

# National Transportation Safety Board Aviation Accident Final Report

Location:	GUYTON, GA	Accident Number:	MIA98FA047
Date & Time:	12/29/1997, 0845 EST	Registration:	N414MT
Aircraft:	Cessna 414A	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

# Analysis

About 26 minutes after takeoff while at 21500 feet, the pilot requested a non existent route. Seven minutes later, the passenger stated the pilot was light headed and fading then he had passed out. The passenger had once held a student pilot certificate and about 5 years earlier she had accrued 73 hours of flight time in Cessna 150/152 aircraft. The air traffic controller, and other pilots on the radio frequency tried to assist the passenger. The passenger was advised to provide oxygen for herself and the pilot, but she was unable. The airplane climbed to 34,200 feet where the airplane departed controlled flight, recovered, then departed controlled flight several more times before beginning a nose low descent. Witnesses reported hearing the airplane orbiting several times while flying above a cloud layer then observed the airplane orbiting beneath the clouds. While in a descending right wing low attitude, the airplane impacted the ground and came to rest submerged in a pond. Examination of the flight controls, engines, and propellers revealed no evidence of preimpact failure or malfunction. A discrepancy with the regulating valve was noted. Two small holes were noted in the cabin door seal. The left wing pressurization duct had been replaced about 8 years earlier but the right wing pressurization duct, had not been replaced. The ducts are on-condition components. There was no preimpact failure or malfunction noted with the barometric pressure switch, the cabin altitude annunciator bulbs, the safety valve, solenoid valve, or differential pressure/cabin altitude gauge. Testing for carbonmonoxide for both was negative.

## **Probable Cause and Findings**

The National Transportation Safety Board determines the probable cause(s) of this accident to be: Inadequate maintenance of the cabin pressurization system, which resulted in inadequate pressurization and incapacitation of the pilot due to the hypoxia. Also causal was the pilot's failure to adequately monitor the cabin pressurization system.

#### Findings

Occurrence #1: MISCELLANEOUS/OTHER Phase of Operation: CLIMB - TO CRUISE

Findings

1. PNEUMATIC SYSTEM - LEAK

2. (F) MAINTENANCE, ANNUAL INSPECTION - INADEQUATE - OTHER MAINTENANCE PERSONNEL

3. (C) AIR COND/HEATING/PRESSURIZATION - UNDETERMINED

4. (C) CAUTION/WARNING SYSTEM/LIGHT(S) - NOT IDENTIFIED - PILOT IN COMMAND

-----

Occurrence #2: LOSS OF CONTROL - IN FLIGHT Phase of Operation: CLIMB

Findings

5. (C) AIRCRAFT CONTROL - NOT MAINTAINED - PILOT IN COMMAND

6. INCAPACITATION (ANOXIA/HYPOXIA) - PILOT IN COMMAND

7. (C) AIRCRAFT HANDLING - NOT POSSIBLE - UNQUALIFIED PERSON

8. (C) INCAPACITATION (ANOXIA/HYPOXIA) - PASSENGER

-----

Occurrence #3: IN FLIGHT COLLISION WITH TERRAIN/WATER Phase of Operation: DESCENT

Findings 9. TERRAIN CONDITION - GROUND

### **Factual Information**

#### HISTORY OF FLIGHT

On December 29, 1997, about 0845 eastern standard time, a Cessna 414A, N414MT, registered to the Valley Forge Manufacturing Corp., collided with terrain while descending near Guyton, Georgia. Visual meteorological conditions prevailed at the time and an IFR flight plan was filed for the 14 CFR Part 91 personal flight. The airplane was destroyed and the commercial-rated pilot and passenger were fatally injured. The flight originated about 0723 from the Orlando Executive Airport, Orlando, Florida.

Review of the Air Traffic Control (ATC) communication tapes with the flight revealed that IFR clearance was received, the flight was cleared to taxi, and takeoff, then ATC tower transferred the flight to Orlando Approach Control, followed by Jacksonville Air Route Traffic Control Center, at 0734.39. At that time, a male voice (pilot) verified climbing to 12,000 feet and about 19 seconds later, the flight was cleared to flight level 190, which was acknowledged by the pilot. The flight was cleared to flight level 230 and at 0743.51, the flight was cleared by the controller to climb to flight level 250. The pilot acknowledged this and requested a routing change. The controller advised the pilot to standby, then about 5 minutes 12 seconds later, the controller advised the pilot to go ahead with his request. The pilot advised that after Savannah, the route would be Jet Route 191, Pulaski, as filed. The controller cleared the flight as requested then about 1 minute 25 seconds later, the controller advised the pilot that Jet Route 191 does not come out of Savannah, and there was no direct airway from Savannah to Pulaski. The pilot acknowledged this by stating that he would have to check his routing then at 0753.07, the flight was cleared direct Pulaksi (VORTAC) after Savannah. The pilot did not acknowledge that clearance; there were no further ATC communication with the pilot (male) voice. All subsequent communications are from the passenger (female) voice.

At 0755.44, the passenger stated "we need help", followed by a mayday call 4 seconds later. Another mayday call transmitted at 0755.53, was acknowledged by the controller, followed by another mayday call at 0756.14. The controller again acknowledged this and at 0756.25, the passenger advised "in trouble the pilot is light headed and fading..." The controller acknowledged this then 11 seconds later, the passenger advised "the pilot is four one four mike tango is passing out do you hear me four one four mike tango pilot is passing out." The controller questioned the passenger whether she could fly the airplane but a flight crew member from a US AIRWAYS flight interjected and asked the passenger if oxygen was available to give to the pilot to which she responded, "I don't know how to get it." The US AIRWAYS flight crew questioned the altitude and the passenger responded, then advised "...The pilot is out I don't know what to do." The US AIRWAYS flight crew advised the passenger to put an oxygen mask on the pilot which the passenger acknowledged at 0757.55, by stating, "I'm looking for it I have to get up." There was no radio contact with the passenger from that point until 0801.46, when she stated that the flight was at flight level 268, and trying to level off. The controller advised her to push forward on the yoke and if oxygen was available, to put it on herself. The US AIRWAYS flight crew also advised her to provide oxygen to herself and to descend. The passenger advised that the pilot was still passed out and acknowledged that the flight needed to descend. The controller and flight crew of US AIRWAYS continued to advise the passenger that the flight needed to descend and at 0802.24, the passenger stated "...I'm pushing I am pushing on the uh wheel." At 0804.02, the passenger stated "trims appears to be going up and I don't understand I seriously don't know how to go down appears

to still be climbing and tell me how to get down...." The US AIRWAYS flight crew then advised her to push very hard forward on the control column and to put oxygen on herself. At 0805.07, the passenger advised that the flight was out of control. The flight crew of US AIRWAYS advised the passenger to push a button on the yoke to release the autopilot. An absence of attempted contact by the passenger was noted between 0811.12, until 0827.38. At that time an open microphone with no voice was noted. The last evidence of attempted communication occurred about 0827.52.

An F/A-18D (F18) that had departed the Beaufort Marine Corps Air Station at about 0810 for a training mission was vectored to fly near the airplane and at 0825.39, the controller advised the pilot of the F18 that the accident airplane was in a slow climb at flight level 336. The pilot of the F-18 reported visually acquiring the airplane at 0828.08, and at 0832.03, the F-18 pilot advised the controller that the airplane begins a descent right wing low and recovers, which occurs 2 more times. About 0834.40, the F18 pilot reports to the controller that the airplane was "...pointing straight down..." and about 0835.09, the F18 pilot observed the airplane enter clouds at flight level 200 while in a nose low attitude of about 80 degrees nose low. The F18 did not pursue the airplane for safety concerns.

According to a statement from a controller at the Savannah Air Traffic Control Tower, the airplane was observed on radar in a rapid descent. The controller continued to track the airplane via radar and at 0840.44, the airplane was descending through 2,900 feet. Radar contact was lost at 500 feet on the 295 degree radial and 14 nautical miles from the Savannah VORTAC.

Numerous witnesses near the crash reported hearing an airplane orbit two to three times above the clouds. The airplane descended beneath the base of the clouds and was seen by several witnesses to orbit two to three times. The airplane then began a right descending turn and impacted the ground first with the right wing tip. The airplane then rolled right, impacted obstacles on the ground, and came to rest in a small pond about **200** feet from the initial impact point.

Review of the National Track Analysis Program (NTAP) track sort from the Jacksonville Air Route Traffic Control Center revealed that the airplane slowed to 78 knots ground speed with a nearly direct crosswind for the winds aloft at that altitude. The airplane then began a right descending turn, the ground speed increased, and the airplane returned to the northnorthwesterly heading while climbing. The airplane continued climbing on about that same heading to flight level 342, and at 0832.14, the airplane began the second right descending turn. According to personnel from the Jacksonville ARTCC, the last radar return with mode C was at 0835.26. A copy of the NTAP track sort is an attachment to this report.

#### OTHER DAMAGE

Damage to a parked vehicle and the pond where the airplane crashed was noted.

#### PERSONNEL INFORMATION

The pilot had received recurrent flight training from January 13-15, 1997, at SIMCOM International, Inc., utilizing a fixed Cessna 421C simulator, with satisfactory results. The training consisted of 11.5 hours of ground instruction which included a total of 3 hours of briefs and debriefs over the 3 days. On the third day, 1.5 hours of ground instruction included training in environmental systems. The ground training was specific to a Cessna 414A airplane. A total of 6.0 hours of simulator instruction was accomplished over the course of five simulator sessions during the 3-day period. On the last simulator lesson of the third day, the loss of pressurization above 10,000 feet was accomplished. The simulator was capable of indicating this by the cabin altitude annunciator light, the cabin altitude gauge, and the cabin rate of climb. Oxygen in the simulator was not available to the pilot, though donning of the oxygen mask was simulated. Additional information pertaining to the pilot is contained on page 3 of the Factual Report-Aviation.

The pilot's wife had received flight training and had accumulated a total of about 73 hours in Cessna 150/152 aircraft between February 17, 1991, and May 3, 1992. She was issued a student pilot medical certificate on June 12, 1991, and had completed a private pilot ground school on July 22, 1991. She did not receive any other pilot certificate. Review of records provided by the pilots daughter pertaining to the passenger revealed handwritten notes which indicate for a disabled pilot, to talk to ATC (Air Traffic Control). The notes also indicate that to descend while the autopilot is engaged, to press and hold the down switch, which is located on the autopilot mode controller. There is no mention in the notes to deactivate the autopilot by moving the autopilot on/off switch found on the autopilot mode controller to the "off" position. There also is no mention in the notes on the oxygen system.

#### AIRCRAFT INFORMATION

The airplane was modified in March 1997, which included the addition of winglets and spoilers, flap changes, and modifications to the engines which resulted in an increase of 25 horsepower per engine. The modifications allowed the increase in the airplane gross weight from 6,750 to 7,087 pounds, and a change in the aircraft performance.

Review of the maintenance records revealed that the airplane was last inspected in accordance with an annual/100 hour inspection on November 19, 1997, at an aircraft total time of 3,866.4 hours. The facility that accomplished the inspection used the manufacturer's inspection checklist. Review of the manufacturer's service manual pertaining to the pressurization system revealed in part that the pressurization differential limiting check and the barometric pressure switch tests are required to be performed every 500 and 600 hours, respectively. All annual/100-hour inspections since October 1987, beginning with an airplane total time of 2,654.9 hours, were performed by the same facility. The maintenance records also indicate that during the annual inspection that was signed off on September 11, 1991, the left cabin pressure ducts were noted to be deteriorated. The ducts were removed and replaced. There was no record of the right pressure ducts being replaced. According to the current Director of Maintenance for the facility that had been inspecting the airplane since 1987, and who was the mechanic who found the deteriorated ducts during the inspection in 1991, there is no record that the barometric warning light test or the pressurization limiting tests having been accomplished in the last two years. Additionally, no documents exist to indicate whether the tests had or had not been performed while they had been inspecting the airplane. Also, there were no mechanics on staff that would be able to perform the flight checks.

The airplane was equipped with a 114.9 cubic foot oxygen tank installed in the nose section of the airplane. The procedure to activate the flow of oxygen from the tank to the respective outlets required pulling the oxygen control located only on the pilot's lower instrument panel. The airplane was also equipped with a KAP 200 control system without the KCS 55A system, with the exception that a KC 290 mode controller was installed. The copilots control wheel did not have an autopilot disconnect switch. According to personnel from the autopilot manufacturer, that system does not contain roll or pitch rate monitors or vertical acceleration monitors which would be required to have an automatic autopilot disconnect feature when the aircraft slows to Vs or Vso with the autopilot engaged. By design the autopilot system will automatically disengage when there is external power failure, or by actuating the manual electric trim which is found on the pilot's control wheel. Additionally, according to the autopilot flight manual supplement for the installed autopilot system, when the autopilot system is engaged, manual application of a force to the pitch axis of the control wheel for a period of 3 seconds or more will result in the autotrim system operating in the direction to create a force opposing the pilot. The opposing mistrim force will continue to increase as long as the pilot applies a force to the control wheel and will ultimately overpower the autopilot. An air-gyro driven attitude indicator was installed in front of the copilot's seat. By design, pressurization air is supplied from each engine turbocharger through the sonic venturi, the heat exchanger, then into the cabin through check valves located in each wing root. The aircraft information manual indicates that adequate flow to maintain pressurization is provided by either engine at normal power settings. Additional information pertaining to the airplane is contained on page 2 of the Factual Report-Aviation.

#### METEOROLOGICAL INFORMATION

Information pertaining to the weather is contained on page 4 of the Factual Report-Aviation. Witnesses located about 1/4 mile from the crash site reported that it was drizzling at the time of the accident and a cloud layer of unknown height above the ground was noted.

#### COMMUNICATIONS

The Jacksonville, Florida, Air Route Traffic Control Center, was the last Air Traffic Control (ATC) facility in contact with the passenger. Transcripts of communications for all contacts with all ATC facilities, and Flight Service Station facilities are attachments to this report.

#### WRECKAGE AND IMPACT INFORMATION

The airplane crashed onto private property with the crash site located at North 32 degrees 15 minutes .49 and West 081 degrees 23 minutes.19. Examination of the site revealed that the main wreckage which consisted of the fuselage and partially separated left wing and right engine, was located in a pond. The fuselage was nearly submerged with the upper half of the vertical stabilizer and the top portion of the fuselage visible. A fuel sheen was noted on the water. The wreckage path from the initial point of impact with the ground to where the airplane came to rest was oriented on a magnetic heading of 054 degrees. The initial impact point on the ground was noted to be from the right wing with broken pieces from the navigation light lens and the right winglet adjacent to that location. A ground scar about 6 inches across continued from the initial impact point about 21 feet and ended at a circular depression made by the right engine. That depression was noted to be adjacent to a 36 feet wide pond which was found to contain the right propeller with all three propeller blades attached, and the right aileron. A ground scar from the left wing was located about 62 feet past the initial ground scar and to the left of the wreckage path with a propeller blade from the left propeller located on the centerline of the wreckage path about 82 feet from the initial impact site. Continuing forward from that point, the left winglet was located about 94 feet from the initial impact site and to the left of the wreckage path. A frame of a metal trailer which was located about 98 feet from the initial impact site, was contacted by the airplane and moved 11 inches forward. Burning of grass due to fire was noted from the forward edge of the pond forward about 63 feet. A vehicle which was located about 129 feet from the initial impact site,

was found to have the oxygen bottle, the nose section of the airplane, and one of the other propeller blades from the left propeller adjacent to it. The rear glass of the vehicle was shattered, the trunk was slightly damaged, and the vehicle was found to be displaced forward from the long standing position where it had been parked. Slight ground scars were noted in the dirt beginning about 10 feet before the edge of the pond where the airplane came to rest about 200 feet from the initial impact point. Numerous components from the airplane were located along the wreckage path.

The pond was drained then initial examination revealed that the fuselage consisted of a point near the pilot's seats, aft to the tailcone, including the horizontal and vertical stabilizers with their respective flight control surfaces. The left wing was noted to be partially attached and located on the left side of the fuselage, and the instrument panel and janitrol heater were noted to be displaced to the right alongside the right engine, which was located on the right side of the fuselage. The right wing was not attached to the airframe. The rudder/elevator/ and their respective trim cables were connected; however, during recovery of the airplane from the pond, the cables either failed aft of the aft pressure bulkhead or were cut to facilitate recovery. The fuselage separated aft of the aft pressure bulkhead during the recovery. The wreckage was recovered for further examination.

Examination of the fuselage revealed elevator, elevator trim, rudder, and rudder trim control cables continuity at their respective attach points at each control surface or actuator. The cabin door seal was found to have two approximate 1/8 inch diameter holes at the aft lower corner of the door frame. The fuel selector handles in the cockpit were found in the right main positions; however, the left fuel selector valve was found positioned to the left tank. The right fuel selector valve could not be determined. Both engines and propellers as well as the nose and right main landing gear were separated from the airframe. The elevator trim was positioned as found during the initial examination of the airplane before recovery from the pond, and was determined to be positioned approximately 4.8 degrees tab down. The rudder trim tab was found positioned approximately 2 degrees tab right and the aileron trim tab was found positioned approximately 2 degrees tab right and the aileron trim tab was found positioned to be retracted.

Examination of the left wing revealed that the flaps, spoiler, and landing gear were retracted. The flap and aileron flight control cables exhibited evidence of overload failure at the wing root area. The leading edge skin of the wing was displaced upwards and the winglet was separated. The pressurization check valve, sonic venturi, and the cabin pressurization air dump valve were examined with no evidence of preimpact failure or malfunction. The dump valve was determined to be closed and no oil or soot was noted at the inlet portion of the sonic venturi. The pressurization ducts were determined to be clamped at all connections from the sonic venturi to the wing root area, and the duct was not torn or failed. Examination of the turbocharger revealed that the hot and cold sections were separated with overload failure noted to the shaft.

Disassembly of the left engine revealed crankshaft, camshaft, and valve train continuity. No evidence or preimpact failure or malfunction of the engine or its components was noted. Examination of two recovered propeller blades from the left propeller revealed both blades exhibited slight forward bending and one of the blades exhibited slight "S" bending.

Examination of the right wing which was impact damaged and comprised of two major segments revealed that the leading edge of the wing displaced upward. The spoiler was determined to be retracted. The engine was separated from the wing and the propeller was

separated from the engine. The aileron and flaps cables exhibited evidence of overload failure near the wing root area. The winglet and engine were separated but the turbocharger was attached to the firewall. The compressor of the turbocharger could not be rotated by hand but impact damage was noted to the compressor housing and to several of the blades. Examination of the check valve, sonic venturi, and cabin pressurization air dump valve revealed no evidence of preimpact failure or malfunction. No soot or oil was noted at the sonic venturi. The dump valve was determined to be closed and the duct from the sonic venturi to the dump valve was examined and found to be torn and ripped in several areas with cracks noted along the length on the exterior surface of the hose. All hose clamps were observed to be in place. The duct was retained for further examination. (See tests and research section).

Disassembly of the right engine revealed crankshaft, camshaft, and valve train continuity. No evidence of preimpact failure or malfunction of the engine or its components was noted. Examination of the right engine propeller revealed one of the blades exhibited evidence of torsional twisting with slight "S" bending, another blade was noted to be bent aft about 60 degrees, and the final blade exhibited slight "S" bending.

The cabin altitude and differential pressure gauge was located and was found to indicate greater than 35,000 feet, and about 3.2 psi, respectively. The cabin altitude control was set to about 500 feet and the rate control knob was impact damaged. The landing gear control was found in the "up" position and the flap selector was found in the partially extended position. The ram dump, left and right pressurization air controls were observed to be in the "full in" position. The aft pressure bulkhead was not damaged in the area of the cabin pressure dump and the cabin pressure regulating valves. Examination of the cabin pressure dump valve and the cabin pressure regulating valves revealed all hoses were securely connected at each fitting. The cabin pressure dump valve was determined to be closed and the cabin pressure regulating valve was determined to be partially open; grass and sand was noted in the area. The valves which were determined to be properly installed, were removed for further examination. Oxygen masks without microphones were determined to be plugged into the pilots and copilots positions. The oxygen knob on the instrument panel was in the "full in" position and bent to the right at about a 45-degree angle; however, the valve at the oxygen bottle was found in the "open" position. The forward ram air valve installed near the janitrol heater was examined and found to be in the "open" position, but the control arm was broken from the valve. The control cable from the cockpit control was connected at the separated control arm. Examination of the autopilot mode controller revealed that the all controls were in the off position. The pilot's and copilot's altimeters were observed to be set to 29.75 and 29.70 inHg, respectively. The impact damaged pressurization switch, cabin altitude and differential pressure gauge, solenoid valve, annunciator panel, and the cabin pressure dump and cabin pressure regulating valves were retained for further examination (see the Tests and Research section of this report).

#### MEDICAL AND PATHOLOGICAL INFORMATION

Review of information from the pilots last medical application dated December 17, 1997, revealed that he reported he was not taking any medication. Located in the wreckage was a medication (Vasotec) written for the pilot in September 1997, with an expiration date of September 20, 1998. Additionally triamterene 75 MG/HCTZ 50 MG tablets were also located in the wreckage. According to the pilot's retired cardiologist, the pilot had high blood pressure which was controlled with medication (Maxide and Vasotec). The pilot also had twice complained of chest pain, once in April 1987, and again in September 1993. A exercise

treadmill test was performed in conjunction with the first complaint, the results being normal. A coronary arteriogram was performed 3 days after the second complaint, the results also being normal. An echocardiogram or a Holter monitor was not performed on the pilot.

Postmortem examinations of the pilot and passenger were performed by the Georgia Bureau of Investigation by Drs. Kaponen and Hellman, M.D.'S, respectively. The cause of death for the pilot was listed as generalized blunt force trauma. The cause of death for the passenger was listed as multiple blunt force injuries. The autopsy report for the pilot pertaining to the cardiovascular system indicates that the ventricular septum bulges into the aortic outflow tract. Also, the interventricular septum and the left ventricular free wall of the left ventricle exhibits a moderate degree of concentric hypertrophy which is asymmetric. Review of the autopsy report for the pilot also indicates evidence of control type injuries to the right arm and leg. Review of the autopsy report for the passenger indicates evidence of control type injuries to the right hand.

Toxicological analysis of specimens of the pilot were performed by the FAA Toxicology and Accident Research Laboratory (CAMI) and the Georgia Bureau of Investigation (GBI). The results of analysis of specimens of the pilot by CAMI were negative for carbonmonoxide, cyanide, and volatiles. Triamterene and Hydrochlorothiazide were detected in the blood and kidney fluid. The results of analysis by the GBI were negative for ethyl alcohol, tested drugs, and carbonmonoxide. Toxicological analysis of specimens of the passenger was also performed by CAMI. The results were negative for carbonmonoxide and cyanide. No other tests of specimens of the passenger were accomplished.

#### TESTS AND RESEARCH

Macroscopic examination of both of the cabin altitude annunciator light bulbs by the NTSB Metallurgy Laboratory located in Washington, D.C., revealed no stretching or sagging of either bulb filament. Continuity of both bulbs was confirmed.

Bench testing of the electrically operated solenoid valve revealed that it was in the closed position and operated to specification.

Visual examination of both the safety valve and the regulating valve revealed absence of adhesive on the screws which is applied during manufacture, and both were missing the three noise suppression screens. Testing of the safety valve revealed that it was out of tolerance regarding the test point "Outflow valve leakage." Testing of the regulating valve revealed that it was out of tolerance for the test points "Head Leakage" and "Outflow valve leakage." According to the report, teardown inspection of the regulating valve revealed a dirty seat area (cause of outflow leakage), and two pin holes were noted in the diaphragm (cause of head leakage). Visual examination of the cabin altitude controller revealed impact damage and the absence of adhesive to the heads of several externally mounted screws which is routinely applied during manufacture. The initial attempt to test the unit was unsuccessful. The unit was disassembled which revealed internal contamination consisting of water and mud. Additionally, a spring shim was not mounted in the correct location. Contamination in the seating area of the spring shim was noted. The unit was cleaned, then reassembled, and subsequent testing was unsuccessful. The impact damaged rate shaft was straightened but testing was again unsuccessful. The altitude dial was then adjusted and the unit was functionally tested and found to be operative.

Examination of the pressurization switch revealed that the handle was missing and with the

switch positioned as if installed in the airplane, damage was noted to the upper portion of the lugs. Review of the systems description for the pressurization system revealed that for the pressurization system to operate, the cabin pressurization switch must be positioned to the "pressurize" position. By design and installation, with the pressurization switch installed in the airplane, the upper position of the switch is the "pressurize" position.

A section of the duct which was retained from the right wing, was tested to 77 psi with no evidence of bursting. By design, the burst pressure is 80 psi.

The cabin differential pressure/cabin altitude gauge was placed in a test bench and operated to 5 psi differential and up to 30,000 feet with no movement noted to either needles. The case leakage was checked as received and found to be within limits. The unit was disassembled which revealed that the needle for the differential pressure was separated from the pointer shaft and was adhering to the glass. Moisture was noted on the inside surface of the glass. The cabin altitude pointer shaft pivots which are .012 inch in length, were determined to be failed. The differential pressure needle was attached to the pointer shaft and a new rocking shaft was installed. The unit was reassembled and functionally tested which revealed that the differential pressure readings at each 1 psi increments were within limits. The cabin altitude readings were determined to be out of limits at the 10,000 and 35,000 feet settings. The damaged rocking shaft pivots were repaired and the original rocking shaft was reinstalled into the unit. The unit was then bench tested and found to be within limits at all but the test point at 5,000 feet which indicated 200 feet below the established limits.

Visual examination of the barometric switch assembly revealed impact damage to the aneroid cover. Two 20-gauge wires that were soldered to the terminals on the microswitch and were connected to the microswitch when recovered at the crash site, subsequently separated. The wires were determined to have been connected to the proper terminals. The unit was placed in a test chamber and was unsuccessfully tested. The impact damaged aneroid cover was removed and the aneroid was observed to have several dents and was bent downward over the mounting stud. The damage to the aneroid cover correlated with the damage to the aneroid. The micro-switch was then hand actuated with no evidence of preimpact failure or malfunction. The accident micro switch was installed into a new aneroid cover, and the switch and cover assembly were then assembled to the original base and damaged aneroid assembly. The unit was then bench tested without being calibrated, and was found to operated at an altitude of 31,250 feet ascending and 30,300 feet descending. By design, the switch is to activate while ascending and descending at 10,000 +/- 300 feet, and before 9,000 feet, respectively. No leakage of the aneroid was noted. The aneroid was removed and examination revealed that the actuator button was displaced .020 inch inward by the impact damage to the aneroid. According to test personnel, this displacement and the deformed shape of the aneroid over the mounting stud would cause contact of the micro switch (actuation point) to occur at a higher altitude. The actuator button of a new barometric switch assembly was placed as found in the accident unit and activation of the microswitch was noted to occur at 22,960 feet. That test only simulated the displacement damage to the top portion of the aneroid. According to test personnel, the increase in the observed actuation point on ascent (31,250 feet), from the normal actuation point (10,000 feet), was consistent with the total damage to the aneroid.

Examination of the two 20 American Wire Gauge (AWG) wires that were attached to the microswitch on the back of the barometric switch was accomplished by the NTSB Materials Laboratory in Washington, D.C. The results of the examination revealed that about 50 percent

of each of the wires exhibited mechanical damage. According to Cessna Electrical Engineering, by design, the wires are rated for 7 amps and with 50 percent of the wires presumably cut, the amperage rating of the remaining wires would be 3.5 amps. By design the cabin altitude annunciator light requires 200 milliamps.

#### ADDITIONAL DATA/INFORMATION

Review of a controller statement revealed that an individual who was a pilot and who had flown that same make and model airplane, was called into the Jacksonville ARTCC from home in the attempt to assist the passenger. Upon his arrival, he noted that the airplane was climbing near flight level 300, and there were no communications with the passenger. He obtained airphone and cellular phone numbers and attempted to call, with negative results.

Review of the pilot's information manual revealed that the cabin altitude annunciator light installed in the annunciator panel is designed to illuminate at approximately 10,000 feet cabin altitude.

Additional parties to the investigation are Mr. William K. Stout, Aerospace Control Products, Inc., Davenport, Iowa; Mr. Carm Russo, Aerosonic Corporation, Clearwater, Florida; and Mr. Don Fraser, Dukes, Inc., Northridge, California.

The wreckage and all retained components were released to Mr. Marshall Dean, of USAIG, on February 22, 1999.

Certificate:	Commercial	Age:	67, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 3 Valid Medicalw/ waivers/lim.	Last FAA Medical Exam:	12/17/1997
Occupational Pilot:		Last Flight Review or Equivalent:	
Flight Time:	1545 hours (Total, this make and model), 3996 hours (Pilot In Command, all aircraft), 11 hours (Last 90 days, all aircraft), 2 hours (Last 30 days, all aircraft)		

#### **Pilot Information**

# Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	Registration:	N414MT
Model/Series:	414A 414A	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	414A-0205
Landing Gear Type:	Retractable - Tricycle	Seats:	7
Date/Type of Last Inspection:	11/19/1997, Annual	Certified Max Gross Wt.:	7087 lbs
Time Since Last Inspection:	6 Hours	Engines:	2 Reciprocating
Airframe Total Time:	3872 Hours	Engine Manufacturer:	Continental
ELT:	Installed, activated, did not aid in locating accident	Engine Model/Series:	TSIO-520-NB
Registered Owner:	VALLEY FORGE MANUFACTURING CRP	Rated Power:	335 hp
Operator:	JOSEPH E. BLACK	Operating Certificate(s) Held:	None

### Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Day
Observation Facility, Elevation:	SAV, 51 ft msl	Distance from Accident Site:	12 Nautical Miles
Observation Time:	0845 EST	Direction from Accident Site:	126°
Lowest Cloud Condition:	Scattered / 500 ft agl	Visibility	8 Miles
Lowest Ceiling:	Broken / 3900 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	7 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	280°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29 inches Hg	Temperature/Dew Point:	43°C / 41°C
Precipitation and Obscuration:			
Departure Point:	ORLANDO, FL (ORL)	Type of Flight Plan Filed:	IFR
Destination:	WHITE SULPHUR, WV (SSU)	Type of Clearance:	IFR
Departure Time:	0723 EST	Type of Airspace:	Class A

### Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroved
Passanger Injuries	1 Eatal	Aircraft Fire:	On-Ground
Cassenger injuries.		Aircraft Finelssiens	Neg
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	

#### Administrative Information

Investigator In Charge (IIC):	TIMOTHY W MONVILLE	Report Date:	10/15/1999
Additional Participating Persons:	ROBERT N YLLA; COLLEGE PARK, GA JOSEPH A HUTTERER; WICHITA, KS DALE CARTER; MARIETTA, GA STEVE MACON; PHOENIX, AZ		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at <u>pubing@ntsb.gov</u> , or at 800-877-6799. Dockets released after this date are available at <u>http://dms.ntsb.gov/pubdms/</u> .		

The National Transportation Safety Board (NTSB), established in 1967, is an independent federal agency mandated by Congress through the Independent Safety Board Act of 1974 to investigate transportation accidents, determine the probable causes of the accidents, issue safety recommendations, study transportation safety issues, and evaluate the safety effectiveness of government agencies involved in transportation. The NTSB makes public its actions and decisions through accident reports, safety studies, special investigation reports, safety recommendations, and statistical reviews.

The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available <u>here</u>.