Aviation Investigation Final Report

Location:	ST. CLOUD, Florida	**Accident Number:**	MIA99LA091
Date & Time:	February 25, 1999, 10:08 Local	**Registration:**	N4671H
Aircraft:	Mooney M20J	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	3 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

While descending, the pilot noted a slight vibration when the throttle only was reduced. He then felt a jolt and the windscreen became covered with oil. He reduced the throttle to idle, initiated a descent for a forced landing in a field, and while descending, the left wing collided with a tree. The airplane then touched down gear up in the field, bounced, and came to rest upright. Post accident examination revealed the No. 1 propeller blade was fractured with only a segment of that blade inside the propeller hub. The No. 2 propeller blade outer bearing race was cracked, and fretting was noted on the face of the propeller hub. Metallurgical examination of the fractured propeller blade revealed evidence of fatigue with no evidence of corrosion or mechanical damage. The No. 2 propeller blade outer bearing race was cracked due to overstrees. Examination of the propeller hub revealed severe fretting inboard of the attach bolts and evidence of gouging on the pilot bore. Review of the maintenance records revealed that the propeller was last installed July 15, 1997; and had accumulated 150.81 hours since last installation at the time of the propeller blade fracture.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The improper installation of the propeller by maintenance personnel resulting in fretting of the face of the propeller hub and fatigue failure of the No. 1 propeller blade. Also, the unsuitable terrain encountered during the descent for the forced landing.

Findings

Occurrence #1: AIRFRAME/COMPONENT/SYSTEM FAILURE/MALFUNCTION
Phase of Operation: DESCENT

Findings
1. (C) PROPELLER SYSTEM/ACCESSORIES,HUB - LOOSE
2. (C) MAINTENANCE,INSTALLATION - IMPROPER - OTHER MAINTENANCE PERSONNEL
3. (C) PROPELLER SYSTEM/ACCESSORIES,BLADE - FATIGUE
4. (C) PROPELLER SYSTEM/ACCESSORIES,BLADE - SEPARATION

Occurrence #2: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: EMERGENCY DESCENT/LANDING

Findings
5. OBJECT - TREE(S)
6. (C) UNSUITABLE TERRAIN OR TAKEOFF/LANDING/TAXI AREA - ENCOUNTERED - PILOT IN COMMAND

Factual Information

On February 25, 1999, about 1008 eastern standard time, a Mooney M20J, N4671H, registered to Trophy 212 Inc., collided with trees while descending for a forced landing to a field near St. Cloud, Florida. Visual meteorological conditions prevailed at the time and no flight plan was filed for the 14 CFR Part 91 personal flight. The airplane was substantially damaged and there were no reported injuries to the private-rated pilot or two passengers. The flight originated about 33 minutes earlier from the St. Lucie County International Airport, Fort Pierce, Florida.

The pilot stated that while descending through 2,800 feet, he noted a slight vibration when the throttle only was reduced. He then felt a jolt and the windscreen was covered with oil. He reduced the throttle to idle and initiated a descent for a forced landing. While descending about 25 feet agl, the left wing of the airplane collided with a tree. The airplane then touched down with the gear retracted, bounced, and came to rest upright.

Examination of the airplane by an FAA airworthiness inspector revealed that one of the two propeller blades was fractured with only a segment of the butt end of the blade remaining inside the propeller hub. A crack in the radius of the crankshaft flange which extended approximately 30 percent circumferentially was noted adjacent to the missing propeller blade. Engine oil was noted on the windshield and portion of the fuselage. The alternator, starter, exhaust system, and air induction system were separated. The engine mount was broken and one of the lord mounts was split. The engine was noted to be shifted aft and the front portion of the engine was contacting the ground with the bottom rear portion of the engine nearly contacting the firewall. The landing gear and flaps were determined to be retracted and damage to the leading edge of the left wing due to contact with a tree was noted 2 feet inboard from the wing tip. Examination of the cockpit revealed that the compass was broken from its mount location as was the column mounted GPS. A placard required by the Type Certificate data sheet pertaining to engine rpm was installed beneath the electronic tachometer. The engine and propeller assembly were recovered for further examination.

Examination of the propeller assembly while installed on the engine revealed five balance washers attached to the propeller spinner bulkhead. The propeller spinner and propeller spinner bulkhead were noted to be almost completely separated from the propeller. The propeller was removed from the engine and during removal, the torque on the attach bolts was noted to be "light." The bolts were properly safety wired and each had one washer under the bolt. The roll pins were determined to be in good condition. Visual examination of the propeller hub revealed no evidence of cracks. Evidence at the bolt holes was the indication that the propeller came in contact with the elevated sleeves at one time. The propeller was retained for further examination.

Examination of the detached propeller assembly revealed that the No. 2 propeller blade was

not bent but did exhibit scratches at the leading edge of the blade near the propeller hub. The No. 2 propeller blade was dye penetrant inspected; no cracks were detected. The No. 1 propeller blade was fractured and separated; with only a segment remaining inside the propeller hub. Fretting was noted on the face of the propeller hub and mechanical damage was noted aft of the o-ring to the inside surface of the pilot bore of the propeller hub. Two slivers of aluminum were found inside the pilot bore. Five washers associated with static balancing were noted adjacent to the No. 2 propeller blade. Disassembly of the propeller revealed that the No. 1 propeller blade phoenolic actuating pin link was broken; the actuating pin was not broken. The No. 2 propeller blade outer bearing race which was determined to be cracked, the two segments of the No. 1 propeller blade that were retained in the propeller hub, and the propeller hub were submitted to the NTSB Materials Laboratory located in Washington, D.C., for metallurgical examination. A copy of the report from the propeller manufacturer is an attachment to this report.

Metallurgical examination of the two segments of the No. 1 propeller blade revealed that the blade was fractured through the relief radius just outboard of the blade retainer shelf. Three fatigue origin areas were detected each with its own area of propagation on the fracture. No mechanical or corrosion damage was noted in the radius at any of the origin areas. The three fatigue regions accounted for more than 60 percent of the fracture surface and the remaining fracture surface consisted of bending overstress stemming from the fatigue regions. Hardness tests and electrical conductivity measurements on the outer diameter were consistent with the specified heat treatment condition. Examination of the No. 2 outer bearing race revealed the fracture features were typical of an overstress separation. A copy of the report is an attachment to this report.

Metallurgical examination of the propeller hub revealed light fretting over large areas of the face of the hub with severe fretting noted in the areas inboard of the bolts. Severe mechanical damage to the pilot hole bore was noted along with linear gouges and plastic deformation around slightly less than half of the perimeter of the hole. The damaged arc was located on the No. 2 propeller blade side of the bore and raised lips on the forward edges of the gouges were noted. The gouges were angled across the pilot bore between 10-15 degrees from vertical with the propeller hub face positioned in a normally installed position parallel to the engine crankshaft flange.

Review of the maintenance records revealed the first entry pertaining to a production test flight was dated May 7, 1979. An entry dated September 5, 1980, indicates that a factory new propeller was installed; the airplane had accumulated 278 hours total time at that time. The propeller was overhauled on December 23, 1986, resealed only on September 14, 1988, and on March 13, 1990, the seals were replaced to correct grease leakage. The final work performed to the propeller was accomplished on July 9, 1997, in which the serviceable tag indicates "reseal only." The propeller was approved for return to service that same day. The entry in the aircraft logbook dated July 15, 1997, indicates "removed & reinstalled propeller after resealing from El Paso Propeller Test ran leak check ok (yellow tag in engine logbook)" The entry was signed and listed an A&P certificate number 450135494. There was no other entry in the

maintenance records pertaining to the propeller. The propeller had accumulated 150.81 hours since last installed at the time of failure.

The airplane minus the retained propeller hub, the two pieces of the No. 1 propeller blade, the cracked outer bearing race from the No. 2 propeller blade, two each aircraft logbooks, one each engine logbook, propeller yellow tags, and other maintenance records was released to Stephen W. Pulak, Insurance Adjuster for Sample International, Inc., on September 21, 1999. The retained components and records were released to Faith A. Collins, President of Sample International, Inc., on October 1, 1999.

Pilot Information

Certificate:	Private	**Age:**	72,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:**	January 23, 1998
Occupational Pilot:	UNK	**Last Flight Review or Equivalent:**	
Flight Time:	2500 hours (Total, all aircraft), 350 hours (Total, this make and model), 2400 hours (Pilot In Command, all aircraft), 25 hours (Last 90 days, all aircraft), 10 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N4671H
Model/Series:	M20J M20J	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	24-0806
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	September 8, 1998 Annual	**Certified Max Gross Wt.:**	2740 lbs
Time Since Last Inspection:	69 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2379 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed	**Engine Model/Series:**	IO-360-A3B6D
Registered Owner:	TROPHY 212 INC.	**Rated Power:**	200 Horsepower
Operator:	ROBERT M. HILL JR.	**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:	MCO ,96 ft msl	**Distance from Accident Site:**	20 Nautical Miles
Observation Time:	09:53 Local	**Direction from Accident Site:**	348°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	10°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	17°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	FORT PIERCE , FL (FPR)	**Type of Flight Plan Filed:**	None
Destination:	KISSIMMEE , FL (ISM)	**Type of Clearance:**	None
Departure Time:	09:35 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	KISSIMMEE MUNICIPAL ISM	**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

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:**	28.240962,-81.27935(est)

Administrative Information

Investigator In Charge (IIC):	Monville, Timothy
Additional Participating Persons:	BOB CUNNINGHAM; ORLANDO , FL THOMAS M KNOPP; VANDALIA , OH
Original Publish Date:	December 4, 2000
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=45829