Aviation Investigation Final Report

Location:	Paramus, New Jersey	**Accident Number:**	ERA19LA062
Date & Time:	December 9, 2018, 12:15 Local	**Registration:**	N5756W
Aircraft:	Mooney M20K	**Aircraft Damage:**	Substantial
Defining Event:	Loss of engine power (total)	**Injuries:**	2 Minor, 2 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

During cruise flight, the pilot noticed an increase in cylinder head temperature on two cylinders and unsuccessfully attempted to reduce the temperature. He reported that he soon heard "an explosion" and noted a hole in the engine cowling. He performed a forced landing to a golf course, during which the landing gear collapsed, which resulted in substantial damage to the right wing.

Postaccident examination of the engine revealed that the Nos. 1 and 2 connecting rods exhibited thermal discoloration consistent with a loss of lubrication. Additionally, the breakaway torques measured at 8 of the 12 through-bolts showed that they were below the manufacturer's specifications. The No. 2 main bearing saddles exhibited impingement damage, and the No. 2 bearing was partially rotated clockwise, which blocked the oil passages leading to the connecting rod bearings. The mating surfaces of the main bearing saddles had remnants of silk thread around the through-bolt holes, which was contrary to manufacturer guidance that prohibited placing silk thread in these areas. Given this information, it is likely that maintenance personnel applied silk thread to a prohibited area during an engine overhaul that occurred about 255.8 flight hours before the accident. This resulted in a loss of torque on the crankcase through-bolts, which allowed the No. 2 main bearings to shift, resulting in restriction of lubrication to that area and subsequent engine failure.

Probable Cause and Findings

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

Maintenance personnel's improper assembly of the engine during overhaul, which resulted in lubrication restriction due to a bearing shift and the subsequent engine failure.

Findings

Aircraft	Recip engine power section - Incorrect service/maintenance
Aircraft	Recip engine power section - Failure
Personnel issues	Incorrect action performance - Maintenance personnel

Factual Information

History of Flight

Prior to flight	Aircraft maintenance event
Enroute-cruise	Loss of engine power (total) (Defining event)
Landing-landing roll	Collision with terr/obj (non-CFIT)

On December 9, 2018, about 1215 eastern standard time, a Mooney M20K, N5756W, was substantially damaged during a forced landing near Paramus, New Jersey. The private pilot and a passenger received minor injuries, and two other passengers were not injured. Visual meteorological conditions prevailed, and no flight plan was filed for the cross-country flight, which originated from Lincoln Park Airport (N07), Lincoln Park, New Jersey, about 1200. The personal flight was conducted under the provisions of Title 14 *Code of Federal Regulations* Part 91 and had an intended destination of Hudson Valley Regional Airport (POU), Poughkeepsie, New York.

According to the pilot, while in cruise flight, he noticed an increase in cylinder head temperature on two cylinders. He attempted to reduce the temperatures; however, he soon heard "an explosion," and noted a hole in the engine cowling. The pilot performed a forced landing to a golf course and during the landing roll, the airplane impacted a berm, became airborne again, and struck the ground resulting in the landing gear collapsing and substantial damage to the right wing.

According to Federal Aviation Administration records, the airplane was manufactured in 1984 and was registered to the pilot in November, 2017. It was equipped with a Continental Motors Inc. TSIO-360-LB1, 210-hp, engine. According to the airframe maintenance logbook, the most recent annual inspection was performed on August 15, 2018, at a total time of 2,401.3 hours. According to the engine logbook, the engine was overhauled on January 11, 2016, at a total time of 2,185 hours. At the time of the accident, the Hobbs meter indicated 2,440.8 hours.

The engine was examined at the manufacturer's facility under NTSB supervision. The examination revealed that the engine case was breached over the No. 2 cylinder. The oil sump was removed and metallic debris was noted. The oil filter was removed and disassembled, and metal was noted in the filter. The oil pump was examined and scoring was noted inside the pump housing. The crankcase was split and the No. 1 connecting rod was separated from the crankshaft, and the Nos. 1 and 2 connecting rods exhibited thermal discoloration. Further examination of the mating surfaces of the main bearing saddles had remnants of silk thread around the through-bolt holes (see figure 1).

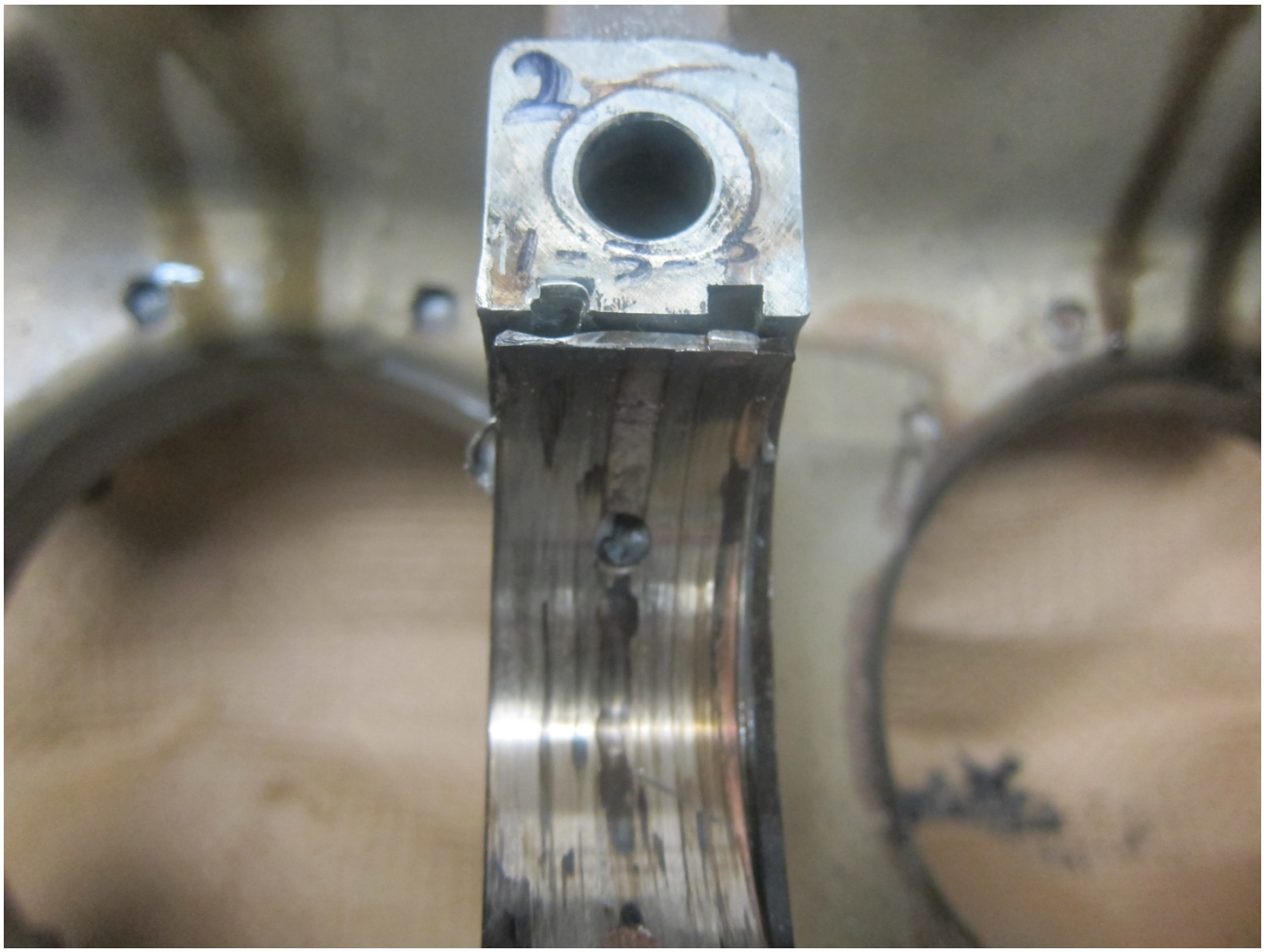

Figure 1. View of No. 2 main bearing saddle and No. 2 main bearing. Note remnants of silk thread.

The break-away torque was measured for the through-bolts on the engine. Eight out of the 12 through bolt torque values were below the manufacturer's recommended torque values as can be seen in the engine teardown report in the public docket associated with this case. The through bolts associated with the Nos. 2 and 3 main bearings and measured between 172 in-lbs and 395 in-lbs, which was below the manufacturer specification of 590-610 in-lbs of torque. The No. 2 main bearing saddles exhibited impingement damage and the No. 2 bearing was partially rotated clockwise, which blocked the oil passage to the connecting rod bearings.

The engine manufacturer published a Service Information Letter (SIL) titled "Sealants, Lubricants, and Adhesives Authorized by CMI" in 1999 (revised September 16, 2014). This guidance, which was applicable at the time of the accident engine's overhaul stated that the when reassembling the crankcase halves, maintenance personnel should *"...apply and position P/N 641543 (a continuous, single piece of grade 'D' silk thread on the 2-4-6 case half as specified (see Figures 5 through 8...). Ensure the free ends of your thread are covered by gaskets (except the nose oil seal)."* Figure 2 below is from the SIL, and shows that the #2 main bearing saddle was one of four "prohibited" areas where silk thread should not be placed.

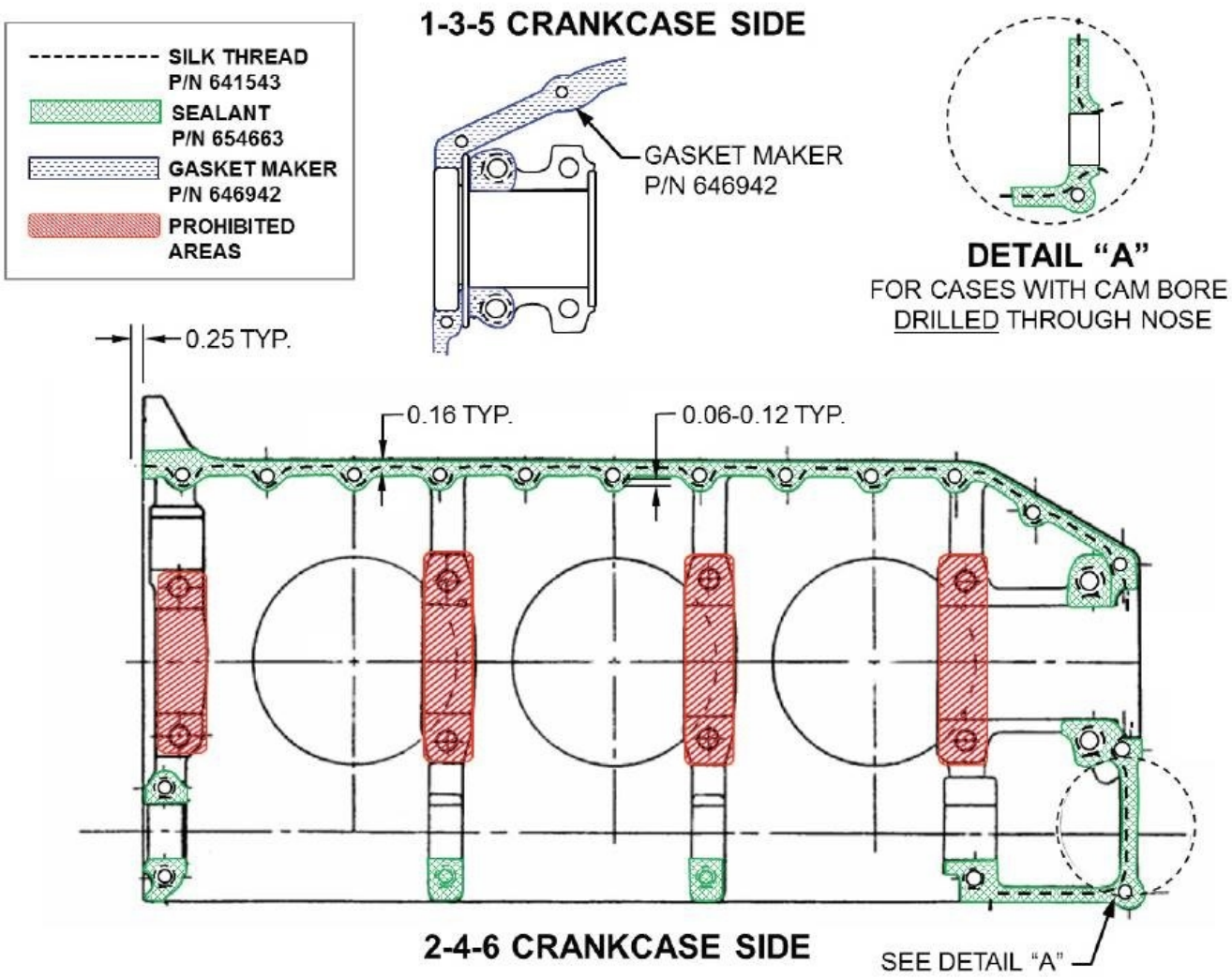

Figure 2 – Areas where silk thread application is prohibited noted in red, which include the No. 2 main bearing saddle.

The Continental Aircraft Engine Maintenance Manual, "Six Cylinder Engine Crankcase Threading," which was released in April 2016, just after the engine overhaul, stated, *"Do not apply any form of sealant to the crankcase cylinder deck, chamfer, cylinder mounting flange, cylinder base O-ring, or cylinder fastener threads. The use of RTV, silicone, Gasket Maker or any other sealant on the areas listed above during engine assembly will cause a loss of cylinder deck stud or through-bolt torque. Subsequent loss of cylinder attachment load, loss of main bearing crush and/or fretting of the crankcase parting surfaces will occur. The result will be cylinder separation, main bearing movement, oil starvation and catastrophic engine failure."*

Pilot Information

Certificate:	Private	**Age:**	53,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
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:**	October 23, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 29, 2018
Flight Time:	916 hours (Total, all aircraft), 114 hours (Total, this make and model), 916 hours (Pilot In Command, all aircraft), 18 hours (Last 90 days, all aircraft), 10 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N5756W
Model/Series:	M20K No Series	**Aircraft Category:**	Airplane
Year of Manufacture:	1984	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	25-0822
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	August 15, 2018 Annual	**Certified Max Gross Wt.:**	3131 lbs
Time Since Last Inspection:	40 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2440.8 Hrs at time of accident	**Engine Manufacturer:**	Continental Motors Inc.
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	TSIO-360-LB1
Registered Owner:		**Rated Power:**	210 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:	TEB,7 ft msl	**Distance from Accident Site:**	6 Nautical Miles
Observation Time:	11:51 Local	**Direction from Accident Site:**	167°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.39 inches Hg	**Temperature/Dew Point:**	1°C / -8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lincoln Park, NJ (N07)	**Type of Flight Plan Filed:**	None
Destination:	Poughkeepsie, NY (POU)	**Type of Clearance:**	None
Departure Time:	12:00 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor, 2 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Minor, 2 None	**Latitude, Longitude:**	40.946388,-74.089721(est)

Administrative Information

Investigator In Charge (IIC):	Kemner, Heidi
Additional Participating Persons:	Christopher LaPenta; FAA/FSDO; Teterboro, NJ Nicole Charnon; Continental Motors Inc.; Mobile, AL
Original Publish Date:	June 29, 2020
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=98746