Aviation Investigation Final Report

Location:	RALEIGH-DURHAM, North Carolina	**Accident Number:**	MIA98FA045
Date & Time:	December 24, 1997, 20:08 Local	**Registration:**	N12172
Aircraft:	Cessna 172M	**Aircraft Damage:**	Destroyed
Defining Event:		**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The single piloted Cessna 172, (N12172) launched into 400 feet overcast, 6 miles visibility in light rain and fog weather conditions, at night, and when queried by the Raleigh-Durham departure controller what his heading was, he responded, '172 has got uh a vacuum problem'. Contrary to departure instructions to commence a right turn after take-off, N12172 entered a left turn after take-off that continued for 2 1/2 minutes until ground impact about 1.3 miles northwest of the airport.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Was loss of control of the airplane on initial climb after entering instrument flight conditions resulting in a turn opposite in direction from that given by ATC, and eventual collision with terrain.

Findings

Occurrence #1: LOSS OF CONTROL - IN FLIGHT
Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings
1. (C) REASON FOR OCCURRENCE UNDETERMINED - PILOT IN COMMAND

Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER

Phase of Operation: DESCENT - UNCONTROLLED

Findings
2. LIGHT CONDITION - DARK NIGHT
3. WEATHER CONDITION - LOW CEILING
4. TERRAIN CONDITION - WET

Factual Information

HISTORY OF FLIGHT

On December 24, 1997, about 2008 eastern standard time, a Cessna 172M, N12172, registered to a private individual, operating as a 14 CFR Part 91 personal flight, crashed shortly after takeoff from Raleigh-Durham International Airport, Raleigh-Durham, North Carolina. Instrument meteorological conditions prevailed and an IFR flight plan was filed. The aircraft was destroyed, and the instrument rated private pilot sustained fatal injuries. The flight departed 2 1/2 minutes before the accident.

The pilot used N12172 to commute to his hospital emergency room practice in Florence, S. C., from his home in Ahoskie, N. C. The pilot and N12172 arrived at the Raleigh-Durham Airport on December 19, 1997, and N12172 was parked until December 24, 1997, on the ramp of Piedmont Aviation, a local FBO. During that time the pilot and his family flew commercially to Denver for a vacation. On the day of the accident, the pilot and family had returned to Raleigh-Durham, where the family drove home, and the pilot planned to fly N12172 to his work in Florence.

According to taped conversations between a person identifying himself as the pilot of N12172 and Raleigh-Durham AFSS, for the time frame planned for his flight, a cold front was moving through the area. A low pressure area was centered west of the Carolinas, "pushing to the east" and a high pressure area prevailed to the northeast of the Piedmont area with clearing not forecast until about 0800 the next morning. The observed and forecast weather along his intended route, in general, was; ceilings between 200 and 1200 agl, reduced visibility in rain, mist, fog, and an occasional thunderstorm. En-route winds at the requested altitude, 6,000 feet, were 190 degrees at 32 to 34 knots, and level 3 precipitation could be expected nearer Florence.

A person identified as the pilot of N12172 received five weather briefings from the Raleigh-Durham Automated Flight Service Station for an IFR flight: one at 1709 where he says, "I'm not gonna file IFR, I'm gonna check again", another at 1806, where he suggests that he will get a new forecast at 7 P.M., a third at 1904 where he says, "thank you sir, I'll think this over a minute", a fourth at 1915 where he files his IFR flight plan to Florence, and the final brief at 1939. When the AFSS briefer queries the pilot about his choice of alternate airports, the pilot mentions his concern about a suitable alternate and answers, " Raleigh-Durham, barely".

According to transcripts of communications with the FAA ATCT at Raleigh-Durham, shortly after takeoff , the pilot made the following transmissions at the times indicated: (1) 0106:38, he read back a new altimeter setting given by the local controller by repeating, "two nine eight eight one seven two, (2) 0107:20, "...do you..(unintelligible)..", (3) 0107:21, when

requested by the local controller to state his heading, the pilot of N12172 responded, "172 has got uh a vacuum problem". The departure clearance would have required a right turn after takeoff, but radar data shows N12172 commencing a left turn that continued until ground impact about 1.3 miles northwest of the tower on a heading of about 82 degrees.

PERSONNEL INFORMATION

The pilot's current logbook was not recovered. At the time of the pilot's application for his third class medical on August 8, 1997, he had stated his flight time as 693 hours with 100 hours flown within the last 6 months. FBO personnel in Florence estimated the pilot had been commuting there by private airplane for about 1.5 years.

AIRCRAFT INFORMATION

Neither the airplane nor the engine logbooks could be located. The only airplane records obtained were the various work orders and billing statements from those FBOs known to have been patronized by the pilot. According to the pilot's family, it would be likely that two round trips from the pilot's home to his work, about 6 hours, could be added to the airplane's total tachometer time since its annual inspection to estimate airframe total time.

The airplane had been modified with the Penn Yan Aero 180 HP Superhawk conversion STC, (SA 703GL) by Williamsburg Aviation of Williamsburg-Jamestown Airport, Virginia, in November, 1994. A standby vacuum system STC manufactured by Precise Flight, Inc., the SVS III, (SA2162NM) had been installed by Carolina Air Services, Inc., of Florence, South Carolina, in December, 1996. The FBO also replaced the artificial horizon with an overhauled unit in early May, 1997. The altimeter, static system, and altitude reporting feature of the transponder had been inspected for proper operation on June 28, 1997, by Bay Avionics of Hampton Roads, Virginia. The airplane had undergone a vacuum pump change due to a sheared shaft, by ISO Aero Service, Inc. of Kinston, North Carolina, on November 25, 1997, at a tachometer recorded time of 2264 hours. The airplane had undergone an annual inspection by Carolina Air Services, 20 days before the accident, on December 4, 1997, at a tachometer recorded time of 2275.7 hours.

METEOROLOGICAL INFORMATION

The 1951weather observation for the Raleigh-Durham Airport was: 6 miles visibility in light rain and mist, sky condition, 400 feet overcast, temperature, 46 degrees F., dew point, 46 degrees F., altimeter setting, 29.89 inches of mercury, remarks, rain ended 2006, and rain began 2027. WRECKAGE AND IMPACT INFORMATION

The wreckage of N12172 was located about 1.3 miles northwest of the geographic center of the Raleigh-Durham International Airport, about 500 yards west of the west perimeter road called Aviation Parkway, in dense pinewoods within the airport boundary, but outside the fenced area. Initial impact appeared to be with tree tops about 40 feet above ground level by

the left wing, in a near wings level attitude, on a heading of 82 degrees. The wreckage path was about 120 feet long with some scattering of fuselage fragments up to 180 feet from initial impact. The descent angle, relative to the terrain, was about 18 degrees from initial collision to ground collision. The left wing and strut were found on the ground near initial impact. The main wreckage consisted of the fuselage, engine and propeller, empennage, and right wing. There was a postcrash fire from about the instrument panel forward. Most through-firewall hoses and cockpit instruments were destroyed by the fire. The propeller, still attached to the crankshaft flange, exhibited uniform rearward bending of both blades, with about 4 inches fractured and missing from one blade. Chordwise striations and burnishing, heavier at the leading edges, were evident on both blades. Two sections of pine tree trunk exhibited helical shaped carving with faint transfer of gray paint. The engine had torn loose from its mount and was displaced right-of-centerline, about 4 feet from the main wreckage, inverted, and exhibited evidence of impact with trees prior to ground collision. The vacuum pump, oil filter/housing and oil-cooler bypass, alternator, carburetor, and muffler assembly had broken their respective mounts, and were found detached.

All airframe components were found in the immediate area. Flight controls and airframe components showed no signs of precrash failure or malfunction. Integrity of all flight controls was established. It was reported the ELT activated on impact, but was not recovered. The ELT bracket and antenna were found intact. Examination of the engine at the crash site revealed the engine assembly rotated and continuity was established with the crankshaft, camshaft, valve train, and accessory drive gears. Both magnetos produced spark at the four leads during hand rotation. The top spark plugs exhibited deposit coloring consistent with normal engine operation. Engine oil appeared new and uncontaminated. The carburetor exhibited fracture consistent with impact overload. Teardown inspection of the carburetor revealed no abnormality. The carburetor bowl contained about 1 inch of uncontaminated fuel and testing for water content was negative. There was no evidence of foreign object ingestion or obstruction of the induction system. The muffler assembly was torn loose and located about 15 feet forward of the engine. The interior coloration was indicative of normal engine operation, and no obstructions to exhaust gas path were noted. Each wing fuel tank had been compromised at a welded seam.

The vacuum pump mounting was fractured, but mechanical integrity was established for the shear coupler and vane and rotor assembly. No evidence of vacuum system contamination within the pump could be found. The vacuum regulator, filter, and associated plumbing were destroyed. All vacuum system hose clamps were secure and tight. The pump-to-firewall vacuum hose had been torn at the firewall through-fitting, but the hose-end and clamp were secured to the fitting. Damage appeared to be impact related. Vacuum system plumbing aft of the firewall sustained fire damage, and system integrity was impossible to access. The suction gage was recovered and the needle was mechanically jammed to the off scale/high reading.

The cockpit control to the standby vacuum system was found pulled out to the "standby system selected" position. The shuttle valve at the other end of the cockpit control was also in

the "standby system selected" position; however, the operating cable had been stretched by impact. Tubing to the sensing unit of the standby system that illuminates a light on the instrument panel placarded, "Instrument source warning/pump inop", when vacuum pressure falls to a predetermined level, 3.5 inches Hg. in this case, was found disconnected. According to factory engineers, had that tubing connection worked loose in-flight, the result would have been illumination of the warning light, but no actual vacuum source malfunction.

Certified repair station disassembly inspection, with NTSB oversight, of the airplane's two primary gyro-operated flight instruments revealed no evidence of in-flight gyro malfunction. One gyro withstood the impact still mounted in its bearings. The other gyro had broken loose from its bearings and showed rotational scoring. The vacuum pump was examined twice for evidence of in-flight malfunction, once at the accident site, and again at an FAA certified instrument repair facility. No indication of precrash malfunction could be found.

MEDICAL AND PATHOLOGICAL INFORMATION

Post-mortem examination of the pilot was performed on December 26, 1997, at the Chief Medical Examiner's Office, Chapel Hill, N.C., by Dr. Robert L. Thompson, and revealed cause of death to be traumatic injuries of head and chest. No findings that could be considered causal were noted. Toxicological tests were conducted at the Federal Aviation Administration Research Laboratory, Oklahoma City, Oklahoma. The tests were negative for ethanol, carbon monoxide, basic, acidic, and neutral drugs.

TESTS AND RESEARCH

Except for fire damaged hoses, the standby vacuum system was removed as a unit and sent to the manufacturer for examination, with FAA oversight. The manufacturer found no component failure, and installation recommendations appeared to have been complied with. The FAA inspector, as well as the manufacturer's representative, tested the vacuum warning sense tubing for installation integrity and for tolerance to twisting and tension and reported no in-flight disconnection of the tubing was likely. Additionally, the interior of the sense tubing or the bayonet fitting that mates to the tubing contained no dirt or foreign matter as would be the case if the tubing were disconnected prior to ground impact. (For additional information see Record of Telephone Call).

The Cessna Aircraft Company publication, "Pilot Safety and Warning Supplements" contains a chapter dedicated to loss of gyro instruments and vacuum pump failures entitled, "Instrument Power". Under the heading, "Gyro Spin Down", the text mentions that vacuum driven gyro operated instruments normally operate between 20,000 and 24,000 rpm and can take up to 10 minutes or more to spin down after power is removed. Total elapsed time between N12172 acknowledging that he is cleared for takeoff and his transmission about a vacuum problem was 2 1/2 minutes.

ADDITIONAL INFORMATION

The aircraft wreckage, less the components listed on the Release of Aircraft Wreckage, was released to Lieutenant Melvin M. Vinson of the Raleigh Durham Airport police on December 27, 1997. The wreckage was subsequently released to Mr. James Brewer, representing the operator's insurance company, on December 31, 1997. All components retained by the NTSB for further examination were returned to Inflite Aviation, 2272 Lakeshore Rd. S., Denver, North Carolina, 28037, per instructions from Mr. Brewer.

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 3 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	August 18, 1997
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	700 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N12172
Model/Series:	172M 172M	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal; Utility	**Serial Number:**	17261858
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	December 4, 1997 Annual	**Certified Max Gross Wt.:**	2300 lbs
Time Since Last Inspection:	6 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	2282 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	O-360A4M
Registered Owner:	ROBERT F. BROWN	**Rated Power:**	180 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	RDU ,436 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	19:51 Local	**Direction from Accident Site:**	165°
Lowest Cloud Condition:	Unknown	**Visibility**	6 miles
Lowest Ceiling:	Overcast / 400 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	9 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	100°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29 inches Hg	**Temperature/Dew Point:**	8°C / 8°C
Precipitation and Obscuration:	N/A - None - Fog		
Departure Point:	(RDU)	**Type of Flight Plan Filed:**	IFR
Destination:	FLORENCE (FLO)	**Type of Clearance:**	IFR
Departure Time:	20:05 Local	**Type of Airspace:**	Class C

Airport Information

Airport:	RALEIGH-DURHAM INT'L RDU	**Runway Surface Type:**	Asphalt
Airport Elevation:	436 ft msl	**Runway Surface Condition:**	Wet
Runway Used:	5R	**IFR Approach:**	
Runway Length/Width:	7500 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Stone, Alan
Additional Participating Persons:	DEREK WATTS; WINSTON SALEM , NC BUCK B WELCH; WICHITA , KS MARK W PLATT; VAN NUYS , CA
Original Publish Date:	February 28, 2000
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=38383