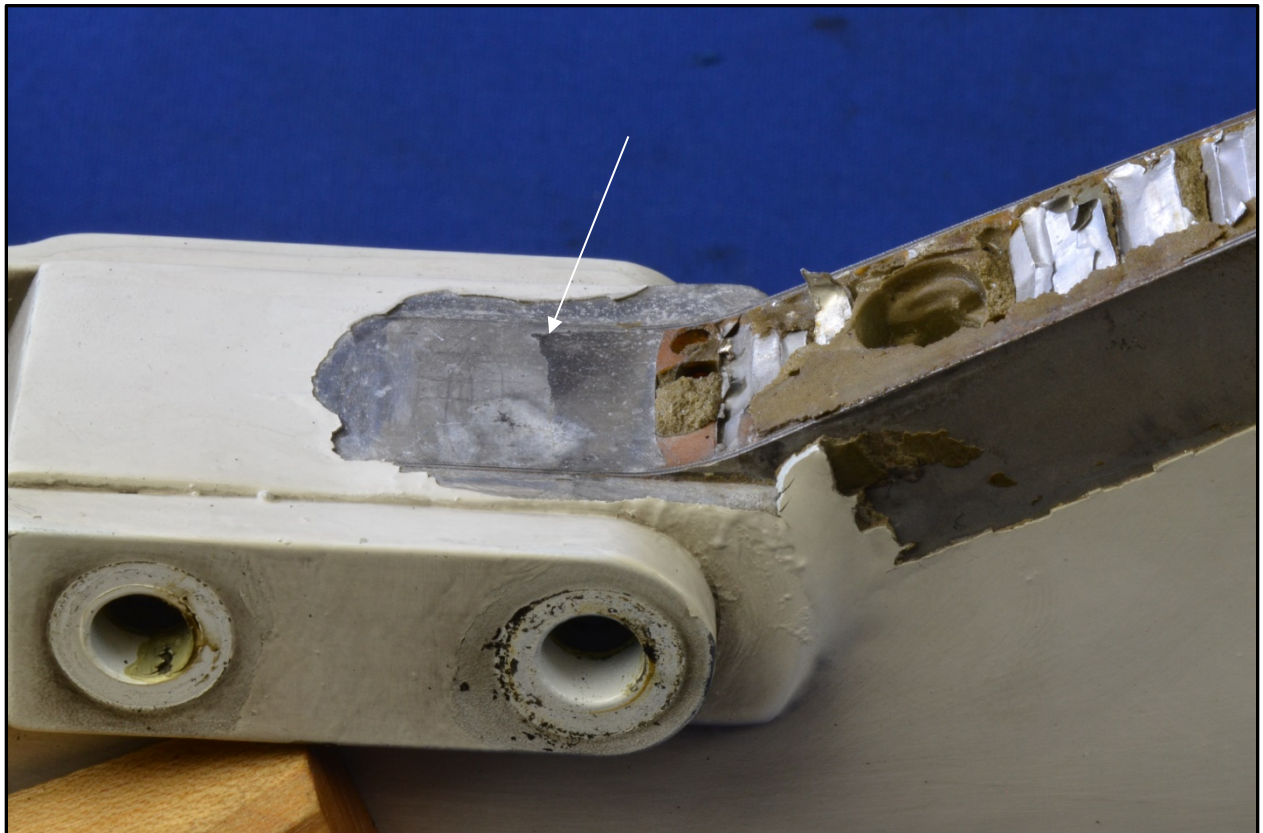


Figure 4: Tail rotor blade (2) root enclosure area with decolorization and oxidation.

On the blade with the missing root enclosure assembly, the void below the outboard nut plate measured about 1.14 inches in depth. The weights, bolts, and nut plates were observed in the appropriate position. No evidence was noted that indicated that the bolts had extended through the nut plate. The scanning electron microscope (SEM) examination of the blade root area revealed corrosion concentrations close to the tang (blade root end closure) and less corrosion as away from the tang area. Examination of the tang area exhibited areas of oxidation.

A spectroscopy examination of the tail rotor blade root block revealed that the material was similar in composition to the specified alloy. Additionally, the hardness measured value conformed to the specified minimum hardness value.

The blade with the leading-edge rectangular indentation about mid-span, had its balance weights, bolts, and nut plates in the appropriate position and there was no evidence to indicate that the bolts had extended through the nut plate.

A sample of the adhesive was examined by the Bell Chemical and Processes Laboratory. The results of the sample were that the material was consistent with the original adhesive used during manufacture and was determined to be chemically similar to the specified adhesive.

Additional Information:

An examination of the adhesive used to bond the enclosure at the time of manufacture was accomplished. The examination revealed that the cure percentage was about 97%, which was consistent with a fully cured adhesive.

The adhesive used in the repair was not located on the surface areas that were prepared.

The root balancing weight plate damage was also examined. At some undetermined point, both of the end portions of the closed-end nuts that are used to attach the tail rotor balancing weights to the nut plate, had penetrated into the honeycomb structure leaving about a 1-inch void. To examine this anomaly, a cross section of the honeycomb structure was cut in the area where the nuts bore through the honeycomb material. The investigation was unable to determine what caused voids into the honeycomb. However, this anomaly exhibited no damage beyond the 1-inch void bore in the honeycomb and was therefore not a factor for the dis-bond and separation of the tail rotor blade's enclosure.

Submitted by: Albert Nixon