



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Western Pacific Region

March 6, 2019

VIDEO/AIRFRAME / ENGINE EXAMINATION SUMMARY

WPR18LA010

This document contains 0 embedded photos.

A. ACCIDENT

Location:	Molokai, Hawaii
Date:	October 16, 2017
Aircraft:	Robinson Helicopter R-44, N820DF
NTSB Investigator-in-Charge:	Joshua Cawthra

B. DETAILS OF THE INVESTIGATION

1.0 Underwater Video Examination

A private company, that was hired by a private individual, reported that they located the wreckage initially in October, 2018, submerged about 2 miles off shore of Molokai, at a depth of 298 ft. A representative from the company reported that they recovered a portion of the wreckage on January 24, 2019

Review of video recordings from an underwater remotely operated vehicle, showed that the fuselage was severely fragmented, and partially embedded within the ocean floor. Both main rotor blades remained attached to the hub, which remained attached to the drive shaft. Both main rotor blades appeared to be straight with visible damage to the tip of one blade. The main rotor pitch link on one blade remained attached to the blade and swashplate, the other was not visible. The main rotor drive shaft was bowed on the lower end. The tailboom was impact damaged and the tailrotor gearbox was separated. The tail rotor drive shaft remained inside the tailcone. The tailrotor drive shaft was disconnected about 10 inches aft of the intermediate flex coupling and appeared angular and jagged. The intermediate flex coupling was not bent or distorted. No visible damage to the grooves of the upper sheave were observed. The forward flex coupling was disconnected/fractured from the clutch shaft. The skid assemblies were separated. Portions of the fuel system, cyclic, and collective controls were not observed.

2.0 Airframe Examination

The recovered airframe components included the tailrotor gearbox, tailrotor blades, main rotor flight control jack shaft, tail rotor pedals, including 1 removable pedal, several sections of interior panels, one section of aft left door frame (including a seatbelt), one forward seatbelt shoulder harness, all three main rotor flight control servos, hydraulic reservoir housing, several small sections of frame tubing, small section of tailrotor flight control tubes, several small sections of main rotor gearbox housing, main rotor gearbox driveshaft bearing race, several instruments (one unidentified, compass housing, portion of the directional gyro), warning light control box, short section of fuel line with a portion of the fuel valve attached, portion of the fuel cross over fuel line, two landing light housings, short section of a wire bundle, section of the tail rotor guard, one V belt, and one life vest.

The recovered main rotor flight control components with rod ends that remained attached were securely fastened. One forward hydraulic servo was separated from its mount. The other forward servo remained attached to the mount, however, the mount was separated from the airframe. The aft servo was separated from the airframe and was severely bent (in excess of 120°). None of the servos could be actuated by hand. The jackshaft was separated from its mount. The hydraulic reservoir housing was separated from the manifold and sustained impact damage. All fracture surfaces within the recovered flight control components exhibited angular and jagged signatures, consistent with overload.

The tailrotor assembly was recovered separately from the airframe. The pilot's side right side pedal was fractured at the bearing block. The pedal was recovered separately. The pilot's side left pedal pip/quick release pin was found displaced from the adjustable pedal assembly and exhibited no damage or bending. No damage was observed to the pedal pin holes. The removable pedals were not installed. The left removable pedal was recovered separately. Both tailrotor flight control tubes were disconnected at the forward end. The rod ends remained secure. The C121-9 control tube was wedged between the pedal assembly.

The tailrotor gearbox was separated from the tailcone. The mounting flanges on the gearbox along with a portion of bulkhead were fractured and exhibited signatures consistent with overload. No additional damage was noted to the gearbox. The input and output shafts rotated more than 360 degrees by hand with no anomalies noted. Blue oil was observed in the gearbox sight gauge. The chip detector revealed no evidence of any metallic chips. The output shaft was straight. The tailrotor pitch control would not move by hand. Both tailrotor blades were bent outward 90 degrees near the blade root, with overload fractures in the area of the bends. One blade had leading edge impact damage and the tip cap was missing. The aft flex coupling was disconnected at the flex plate ears. The remaining yoke ears on the input shaft were bent 45 degrees. The mounting hardware remained secure.

The section of recovered wire bundle exhibited connector pins, with the opposing end exhibited overload signatures.

The main rotor gearbox housing exhibited angular and jagged fracture surfaces. No evidence of any mechanical damage to the recovered inside areas of the main rotor gearbox housing.

The airframe tube sections exhibited overload signatures on all the fracture surfaces and were bent/distorted. The section of the aft rear doorframe exhibited severe wrinkling along with overload signatures on all fracture surfaces.

The V-belt was separated in overload and appeared to have normal wear.

Portions of the airframe that remained to the engine included the horizontal firewall, small portions of the vertical firewall, portions of the upper frame tubes, portions of the main rotor gearbox housing, small portions of interior components. The portions of the forward firewall and lower airframe tubes were hydro formed tightly around the aft portion of the engine. The forward portion of the upper frame were collapsed downward and aft. The aft portion of the upper frame had a dent in the center cross tube adjacent to the clutch with no rotational scoring observed. The horizontal firewall was dented and distorted throughout. Puncture marks were observed adjacent to the forward flex plate with no apparent rotational signatures. The oil cooler and cooling panels did not exhibit any signatures of contact with the starter ring gear.

3.0 Engine Examination

Examination of the recovered engine revealed that the right magneto was separated, alternator, entire bottom plenum, carburetor, induction pipes (partially displaced), and exhaust system were separated. The engine remained attached to the engine mount structure along with portions of the upper horizontal firewall. All six cylinders remained attached. The cooling fan and lower sheave remained attached to the engine crankshaft. The upper spark plugs were removed. The crankshaft would not rotate freely.

Internal examination of each cylinder using a lighted borescope revealed varying degrees of corrosion, ocean byproducts, and sea life inside. No evidence of any foreign object ingestion was observed within the cylinder combustion chamber. The rocker box covers were removed and the rocker arm areas were cleaned using compressed air. All intake and exhaust rocker arms remained in place on each cylinder. All of the intake and exhaust pushrods were intact and impact damaged. The intake and exhaust valve springs were intact on each cylinder. The number 2 cylinder hold down nuts were removed. Despite numerous attempts utilizing various hand tools, the cylinder was unable to be removed.

Holes were drilled in various locations along the top part of the engine crankcase, inline with the internal rotational plane of each connecting rod/cylinder. The crankcase was examined internally using a lighted borescope. The crankshaft, camshaft, and connecting rods were observed intact and undamaged. A significant amount of corrosion, ocean byproducts, and sea life was observed within the crankcase. No evidence of any mechanical damage or heat distress was observed throughout the internal area of the engine.

The accessory case was removed and examined. The internal areas of the accessory case exhibited varying degrees of corrosion, ocean byproducts, and sea life. The crankshaft gear, dowel pin and bolt were observed intact and secure. The accessory gears were intact and exhibited a significant amount of corrosion.

The left magneto was removed, and the driveshaft would not rotate by hand. The magneto exhibited impact damage, corrosion, and varying degrees of sea life. The magneto was unable to be disassembled due to corrosion.

The ignition harness exhibited varying degrees of impact damage.

The upper and lower spark plugs were removed. The spark plugs contained a significant amount of corrosion, ocean byproducts, and sea life within the electrode area. No evidence of any mechanical damage was observed.

Submitted by: Joshua Cawthra