

CEN17LA174 - Tail Rotor Examination Notes

Monday, May 15, 2017

9:30 AM

National Transportation Safety Board

Office of Aviation Safety

Washington, D.C. 20594

A. ACCIDENT:

Location:	Boothville, LA
Date:	2 May, 2017
Aircraft:	Bell 407, N457PH

B. EXAM LOCATION & PARTICIPANTS:

NTSB Materials Laboratory

Washington, DC 20594

NTSB	Van McKenny Aerospace Engineer (Helicopters) Washington, DC
NTSB	Joe Epperson Senior Metallurgist Washington, DC
PHI	Tom Yakubovich Manager Aircraft Availability Lafayette, LA
Bell Helicopter	Robert Figueroa Field Investigations Lab Fort Worth, TX
Bell Helicopter	Tim Ledbetter Technical Fellow-Rotor Blades Fort Worth, TX

C. ACCIDENT SUMMARY:

On May 2, 2017, about 0635 central daylight time, a Bell 407 helicopter, N457PH, registered to and operated by PHI Helicopters, Inc., Lafayette, Louisiana, made a precautionary landing at Grand Bay receiving station in the Gulf of Mexico, near Boothville, Louisiana, after the pilot noticed a vibration in-flight. Visual meteorological conditions prevailed at the time of the accident. The non-scheduled domestic passenger flight was being conducted under the provisions of Title 14 CFR Part 135, and a company VFR flight plan had been filed and activated. The pilot and five passengers on board the helicopter were not injured. The cross-country flight originated from Boothville (LS08), Louisiana, at 0629, and was en-route to Main Pass 311A in the Gulf of Mexico when the accident occurred.

The pilot had noticed a vibration in-flight and landed the helicopter on the helipad at Grand Bay. As he was shutting down the engine, the vibration worsened and he completed the shutdown using the rotor brake. Post-accident inspection revealed a tip block had separated from one of the tail rotor blades, and cracks were noted on the tail rotor gear box, mounting hardware, and tail boom, all considered to be substantial damage.

D. VISUAL EXAMINATION OF PARTS

Two shipping crates were opened and the following parts were removed; tail rotor hub & blade assembly, tail rotor gear box (TRGB) with attach studs, and tail boom support casting. Visual examination of the tail rotor revealed that both rotor blades were attached to the hub, no deformation or damage to the tail rotor was observed, however, the tip block and blade tip weights missing from blade SN BH051533. The TRGB had been detached from the tail boom support casting, the two outboard attach studs had been fractured in half, and the inboard nuts were removed from the studs by maintenance personnel. Fretting and rub marks were observed on both the support casting and TRGB where the attach studs are fixed. The two TRGB alignment dowel pins were missing. The tail boom support casting had cracks at the two forward stud hole locations, stud hole elongation at the two aft stud hole locations, a circumferential crack had formed from the forward left stud hole along the left side.

Item	PN	SN
Tail Rotor Blade	406-016-100-119	A-4436
Tail Rotor Blade	406-016-100-119	BH051533
Tail Rotor Hub	406-012-101-113	A-612
Pitch Change Link	406-312-103-101	NFHS13109 (attached to BH051533)
Pitch Change Link	406-312-103-101	NHFS13032 (attached to A-4436)
Tail Rotor Gear Box	406-040-400-121 FM	A-1003
Tail boom Support Casting	407-030-016-105	33488
TRGB attach studs (x4)	AN126324	

E. MAINTENANCE INFORMATION

Item	Installation Date	Hours since installation/insp
Tail rotor assembly installed	4.13.2017	65 hrs
TRGB installed	4.8.2016	1,419 hrs
300 hr inspection on TRGB studs	2.16.2017	266 hrs

BH051533 Repair Information

- Tip block replaced Jan 31 - Feb 2, 2017
- Blade cleaning & finishing Feb 6 - 13, 2017
- Tip weights added Mar 8, 2017
 - 53.8g + 41g (standard tip block weight)
- Blade weight and balance - Mar 8, 2017

BH051533 Repair History

- Block replaced during initial blade manufacturing, end of 2013.
- 2/4/2016 Removed from service, tip block crack, 1696.05 hrs
- 5/31/2016 Returned to service
- 11/29/2016 Removed from service, tip block crack, 2592.45 hrs
- 4/10/2017 Returned to service.
- 5/2/2017 Removed from service, tip block separation 2657.45 hrs

A-4436 Repair History

- 1/12/2007 Placed in service, 0.0 hrs
- 12/23/2010 Removed for unidentified damage, 3207.09 hrs
- 3/3/2011 Returned to service, 3207.09 hrs
- 5/19/2015 Removed from service, tip block crack repair, 6472.05 hrs
- 7/16/2015 Returned to service, 6472.05 hrs
- 11/14/2016 Removed from service, tip block crack repair, 6808.36 hrs
- 4/10/2017 Returned to service, 6808.44 hrs

F. Rotor Blade BH051533 Exam

Tip block was not present in the rotor blade. Depth of the tip block space was about 12mm deep, and 6 holes, approx 8-9mm in diameter were positioned longitudinally across the blade core material. Pink adhesive residue forming a square waffle like pattern consistent with voids between the imbedded nylon scrim on the upper and lower interior surface of the rotor blade end and across the blade core material. Visual assessment of the skin surface appears to be about 50% coverage of adhesive to skin.

The blade was sectioned along the chord line about 11 cm from the end to simplify examination handling.

A 4 mm by 12 mm piece of skin with adhesive remnants was sectioned out, and placed in an acrylic cold mount with cross section view. The cross section view revealed the thickness of layers of the buildup.

A section of the blade skin was prepared for SEM examination.

G. Rotor Blade A-4436

Visual examination of the rotor blade was unremarkable. Tap test revealed a possible void located approximately 6mm from the leading edge on the non-cambered side of the blade, 1 cm inboard from the end.

A 5.0cm by 3.5cm portion of the blade skin on the cambered side centered from the blade tip was cut through using a dremel wheel. The skin was then peeled up using a screw driver to pry up the skin and pliers to pull the skin back, completely removing the skin section. The adhesive bond between the skin and the tip block was revealed, exhibiting a cohesive separation (good bond). The bond surface was evenly colored pink with no voids visible to the unaided eye. Three tip weights were visible at the cutout location.

H. Additional Information

Bell informed the group that apparently in the past the tip block manufacturer had been using or mixing mold release compounds into the tip block material (in an effort to facilitate the molding process). The mold release material/compound would soak into the tip block material which would inhibit adhesive function. The tip block material can be baked/heated and observed. If mold release compound is present it will bleed out on the surface of the tip block material. Bell is actively addressing the issue with the manufacturer, and has checked current stocks of tip block for the presence of the mold release.