Aviation Investigation Final Report

Location:	SPANISH FORK, Utah	**Accident Number:**	FTW98GA097
Date & Time:	January 14, 1998, 13:00 Local	**Registration:**	N1461W
Aircraft:	Bell 47G-3B-2	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Fatal, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Public aircraft		

Analysis

While maneuvering at low level during a coyote hunting operation, a total loss of engine power occurred and the helicopter collided with trees during a forced landing to unsuitable terrain. Examination of the engine provided evidence of partial failure and/or total failure of the valve assemblies in all cylinders. Laboratory analysis revealed evidence of progressive failure in the valve seats. This was indicative of repeated overspeed of the engine.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A total loss of power due to repeated engine overspeeds. A related factor was unsuitable terrain.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: MANEUVERING

Findings
1. ENGINE ASSEMBLY,PUSH ROD - FAILURE
2. ENGINE ASSEMBLY,ROCKER ARM/TAPPET - FAILURE
3. ENGINE ASSEMBLY,VALVE KEEPER - FAILURE
4. (C) POWERPLANT - OVERSPEED
5. ROTOR RPM - EXCESSIVE

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: DESCENT - EMERGENCY

Findings
6. OBJECT - TREE(S)

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
7. TERRAIN CONDITION - NONE SUITABLE

Factual Information

HISTORY OF FLIGHT

On January 14, 1998, approximately 1300 mountain standard time, a Bell 47G-3B-2 helicopter, N1461W, impacted terrain while maneuvering at 8,400 feet above mean sea level (msl), approximately 57 miles southeast of Spanish Fork, Utah near Soldier Summit, Utah. The commercial pilot received minor injuries, his passenger fatal injuries, and the helicopter sustained substantial damage. Visual meteorological conditions prevailed for this public use flight being conducted under Title 14 CFR Part 91 and no flight plan was filed. The flight had been airborne approximately an hour, after refueling, when the accident occurred.

According to the pilot, the flight was a coyote hunt under a contract with the Department of Agriculture. He said they were flying in a draw, approximately 150 feet above ground level, tracking a coyote and when he pulled up to turn, he heard a "clunk" and the helicopter lost all power. The helicopter struck a large pine tree and the pilot said he lost consciousness for about one minute. When he regained consciousness, he checked his passenger for vital signs and found none. He said the emergency locator transmitter activated automatically and he attempted to radio for help.

The accident occurred in a remote area covered by deep snow. Search aircraft found the accident site at 1700 and a snow cat removed the pilot and passenger about 0600 on January 15, 1998.

INJURIES TO PERSONS

According to the medical examiner, the passenger received fatal blunt force trauma injuries when the helicopter struck a tree, which entered the right side of the cockpit during the impact sequence. The pilot received minor facial and back injuries during the impact.

PERSONNEL INFORMATION

The 57-year-old pilot held commercial pilot certificate number 529603389 issued June 2, 1980. He held a helicopter rating and did not possess a helicopter instrument rating.

The pilot held a second class medical certificate issued April 4, 1997 with the restriction that he wear corrective lenses for distant vision and possess glasses for near vision.

According to the pilot, he had 11,196 hours of flight time, all in helicopters. He had flown 64 hours in the previous 90 days, 58 hours in the previous 30 days and 4.5 hours the day of the accident. He performed a biennial flight review in a Bell 47G-3-B2 on June 23, 1997.

The pilot also held an airframe and powerplant mechanic's certificate with the same number. The certificate was issued September 8, 1983.

AIRCRAFT INFORMATION

The aircraft was registered in 1969 and, at the time of the accident, had a total airframe time of 8,141.0 hours. It was powered by a Lycoming TVO-435-G1A engine rated at 280 shaft horsepower. The engine serial number was L-2651-52 and according to the pilot report, the engine total time was 5,606.6 hours, with 635.5 hours since overhaul and 57.4 hours since inspection. The last inspection was performed on December 6, 1997.

METEOROLOGICAL INFORMATION

According to the National Weather Service, the closest weather reporting station was an automated station located at Provo, Utah, approximately 45 miles west of the accident site. At 1156, the Provo weather was clear skies, 10 statute miles visibility, wind from 140 degrees magnetic heading at 7 knots, temperature of 02 degrees Celsius, dew point of minus 03 degrees Celsius, and an altimeter setting of 30.23 Hg.

According to the pilot, weather at the accident site was scattered clouds at 1,000 feet above the surface, 20 miles visibility, calm wind, a temperature of minus 1 degree Celsius, and an altimeter setting of 29.92 Hg.

WRECKAGE AND IMPACT INFORMATION

The aircraft impacted into trees and deep snow, in a draw at 8,400 feet msl. Due to snow depth, the aircraft was not examined until it was removed to facilities located at Spanish Fork, Utah. Parties to the investigation were the United States Department of Agriculture, Textron Lycoming Engines, Skyhawk Helicopters, and Bell Helicopter. All parties had representatives present during initial examination of the helicopter and engine.

The cabin section right of the center console and right passenger seat exhibited aft crushing to approximately fuselage station 40. The left side cabin structure was deformed but no intrusions into the pilot's living environment were found. The Plexiglas bubble canopy was shattered and the cockpit/cabin area had both wood and pine needles as a result of impact intrusion.

The passenger shoulder harness was separated and the separated edges were smooth. According to emergency personnel on scene, it was cut to facilitate removal of the passenger from the aircraft. The lap belt restraint latch operated normally.

The pilot's shoulder harness webbing above the 'Y' was separated. The separation exhibited rough edges and stretching. It was removed and sent to the NTSB Materials Laboratory for

examination. For the results of that examination, see the TESTS AND RESEARCH section of this document. The pilot's lap belt restraint latch operated normally and the structure beneath the pilot had downward deformation.

The fore and aft cyclic control servo support was fractured aft of the firewall mounting plate. The upper lever was fractured at the lower support connection point. Tubes in the lateral cyclic control system showed evidence of slight deformation and the torque tube was fractured at the transmission side support assembly. The entire area had impact related deformation.

The collective portion of the flight control system remained intact and control continuity was established.

The engine throttle control system was fractured at the forward firewall and aft of the bearing lever. The lever was fractured above the bearing attach point. The left cross tube pin was pulled out of the support assembly and impact related deformation was present throughout the area.

The tail boom was severed at approximately station 80. The tail boom structure between station 80 and 230 was not recovered. The tail boom aft of the powerplant to station 80 was deformed upward.

The main rotor blade and hub assembly remained attached. The red blade was cut off to facilitate recovery. Each blade exhibited damage near the leading edge. Both pitch links were fractured and deformed.

The 900 series transmission was intact and still mounted to the powerplant. The transmission could be rotated by hand and exhibited no evidence of binding, and the tail rotor output shaft was observed to rotate.

The tail rotor system and its support structure were intact aft of the tail rotor "U-joint." The drive shaft was fractured forward of the U-joint. Bell Helicopter, in the presence of NTSB investigator Mr. Hector Casanova, analyzed the fractured end. For details of the examination see the TESTS AND RESEARCH section of this document. The tail rotor blades appeared normal and there was no indication of damage to the tail rotor pitch change control assembly.

The fuel system remained intact and the break away valve poppets were closed on both tanks.

During examination of the engine, the number 3 cylinder spark plugs exhibited damage to the igniter faces. The rocker box cover was removed and numerous pieces of metal and half of the retainer spring washer were found loose in the cover. The intake rocker arm was found inside the spring holding the remaining half of the retainer washer. The intake manifold was removed and the number 3 intake valve stem and a portion of the valve head were found inside. The intake valve push rod was bent. On removal of the cylinder, the remaining portion

of the valve and pieces of the valve guide were found loose inside. Damage to the top of the piston was observed and pieces of the valve head were imbedded into the cylinder head. The number 3 cylinder and associated components were sent to the NTSB Materials Laboratory for further examination.

On May 5, 1998, further tests and disassembly of the engine took place at the facilities of Estergard Aviation, Chandler, Arizona. In attendance were Mr. Jim Struhsaker from the NTSB, and representatives of Lycoming Engines and Superior Air Parts. Additional parts, as indicated in the attached Materials Laboratory report, were forwarded to the NTSB laboratory for analysis.

TESTS AND RESEARCH

The components examined by the NTSB Materials Laboratory consisted of the number 1 piston and valve mechanism, number 2 valve mechanism, number 3 cylinder, piston, and valve mechanism, number 4 cylinder, piston and valve mechanism, number 5 piston and valve mechanism, number 6 valve mechanism, and the pilot's shoulder harness. All engine components received damage during engine rotation as indicated in the Materials Laboratory examination.

The pilot's shoulder harness examination revealed degradation of the harness material, which allowed it to fail below its certified tensile strength. See the attached report for details of the analysis.

The fractured end of the tail rotor "U-joint" was examined at the facilities of Bell Helicopter. The fracture surface was examined under magnification and by utilization of a scanning electron microscope. According to the examination, the joint failed in overload. No evidence of material defects were found.

ADDITIONAL INFORMATION

Parties to the investigation were the United States Department of Agriculture, Lycoming Engines, Skyhawk Helicopter, Bell Helicopters, Superior Aircraft Parts, and the Federal Aviation Administration.

The wreckage was verbally released to the owner's representative on May 5, 1998. Retained parts were shipped directly to Estergard Aviation, Chandler, Arizona, following examination.

Pilot Information

Certificate:	Commercial	**Age:**	57,Male
Airplane Rating(s):	None	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	April 1, 1997
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	11196 hours (Total, all aircraft), 11196 hours (Total, this make and model), 11150 hours (Pilot In Command, all aircraft), 64 hours (Last 90 days, all aircraft), 58 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Bell	**Registration:**	N1461W
Model/Series:	47G-3B-2 47G-3B-2	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	6733
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	December 6, 1997 Annual	**Certified Max Gross Wt.:**	2950 lbs
Time Since Last Inspection:	57 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	8141 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, aided in locating accident	**Engine Model/Series:**	TVO-435-G1A
Registered Owner:	SKYHAWK HELICOPTER SERVICE	**Rated Power:**	280 Horsepower
Operator:		**Operating Certificate(s) Held:**	On-demand air taxi (135)
Operator Does Business As:		**Operator Designator Code:**	ZHLG

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	PVU ,4491 ft msl	**Distance from Accident Site:**	45 Nautical Miles
Observation Time:	11:56 Local	**Direction from Accident Site:**	280°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	140°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	2°C / -3°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	, UT (U77)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	08:00 Local	**Type of Airspace:**	Class G

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Minor	**Latitude, Longitude:**	40.020858,-111.549148(est)

Administrative Information

Investigator In Charge (IIC):	Wiemeyer, Norman
Additional Participating Persons:	BRYAN NEVILLE; SALT LAKE CITY , UT
Original Publish Date:	September 28, 1999
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=20435