Aviation Investigation Final Report

Location:	BROOMFIELD, Colorado	**Accident Number:**	FTW94FA141
Date & Time:	May 1, 1994, 12:20 Local	**Registration:**	N1905Y
Aircraft:	MOONEY M20E	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

SHORTLY AFTER TAKEOFF, THE PILOT REQUESTED CLEARANCE TO RETURN FOR AN IMMEDIATE LANDING. A WITNESS SAID THAT HE HEARD A METALLIC NOISE FROM THE PLANE AS IT PASSED OVERHEAD. HE SAID THE PILOT MADE A STEEP RIGHT BANK TO LAND ON RUNWAY 29L; HOWEVER, THE PLANE IMPACTED BETWEEN THE PARALLEL RUNWAYS. AN EXAM OF THE ENGINE REVEALED 2 FINGER-TIGHT CYLINDER BASE NUTS & UNDERTORQUED BASE NUTS & CRANKCASE THROUGH-NUTS. A TEARDOWN REVEALED THE CRANKSHAFT HAD FAILED FROM FATIGUE BETWEEN THE #3 & #4 CONNECTING ROD JOURNALS. A METALLURGICAL EXAM OF THE CRANKSHAFT REVEALED HIGH LOCALIZED STRESS-INDUCED FATIGUE CRACKS. THE ENGINE HAD ACCUMULATED 266 HRS OF FLIGHT TIME SINCE MAJOR OVERHAUL ON 1/11/91. THE PLANE HAD BEEN MODIFIED WITH 2 STC'S, 1 FOR INSTALLATION OF A RAYJAY TURBOCHARGER, ANOTHER FOR INSTALLATION OF A 'BLACKMAC' PROPELLER. THE HOLDER OF THE PROPELLER STC REPORTED THE COMPANY WOULD NOT HAVE INSTALLED THE PROPELLER ON A TURBOCHARGED ENGINE, SINCE CERTIFICATION VIBRATORY TESTS WERE ONLY MADE ON NORMALLY ASPIRATED ENGINES. AFTER INSTALLATION ON 1/17/91, THE PROPELLER WAS REMOVED ON 3/19/91 FOR STATIC BALANCE & 'RE-INDEX PROP #1 BLADE 180 DEGREES;' ON 3/28/91, IT WAS REMOVED FOR A BLADE ANGLE CHECK; AND ON 5/23/91, IT RECEIVED A DYNAMIC BALANCE.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: FATIGUE FAILURE OF THE ENGINE CRANKSHAFT; AND FAILURE OF THE PILOT TO MAINTAIN ADEQUATE AIRSPEED, WHILE MANEUVERING TO LAND, WHICH RESULTED IN A STALL AND COLLISION WITH THE TERRAIN. FACTORS RELATED TO THE ACCIDENT WERE: THE

UNDESIRABLE ENGINE/PROPELLER VIBRATION, AND THE LOOSE CRANKCASE AND CYLINDER BASE NUTS.

Findings

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

Findings
1. MAINTENANCE,MODIFICATION - PERFORMED
2. (F) MISCELLANEOUS,ENGINE - VIBRATION
3. (F) PROPELLER SYSTEM/ACCESSORIES - VIBRATION
4. (F) MISCELLANEOUS,BOLT/NUT/FASTENER/CLAMP/SPRING - LOOSE
5. (C) ENGINE ASSEMBLY,CRANKSHAFT - FATIGUE

Occurrence #2: FORCED LANDING
Phase of Operation: MANEUVERING - TURN TO LANDING AREA (EMERGENCY)

Occurrence #3: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: MANEUVERING - TURN TO LANDING AREA (EMERGENCY)

Findings
6. (C) AIRSPEED - INADEQUATE - PILOT IN COMMAND
7. (C) STALL/SPIN - INADVERTENT - PILOT IN COMMAND

Occurrence #4: IN FLIGHT COLLISION WITH TERRAIN/WATER
Phase of Operation: MANEUVERING - TURN TO LANDING AREA (EMERGENCY)

Factual Information

HISTORY OF FLIGHT

On May 1, 1994, at 1220 mountain daylight time, N1905Y, a Mooney M20E, was destroyed during a forced landing in Broomfield, Colorado. The private pilot and passenger were fatally injured. Visual meteorological conditions prevailed.

Shortly after taking off from runway 11L at the Jefferson County Airport, the pilot requested clearance to make an immediate landing; he did not indicate the nature of his emergency. A witness said he heard a loud metallic noise coming from the engine as the airplane passed overhead. He said the pilot made a steep right bank in an attempt to land on runway 29L and impacted terrain.

WRECKAGE AND IMPACT INFORMATION

A ground scar was located abeam the 2,000 foot distance-to-go marker of runway 11L, between runways 11L and 11R. Just beyond this scar was a 60 foot gouge in the earth, aligned on a magnetic heading 250 degrees. At the end of this gouge was a 40 foot wide and 10 foot deep ravine. The airplane was found on the bank of the ravine on a magnetic heading of 080 degrees.

The propeller assembly remained attached to the engine but one blade was broken off. All three blades exhibited chordwise scratches on the cambered surfaces and were S-curled midspan. The empennage was severed just aft of the baggage compartment. The left wing remained attached to the fuselage but had a circumferential crack at the inboard aileron hinge point. The flap was broken off. The right wing lay next to the fuselage but was twisted 180 degrees.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was conducted by the Jefferson County Coroner's Office, Golden, Colorado. In addition, FAA's Civil Aeromedical Institute (CAMI) conducted a toxicology screen. Trace amounts of pseudoephedrine was detected in blood and urine, and guaiphenesin was detected in urine. Acetaminophen was detected in blood (6.900 ug/ml, ug/g) and urine (152.600 ug/ml. ug/g). According to a CAMI toxicologist, acetaminophen is found to Tylenol; pseudoephedrine is a decongestant, and guaiphenesin is an expectorant. On his most recent medical examination dated October 13, 1993, the pilot indicated he was taking medications that included acetaminophen and pseudoephedrine. The toxicologist was unable to say definitively whether any of these medications, either taken singularly or together, may have been contributory to the accident.

TESTS AND RESEARCH

Engine disassembly revealed the crankshaft had failed at the crankcheek between numbers 3 and 4 connecting rod journals. The number 4 cylinder lower right base nut and the number 3 cylinder upper left base nut were finger tight. The upper right base nuts on numbers 2 and 4 cylinders broke free approximately 400 inch-pounds. The number 1 cylinder lower right and left base nuts and the number 3 cylinder lower right base nut loosened at less than 500 inch-pounds. All other base nuts loosened at less than 350 inch-pounds. Metal shavings were found inside the left magneto mounting on the accessory case, on the oil suction screen, and in the oil sump. There were two breaks on the bottom of the crankcase below the numbers 3 and 4 cylinders. The engine received a major overhaul on January 11, 1991. Total engine time was 4,412 hours: 266 hours since major overhaul and 11 hours since a 100-hour inspection.

The crankshaft was sent to NTSB's metallurgical laboratory for analysis. According to its report, the crankshaft failed as the result of "fatigue cracking that originated from the radius on the aft end on the number 3 connecting rod journal and propagated through most of the crankcheek before final separation." There was "no evidence of metallurgical or manufacturing defects" in the crankshaft.

The airplane had been modified by two Supplemental Type Certificates (STCs). The engine was equipped with a Rayjay turbocharger (SE32WE) and a McCauley "BlackMac" 3-blade propeller (SA704NE). According to a spokesman for U.S. Propeller Service in East Haddon, Connecticut, holder of STC SA704NE, the company will not install the "BlackMac" propeller on an airplane with a turbocharged engine because certification vibratory tests were made on normally aspirated engines only. No data exists for turbocharged engines.

Maintenance records indicate that after its installation on January 17, 1991, the propeller was removed on March 28, 1991, "for blade angle check," and on March 19, 1991, for "static balance" and "re-index prop #1 blade 180 degrees." On May 23, 1991, the propeller received a "dynamic balance --- before .55 IPS, after .1 IPS."

ADDITIONAL INFORMATION

The wreckage was released to the owner's representative on May 3, 1994. The crankshaft was released on August 15, 1994.

Pilot Information

Certificate:	Private	**Age:**	42,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:**	Yes
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	October 13, 1993
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	560 hours (Total, all aircraft), 347 hours (Total, this make and model), 502 hours (Pilot In Command, all aircraft), 10 hours (Last 90 days, all aircraft), 9 hours (Last 30 days, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	MOONEY	**Registration:**	N1905Y
Model/Series:	M20E M20E	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	288
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	March 25, 1994 100 hour	**Certified Max Gross Wt.:**	2575 lbs
Time Since Last Inspection:	11 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	4412 Hrs	**Engine Manufacturer:**	LYCOMING
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-360-A1A
Registered Owner:	VERBOSH, GEORGE M.	**Rated Power:**	200 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	BJC ,5671 ft msl	**Distance from Accident Site:**	
Observation Time:	12:29 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Scattered / 7000 ft AGL	**Visibility**	60 miles
Lowest Ceiling:	Broken / 20000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	14°C / -1°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	(BJC)	**Type of Flight Plan Filed:**	None
Destination:	(BJC)	**Type of Clearance:**	VFR
Departure Time:	12:18 Local	**Type of Airspace:**	Class D

Airport Information

Airport:	JEFFERSON COUNTY BJC	**Runway Surface Type:**	Asphalt
Airport Elevation:	5657 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	29L	**IFR Approach:**	
Runway Length/Width:	7000 ft / 75 ft	**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	39.890476,-105.109741(est)

Administrative Information

Investigator In Charge (IIC):	Scott, Arnold
Additional Participating Persons:	ROBERT C BUNDERSON; DENVER , CO
Original Publish Date:	July 31, 1995
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=18894