Aviation Investigation Final Report

Location:	Clever, Missouri	**Accident Number:**	CEN17LA110
Date & Time:	February 18, 2017, 16:57 Local	**Registration:**	N6807V
Aircraft:	AEROSTAR ACFT CORP OF TEXAS M20E	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 Serious
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The flight instructor reported that, after takeoff on the instructional flight, the engine was running smoothly before it "missed" or "hesitated." The flight instructor initiated a return to the airport; shortly thereafter, the engine began to make loud noises and vibrate, ultimately experiencing a total loss of power. The flight instructor performed a forced landing to a field, resulting in substantial damage.

Examination of the engine revealed that the No. 2 connecting rod had failed. Remnants of the connecting rod bearing found within the oil pan exhibited evidence of bearing failure and extrusion. Due to the extensive secondary engine damage, the reason for the failure of the No. 2 bearing could not be determined. The engine was overhauled 11 years 6 months before the accident, and had accumulated about 16 hours of flight time in the preceding 3 years. Guidance published by the engine manufacturer stated that abnormal wear could occur during engine start due to a loss of protective oil film after an extended period of inactivity and recommended that all engines not in continuous service be overhauled every 12 years.

Probable Cause and Findings

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

The failure of the engine No. 2 connecting rod bearing for reasons that could not be determined due to the extensive secondary engine damage.

Findings

Aircraft	Recip engine power section - Failure
Not determined	(general) - Unknown/Not determined

Factual Information

History of Flight

Enroute-cruise	Loss of engine power (total) (Defining event)

On February 18, 2017, about 1657 central standard time, an Aerostar model M20E airplane, N6807V, sustained substantial damage during a forced landing following a complete loss of engine power during cruise flight near Clever, Missouri. The pilot and flight instructor received serious injuries. The airplane's fuselage and both wings were damaged. The aircraft was registered to and operated by the pilot under the provisions of 14 *Code of Federal Regulations* Part 91 as an instructional flight. Visual meteorological conditions prevailed for the flight, which was not operated on a flight plan. The local flight originated from the Gimlin Airport (18MO), Ozark, Missouri, about 1650.

The flight instructor reported that he and the pilot departed on an instructional flight to practice instrument approaches. He reported that a complete runup was performed and the flight departed without incident. He reported that the engine was running smooth when it "missed or hesitated." Less than 20 seconds later the engine again missed and they started heading back to 18MO. Before the 180-degree turn was completed, the engine started making loud noises and vibrating. The pilot transferred control of the airplane to the flight instructor. The vibration increased and oil covered the windshield. Ultimately the engine stopped and a forced landing was made to a field. The airplane struck a ditch that was not visible due to the oil covered windshield.

A report of the accident was not received from the pilot.

Examination of the airframeand engine was conducted after its recovery from the accident site. The aft fuselage of the airplane had been cut to facilitate removal from the accident site. The engine was separated from the airframe and was resting on the ground when the examination began. The wings and aft fuselage had impact damage but remained predominately intact. All control surfaces remained attached in their proper locations and no evidence of control system anomalies were found. The electronic engine tachometer reading was 3776.64 hours.

There were cracks in the engine case. The magnetos were removed and they both produced spark when rotated by hand. The engine was completely disassembled and oil was present in the engine. The accessory gears were intact and no anomalies were noted with respect to the accessory section of the engine. The crankshaft and camshaft were intact. During disassembly, it was discovered that the No. 2 connecting rod had failed at the crankshaft end. The connecting rod remained attached to the piston. The piston with the attached portion of the connecting rod could not be removed from the cylinder due to subsequent damage to the cylinder skirt. Remnants of the broken pieces of connecting rod were found in the engine oil pan. Remnants of the No. 2 rod bearing were also found in the oil pan. The portions of rod bearing material found within the oil pan were consistent with bearing failure and extrusion. The No.2 rod bearing journal on the crankshaft had rotational scoring. The other crankshaft bearings exhibited varying wear signatures. The forward and rear main crankshaft bearings had anormal appearance, while the center main bearing exhibited wear through of the outer layer exposing the copper backing. The

No.1 rod bearing exhibited crushing damage and the rod cap was gouged and deformed consistent with impact damage. The bearing outer layer was not worn through. As mentioned previously, remnants of the No. 2 bearing showed evidence of extrusion and failure. The No. 3 rod bearing had its outer layer of material worn through exposing the copper layer underneath. The No. 4 rod bearing had some wear through of the outer layer but had an overall normal appearance. There was one broken valve lifter body for the No. 2 cylinder, but there were impact marks inside the engine case adjacent to the location of the broken lifter. No additional anomalies were observed. Due to the extensive internal engine damage, no evidence of what may have precipitated the failure of the No. 2 bearing could be found.

Review of the airplane maintenance records showed that the engine, a Lycoming IO-360-A1A, serial number L-7199-51A, had last been overhauled on August 20, 2005, and was installed on the airplane at 3344.1 hours recording tachometer time. Based on the logbook entry and the recording tachometer reading at the time of the examination, the engine had accumulated 432.54 hours, in the 11 years and 6 months since the overhaul. According to the aircraft maintenance records, the engine had accumulated the following hours between the annual inspection dates noted:

June 1, 2012 to July 8, 2013 – 45.12 hours

July 8, 2013 to August 18, 2014 – 2.4 hours

August 18, 2014 to August 20, 2015 – 4.28 hours

August 20, 2015 to October 8, 2016 – 9.3 hours

Lycoming Service Instruction No. 1009AZ, detailed the engine manufacturer's recommendation regarding time between overhaul (TBO). The recommended TBO for the accident engine was specified as 2,000 hours. The document stated that the recommendation applied to engines in "continuous service", which meant that the engine would not be out of service for more than 30 consecutive days. The Service Instruction further stated:

"Engine deterioration in the form of corrosion (rust) and the drying out and hardening of composition materials such as gaskets, seals, flexible hoses and fuel pump diaphragms can occur if an engine is out of service for an extended period of time. Due to the loss of a protective oil film after an extended period of inactivity, abnormal wear on soft metal bearing surfaces can occur during engine start. Therefore, all engines that do not accumulate the hourly period of TBO specified in this publication are recommended to be overhauled in the twelfth year."

Pilot Information

Certificate:	Private	**Age:**	71,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	February 3, 2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

Flight instructor Information

Certificate:	Airline transport	**Age:**	55,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Lap only
Instrument Rating(s):	Airplane; Helicopter	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Helicopter; Instrument airplane; Instrument helicopter	**Toxicology Performed:**	No
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	June 28, 2016
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	September 18, 2016
Flight Time:	15000 hours (Total, all aircraft), 700 hours (Total, this make and model), 75 hours (Last 90 days, all aircraft), 0 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	AEROSTAR ACFT CORP OF TEXAS	**Registration:**	N6807V
Model/Series:	M20E NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1971	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	21-0003
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	October 8, 2016 Annual	**Certified Max Gross Wt.:**	2575 lbs
Time Since Last Inspection:	13.14 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3776.64 Hrs at time of accident	**Engine Manufacturer:**	LYCOMING
ELT:	Installed	**Engine Model/Series:**	IO-360-A1A
Registered Owner:		**Rated Power:**	200 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:	KSGF	**Distance from Accident Site:**	15 Nautical Miles
Observation Time:	22:52 Local	**Direction from Accident Site:**	0°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	5 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	220°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.8 inches Hg	**Temperature/Dew Point:**	18°C / 9°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	OZARK, MO (18MO)	**Type of Flight Plan Filed:**	None
Destination:	OZARK, MO (18MO)	**Type of Clearance:**	None
Departure Time:	16:50 Local	**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	2 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Serious	**Latitude, Longitude:**	37.030277,-93.473052

Administrative Information

Investigator In Charge (IIC):	Brannen, John
Additional Participating Persons:	William Taylor; FAA - Kansas City FSDO; Kansas City, MO
Original Publish Date:	September 6, 2017
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=94761