



National Transportation Safety Board Aviation Accident Final Report

Location:	Fredericksburg, PA	Accident Number:	ERA13LA268
Date & Time:	06/01/2013, 0830 EDT	Registration:	N40337
Aircraft:	MAULE M-4-220C	Aircraft Damage:	Substantial
Defining Event:	Loss of engine power (total)	Injuries:	1 Minor, 1 None
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The pilot reported that, while the airplane was in cruise flight, the engine began to vibrate and lose power. The pilot shut down the engine and performed a forced landing to a field. During the landing roll, the airplane nosed over and was substantially damaged.

Examination of the engine revealed that the No. 4 cylinder head was partially separated and that the No. 4 piston pin was fractured. The piston pin fractured due to fatigue that had initiated at the pin's outer diameter, and the fracture corresponded to the location of the pin bearing separation from the connecting rod. The bearing fracture surface was obliterated. It is likely that pin and bearing wear altered the stress distribution and precipitated the failure.

A review of maintenance records revealed that the 41-year-old engine had been operated for about 1,400 total hours since new and about 50 flight hours since its most recent annual inspection, which was performed about 1 year before the accident. In addition, the No. 4 cylinder was overhauled about 23 years and 560 flight hours before the accident. It was also removed, reconditioned, and reinstalled about 4 years and 165 flight hours before the accident.

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 the fatigue failure of the No. 4 cylinder piston pin.

Findings

Aircraft	Recip eng cyl section - Fatigue/wear/corrosion (Cause) Engine (reciprocating) - Not serviced/maintained
-----------------	--

Factual Information

On June 1, 2013, about 0830 eastern daylight time, a Maule M-4-220C, N40337, operated by a private individual, was substantially damaged during a forced landing, after it experienced a total loss of engine power shortly after takeoff from Farmers Pride Airport (9N7), Fredericksburg, Pennsylvania. The airline transport pilot sustained minor injuries and a passenger was not injured. Visual meteorological conditions prevailed and no flight plan had been filed for the flight destined for Baublitz Commercial Airport (9W8), Brogue, Pennsylvania. The personal flight was conducted under the provisions of 14 Code of Federal Regulations Part 91.

The pilot reported that he departed 9N7 and had climbed to an altitude of 2,500 feet mean sea level, when the engine began to vibrate and lose power. In addition, the cabin began to fill with white smoke. The pilot shut-down the engine and performed a forced landing to a soy bean field. During the landing roll, the airplane entered a wheat field and nosed over, which resulted in substantial damage to the fuselage and vertical stabilizer.

The airplane was manufactured in 1972 and equipped with a Franklin 6A-350-C1, 220-horsepower engine. Initial examination of the engine by a Federal Aviation Administration inspector revealed that the No. 4 cylinder head was partially separated from the cylinder barrel, the No. 4 cylinder piston was fragmented, and the No. 4 piston pin was fractured. The No.4 cylinder, connecting rod, fractured piston pin, and piston fragment were forwarded to the NTSB Materials Laboratory, Washington, DC, for further examination.

Examination of the retained engine components by an NTSB metallurgist revealed that the No. 4 piston pin was circumferentially fractured near its midpoint. The connecting rod was not fractured, but the piston pin bearing in the small end was fractured and damaged. The separation surface of the bearing was completely obliterated. When installed, the piston pin fracture corresponded to the separation location of the piston pin bearing in the connecting rod. Additional examination of the piston pin fracture features with a scanning electron microscope revealed striations consistent with fatigue propagation that initiated at the pin outer diameter.

The No. 4 piston fragment which was estimated to comprise about one-third of the piston crown was severely battered. Almost all of the fracture surfaces were obliterated by mechanical damage; however, the few undamaged fracture areas appeared typical of overstress separations. The No. 4 cylinder was fractured through its bore consistent with overstress features on both the aluminum cylinder and steel liner, with no indications of preexisting cracking.

According to maintenance records, the airplane and engine had been operated for about 50 hours since its most recent annual inspection, which was performed on June 27, 2012. The engine had been operated for about 1,400 total hours since new. In addition, the No. 4 cylinder was overhauled during June 1990, about 560 hours prior to the accident, and was also removed, reconditioned, and reinstalled during April 2009, about 165 hours prior to the accident.

History of Flight

Enroute-cruise	Loss of engine power (total) (Defining event)
Emergency descent	Off-field or emergency landing
Landing-landing roll	Nose over/nose down

Pilot Information

Certificate:	Airline Transport	Age:	36
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 1 With Waivers/Limitations	Last Medical Exam:	04/23/2013
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	10/14/2012
Flight Time:	8100 hours (Total, all aircraft), 250 hours (Total, this make and model), 6200 hours (Pilot In Command, all aircraft), 150 hours (Last 90 days, all aircraft), 60 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Manufacturer:	MAULE	Registration:	N40337
Model/Series:	M-4-220C	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	2112C
Landing Gear Type:	Tailwheel	Seats:	4
Date/Type of Last Inspection:	06/27/2012, Annual	Certified Max Gross Wt.:	2300 lbs
Time Since Last Inspection:	47 Hours	Engines:	1 Reciprocating
Airframe Total Time:	1638 Hours	Engine Manufacturer:	FRANKLIN
ELT:	Installed, not activated	Engine Model/Series:	6A-350SER
Registered Owner:	On file	Rated Power:	220 hp
Operator:	On file	Air Carrier Operating Certificate:	None

Meteorological Information and Flight Plan

Observation Facility, Elevation:	MUI, 487 ft msl	Observation Time:	0822 EDT
Distance from Accident Site:	10 Nautical Miles	Condition of Light:	Day
Direction from Accident Site:	280°	Conditions at Accident Site:	Visual Conditions
Lowest Cloud Condition:	Clear	Temperature/Dew Point:	23° C / 19° C
Lowest Ceiling:	None	Visibility	10 Miles
Wind Speed/Gusts, Direction:	Calm	Visibility (RVR):	
Altimeter Setting:	30.03 inches Hg	Visibility (RVV):	
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Fredericksburg, PA (9N7)	Type of Flight Plan Filed:	None
Destination:	BROGUE, PA (9W8)	Type of Clearance:	None
Departure Time:	EDT	Type of Airspace:	Class G

Airport Information

Airport:	Farmers Pride (9N7)	Runway Surface Type:	Grass/turf
Airport Elevation:	495 ft	Runway Surface Condition:	Vegetation
Runway Used:	28	IFR Approach:	None
Runway Length/Width:	3410 ft / 150 ft	VFR Approach/Landing:	Forced Landing

Wreckage and Impact Information

Crew Injuries:	1 Minor	Aircraft Damage:	Substantial
Passenger Injuries:	1 None	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Minor, 1 None		

Administrative Information

Investigator In Charge (IIC):	Luke Schiada	Adopted Date:	08/25/2015
Additional Participating Persons:	Joseph K Hemler, Jr.; FAA/FSDO; Harrisburg, PA		
Publish Date:	08/25/2015		
Note:	The NTSB did not travel to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=87094		

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.