Aviation Investigation Final Report

Location:	Gary, South Dakota	**Accident Number:**	CEN13LA431
Date & Time:	July 23, 2013, 15:20 Local	**Registration:**	N7507A
Aircraft:	Schweizer 269C	**Aircraft Damage:**	Substantial
Defining Event:	Powerplant sys/comp malf/fail	**Injuries:**	1 Minor, 2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was descending the helicopter from about 1,000 feet above ground level (agl) and setting up for a landing at an off-airport location. At 300 to 500 feet agl, the pilot felt a major vibration in the helicopter. He immediately initiated an autorotation and landed the helicopter. During the forced landing, the helicopter rolled over on its right side and sustained substantial damage. Examination of the engine revealed that the No. 3 connecting rod had failed. Material examination of the connecting rod showed the rod failed due to multiple fatigue cracks.

Probable Cause and Findings

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

The failure of the engine connecting rod due to fatigue.

Findings

Aircraft	Recip engine power section - Failure
Environmental issues	Sloped/uneven terrain - Contributed to outcome

Factual Information

History of Flight

Approach	Powerplant sys/comp malf/fail (Defining event)
Autorotation	Collision with terr/obj (non-CFIT)

On July 23, 2013, at 1520 central daylight time, a Schweizer 269C helicopter, N7507A, impacted terrain during a forced landing near Gary, South Dakota. The pilot and one passenger were not injured, and one passenger sustained minor injuries. The helicopter sustained substantial damage to the fuselage and main rotor system. The helicopter was registered to Novne Aviation LLC, and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed for the flight, which was not operated on a flight plan. The local flight originated from Canby, Minnesota, at 1500.

According to the pilot, he was descending from approximately 1,000 feet above ground level (agl) and setting up for a landing at an off airport location. At 300 to 500 feet agl, the pilot felt a major vibration with the helicopter. He immediately initiated an autorotation and landed the helicopter. During the forced landing, the helicopter rolled over on its right side and sustained substantial damage.

On September 18, 2013, under the supervision of a Federal Aviation Administration inspector, the Lycoming HIO-360-D1A engine, serial number L-11954-51A, and helicopter were examined. Visual examination of the engine revealed a hole in the crankcase near the number 3 cylinder. Prior to engine disassembly, the inspector attempted to rotate the engine crankshaft by hand; however, the crankshaft was unable to rotate. The engine was then disassembled. Disassembly of the engine revealed the number 3 connecting rod was fractured into multiple sections. The connecting rod and associated hardware were retained for further examination. No evidence of fretting was noted on the base of the cylinders or engine crankcase mating surfaces. The number 3 crankshaft journal displayed dark discoloration. No evidence of oil starvation was noted on the crankshaft bearings. Extensive damage, consistent with the failure of the number 3 connecting rod, was noted throughout the engine.

A review of the airframe and engine logbooks revealed that a major overhaul on the engine was completed on April 20, 1998. The most recent annual inspection was completed on the engine on October 29, 2012, at 881.9 hours since major overhaul. During the annual inspection, all four engine cylinders were removed and overhauled. On May 14, 2013, at 893 hours since major overhaul, the engine oil was changed with no anomalies noted. At the time of the accident, the engine had accumulated 899 hours since major overhaul.

The National Transportation Safety Board's Materials Laboratory examined the engine's number 3 connecting rod and associated hardware. According to the examination, the connecting rod and cap had fractured in multiple locations, and the head of one of the connecting rod bolts had fractured. A fracture surface located on one of the connecting rod yokes exhibited crack arrest and ratchet marks, consistent with progressive crack growth and failure. More than any of the other fractures, this fracture exhibited the largest percentage of progressive fracture relative to overstress features. A thin middle portion of the

fracture surface exhibited a morphology consistent with overstress. This overstress area was bounded on the opposite side by progressive cracking that had initiated and grown from the inner bearing surface and bolt hole inner bore of the connecting rod yoke.

The inside bore of the connecting rod bolt hole where the main progressive cracking had initiated exhibited relatively deep grooves. Several of the crack initiation sites corresponded with these grooves on the inside bore.

A fracture surface located in the connecting rod cap exhibited several thumbnail-shaped features indicative of progressive crack growth on the inner bearing surface. These cracks were not located along the same plane and were staggered in location, while being oriented parallel to each other.

The inside surface of the rod cap exhibited multiple cracks less than 0.25 inches in length, perpendicular to the rotational direction of the rod. These cracks were consistent with fatigue that typically occurs in heavy wear during contact between mating surfaces. Fatigue cracking was found emanating from both the connecting rod bolt hole inner bore, as well as from the inside bearing surface. The existence of ratchet marks near the start of the fatigue crack was consistent with multiple crack initiation sites. A thin section of the fracture surface between the fatigue cracks exhibited dimple rupture, indicative of failure from tensile overstress. This fracture pattern was consistent with the final remaining cross section failing from overstress after the fatigue cracks had progressed deep enough. Inspection of the connecting rod found the chemical composition to be consistent with an American Iron and Steel Institute (AISI) 4XXX or 8XXX series alloy steel.

To determine the nature of the cracks on the inner bearing surface of the connecting rod cap, the largest one was backcut and intentionally overstressed to expose the crack faces. Three small thumbnail-shaped cracks were revealed; these cracks exhibited features consistent with fatigue.

Pilot Information

Certificate:	Private	**Age:**	46
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	February 6, 2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	1095 hours (Total, all aircraft), 250 hours (Total, this make and model), 37 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Schweizer	**Registration:**	N7507A
Model/Series:	269C	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	S1297
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	October 29, 2012 Annual	**Certified Max Gross Wt.:**	2050 lbs
Time Since Last Inspection:	15 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3891 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	Not installed	**Engine Model/Series:**	HIO-360-D1A
Registered Owner:	On file	**Rated Power:**	190 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	CNB	**Distance from Accident Site:**	10 Nautical Miles
Observation Time:	15:00 Local	**Direction from Accident Site:**	90°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	24°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Canby, MN (CNB)	**Type of Flight Plan Filed:**	None
Destination:	Canby, MN (CNB)	**Type of Clearance:**	None
Departure Time:	15:00 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor, 1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 2 None	**Latitude, Longitude:**	44.793056,-96.457496(est)

Administrative Information

Investigator In Charge (IIC):	Sauer, Aaron
Additional Participating Persons:	Jim O Bad Horse; Federal Aviation Administration; Rapid City, SD
Original Publish Date:	October 27, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=87559