Aviation Investigation Final Report

Location:	Forest Grove, Oregon	**Accident Number:**	WPR09FA459
Date & Time:	September 20, 2009, 13:09 Local	**Registration:**	N956SH
Aircraft:	ROBINSON HELICOPTER R22 BETA	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The pilot under instruction was preparing for a certified flight instructor (CFI) check ride and was in the left seat. The CFI was in the right seat, and the two airmen were going to practice autorotations with power recoveries. A witness with helicopter experience observed several uneventful autorotations and then stopped watching; another witness heard a bang. The witnesses then observed the helicopter descending upright with the left skid low. Investigators examined the wreckage and observed signatures indicating that the engine and main rotor blades were rotating at a low speed at impact. The main rotor blades were also coned upward, which is indicative of a low main rotor rpm state. A safety notice issued by the helicopter's manufacturer notes that main rotor blade stall due to low main rotor rpm causes a high percentage of helicopter accidents. It points out that the stall causes the main rotor rpm to rapidly decrease, and leads to an immediate uncontrolled descent.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The flight crew’s failure to maintain adequate main rotor speed while maneuvering, which resulted in a main rotor blade stall and an uncontrolled descent into terrain.

Findings

Aircraft	Main rotor control - Incorrect use/operation
Aircraft	Prop/rotor parameters - Not attained/maintained
Personnel issues	Use of equip/system - Flight crew
Personnel issues	Incorrect action performance - Flight crew

Factual Information

History of Flight

Autorotation	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On September 20, 2009, about 1309 Pacific daylight time, a Robinson R22 Beta, N956SH, collided with terrain near Forest Grove, Oregon. Hillsboro Aviation, Inc., was operating the helicopter under the provisions of 14 Code of Federal Regulations (CFR) Part 91. The certified flight instructor (CFI) and the commercial licensed pilot under instruction (PUI) sustained fatal injuries. The helicopter sustained substantial damage from impact forces and a post crash fire. The local instructional flight departed Hillsboro, Oregon, at 1204. Visual meteorological conditions prevailed, and no flight plan had been filed.

The operator reported that the PUI was preparing for a CFI check ride, and was in the left seat. The two airmen were going to practice autorotations with power recoveries.

A witness with helicopter experience reported to a Federal Aviation Administration (FAA) inspector that he observed several uneventful autorotations, and then stopped watching. Another witness reported to the FAA that he heard a bang. These witnesses then observed the helicopter descending upright with the left skid low. Another witness reported to law enforcement that he observed the helicopter flying overhead, and it appeared to be out of control. The front of the helicopter dropped down towards the ground, and it appeared to tumble or flip. It disappeared behind trees, and he observed a big fire ball.

PERSONNEL INFORMATION

Certified Flight Instructor

A review of FAA airman records revealed that the 34-year-old CFI held a commercial pilot certificate with ratings for rotorcraft-helicopter and instrument helicopter. He held a certified flight instructor (CFI) certificate with ratings for rotorcraft-helicopter and instrument helicopter.

The CFI held a second-class medical certificate issued on December 1, 2008. It had no limitations or waivers.

Family members reported that the pilot had a total flight time of over 1,000 hours with over 950 as pilot-in-command. The operator did not have logbooks, but their company records indicated that the CFI had 1,012.5 hours in helicopters with 1,010 hours in the R22.

Pilot Under Instruction

A review of FAA airman records revealed that the 32-year-old PUI held a commercial pilot certificate with a rating for rotorcraft-helicopter.

The pilot held a second-class medical certificate issued on October 17, 2008, with the limitations that the pilot must wear corrective lenses and possess glasses for near and interim vision.

Family members reported that the pilot had a total flight time in helicopters of over 200 hours since beginning his instruction. The operator did not have logbooks but their company records indicated that the PUI had 205.5 hours in helicopters with 202 in the R22.

AIRCRAFT INFORMATION

The helicopter was a Robinson R22 Beta, serial number 0956. A review of the helicopter's logbooks revealed that the helicopter had a total airframe time of 10,147 hours at the last 100-hour inspection dated August 21, 2009.

The engine was a Textron Lycoming O-320-B2C, serial number L-16024-39A. Total time recorded on the engine at the last 100-hour inspection was 10,402 hours.

METEOROLOGICAL INFORMATION

The closest official weather observation station was Hillsboro (KHIO), which was 6 nautical miles (nm) northeast of the accident site. The elevation of the weather observation station was 208 feet mean sea level (msl). An aviation routine weather report (METAR) for KHIO was issued at 1253 PDT. It stated: winds from 350 degrees at 5 knots; visibility 10 miles; skies clear; temperature 20/68 degrees Celsius/Fahrenheit; dew point 8/47 degrees Celsius/Fahrenheit; altimeter 30.35 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

An FAA inspector examined the wreckage on scene. He noted that the helicopter was upright and extensively burned; there were no ground scars leading to the wreckage. The skids were spread outward, and the fuel tank was ruptured. The tail boom was intact, and there was no rotational damage to the tail rotor. The main rotor grips were bent up. The main rotor blades coned upward beginning about 18 inches from the hub.

MEDICAL AND PATHOLOGICAL INFORMATION

The Oregon State Police Medical Examiner Division completed autopsies, and ruled that the cause of death was blunt force trauma for both pilots. The FAA Forensic Toxicology Research

Team, Oklahoma City, Oklahoma, performed toxicological testing of specimens of the pilots.

Analysis of the specimens for the CFI contained no findings for volatiles or tested drugs. They did not perform tests for carbon monoxide or cyanide.

Specimens for the PUI were not performed for carbon monoxide or cyanide. The report contained the following findings for tested drugs: quinine detected in liver. The report contained the following findings for volatiles: 22 (mg/dL, mg/hg) ethanol detected in muscle; no ethanol detected in the brain. The report stated that the ethanol found in this case was from sources other than ingestion.

TESTS AND RESEARCH

Investigators examined the wreckage at Avtec Services, Maple Valley, Washington, on November 20, 2009. The detailed examination notes are part of the public docket for this accident.

Airframe

Fire consumed much of the cabin, and destroyed the fuel selector valve.

Fire extensively damaged the flight control system, and many portions could not be identified. The disconnected segments that were observed had jagged and angular fracture surfaces. The tail rotor pitch change slider was not free, and could not slide along the tail rotor gearbox output shaft. The forward end of one push pull tube had been unbolted for recovery.

The airframe was crushed up and aft. The vertical firewall was displaced aft, and partially wrapped around the engine. The engine was displaced aft about 1 foot.

Both elastomeric teeter stops were split horizontally through the middle. The droop stops were undamaged and in place, but one was displace slightly away from the main rotor shaft. The droop stop bolt was bent, and the droop stop tusk separated. Investigators observed slight scoring on the main rotor hub slightly inboard of the pitch change housings; the scoring was in an arc pattern on the second main rotor blade.

One main rotor blade bent up approximately 90 degrees about 3 feet out from the coning bolt. The aft portion of the blade separated from the spar, and was split. It sustained fire damage between the upward bend and a point about 2 feet from the tip.

The other main rotor blade bent sharply downward (about 140 degrees) about 3 feet from the coning bolt. It then began a gentle upward bend (along with trailing edge buckling) from that point outward to a point about 4 feet from the tip. At that point, the spar fractured, and the blade exhibited a slight downward bend.

The empennage separated from the aft tail cone bay; it exhibited little damage.

The low rotor revolutions per minute (rpm), low oil pressure, and alternator low voltage light elements were all stretched.

Engine

Visual examination revealed no marks indicating that either the alternator or oil cooler came into contact with the starter ring gear. The upper cooling fan scroll exhibited circular arc damage on the inlet lip. The upper scroll exhibited a score on the horizontal surface adjacent to the fan outer perimeter. The scoring was in a direction parallel to the rotation direction of the cooling fan.

Examination of the spark plugs revealed that none of the electrodes had mechanical deformation. The spark plug electrodes were elliptical and gray, which corresponded to extended service life and normal operation according to the Champion Aviation Check-A-Plug AV-27 Chart.

The crankshaft rotated freely and investigators established valve train continuity. They obtained thumb compression on all cylinders.

ADDITIONAL INFORMATION

Safety Notice

Robinson revised Safety Notice SN-24, originally issued in September 1986, in June 1994. It notes that main rotor blade stall due to low main rotor rpm causes a very high percentage of helicopter accidents. It points out that the stall can occur at any airspeed; the main rotor stops providing lift, which will lead to an immediate uncontrolled descent. It states that the main rotor blade airfoil stalls at a critical angle of attack, which results in a sudden loss of lift and a large increase in drag. The increased drag would act like a large rotor brake; this causes the main rotor rpm to rapidly decrease, which will further increase the rotor stall. As the helicopter falls, upward rushing air will continue to increase the angle of attack on the blades, which are slowly rotating. It states that this would make recovery virtually impossible, even with full down collective. It indicated that rotor stall above 40-50 feet will most likely be fatal.

Flight instructor Information

Certificate:	Commercial; Flight instructor	**Age:**	34,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Helicopter; Instrument helicopter	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	December 1, 2008
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	1012 hours (Total, all aircraft), 1010 hours (Total, this make and model)		

Student pilot Information

Certificate:	Commercial	**Age:**	32,Male
Airplane Rating(s):	None	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 17, 2008
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	205 hours (Total, all aircraft), 202 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	ROBINSON HELICOPTER	**Registration:**	N956SH
Model/Series:	R22 BETA	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	0956
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	August 21, 2009 100 hour	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	10147 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	Not installed	**Engine Model/Series:**	O-320-B2C
Registered Owner:	HILLSBORO AVIATION INC	**Rated Power:**	180 Horsepower
Operator:	HILLSBORO AVIATION INC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KHIO,208 ft msl	**Distance from Accident Site:**	
Observation Time:	12:53 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	350°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.35 inches Hg	**Temperature/Dew Point:**	20°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Hillsboro, OR (HIO)	**Type of Flight Plan Filed:**	None
Destination:	Hillsboro, OR (HIO)	**Type of Clearance:**	None
Departure Time:	12:04 Local	**Type of Airspace:**	

Airport Information

Airport:	Hillsboro HIO	**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	2 Fatal	**Latitude, Longitude:**	45.810001,-123.178337(est)

Administrative Information

Investigator In Charge (IIC):	Plagens, Howard
Additional Participating Persons:	Tim Moon; Federal Aviation Administration FSDO; Portland, OR Ken Martin; Robinson Helicopter Company; Torrance, CA John Butler; Textron Lycoming; Williamsport, PA
Original Publish Date:	October 3, 2011
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=74768

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