Aviation Investigation Final Report

Location:	Brandon, Mississippi	**Accident Number:**	MIA04LA127
Date & Time:	September 5, 2004, 14:32 Local	**Registration:**	N9708M
Aircraft:	Mooney M20F	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot stated that he performed a preflight inspection of the airplane and noted the oil capacity was full (8 quarts). Approximately 2 hours into the flight while flying at 10,500 feet, the engine began running rough. He advised air traffic control (ATC), and attempts to correct the rough running engine were unsuccessful. The flight continued and shortly afterwards, the engine developed a severe roughness and he then heard a bang with smoke entering the cockpit. He declared "mayday" with ATC, and requested vectors to the nearest airport. Unable to land there, he executed a forced landing on a nearby highway and collided with a vehicle during the landing roll-out. The No. 3 cylinder was found separated from the crankcase, and all cylinder studs and/or thru-bolts exhibited various forms of fatigue. The No. 3 cylinder connecting rod bolts which were fractured exhibited evidence of either bending or shear overstress. The No. 2 cylinder connecting rod bearing was found welded to the crankpin, and a piece of aluminum lined bearing material was found inside the oil passage of the No. 2 cylinder crankpin journal. Fretting was noted at the No. 3 cylinder contact area, and also at the split-line surface of the right crankcase half at the main bearing locations. The fretting was the greatest at the cylinder contact area between studs Nos. 1 and 2, and also at the split line surface on the right crankcase half at the No. 3 main bearing location. The engine had accumulated 1,390 hours since major overhaul and approximately 873 hours since the No. 3 cylinder was removed and reinstalled.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A loss of engine power due to the fatigue failure of all studs and/or thru-bolts of the No. 3 cylinder for undetermined reasons causing separation of the cylinder. Contributing to the accident was the unsuitable terrain encountered by the pilot.

Findings

Occurrence #1: LOSS OF ENGINE POWER(TOTAL) - MECH FAILURE/MALF
Phase of Operation: CRUISE

Findings
1. (F) ENGINE ASSEMBLY,CYLINDER - FATIGUE
2. ENGINE ASSEMBLY,CYLINDER - SEPARATION

Occurrence #2: FORCED LANDING
Phase of Operation: DESCENT - EMERGENCY

Occurrence #3: ON GROUND/WATER COLLISION WITH OBJECT
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
3. OBJECT - VEHICLE
4. (C) UNSUITABLE TERRAIN OR TAKEOFF/LANDING/TAXI AREA - ENCOUNTERED - PILOT IN COMMAND

Factual Information

On September 5, 2004, about 1432 central daylight time, a Mooney M20F, N9708M, registered to a private individual, experienced a total loss of engine power and collided with a vehicle during a forced landing on a highway near Brandon, Mississippi. Visual meteorological conditions prevailed at the time and a visual flight rules (VFR) flight plan was filed for the 14 CFR Part 91 personal flight from Dekalb-Peachtree Airport, Atlanta, Georgia, to Shreveport Downtown Airport, Shreveport, Louisiana. The airplane was substantially damaged and there were no injuries to the private-rated pilot and two passengers in the airplane, or to the driver of the vehicle. The flight originated about 1310, from Dekalb-Peachtree Airport.

The pilot stated that he performed a preflight inspection of the airplane and noted the oil capacity was full (8 quarts). The flight departed and approximately 2 hours into the flight while flying at 10,500 feet, the engine began running rough. He advised air traffic control (ATC) and attempts to correct the rough running engine were unsuccessful. The flight continued and shortly afterwards, the engine developed a severe roughness and he then heard a bang with smoke entering the cockpit. He declared "mayday" with air traffic control and requested vectors to the nearest airport. Recognizing that he would be unable to reach the Jackson International Airport, he advised ATC of his intention of landing on a nearby highway. After landing on the highway during the landing roll, the left wing of the airplane collided with the left rear portion of a truck. He and his passengers exited the airplane which was later taken to a fixed-base operator (FBO) located on the Jackson International Airport.

Postaccident examination of the engine by an FAA airworthiness inspector revealed the No. 3 cylinder was separated from the engine crankcase; all cylinder studs were fractured. The No. 3 cylinder connecting rod cap was found at the accident site; the connecting rod bearing was missing. Two fractured 7/16 inch cylinder hold down studs with nuts attached, two fractured 5/16 inch cylinder hold down studs with nuts attached, one partial connecting rod bolt with nut, and one hydraulic lifter were found on the bottom engine cowling. Disassembly of the engine revealed that the No. 2 piston and connecting rod exhibited extreme heat discoloration. The No. 2 connecting rod bearing was "welded" to the crankpin journal, and a foreign object was noted in the oil passage at the journal; the foreign object was retained for further examination. Examination of the oil pump revealed the gears were not failed; metal particles were present in the oil pump housing. The right crankcase half which contains cylinder Nos. 1 and 3 was retained for further examination by the NTSB Materials Laboratory, located in Washington D.C.

NTSB examination of the right crankcase half revealed cylinder hold down studs identified for the investigation as Nos. 1 and 8 which were the aft two cylinder hold down studs exhibited fracture features consistent with low-stress, long-term fatigue propagation. The fracture features of studs identified as Nos. 2, 3, 6, and 7, and thru-bolt No. 5 were consistent with rapid, high-stress fatigue propagation. The fracture features of thru-bolt identified as No. 4

was consistent with reverse bending fatigue. Examination of the No. 3 cylinder connecting rod bolt remaining inside the separated connecting rod cap revealed fracture features consistent with shear overstress, while the section of connecting rod bolt which was found at the bottom of the engine cowling exhibited fracture features consistent with bending overstress. The two available connecting rod bolt sections did not appear to mate with each other, and the remaining fracture halves of both bolts were not recovered. The cylinder attachment area for the No. 3 cylinder exhibited a large circular impression which was consistent with impact damage from the piston contacting the crankcase. Some fretting, which appears as a brown stain, was found around most of the contact surface of the No. 3 cylinder contact area, with the most significant fretting between studs Nos. 1 and 2. Additionally, wear lips were observed mostly in the vicinity of the large diameter studs/bolts, with the damage being more severe adjacent to thru-bolts Nos. 4 and 5. Some fretting was also noted at the split-line surface of the right crankcase half at the No. 3 main bearing location, while "...minimal fretting..." was noted at the split-line surface of the right crankcase half at the Nos. 1, 2, and 4 main bearing locations. The object retrieved from the oil passage of the No. 2 crankpin journal was examined and found to be consistent with aluminum lined bearing material.

Review of the maintenance records revealed the engine was overhauled on June 9, 1978; there was no entry in the airframe logbook indicating engine installation following overhaul. On July 22, 1984, the Nos. 2 and 3 cylinders were removed and an oversized thru-bolt was installed at the "center upper thru-bolt" location. The engine had accumulated 1,390 hours (by tachometer time) since overhaul at the time of the failure, and 873.3 hours since the No. 3 cylinder was removed and reinstalled.

The airplane minus the retained components were released to Shaen Phillips of U.S. Aviation Underwriters, Inc., on October 21, 2004. The retained components were also released to Shaen Phillips on May 5, 2005.

Pilot Information

Certificate:	Private	**Age:**	46,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	October 31, 2002
Occupational Pilot:		**Last Flight Review or Equivalent:**	May 1, 2004
Flight Time:	319 hours (Total, all aircraft), 37 hours (Total, this make and model), 265 hours (Pilot In Command, all aircraft), 30 hours (Last 90 days, all aircraft), 4 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N9708M
Model/Series:	M20F	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	670268
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	August 1, 2004 Annual	**Certified Max Gross Wt.:**	2740 lbs
Time Since Last Inspection:	3 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	4020.7 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	Installed, not activated	**Engine Model/Series:**	I0-360-A1A
Registered Owner:	On file	**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:	KJAN,346 ft msl	**Distance from Accident Site:**	
Observation Time:	14:54 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:		**Visibility**	9 miles
Lowest Ceiling:	Broken / 4700 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	310°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.93 inches Hg	**Temperature/Dew Point:**	31°C / 20°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Atlanta, GA (KPDK)	**Type of Flight Plan Filed:**	VFR
Destination:	Shreveport, LA (KDTN)	**Type of Clearance:**	VFR
Departure Time:	13:10 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 None	**Latitude, Longitude:**	32.357223,-90.013053

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	Melvin R Athey; FAA; Jackson, MS
Original Publish Date:	September 13, 2005
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=60164