Aviation Investigation Final Report

Location:	COUER D'ALENE, Idaho	**Accident Number:**	SEA98FA104
Date & Time:	June 18, 1998, 08:20 Local	**Registration:**	N869W
Aircraft:	Garlick UH-1H	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 None
Flight Conducted Under:	Part 133: Rotorcraft ext. load		

Analysis

The pilot stated that he heard a loud metallic bang coming from the rear of the aircraft, followed immediately by a loss of power. He elected not to auto-rotate to a landing at the log-landing because of personnel in the vicinity, so he initiated an approach to a logging road adjacent to the log-landing. He landed with skids level, no power, and very low rotor rpm, but felt that he had the road made. After touching down, the helicopter rocked backward and rolled over on its left side. The engine was still running, and the pilot shut it down with the fuel valve. During the course of engine disassembly and inspection, output reduction gearbox damage was found to be consistent with a number one planet gearshaft separation caused by fatigue initiating at the outside diameter of the gear shaft within the shaft/gear web shoulder fillet radius. Laboratory analysis of the remnants of the number one planet gear noted that a cross section through the apparent fatigue origin did not exhibit evidence of material defects; however the fatigue initiation area was obscured as a result of secondary damage. The outer diameter of the planet gear shaft was found to have been plated with chromium or nickel and the case hardness of the carburized case on the planet gear was below that specified by the manufacturer. Investigation determined that none of the three planet gears in this engine were of OEM manufacture. Plating of the planet gear is not an authorized repair procedure, and no military repair procedure was identified authorizing this type of repair.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Fatigue failure of a reduction drive planetary gear. Factors include an unapproved part and plating process, and uneven terrain at the emergency landing site.

Findings

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

Findings
1. (F) REDUCTION GEAR ASSY,REDUCTION GEAR - UNAPPROVED PART
2. (C) REDUCTION GEAR ASSY,REDUCTION GEAR - FATIGUE

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

Occurrence #3: ROLL OVER
Phase of Operation: EMERGENCY LANDING

Findings
3. (F) TERRAIN CONDITION - ROUGH/UNEVEN

Factual Information

HISTORY OF FLIGHT

On June 18, 1998, approximately 0820 pacific daylight time, a Garlick UH-1H, N869W, sustained substantial damage during a forced landing after a loss of power while on approach to disembark logs being carried as an external load in helicopter logging operations. The commercial pilot, the sole occupant, was uninjured. Visual meteorological conditions prevailed at the time of the accident. The ELT actuated, but did not aid in locating the accident scene.

The pilot stated that he heard a loud metallic bang coming from the rear of the aircraft, followed immediately by a loss of power; there was no pronounced yaw, however, the helicopter felt like it did when performing a simulated forced landing on a check ride. The pilot stated that he had about 2500 pounds of load on a 250-foot long line at 40 pounds of torque and about 40 knots airspeed.

The pilot noted that he did not believe he heard the engine surge or overspeed, and in the back of his mind it seemed that the engine was running at ground idle, although he had not rolled off the throttle. He jettisoned the long line and load and immediately lowered the collective. He suspected that rotor rpm at that time was about 300 rpm.

The pilot elected not to perform a forced landing at the log-landing because of personnel in the vicinity, so he initiated an approach to an overgrown logging road adjacent to the log-landing. He landed with skids level, no power, and very low rotor rpm, but felt that he had the road made. After touching down, the helicopter rocked backward and rolled over on its left side. The engine was still running, and the pilot shut it down with the fuel valve. He stated that there was no warning, no chip lights, and all of the instruments were reading normal just prior to the failure.

FAA inspectors who went to the accident scene determined that there was a mechanical anomaly within the engine. The engine was transported to AlliedSignal for further inspection.

TESTS AND RESEARCH

The engine was partially disassembled and inspected at AlliedSignal in Phoenix in the presence of NTSB investigators. The combustor and turbine sections were removed and externally inspected, but were not disassembled.

During the course of disassembly and inspection, output reduction gearbox damage was found to be consistent with a number one planet gearshaft separation caused by fatigue initiating at

the outside diameter of the gear shaft. According to AlliedSignal, the resultant separation of the aft planet gear bearing would result in misalignment and interference of the number one planet-gear aft (or primary) gear spline with the sun gear forward (output) spline, resulting in the damage observed to the sun gear and oil deflector.

Additional damage within the accessory drive and tachometer and overspeed governor drive gearboxes, and the oil pump, appeared consistent with contamination by metallic debris generated by a number one planet gearshaft separation and subsequent sun gear and oil deflector damage.

The planet gear separation of the stub shaft on the forward end of the gear was consistent with fatigue initiating at the outer diameter of the shaft within the shaft/gear web shoulder fillet radius. Laboratory analysis of the remnants of the number one planet gear noted that a cross section through the apparent fatigue origin did not exhibit evidence of material defects; however the fatigue initiation area was obscured as a result of secondary damage. The outer diameter of the planet gear shaft was found to have been plated with chromium or nickel. The thickness of the coating indicated that the outer diameter of the shaft was built-up by approximately .0018 inch at the fracture. The case hardness of the carburized case on the planet gear was below that specified by the manufacturer. Features within the bore of the planet gear, described as rough and irregular (as noted at the time of disassembly), were found to be the result of aggressive machining operations or the use of dull tooling; however, this did not appear to have contributed to the separation.

Investigation determined that none of the three planet gears were manufactured by the OEM (original equipment manufacturer), which was acquired by AlliedSignal. Plating of the planet gear is not an authorized repair procedure, and no military repair procedure was identified authorizing this type of repair. Additionally, during inspection, it was found that the timing of the planet gears with respect to the output gear did not meet factory specifications, which the manufacturer believed could contribute to abnormal loads within the output reduction gear train. No pre-existing fuel control or lubrication system conditions were identified which would have caused or contributed to the observed damage.

ADDITIONAL INFORMATION

The wreckage was released to Kern and Wooley, representative to the owner, on December 11, 1998, while it remained at Horizon Helicopters, Rancho Murieta, California.

Pilot Information

Certificate:	Commercial	**Age:**	47,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Helicopter	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	November 19, 1997
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	15440 hours (Total, all aircraft), 6000 hours (Total, this make and model), 14500 hours (Pilot In Command, all aircraft), 150 hours (Last 90 days, all aircraft), 58 hours (Last 30 days, all aircraft), 5 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Garlick	**Registration:**	N869W
Model/Series:	UH-1H UH-1H	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Restricted (Special)	**Serial Number:**	68-15530
Landing Gear Type:	Skid	**Seats:**	2
Date/Type of Last Inspection:	June 12, 1998 AAIP	**Certified Max Gross Wt.:**	9500 lbs
Time Since Last Inspection:	21 Hrs	**Engines:**	1 Turbo shaft
Airframe Total Time:	6218 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	T53-L13BA
Registered Owner:	HORIZON HELICOPTERS	**Rated Power:**	1400 Horsepower
Operator:		**Operating Certificate(s) Held:**	
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:		**Distance from Accident Site:**	
Observation Time:		**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	100 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	270°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	21°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	COEUR D'ALENE , ID	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	07:50 Local	**Type of Airspace:**	

Airport Information

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

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 None	**Latitude, Longitude:**	47.590782,-116.910469(est)

Administrative Information

Investigator In Charge (IIC):	Stockhill, Michael
Additional Participating Persons:	MARION TILTON; SPOKANE , WA DAVID LOOPER; PHOENIX , AZ THOMAS A BURRISS; RANCH MURIETA , CA
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Investigation Class:	Class
Note:	
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