



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

| | | | |
|--------------------------------|---|-------------------------|--------------------|
| Location: | Hayward, California | Accident Number: | WPR19FA188 |
| Date & Time: | July 15, 2019, 14:26 Local | Registration: | N144TG |
| Aircraft: | Robinson R44 | Aircraft Damage: | Substantial |
| Defining Event: | Unknown or undetermined | Injuries: | 1 Fatal, 1 Serious |
| Flight Conducted Under: | Part 91: General aviation - Instructional | | |

Analysis

Following several rounds in the helicopter airport traffic pattern, the flight instructor and student pilot performed hovering maneuvers on a taxiway designated for helicopter training. During one of the hovering maneuvers, the helicopter drifted away from the taxiway, over the grass area, and rapidly advanced towards a fence line. According to the student pilot, the flight instructor initiated a left turn, and the helicopter turned “very rapidly.” Analysis of a surveillance video indicated the helicopter rolled left about 70° as it neared the fence line. The helicopter’s bank angle decreased to about 40° as the helicopter continued to turn left. As the helicopter turned to a northern heading, the left roll angle increased to about 90°. The main rotor blades contacted the ground immediately after and the helicopter came to rest.

Postaccident examination of the helicopter revealed a punch tool at the aft bulkhead of the cabin resting against the tail rotor control bell crank. Testing performed by the helicopter manufacturer indicated the proximity of the punch to the tail rotor control bell crank could have inhibited some tail rotor control authority. However, as the examination did not reveal any other anomalies with the flight control system or powerplant, even if the pilot’s tail rotor authority was inhibited, he still had the authority to reduce engine power, lower the collective and land the helicopter at any moment during the flight. Further, the restricted tail rotor authority would not have affected the helicopter’s roll axis, and the rapid, steep roll angles that occurred moments before impact.

The instructor and student pilot likely lost control of the helicopter during its final 90° left bank, but the cause of this and previous excessive bank angles and whether they were intended during the helicopter’s final movements could not be determined. The student pilot’s history with another flight instructor, of aggressive control inputs and lack of attention to the surrounding environment suggest that the instructor, in the accident, may have been forced to intervene and recover the helicopter. However, a lack of available evidence precluded the investigation from determining when this intervention occurred and whether it contributed to the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

The pilots’ loss of control during a low altitude maneuver for undetermined reasons, which resulted in impact with terrain.

Findings

| | |
|------------------|---|
| Not determined | (general) - Unknown/Not determined |
| Personnel issues | Aircraft control - Instructor/check pilot |
| Aircraft | (general) - Unknown/Not determined |

Factual Information

History of Flight

| | |
|----------------------------|--|
| Maneuvering-low-alt flying | Unknown or undetermined (Defining event) |
| Maneuvering-low-alt flying | Loss of control in flight |
| Maneuvering-low-alt flying | Low altitude operation/event |

On July 15, 2019, about 1426 Pacific daylight time, a Robinson R-44 II helicopter, N144TG, was substantially damaged when it was involved in an accident at Hayward Executive Airport (HWD), Hayward, California. The flight instructor was fatally injured, and the student pilot was seriously injured. The airplane was operated as a Title *14 Code of Federal Regulations* Part 91 instructional flight.

The accident flight data was compiled from a combination of archived Federal Aviation Administration (FAA) air traffic control (ATC) audio and radar data acquired from a commercially available third party. Following several rounds in the helicopter airport traffic pattern, the flight instructor and student pilot performed hovering maneuvers on a taxiway designated for helicopter training. At 1422, the instructor requested to takeoff, but ATC denied the request and asked the flight instructor to standby.

GPS flight tracking data showed the helicopter continue 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 shadow of the helicopter entered the camera view from the left with its nose facing west. After a brief side hover to the left, in a southern direction, the helicopter performed a rapid turn to the southeast and its speed over the ground increased from about 2.5 mph to about 18 mph. In its final movements, the helicopter made a rapid turn to the north in a high bank angle on its left side and a cloud of dust was observed before the helicopter’s shadow disappeared from the camera view. Figure 1 is a flight path diagram compiled from both tracking data and the surveillance video.

According to the student pilot, the accident occurred about 1 hour into the flight towards the end of their lesson. The instructor appeared calm and confident during the flight. Much of the instructional flight had consisted of flying a left-hand traffic pattern (the helicopter traffic pattern), takeoffs and landings, hovering, flying the taxiway and left and right turns. During the lesson, the instructor asked the student pilot to hover-taxi over the runway and then return to the yellow spot labeled as “C” in Figure 1. According to the student, the instructor would take the controls from him when the helicopter “was away from the taxiway over the grassy area.” In the last few minutes of the accident flight, they were hovering when the instructor took the controls and explained that the student pilot should keep his eyes on the horizon and “don’t look down.” The instructor then requested take-off clearance from ATC but was instructed to hold. He began a left turn, but the helicopter turned “very rapidly and pitched to the left.” The instructor made a right turn, and the student pilot observed the helicopter again “turn rapidly and also pitched to the right,” before impacting the ground.

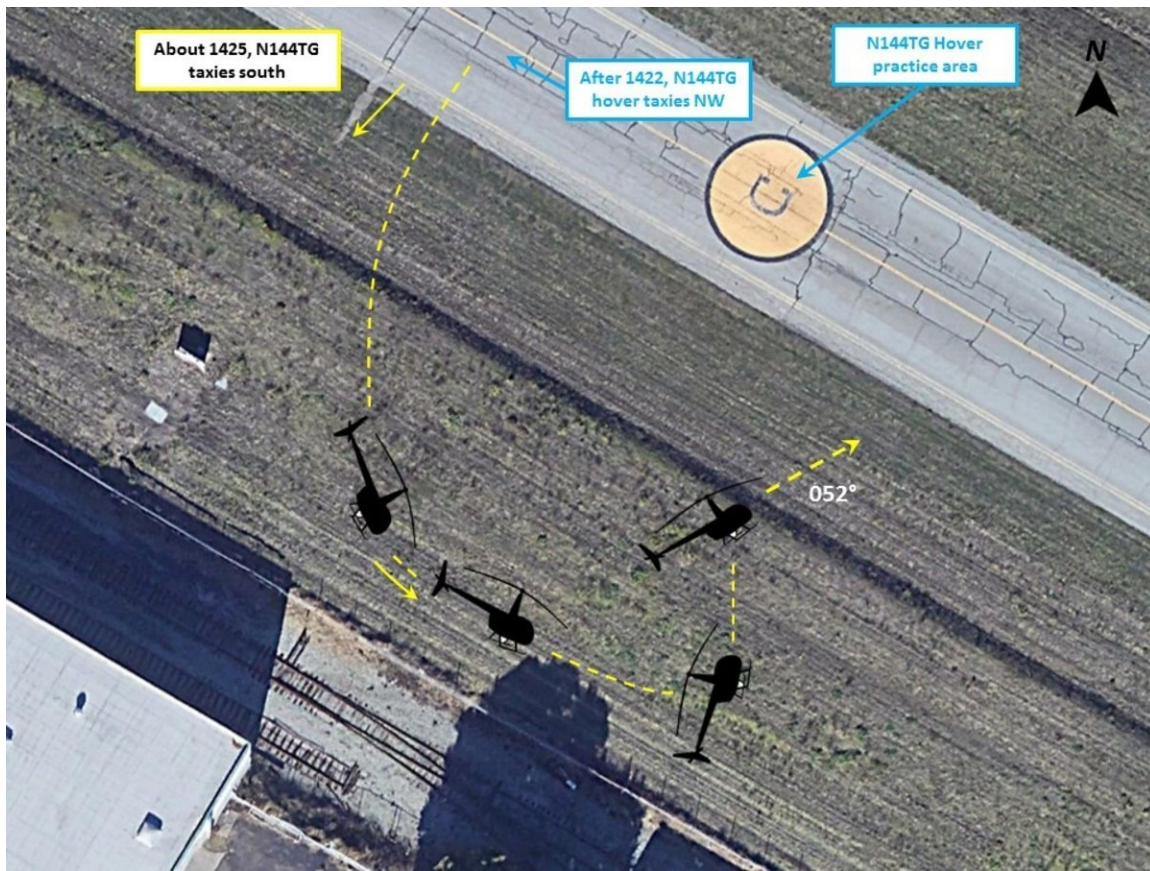


Figure 1: Helicopter Flight Path

A video study of the surveillance footage conducted by the National Transportation Safety Board (NTSB) showed the roll angle of the helicopter in the last few seconds before the helicopter impacted the ground. The helicopter's actual height above the ground could not be determined. According to the analysis, once over the berm and on a southern heading, the helicopter rolled left about 70° as it neared a fence line. Immediately after, the helicopter's roll angle decreased to about 40° as the helicopter continued to turn left. As the helicopter turned to a northern heading, the left roll angle increased to about 90° . The main rotor blades contacted the ground immediately after and the helicopter came to rest.

Pilot Information

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|----------------------------------|--|--|----------------|
| Certificate: | Commercial; Flight instructor | Age: | 62, Male |
| Airplane Rating(s): | None | Seat Occupied: | Left |
| Other Aircraft Rating(s): | Helicopter | Restraint Used: | 3-point |
| Instrument Rating(s): | Helicopter | Second Pilot Present: | No |
| Instructor Rating(s): | Helicopter | Toxicology Performed: | Yes |
| Medical Certification: | Class 2 With waivers/limitations | Last FAA Medical Exam: | June 11, 2019 |
| Occupational Pilot: | Yes | Last Flight Review or Equivalent: | March 29, 2019 |
| Flight Time: | 3026.8 hours (Total, all aircraft), 112.6 hours (Total, this make and model) | | |

Student pilot Information

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|----------------------------------|--|--|----------|
| Certificate: | None | Age: | 46, Male |
| Airplane Rating(s): | None | Seat Occupied: | Right |
| Other Aircraft Rating(s): | None | Restraint Used: | Unknown |
| Instrument Rating(s): | None | Second Pilot Present: | No |
| Instructor Rating(s): | None | Toxicology Performed: | No |
| Medical Certification: | None | Last FAA Medical Exam: | |
| Occupational Pilot: | No | Last Flight Review or Equivalent: | |
| Flight Time: | 20.3 hours (Total, all aircraft), 20.3 hours (Total, this make and model), 0 hours (Last 90 days, all aircraft), 0 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft) | | |

According to the student pilot's logbook, he began his flight training in July 2018 in the accident helicopter make and model. The flight instructor who taught the student pilot during this time stopped instructing him in December 2018. The instructor recounted that the student pilot progressed slower than his other students and observed him make an unnecessarily aggressive control input every few flight hours. During hover practice the student pilot would input too much right or left pedal and shift the helicopter in that direction. Most of the time the student pilot would correct the movements on his own, but occasionally he would not catch the improper movement and the instructor would intervene and remediate.

Aircraft and Owner/Operator Information

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|--------------------------------------|---|---------------------------------------|-----------------|
| Aircraft Make: | Robinson | Registration: | N144TG |
| Model/Series: | R44 II | Aircraft Category: | Helicopter |
| Year of Manufacture: | 2003 | Amateur Built: | |
| Airworthiness Certificate: | Normal | Serial Number: | 10227 |
| Landing Gear Type: | N/A; Skid | Seats: | 4 |
| Date/Type of Last Inspection: | June 6, 2019 100 hour | Certified Max Gross Wt.: | 2500 lbs |
| Time Since Last Inspection: | 25 Hrs | Engines: | 1 Reciprocating |
| Airframe Total Time: | 2595 Hrs as of last inspection | Engine Manufacturer: | Lycoming |
| ELT: | C91A installed, activated, did not aid in locating accident | Engine Model/Series: | IO-540-AE1A5 |
| Registered Owner: | Pacific Helicopters LLC | Rated Power: | 245 Horsepower |
| Operator: | Pacific Helicopters LLC | Operating Certificate(s) Held: | None |

Meteorological Information and Flight Plan

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|---|----------------------------------|---|-------------|
| Conditions at Accident Site: | Visual (VMC) | Condition of Light: | Day |
| Observation Facility, Elevation: | HWD, 52 ft msl | Distance from Accident Site: | |
| Observation Time: | 14:48 Local | Direction from Accident Site: | |
| Lowest Cloud Condition: | Clear | Visibility | 10 miles |
| Lowest Ceiling: | None | Visibility (RVR): | |
| Wind Speed/Gusts: | 11 knots / | Turbulence Type Forecast/Actual: | / |
| Wind Direction: | 270° | Turbulence Severity Forecast/Actual: | / |
| Altimeter Setting: | 30.01 inches Hg | Temperature/Dew Point: | 22°C / 13°C |
| Precipitation and Obscuration: | No Obscuration; No Precipitation | | |
| Departure Point: | Hayward, CA (HWD) | Type of Flight Plan Filed: | None |
| Destination: | Hayward, CA (HWD) | Type of Clearance: | VFR |
| Departure Time: | 13:41 Local | Type of Airspace: | Class D |

Airport Information

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|-----------------------------|-----------------------|----------------------------------|------|
| Airport: | Hayward Executive HWD | Runway Surface Type: | Dirt |
| Airport Elevation: | 52 ft msl | Runway Surface Condition: | Dry |
| Runway Used: | | IFR Approach: | None |
| Runway Length/Width: | | VFR Approach/Landing: | None |

Wreckage and Impact Information

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|----------------------------|--------------------|-----------------------------|----------------------|
| Crew Injuries: | 1 Fatal, 1 Serious | Aircraft Damage: | Substantial |
| Passenger Injuries: | | Aircraft Fire: | None |
| Ground Injuries: | | Aircraft Explosion: | None |
| Total Injuries: | 1 Fatal, 1 Serious | Latitude, Longitude: | 37.655834,-122.12361 |

The helicopter came to rest on its left side, approximately 50 ft from taxiway Zulu at the top of an approximately 3-foot-tall berm. The main wreckage was comprised of most of the major sections of the helicopter and oriented on a heading of 052° magnetic. The first identified point of impact was a ground scar about 95 inches in length located 14 ft south of the main wreckage and was consistent with a main rotor blade impact. Several plexiglass fragments were found several feet forward of the cabin beyond the berm. Two ground scars were adjacent to the main wreckage and another ground scar was collocated with the main wreckage. A 2-foot-long section of main rotor blade tip came to rest about 250 ft southwest of the main wreckage on the roof of a building (see Figure 2).

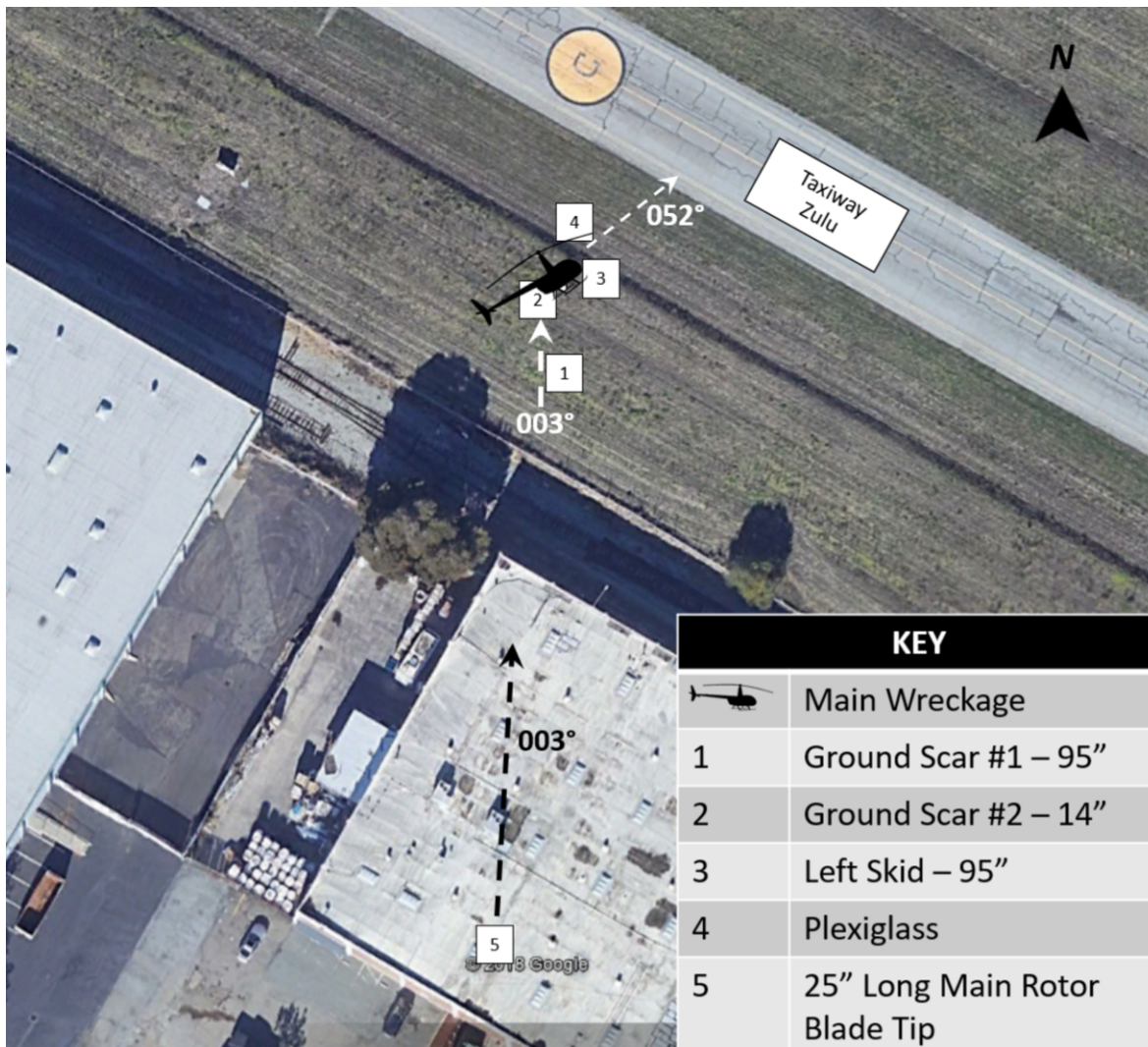


Figure 2: Wreckage Diagram

Cyclic control movement was confirmed from the cockpit to the main rotor blades and collective control was verified from the collective to the main rotor blades through the swashplate. Both main rotor blade pitch change links were broken, but the fracture surfaces were consistent with overload separation. All three main rotor servos operated smoothly when the cyclic and collective were actuated by hand. The anti-torque pedals were crushed and could not be moved, but continuity of the anti-torque system was traced from the cockpit to the tail rotor through a separation at the bell crank.

The main rotor drive/output shaft rotated smoothly, and oil was present in the gearbox. The tail rotor drive/output shaft was continuous from the transmission to the tail rotor blades through a separation in the drive shaft at bay 2. The four V-belts were in good condition but had skipped one groove aft in the upper sheave and the V-belts on the lower sheave were displaced. Continuity of the main rotor and tail rotor drive systems were confirmed from the lower sheave to the main rotor blades through the main rotor drive shaft and from the upper sheave to the tail rotor blades through its respective drive shaft.

Both main rotor blades remained attached to the hub. One blade was bowed upward with several chordwise creases and wrinkle. A two-foot section of the blade tip was separated and displayed

chordwise scuff marks along the leading edge of the blade. The spar was bent opposite the direction of rotation at the fracture.

The other main rotor blade displayed bending slightly downward and opposite the direction of rotation throughout the blade length, with multiple chordwise creases and wrinkles. The tip displayed chordwise scuff marks along the leading edge of the blade.

Both tail rotor blades remained attached to the hub. One tail rotor blade displayed a chordwise wrinkle. Tree residue was observed on both the inboard and outboard skins on both tail rotor blades.

Rotational continuity was established throughout each of the six cylinders, when the crankshaft was rotated by hand using the engine-cooling fan, which showed intake and exhaust compression on each cylinder. The engine did not display evidence of a catastrophic internal failure. Both magnetos were intact and produced spark when tested.

The helicopter examination further identified a punch tool about 5 inches in length that was resting beneath the tail rotor control bell crank behind the aft bulkhead of the cabin.

Tests and Research

According to the helicopter flight manual, the hydraulic system was comprised of a pump, three servos, a reservoir and interconnecting lines. Each part was removed from the accident helicopter, examined and tested at the manufacturer's facility with oversight from an NTSB investigator. The right servo, left servo, aft servo, hydraulic pump and hydraulic reservoir all passed their respective acceptance test procedures. Inspection of the hoses that connected the control servos to the hydraulic system revealed a trace amount of dark particles, but the hoses were not obstructed.

The helicopter manufacturer performed tests to determine if the punch tool, that was found beneath the tail rotor bell crank, would have interfered with bell crank travel. The testing revealed the punch could have inhibited left pedal input by up to 40%.

Bank Angle

According to the FAA Helicopter Flying Handbook (FAA-H-8083-21B),

At 30° of bank, the apparent increase in gross weight soars. At 30° of bank, or pitch, the apparent increase is only 16%, but at 60°, it is twice the load on the wings and rotor disk. For example, if the weight of the helicopter is 1,600 lbs, the weight supported by the rotor disk in a 30° bank at a constant altitude would be 1,856 pounds (1,600 + 16% (or 256)). In a 60° bank, it would be 2,300 pounds; in an 80° bank, it would be almost six times as much, or 8,000 pounds.

Administrative Information

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| Investigator In Charge (IIC): | Stein, Stephen |
| Additional Participating Persons: | Bart Hauger; Federal Aviation Administration; Oakland, CA Thom Webster; Robinson Helicopter Company; Torrance, CA Troy Helgeson; Lycoming Engines; Williamsport, PA |
| Original Publish Date: | October 20, 2021 |
| Last Revision Date: | |
| Investigation Class: | Class 3 |
| Note: | The NTSB traveled to the scene of this accident. |
| Investigation Docket: | https://data.nts.gov/Docket?ProjectID=99849 |

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).