Aviation Investigation Final Report

Location:	BURLINGTON, Washington	**Accident Number:**	SEA00LA188
Date & Time:	September 24, 2000, 12:45 Local	**Registration:**	N9355F
Aircraft:	Hughes 269B	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	3 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot aborted his landing in the Hughes 269B helicopter after encountering dust and reduced visibility at the landing site. During the climbout, and at 50-60 mph and approximately 140 feet above ground, the engine rapidly lost power. The pilot executed an autorotation landing from an airspeed/altitude condition slightly outside the limitations of the height-velocity diagram and landed hard. Post crash examination revealed that the #1 cylinder fuel injector line had separated approximately one inch outboard of the injector unit. Metallurgical examination revealed the separation as fatigue. The engine log showed this to be the second #1 cylinder fuel injector line separation in recent history. Further examination revealed that 3 of the hold down bolts for the #3 cylinder had separated and metallurgical examination revealed the separations as fatigue. The flange for the #3 cylinder was observed to be painted with primer paint measuring from about 0.0014 inch to 0.0028 inch in thickness. Both cylinder hold down plates were examined and showed fretting and rubbing damage. According to Textron Lycoming Service Bulletin 271A, the primer paint thickness on the flange should not exceed 0.0005 inch. According to the engine log the engine underwent a major overhaul on July 8, 1994, during which the '...engine was painted assembled and delivered to Cascade Airframe Repair....' The #3 cylinder was subsequently removed and honed on an unspecified date. The date when the #3 cylinder flange was painted was not determined.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Mintenance personnel not following the mandatory service bulletin procedure of not exceeding 0.0005 inch paint thickness on the cylinder flange. Factors were the fatigue separation of multiple cylinder hold down bolts resulting in looseness of the cylinder; and the subsequent vibration and fatigue separation of the fuel injector line. An additional factor was the pilot's

operation of the rotorcraft outside the height/velocity parameters for a successful autorotation.

Findings

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

Findings
1. (F) ENGINE INSTALLATION,MOUNTING BOLT - FATIGUE
2. (C) MAINTENANCE,SERVICE BULLETIN/LETTER - NOT FOLLOWED - OTHER MAINTENANCE PERSONNEL
3. ENGINE INSTALLATION,MOUNTING BOLT - SEPARATION
4. ENGINE ASSEMBLY,CYLINDER - LOOSE
5. (F) FUEL SYSTEM,LINE - FATIGUE
6. FUEL SYSTEM,LINE - SEPARATION

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

Occurrence #3: HARD LANDING
Phase of Operation: LANDING - FLARE/TOUCHDOWN

Findings
7. (F) HEIGHT/VELOCITY CURVE - EXCEEDED - PILOT IN COMMAND

Factual Information

On September 24, 2000, approximately 1245 Pacific daylight time, a Hughes 269B, N9355F, registered to a private owner, and being flown by a commercial pilot, was substantially damaged during a hard landing one mile southwest of Burlington, Washington. The pilot and two passengers sustained minor injuries. Visual meteorological conditions existed and no flight plan had been filed. The flight, which was personal, was operated under 14CFR91, and originated from the Arlington airport, Arlington, Washington, approximately 1200.

The pilot was telephonically interviewed and reported that he was executing a landing at a construction area just southeast of the intersection of Interstate 5 and Route 20 (refer to CHART I). Approximately 10 feet above ground he aborted the landing due to excessive dust conditions and reduced visibility. He initiated a climbing left turn at 30 to 40 miles per hour, and approximately 150 feet above ground, having reversed his course, the engine rapidly lost power. The pilot continued straight ahead covering approximately 150 to 200 feet of terrain while auto rotating to a landing. During the touchdown, the helicopter's main rotor blades contacted the tail boom and terrain, and the skids collapsed.

The pilot submitted a copy of the height-velocity diagram showing the airspeed range (50-60mph) and altitude (140 feet) at the time of the power loss (refer to ATTACHMENT HV-I).

Post-crash examination of the helicopter's engine revealed a separated number one cylinder fuel injector line approximately one inch outboard of the injector unit. This line had been clamped to cylinder number three. Additionally, three of the eight hold down nuts from the number three cylinder were found lying beneath the engine. The bolts associated with all three nuts and were broken off. Of the five remaining hold down nuts, one was tight at removal and the remaining four were unscrewed with minimal torque.

The separated number one injector line sections as well as the number three cylinder, the associated hold down nuts (8) and three captured bolt ends, as well as the two associated cylinder hold down plates were sent to the Safety Board's Materials Laboratory for further examination.

The materials laboratory examination revealed "ratchet marks" on the surfaces of all separated bolts, which were captured within the three respective hold down nuts. Additionally, the fracture surfaces of the separated injector line were examined and fatigue striations were observed across its surfaces. The flange of the number three cylinder was observed to have a coating of yellow primer paint over approximately 70% of its outboard flange surface. The primer appeared to be rubbed away from some areas of the flange. A small chip of the primer paint was removed from the flange and the thickness of the chip was measured with a scanning electron microscope. The thickness of the paint chip varied from about 0.0014 inch

to 0.0028 inch. According to Textron Lycoming Service Bulletin 271A, the primer paint thickness on the flange should not exceed 0.0005 inch (refer to ATTACHMENT OM-I). The cylinder hold down plates were examined and showed fretting and rubbing damage on the inboard surfaces of both hold-down plates (refer to attached metallurgical report).

The aircraft's Lycoming HIO-360-A1A engine log was examined. An entry dated 7-8-94 was noted for the engine at a total airframe time of 1968.9 hours. This entry read in part "...Major overhaul of basic engine..." and included the statement "This engine was painted assembled and delivered to Cascade Airframe Repair. Final installation of accessories and test run to be done by others" (refer to ATTACHMENT EL-I).

The following log page showed an undated log entry between the 7-8-94 overhaul and the next entry (May 5, 1998) which stated in part "...Removed #3 cyl., sent to Sky Services to be honed..." (refer to ATTACHMENT EL-II). The following log page entry (1Jan99) showed a total time since overhaul of 184.8 hours and stated in part "...replaced fuel injector to cylinder lines..." (refer to ATTACHMENT EL-III). The last engine logbook entry (4-7-2000) showed a total airframe time of 2,236.8 hours and a Hobbs time of 909.3 hours. The Hobbs read 974.4 hours at the time of the accident.

The number three cylinder, two cylinder hold-down nuts with pieces of fractured cylinder through bolts, one cylinder hold-down nut with a piece of a fractured cylinder stud, five additional cylinder hold-down nuts, two cylinder hold-down plates from the number 3 cylinder, number three cylinder fuel injection line, and number one cylinder fuel injection line were released to the owner on June 6, 2001, along with all retained aircraft logs and records.

Pilot Information

Certificate:	Commercial; Private	**Age:**	38,Male
Airplane Rating(s):	Single-engine land	**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--no waivers/lim.	**Last FAA Medical Exam:**	June 3, 1999
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:	3200 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Hughes	**Registration:**	N9355F
Model/Series:	269B 269B	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	44-0073
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	April 7, 2000 100 hour	**Certified Max Gross Wt.:**	1670 lbs
Time Since Last Inspection:	65 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2302 Hrs	**Engine Manufacturer:**	Lycoming
ELT:		**Engine Model/Series:**	HIO-360-A1A
Registered Owner:	JOHNSON, STEPHEN & CHARLOTTE	**Rated Power:**	180 Horsepower
Operator:	KELLY, DAVID M.	**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BLI ,170 ft msl	**Distance from Accident Site:**	20 Nautical Miles
Observation Time:	12:53 Local	**Direction from Accident Site:**	323°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	0°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	66°C / 43°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	ARLINGTON , WA (AWO)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	12:00 Local	**Type of Airspace:**	Class G

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Minor	**Latitude, Longitude:**	48.529411,-122.310058(est)

Administrative Information

Investigator In Charge (IIC):	Mccreary, Steven
Additional Participating Persons:	KEN SIMON; RENTON , WA
Original Publish Date:	July 17, 2001
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=50345