Aviation Investigation Final Report

Location:	SAN ANGELO, Texas	**Accident Number:**	FTW99LA027
Date & Time:	November 16, 1998, 18:45 Local	**Registration:**	N201QK
Aircraft:	Mooney M20J	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airplane was en route cruising at 9,500 feet msl approximately 12 miles east of its destination, when the pilot reported a loss of engine power. At 2,200 feet msl, the pilot reported that he would not make the runway. During the off airport landing, the airplane struck a tree, the right wing separated from the airframe, the airplane descended into the water, and came to rest inverted in water 7 feet deep. Examination of the wreckage revealed engine oil in the single drive dual magneto and one of the rear case bearing retaining plate screws was broken. The magneto was removed from the engine and disassembled. A metallurgist found that screw failure was a result of delayed fracture from hydrogen embrittlement and the 'hydrogen was most likely picked up during the cadmium plating for corrosion resistance at original manufacture of the screw.' The magneto had accumulated 775.58 hours since last overhaul in 1993. At the last annual inspection, November 1998, the magneto points and timing were checked. Time since that annual inspection was 3.27 hours. Service Bulletin (SB) 643 dated 02/08/94 recommended magnetos be 'overhauled or replaced at the expiration of four years without regard to the accumulated operating hours since new or last overhaul.' No evidence was found that the SB had been accomplished; however, under 14 CFR Part 91 operations, compliance with the SB is not required.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The total loss of engine power due to the magneto failure resulting from oil contamination when the bearing plate retainer screw fractured due to improper manufacturing. Factors were the lack of suitable terrain for the forced landing, and the dark night conditions.

Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: CRUISE

Findings
1. IGNITION SYSTEM,MAGNETO - FAILURE,TOTAL
2. IGNITION SYSTEM,MAGNETO - CONTAMINATION,OTHER THAN WATER
3. (C) MISCELLANEOUS,BOLT/NUT/FASTENER/CLAMP/SPRING - FRACTURED
4. (C) MATERIAL INADEQUATE,IMPROPER - MANUFACTURER

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

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: DESCENT - EMERGENCY

Findings
5. OBJECT - TREE(S)
6. (F) LIGHT CONDITION - DARK NIGHT

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
7. TERRAIN CONDITION - WATER

Factual Information

On November 16, 1998, at 1845 central standard time, a Mooney M20J airplane, N201QK, impacted trees and water, during a forced landing following a loss of engine power near San Angelo, Texas. The airplane was owned and operated by a private individual under 14 Code of Federal Regulations (CFR) Part 91. The private pilot received minor injuries and the airplane sustained substantial damage. Visual meteorological conditions prevailed for the personal dark night cross country flight which departed Levelland, Texas, at approximately 1730, with a planned destination of San Antonio, Texas. The pilot received VFR flight following from the Midland Air Traffic Control facility.

During personal telephone interviews, conducted by the investigator-in-charge (IIC), with local authorities, air traffic control personnel, the FAA inspector, and the pilot, the following information was revealed. The airplane was en route cruising at 9,500 feet msl approximately 12 miles east of San Angelo at 1841, when the pilot reported a loss of engine power. The pilot requested and received vectors to the San Angelo Mathis Field Airport (elevation 1916 feet). The pilot was given a heading of 280 degrees, an altimeter setting of 29.90, and cleared for the straight in approach to runway 27. A helicopter pilot kept the Mooney in sight as the flight tracked toward the runway. The Mooney was 8 miles east of the airport at 5,100 feet msl when the runway 27 lights were turned to full bright. Subsequently, the pilot reported the airport in sight and continued toward the runway. When the airplane was at 2,200 feet msl, the pilot reported that he would not make the runway. During the off airport landing, the airplane struck a tree, separating a wing from the airframe. The airplane descended into the tributary waters of Lake Nasworthy approximately 3/4 mile short of runway 27. The airplane came to rest inverted where the water depth was 7 feet. The pilot released his restraint system, exited the airplane through the cockpit door, and was rescued by boat.

A review of the pilot logbook and the FAA records revealed that the private pilot held airplane single engine land and instrument ratings. He was issued a third class medical certificate on March 6, 1997. The pilot first flew the Mooney M20J on March 14, 1997. On the Pilot/Operator Aircraft Accident Report (NTSB Form 6120.1/2) the pilot reported a total flight time of 385 hours of which 310 hours were in N201QK.

The FAA inspector responding to the site reported that the airplane traveled approximately 100 feet at tree top level before descending into the water. The right aileron and right outboard wing tip were found lodged in a tree approximately 30 feet from the water. Upon removal of the aircraft from the water, the FAA inspector found that the right wing was separated near the inboard end of the aileron. The tachometer reading was 3,931.65 hours. Mixture, throttle, and propeller controls were full forward at the cockpit quadrant. The fuel selector was on the left tank and approximately 18 gallons of fuel was drained from the left fuel tank. Fuel was found in the engine supply line. The left fuel tank screen was clean. Flight control continuity was

confirmed. The gear and flaps were in the retracted position.

The pilot reported to the FAA inspector that following the last annual inspection, he noticed a change in the normal operating cylinder head temperature and exhaust gas temperature. He further stated that at 9,500 feet msl the tachometer was indicting 2,500 rpm and "just before the engine failed the engine was running smoothly then began to pop or backfire." The tachometer then indicated 1,200 to 1,500 rpm. Prior to the departure from Levelland, there were no discrepancies noted by the pilot.

A review of the maintenance records by the FAA inspector, a NTSB investigator, and the IIC, revealed that the engine, a Lycoming IO-360-A1B6D, S/N L-22279-51A, was installed on the airplane on December 16, 1993, at a tachometer time 3,156.07, following a major overhaul by Lycoming. The major overhaul maintenance entry on November 5, 1993, stated that "All accessories as part of the type certificate are either new or newly overhauled."

At the time of the accident, the total time on the engine was 4,836.98 hours with 775.58 hours since the major overhaul. On October 8, 1997, at tachometer time 3,745.4 hours, Airworthiness Directive (AD) 78-09-07 was complied with on the Bendix D4LN-3000 dual magneto, S/N 3050584, by inspection of the impulse coupling. A maintenance entry related to the magneto, dated November 13, 1998, at the last annual inspection at tachometer 3,928.38, stated "checked mag[neto] points and mag[neto] timing." Time in service since that annual inspection was 3.27 hours.

Teledyne Continental (formerly Bendix) recommends in Service Bulletin SB643, issued February 8, 1994, that magnetos "must be overhauled or replaced at the expiration of four years without regard to the accumulated operating hours since new or last overhaul." There was no evidence found that the SB had been accomplished; however, under 14 Code of Federal Regulations Part 91 operations, compliance with the Service Bulletin is not required.

A mechanic at the recovery facility reported that when the magneto's distributor cap was removed during engine preservation (authorized by the IIC), approximately 12 ounces of engine oil drained from the magneto.

During an NTSB investigator's examination of the engine, the magneto was removed from the engine. The head and about 2/3rds of the shank of one of the four screws (P/N 10-382789) that retain the bearing, fell out of the rear case of the magneto.

When the propeller was hand rotated with the magneto distributor cap removed, the magneto points were not opening. The plastic cam followers of both contact assemblies (P/N 10-382585) were melted where they rested against the cam. The point gaps were reset, and the magneto was re-installed on the engine. The engine was then started and run for approximately 20 minutes. Operation of the left side of the dual magneto was intermittent.

The magneto was removed from the engine and disassembled. The lower 1/3 of the shank of

the broken screw was found still screwed into the bearing retaining plate (P/N 10-382787). The plate was wet with oil in the vicinity of the broken screw.

The bearing retaining screws and the plate from the magneto were forwarded to the NTSB Materials Laboratory for further examination. The NTSB Metallurgist found that all 4 screws had been threaded into the retainer, about 5 threads. The fracture location of the broken screw was generally in the thread root above the last thread in the retainer plate. Micro-hardness measurements were performed on the tail section of the fractured screw and on longitudinal sections through the other three screws. The hardness data for the fracture screw indicated a numerical average (HRC) of 45.4. HRC 45 equates to an approximate ultimate tensile strength of 211,000 psi. According to the metallurgist, socket head cap screws are typically manufactured from carbon steels heat treated to 160,000 psi minimum (HRC 36). See the enclosed metallurgical report for additional details.

The airplane was released to the owner.

Pilot Information

Certificate:	Private	**Age:**	40,Male
Airplane Rating(s):	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 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	March 6, 1997
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	385 hours (Total, all aircraft), 310 hours (Total, this make and model), 314 hours (Pilot In Command, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N201QK
Model/Series:	M20J M20J	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	24-0290
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	November 13, 1998 Annual	**Certified Max Gross Wt.:**	2740 lbs
Time Since Last Inspection:	3 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3932 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed	**Engine Model/Series:**	IO-360-A1B6D
Registered Owner:	KENNETH E. SHIPLEY	**Rated Power:**	200 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:	SHIPLEY BROTHERS, INC.	**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	SJT ,1916 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	18:54 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	0°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	17°C / 9°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	LEVELLAND , TX (Q24)	**Type of Flight Plan Filed:**	None
Destination:	(SJT)	**Type of Clearance:**	VFR
Departure Time:	17:30 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	MATHIS FIELD SJT	**Runway Surface Type:**	Asphalt
Airport Elevation:	1916 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	27	**IFR Approach:**	
Runway Length/Width:	4401 ft / 75 ft	**VFR Approach/Landing:**	Forced landing;Straight-in

Wreckage and Impact Information

Crew Injuries:	1 Minor	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor	**Latitude, Longitude:**	31.610733,-100.549987(est)

Administrative Information

Investigator In Charge (IIC):	Roach, Joyce
Additional Participating Persons:	ED TRAYHAN; SAN ANTONIO , TX
Original Publish Date:	September 28, 1999
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=45294