



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

AIRFRAME AND ENGINE EXAMINATION

WPR17LA211

This document contains 8 embedded photos.

A. ACCIDENT

Location: Long Beach, California
Date: September 20, 2017
Aircraft: Robinson Helicopter Company, N7514S, R22 Beta II
NTSB IIC: Elliott Simpson

B. EXAMINATION PARTICIPANTS:

Elliott Simpson
Senior Aviation Accident Investigator
National Transportation Safety Board
Western Pacific Regional Office
Los Angeles, California

Thom Webster
Aviation Safety Investigator
Robinson Helicopter Company
Torrance, California

Hannah Warren
Engineer
Robinson Helicopter Company
Torrance, California

C. SUMMARY

Examination of the helicopter was conducted at the facilities of South West Aircraft Transportation and Recovery in Chino, California, on October 2, 2017.

D. DETAILS OF THE INVESTIGATION

1.0 Airframe Examination

The main cabin sustained crush damage to the belly structure, and the left skid was bent almost level with the belly (Photo 1). The forward right skid was similarly bent and remained attached to the belly frame; the aft section of the skid had separated from the cross tube and aft frame attach point. The forward and aft cross tubes, normally straight, had bowed downwards in the center. Neither door was located, and appeared to have been removed prior to the flight. The canopy bubble plexiglass had fractured into multiple shards, with about 50% remaining in the left frame and small remnants remaining in the right frame. The left seat was largely intact; the right seat exhibited downward deformation focused on the right side of its lower box structure. The tailboom remained partially attached to the rear frame, and exhibited buckling and bending damage to the skin at the

forward mount (Photo 2). The vertical and horizontal stabilizer assembly along with the tail rotor gearbox had detached from the tailcone, and remained partially tethered by the tail rotor drive shaft and control tube. Both tail rotor blades had detached about 4 inches outbound from their roots.

The main rotor mast was intact and remained connected to the cabin structure. Both main rotor blades were still attached to the teetering hinge. The blue blade was bent abruptly up about 110° about 2 ft from the teetering hinge. The remainder of the blade had bowed down in a sweeping arc along its entire length (Photo 3). The red blade was straight, and exhibited minor aft bending. The outboard 18-inch section of the tip had torn away.

The lower swash plate was intact and the left and right pushrods were continuous to their respective cabin controls; the aft pushrod control had separated from the bellcrank within the lower cabin structure. The pitch link for the red blade had detached from the upper swash plate and separated pitch horn, with both eyebolt ends remaining in place. The pitch link for the blue blade remained attached to the upper swashplate at the upper rod end.

The right foot pedal moved freely, and closer examination revealed that it had separated from the bellcrank in the lower aft cabin. The left foot pedal push pull tube appeared impinged against the lower cabin structure, but was continuous to the tail rotor pitch link bellcrank.

The tail rotor flight control pushrod had torn at the forward end of tail cone where it appeared to have been severed by the tail rotor drive flex plate.

All flight control failures exhibited bending and buckling damage consistent with impact overload.

The carburetor heat was in the OFF position and unlocked, the mixture was in the full rich position. The clutch switch was guarded and in the ENG position. The governor switch was in the ON position.

The main rotor gearbox chip detector free of debris (Photo 4), and blue-colored oil observed to the ¼ level in sight glass. The head of the forward left main gearbox Allen bolt had detached, leaving the stud within its gearbox bore; the separation surfaces were brown and appeared to be corroded, consistent with a pre-accident separation.

The main rotor blades were rotated at the mast, and drive train continuity was confirmed through to the tail rotor. The aft end of the tail rotor drive shaft had twisted more than 360 °, but remained intact, and the tail rotor gearbox could be rotated and felt smooth.

One drive belt had detached from the upper and lower sheaves, the second belt remained intact and had jumped, centering itself on the middle ribs of both sheave's. With the belts removed, sprag clutch directional operation was confirmed. The tail rotor damper bearing was intact and could be rotated smoothly. Rotational damage was observed to the tail rotor intermediate flex plate which had bent, and adjoin area of the frame which exhibited rotational scoring.

Radial scoring was observed on the outer surfaces of the upper sheave with corresponding scoring to the upper frame tubes and the clutch actuator (Photo 5, 6). The scoring damage was consistent with engine operation at the time of impact.

The auxiliary fuel tank contained about 2.5 gallons of light blue colored fuel. The main fuel tank contained similar quantities, and neither tank was breached. The fuel vent lines were free of obstruction. Both tank screens were free of debris.

Engine

The engine remained attached to the airframe (Photo 7). The airbox sustained crush damage and had detached along with the carburetor bowl. The gascolator sustained damage to the lower drain attachment fitting; the unit contained fuel up to the lower edge of the drain fitting. The carburetor inlet fuel screen was clear and free of debris. The throttle, mixture, and carburetor heat control cables were still attached at their respective control arms. The cables were impinged against the cabin belly, and as such the cabin controls could not be moved.

The carburetor heat slider valve was in the $\frac{3}{4}$ carb heat ON position. The air filter was crushed and covered in dirt.

The cylinders were examined internally using a borescope and exhibited grey/brown deposits and coloration, with no indication of internal catastrophic failure. Similar grey/brown deposits were present on the inner surfaces of the exhaust tailpipe. About 2 tablespoons of mud and grass was found within cylinder 1, with similar smaller amounts of debris also present in cylinder 3. The lower spark plugs for cylinders number 2 and 4 were oil soaked. The lower plugs for cylinder 1 and 3 displayed light grey deposits and coloration (Photo 8). All plugs exhibited normal wear signatures when compared to the Champion AV-27 chart.

Mechanical rotational continuity was established throughout the engine and valve train when the crankshaft was rotated by hand using the engine cooling fan; all valves and their associated rockers moved freely and about equal amounts. Cylinder compression was obtained on all four cylinders in proper firing order after the debris was flushed from each cylinder using carburetor cleaner. The magneto switch was set to both, and then the engine was turned over utilizing the starter motor, and sparks were observed at each spark plug lead.

1.1 Examination Photos



Photo 1 – Helicopter before Examination



Photo 2 – Tailboom Mount



Photo 3 – Main Rotor Blade



Photo 4 – Main Rotor Gearbox Chip Detector



Photo 5 – Upper Sheave Radial Scoring



Photo 6 – Upper Frame Scoring at the Clutch Actuator



Photo 7 – Engine



Photo 8 – Lower Spark Plugs (1 to 4, left to right)

Submitted by: Eliott Simpson