



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Passadumkeag, Maine	Accident Number:	ERA18LA190
Date & Time:	July 11, 2018, 19:20 Local	Registration:	N352GL
Aircraft:	GLASAIR SH2	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (total)	Injuries:	1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

While in cruise flight, the experimental, amateur-built airplane's engine started to run "rough" and lost partial power. The pilot checked the engine gauges, noted no irregularities, and unsuccessfully attempted to restore engine power by turning the fuel boost pump on. Within about 30 seconds of the initial power loss, the engine lost total power and the propeller stopped. The pilot performed a forced landing to a bog and the airplane came to rest inverted, resulting in substantial damage to the empennage.

Disassembly and examination of the engine revealed that the crankshaft had fractured at the No. 4 cylinder journal. Further examination of the fracture surface revealed fatigue striations consistent with fatigue crack propagation. These striations were finely spaced and exhibited changing or erratic thicknesses on different areas of the fracture surface, consistent with propagation through high-cycle fatigue. The reason for the crack initiation could not be determined.

According to the engine maintenance log, the engine experienced a propeller strike during a landing incident about 5 years and 368 flight hours before the accident. The pilot elected not to have the propeller strike or sudden stoppage inspection performed, since it was not mandatory for non-certificated engines.

Probable Cause and Findings

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

A total loss of engine power due to a fatigue fracture of the crankshaft.

Findings

Aircraft	Recip engine power section - Fatigue/wear/corrosion
Aircraft	Recip engine power section - Failure

Factual Information

History of Flight

Enroute-cruise	Powerplant sys/comp malf/fail
Enroute-cruise	Loss of engine power (partial)
Enroute-cruise	Loss of engine power (total) (Defining event)
Landing	Off-field or emergency landing

On July 11, 2018, about 1920 eastern daylight time, an experimental, amateur-built Glasair SH2, N352GL, was substantially damaged when it was involved in an accident near Passadumkeag, Maine. The commercial pilot was not injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot performed a preflight inspection, noted 19 gallons of fuel on board, and reported that there were no anomalies before takeoff. The pilot climbed the airplane to 1,200 ft mean sea level (msl) and noted that the engine parameters were "normal." About 10 miles southwest of the airport, the engine started to run "rough" and lost partial power. The pilot checked the engine gauges, noted no irregularities, and unsuccessfully attempted to restore engine power by turning the fuel boost pump on. Within about 30 seconds of the initial power loss, the engine lost total power and the propeller stopped turning.

The pilot performed a forced landing to a bog, during which the airplane came to rest inverted and the empennage separated.

Examination revealed that the No. 4 connecting rod exhibited thermal discoloration and impact damage. The No. 4 connecting rod journal was fractured, exhibited thermal discoloration, and rotational scoring. The crankshaft was removed from the engine and was found fractured at the forward section of the No. 4 connecting rod journal. The Nos. 1 and 2 main bearing journals exhibited no anomalies. The No. 3 main bearing journal exhibited rotational scoring and wear. The No. 4 main bearing journal exhibited a small amount of wear on the forward section, but no anomalies were noted. All of the crankshaft oil passages were free of debris. The Nos. 1 and 3 connecting rod journals revealed no anomalies. The No. 2 connecting rod journal exhibited rotational scoring.

The No. 4 cylinder journal had fractured perpendicular to the crankshaft direction, located along the radius at the web forward of the journal. About half of the fracture surface exhibited smearing, consistent with post-fracture damage to the forward surface. The lower half of this fracture surface exhibited crack arrest marks, consistent with progressive crack propagation. The crack initiation site was located on the journal surface, denoted in Figure 1.



Figure 1. Angled view of the aft fracture surface, facing the crack initiation area. Yellow area points to the crack initiation area.

Closer examination of the fracture surface revealed fatigue striations consistent with fatigue crack propagation. These striations were finely spaced and exhibited changing or erratic thicknesses on different areas of the fracture surface, consistent with propagation through high-cycle fatigue. Outside of the fatigue regions, only dimple rupture features were found, consistent with subsequent and final overstress fracture of the crankshaft journal. Examination using a scanning electron microscope found three primary initiation sites, with possible smaller initiation sites collocated in the area. These initiation sites were all located on the fracture surface edge with the journal surface. There were no material features (such as cracks, pores, or voids) located at these initiation sites. However, mechanical defects, such as gouges and streaks, were present at the crack initiation sites. Whether the mechanical damage to the journal surface was entirely present before the crankshaft fracture, or if the damage developed after the final fracture of the part could not be determined.

According to the engine maintenance log, on March 25, 2013, at a tachometer time of 324.4 hours, the "engine experienced a propeller strike during a landing incident. Crankshaft flange dials 0.001 or less. According to FAA Advisory Circular AC 39-7D, 9b prop strike inspection AD 2004-10-14 is not mandatory on a non type certificated (experimental) engine. Although recommended, I have elected not to have the inspection performed and accept all future responsibility related to non-compliance of the airworthiness directive."

Pilot Information

Certificate:	Commercial	Age:	65,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	November 29, 2017
Occupational Pilot:	No	Last Flight Review or Equivalent:	February 1, 2018
Flight Time:	5600 hours (Total, all aircraft), 500 hours (Total, this make and model), 5575 hours (Pilot In Command, all aircraft), 25 hours (Last 90 days, all aircraft), 12.5 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	GLASAIR	Registration:	N352GL
Model/Series:	SH2	Aircraft Category:	Airplane
Year of Manufacture:	1995	Amateur Built:	Yes
Airworthiness Certificate:	Experimental (Special)	Serial Number:	305
Landing Gear Type:	Tailwheel	Seats:	2
Date/Type of Last Inspection:	August 12, 2017 Condition	Certified Max Gross Wt.:	1600 lbs
Time Since Last Inspection:	83 Hrs	Engines:	1 Reciprocating
Airframe Total Time:	692.41 Hrs at time of accident	Engine Manufacturer:	Lycoming
ELT:	C91A installed, activated, did not aid in locating accident	Engine Model/Series:	O-320-E2D
Registered Owner:		Rated Power:	160 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:	MLT,402 ft msl	Distance from Accident Site:	28 Nautical Miles
Observation Time:	18:53 Local	Direction from Accident Site:	349°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	6 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	310°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.01 inches Hg	Temperature/Dew Point:	24°C / 5°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lincoln, ME (LRG)	Type of Flight Plan Filed:	None
Destination:	Lincoln, ME (LRG)	Type of Clearance:	None
Departure Time:	18:55 Local	Type of Airspace:	

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:	45.186389,-68.568885(est)

Administrative Information

Investigator In Charge (IIC):	Kemner, Heidi		
Additional Participating Persons:	Glenn Pieri; FAA/FSDO; Portland, ME		
Original Publish Date:	May 27, 2021	Investigation Class:	3
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=97743		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).