



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

October 8, 2020

HELICOPTER & ENGINE EXAMINATION

WPR19FA188

A. ACCIDENT

Location: Hayward, California

Date: July 15, 2019

Aircraft: Robinson R-44 II

NTSB IIC: Stephen Stein

B. EXAMINATION PARTICIPANTS

Stephen Stein
Aviation Accident Investigator (IIC)
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C. DETAILS OF THE INVESTIGATION

HISTORY OF FLIGHT

On July 15, 2019, about 1426 Pacific daylight time, a Robinson R-44 II helicopter, N144TG, was substantially damaged during a low altitude maneuver at Hayward Executive Airport (HWD), Hayward, California. The commercial pilot was fatally injured and the student pilot received serious injuries. The airplane was registered to and operated by Pacific Helicopters, LLC as an instructional flight, conducted under the provision of Title 14 *Code of Federal Regulations* Part 91. Visual meteorological conditions prevailed and a flight plan was not filed for the local flight.

According to the owner of Pacific Helicopters, Inc, the instructor pilot was a part time employee who had been checked out in the accident helicopter on March 29, 2019. On the day of the accident, following several rounds in the helicopter airport traffic pattern, the instructor pilot and student pilot performed hovering maneuvers on a taxiway designated for helicopter training. Archived Federal Aviation Administration Air Traffic Control (ATC) audio showed that the instructor pilot requested to return to the traffic pattern about 1422, but ATC denied the request and asked the accident flight to hold temporarily. Flight tracking data showed that the helicopter continued to hover for several seconds before slowly maneuvering west and then entering a left turn over a patch of hard dirt and vegetation to the southwest of the taxiway. A surveillance

video retrieved from an adjacent building that faced northeast captured the helicopter's shadow during its final movements. The helicopter entered the camera view from the left with its nose facing west. After momentarily drifting to the left, in a southern direction, the helicopter performed a rapid turn to the southeast. In its final movement, the helicopter made a rapid turn to the north in a high angle of bank on its left side and a cloud of dust was observed before the helicopter shadow disappeared from the camera view.

PERSONNEL INFORMATION

The pilot, age 62, held a flight instructor certificate with a rating for rotorcraft-helicopter and a commercial pilot certificate with ratings for rotorcraft-helicopter and instrument helicopter. The pilot's most recent second-class medical certificate was issued on June 11, 2019, which included a medical restriction, "must wear corr. lenses for distant vision and have glasses for near vision." The pilot had logged about 113 total hours in the accident helicopter at the time of the accident. In the previous 90 days, he accrued 3.7 flight hours in the accident helicopter make and model, all of which was in the capacity as a flight instructor. He had amassed a total of 3,020 flight hours in helicopters at the time of the accident. The pilot received a checkout in the accident helicopter on March 29, 2019 with the chief flight instructor of Pacific Helicopters, Inc., for a duration of 1 flight hour.

AIRCRAFT INFORMATION

Federal Aviation Administration records showed that the airplane was manufactured in 2003 and registered to the owner on February 23, 2018. The helicopter was powered by a Lycoming Engines IO-540-AE1A5, air cooled, 260 horsepower reciprocating engine, derated to 235 hp. Maintenance records showed that the airplane's most recent 100 hour inspection was completed on June 6, 2019 at an aircraft total time of 2,595.4 flight hours, and engine total time of 4,784.1 flight hours. The engine's most recent overhaul was completed 422.8 flight hours prior to the accident on May 12, 2016. The engine's recent inspection was listed as "100 hour/annual inspection," but did not indicate that it was signed off by an airframe and powerplant mechanic with inspection authorization. This inspection was completed on November 30, 2018 at 201.8 hours since the engine's most recent major overhaul.

METEOROLOGICAL INFORMATION

The 1448 recorded weather observation at HWD included wind 270° at 11 knots, visibility 10 statute miles, clear sky, temperature 22° C, dew point 13° C, and an altimeter setting of 30.01 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The helicopter came to rest on its left side, approximately 50 ft from a nearby taxiway, locally referenced as taxiway "Z," at the top of an approximately 4 foot-tall berm. The main wreckage was comprised of most of the major section of the helicopter and oriented on a heading of 052° magnetic. Several plexiglass fragments were found several feet forward of the cabin beyond the berm. Two ground scars were adjacent to the main wreckage; one ground scar, about 95 inches

in length, was about 14 ft from the main wreckage. The other ground scar was collocated with the main wreckage and marked by two 5 inch deep holes, 14 inches in diameter across both holes. The magnetic heading between the two ground scars was 161° magnetic. A 95 inch section of the left landing gear skid was located about 14 ft southeast of the main wreckage and a 2 foot-long section of main rotor blade tip came to rest about 250 ft southwest of the main wreckage.

The left side of the cockpit was crushed and the cockpit roof was crushed. Vertical crush damage was observed throughout the belly of the fuselage. Deformation and multiple compression wrinkles were observed all along the rest of the belly. The left landing gear skid had separated from the fore and aft struts. The left forward strut was also separated from the forward cross tube. The right landing gear skid remained attached at the struts. The aft cross tube separated from the fuselage.

Both the upper and lower sheaves remained attached to their shafts. The V-belts were displaced from their grooves on both sheaves. One belt displayed score marks on the backing around the entire circumference. The belt tension actuator was fractured at the screw tube.

The tailboom displayed circumferential deformation near bay 1. Continuity of the tail rotor drive shaft was traced from the transmission to the tail rotor blades through a separation in the drive shaft at bay 2. The drive couplings were unremarkable. The tail rotor blades were undamaged with the exception of a dent in one of the blades. Both the vertical stabilizer and horizontal stabilizer remained attached to the tail section. The vertical stabilizer exhibited deformation throughout its skin and the horizontal stabilizer was unremarkable.

Both main rotor blades remained attached to the main rotor hub. The blue label main rotor blade exhibited slight upward bending and was bent opposite the direction of rotation. Downward bending was observed along the length of the red label blade, which was also bent opposite the direction of rotation. The red label main rotor blade pitch change link had separated at the swash plate attachment and the blue label main rotor blade pitch change link separated at the blade pitch horn.

ADDITIONAL INFORMATION

Airframe Examination

Fuselage

Right side, nose. Damage from the belly going upward creating wrinkles and cracks in the fiberglass. One crack runs from the belly of the helicopter to the bottom of the front right (FR) door opening. The green navigation light located just underneath the FR door was intact with the lens intact. The FR door was found attached at both hinges but held in the open position by the gas strut. The door latch was in the open position. The acrylic window was found intact.

The right rear passenger door was found attached to the fuselage with both hinges. The door was open and the door latch was latched in the closed position. The acrylic window was intact.

The right side of the fuselage was cracked apart just above the forward landing gear strut, about ten inches behind the forward and bottom corner of the rear door.

Fuselage aft of rear door to engine nacelle. There was wrinkling of the sheet metal from the belly to the bottom of the fuel tank. The engine nacelle area displayed crush damage from the bottom upward.

Left side. The helicopter appeared to impact hard terrain about 40 degrees on the left side. Displayed upward crush damage. From the nose to the engine nacelle area. The front left door was fragmented, with remnants attached to the fuselage at both hinges. The left rear door was separate from the fuselage. The top hinge assembly was absent, and the lower hinge was found attached to the fuselage and bent. The door was found in the debris field. The top hinge assembly was attached to the door. The acrylic window was broken. The post between the doors was found bowed outwards about 10 inches from the top of the post near the roof.

The aft fuselage / engine nacelle area displayed crush damage from the bottom upwards.

The forward landing gear strut was absent and found in the debris field adjacent to the bellow of the helicopter, Both the upper and lower attachment points appeared to have overload.

The main and auxiliary fuel tanks remained attached. The caps were secure and the seals were normal. The fuel vent crossover line separated and allowed some fuel to drain out.

Tail Cone and Empennage

Bay 1. Bay 1 displayed damage from below. Maximum damage was found at the 4 to 5 O'Clock position as if looking from the rear forward.

Tail Cone Bays 2 through 7. All remaining bays displayed normal to minor damage consisting of minor scratches and dents.

Empennage. Vertical fin, lower. Minor dents and wrinkling found. Vertical Fin Upper. Minor dents and wrinkling of skin found. Horizontal stabilizer.

Red T/R Blade. Displayed a chordwise wrinkle. No further damage detected. Leading edge and trailing edge found in good condition.

Blue T/R Blade. No damage found. The leading edge and trailing edge found in good condition.

The red and blue pitch-change links were found in good condition and attached at both ends to their respective components.

The tail rotor gearbox was found attached to the tail cone and in good condition. There was oil in the sight gauge and the gears turned freely. The slider assembly turned freely. The stinger and tail rotor guard were found in good condition. The cross head was found in good condition. The

tail-light and anti-collision light were found in good condition. The wire bundle running through the tail cone to the empennage was found in good condition.

The tail rotor drive shaft was found severed at the bay 1 location, adjacent to the skin damage at Bay 1. The hanger bearing at Bay 3 was found in good condition. The drive shaft displayed warpage along its length around bay 4 to 6. The flex couplings at bay 1 and 7 were found in good condition. The four drive V-Belts were found attached but had skipped one groove aft in the upper sheave. The aft V-belt had displaced off of the lower sheave and the three forward V-Belt displaced one groove forward on the lower sheave. The free-wheeling unit functioned normally.

Main Rotor Assembly

The hub remained attached to the mast. The mast remained attached to the transmission. The transmission rubber mounts were found in normal condition. The Red and blue droop stop tusk were normal. The blade red and blue blade teeter stops appeared normal. The drive collar was fractured. The drive link was found in good condition. The rotating and non-rotating swashplate assembly was normal and rotated freely. The main rotor was rotated by hand more than 360° with no anomalies, confirming continuity to the input shaft.

The blue pitch-change link was broken at the upper rod end bearing (REB) which connects to the blade pitch horn. The safety wire was intact. The lower REB remained attached to the rotating star of the swash plate.

The red pitch-change link was broken at the barrel nut. The safety wire was stretched out. The lower REB remained attached to the rotating star of the swash plate and the upper REB remained attached to the Pitch horn.

The hub retention bolt and nut were normal.

The red and blue cone bolts and nuts were normal.

The blue main rotor blade remained attached at the hub. The seal was torn at the outer band clamp. All retention nuts on the blade grip were present and secure, displaying white slippage marking. There was contact at the hub by the pitch horn. The blade tip + about 25 inches separated from the blade and was found on top of a nearby building. The blade displayed upward bending throughout the length of the blade. From the 26 inch mark to about 164 inches inward the blade displayed a uniform upward bend. Creases were observed about 48, 81, and 92 inches from the tip. There was an additional upward bend at the 145" mark, about at the first doubler. The liberated tip +25 inches displayed a black tar looking deposit. The trailing edge at the tip was observed to be bent downward.

The red main rotor blade remained attached to the hub. The seal was torn at the outer clamp. There was minor contact between the pitch horn and the hub. All blade grip retention bolts remained attached and had white slippage marks. The blade tip remained attached. There was aft

bending throughout the length of the blade. There were six chordwise bends located at about 17, 25, 43, 60, 78, and 105 inches. There was downward bending at about 135 inches. A light deposit of dirt was observed at about 100 to 113 inch area. The first 46 inches of the blade

Displayed a light dusting of dirt on the top and bottom side.

Swash Plate. The swash plate remained attached and rotated freely. The drive link yoke was fractured. The forward, left and right swash plate push-pull tubes remained attached at both ends and appeared normal. The fore and aft swash plate push-pull tube remained attached at both ends and displayed a bend towards the mast.

Hydraulics

The aft hydraulic servo was attached, but the connecting REB was fractured. The left and right servos remained attached. The right servo, pressure hose fracture separated from the servo. The hydraulic pump displayed normal indications. The temperature probe did not display overheating. The hydraulic reservoir remained attached and appeared normal.

Landing Gear

Right Side. The landing gear remained attached at the forward upper attachment point. The upper rear attachment point released the strut. The rear and forward struts remained attached to the skid. The skid appeared normal.

The left skid released from the struts. The aft 15" remained attached to the rear strut. The forward strut released from both the upper and lower attachment points.

Instruments

Dual Tach: Rotor: 0 RPM, Engine: 0 RPM

Manifold Pressure: 30" Hg

Amps: 0

Oil Pressure: 0

Fuel: Main Tank: 0

Aux: 0

Oil Temp: 0

Cylinder Head Temp: 0

Altimeter: 10 ft MSL

Hour Meter, Oil Pressure: 535.4

Clutch: Covered

ALT: OFF

Master battery: OFF

Ignition Key: OFF

Mixture: IN

Hour meter, Collective Activated: 422.8

Panel Lights: Mid Intensity

NAV Lights: OFF

Strobe: OFF

Landing Light: OFF

Flight Controls

Flight Control Continuity was confirmed for cyclic, collective, pedals, and throttle handles.

Cyclic. The Left side cyclic handle was released and absent. The right cyclic handle was attached and pivoted normally at the center post. The cyclic control tubes were connected to the left, right, and fore and aft hydraulic servos. Cyclic continuity was maintained to the swash plate except for the separation of the aft servo lower control tube.

Collective. The collective remained attached to the helicopter. Continuity was maintained to the base of the aft hydraulic servo where the push-pull tube overload separated from the rod end bearing.

The pedals remained attached to the helicopter. The left pedal was positioned full forward. The left pedals were crushed inwards from the left. Pedal continuity was maintained to the belly of the helicopter where continuity was lost at a bell crank. Continuity was reestablished to the tail rotor.

Throttle continuity was maintained to the fuel servo.

Seat Belts

Pilots Left Side (Instructor Pilot's side). The lap belt was intact and undamaged. The lap belt was disconnected at the latch and the shoulder harness was intact and undamaged.

Pilots Right Side (Student Pilot's side). The right pilot's seat structure was crushed on the inboard side and the aft panel was distorted. The seat back and seat were in good condition.

Passenger left side. The lap belt was secured to the seat in a stowed fashion.

Passenger right side. The lap belt was secured to the seat in a stowed fashion.

Seats

Pilot's Left seat (Instructor Pilot's Seat). The seat was deformed from upward movement of the floor. The seat back was pushed backwards to the horizontal support bar and distorted in shape. The support bar was deformed aft behind the seat.

Pilot's Right Seat (Student Pilot's seat). The right pilot's seat structure was crushed on the inboard side and the aft panel was distorted. The seat back and seat were in good condition.

Left Passenger seat. The left seat was damaged from the upward movement of the floor and the forward movement of the aft bulk head.

Right Passenger seat. The right seat was found in good condition.

Engine Examination

The left side of the engine mount tubing was crushed and the cylinder nos. 1 and 3 intake and exhaust tubes were displaced while the cylinder no 5 intake and exhaust tubes had separated. The ignition harness wire braids to the cylinder nos 3 and 5 bottom spark plugs were partially detached and the cylinder no 1 bottom spark plug ignition harness wire braid was securely attached to the spark plug. The exhaust and intake tubes to cylinder nos. 2, 4 and 6 were unremarkable. Most of the spark plugs were normal in appearance when compared to the Champion Check-A-Plug chart, except for the bottom plugs to cylinder nos. 3 and 5, which were both oil fouled due to the position of the engine after the accident. Both magnetos remained secured to the accessory case and the ignition harnesses were attached to both magnetos. Both P lead terminals were secure.

An extensive burn signature was found on the structural tubing adjacent to the cylinder no. 3 exhaust and a burn mark was observed on the scat tubing adjacent to the cylinder no. 5 exhaust.

The engine was rotated by hand at the squirrel cage and both intake and exhaust compression were observed at each of the six cylinders. Valvetrain continuity was confirmed for both valves for each of the six cylinders as the crankshaft was rotated through. Additionally, the magneto switch was turned to the BOTH position and spark was observed at each ignition coil or braid end, with the exception of the cylinder no. 1 bottom ignition coil and the cylinder no. 5 top ignition coil.

The forward face of the upper sheave had rotational score marks as did the adjacent frame tube.