

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
CHI85LA220	N6458S	6/2/1985	CESSNA	150H	<p>HISTORY OF FLIGHT</p> <p>On February 18, 1995, approximately 0800 Pacific standard time, a Bruce Tifft Varieze, N115EZ, collided with trees near Tiller, Oregon. Visual meteorological conditions prevailed at the time and no flight plan was filed. The airplane was substantially damaged and the private pilot and his passenger were fatally injured. The flight had departed from Cottage Grove, Oregon, on February 18, 1995, at 0730 and was en route to Mohave, California.</p> <p>The individual in California, whom the pilot was going to visit, stated that the intended route of flight was to follow southbound Interstate 5 to California. This person stated that if the pilot had taken off with full fuel tanks, there would not have been a need to stop for fuel. The flight was expected in Mohave, approximately 1200.</p> <p>WRECKAGE AND IMPACT INFORMATION</p> <p>Douglas County Sheriff's Office personnel reported that an individual who had been travelling on the Tiller Trail Highway at 0700 on February 18, did not notice anything unusual at this time. When the individual returned on the highway at 0800, he noticed tree branches and yellow colored objects on the road, that were later identified as a wing storage pod and wing tip. This individual stopped and looked around the area and eventually found the airplane partially submerged in the creek. The individual then called 911 to report the accident.</p> <p>Sheriff's office personnel mapped out the wreckage distribution path and reported evidence of broken tree tops near the roadway on the south side. A major point of impact was noted at a scrub oak, and it appeared that the left wing had struck this oak which caused the airplane to veer to the left where the airplane struck another tree. Direction of travel was in a westerly direction.</p> <p>Ground disturbance was noted at the north side of the creek where the airplane struck head on into a tree and a large rock. The plane then slid into the creek with the nose down. The total length of the distribution path was measured at 788 feet and 59 feet south of the roadway baseline.</p> <p>After the victims were removed, the airplane was retrieved by a tow truck operator and taken to Myrtle Creek, Oregon, for security.</p>	<p>THE PURPOSE OF THE FLT WAS TO DEMONSTRATE THE ACFT TO A POSSIBLE BUYER. WHILE TAKING OFF, THE ENG LOST POWER SHORTLY AFTER THE ACFT LIFTED OFF AT ABOUT MID-FIELD. THE PLT ATTEMPTED TO TURN THE ACFT &amp; LAND ON A CROSS-RUNW. HOWEVER, DUE TO HIS LOW SPEED &amp; LOW ALT, HE WAS UNABLE TO ALIGN THE ACFT WITH THE RWY. THE ACFT WAS LANDED IN GRASS WHERE IT SUBSEQUENTLY NOSED OVER. THE ENG HAD ONLY 1 HR OF FLT TIME SINCE IT HAD BEEN OVERHAULED. DURING OVERHAUL, A FACET AEROSPACE CARBURETOR FLOAT KIT, NUMBER 666-915, HAD BEEN INSTALLED IN THE MARVEL SCHEBLER CARBURETOR BY THE PLT/OWNER, WHO WAS ALSO AN A&amp;P MECHANIC. AN EXAM REVEALED THAT SERVICE BULLETIN NUMBER 84A WAS NOT COMPLIED WITH, THE FLOAT DROP WAS NOT ADJUSTED PROPERLY, FUEL FLOW WAS LOW, THE THROTTLE SHAFT LOOSE, THE ACCELERATOR PUMP WAS DRY ROTTED &amp; CRACKED, &amp; THE BUTTERFLY VALVE WAS INSTALLED UPSIDE DOWN.</p> <p>DURING A PERSONAL CROSS COUNTRY FLIGHT, THE AIRPLANE COLLIDED WITH TREES NEAR A ROADWAY. THE AIRPLANE TRAVELLED SEVERAL HUNDRED FEET BEFORE COMING TO REST, NOSE DOWN IN A CREEK. DURING THE POST CRASH INSPECTION OF THE ENGINE, IT WAS FOUND THAT THE PILOT HAD PERFORMED SEVERAL MODIFICATIONS; HOWEVER, THERE WAS NO EVIDENCE FOUND TO INDICATE A MECHANICAL FAILURE OR MALFUNCTION.</p>

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AIRCRAFT INFORMATION

During the airplane and engine inspection at Myrtle Creek by a Federal Aviation Administration Inspector and a representative from Textron Lycoming, it was reported that upon initial inspection, the engine was still attached to the airframe and the cowling was in place. The wood propeller remained attached to the crankshaft and one propeller tip was separated and shattered. Visual inspection of the engine revealed no impact damage or crankcase disruption. The engine data plate had been removed, however, at one time the engine was a standard Lycoming IO-360. Evidence of extensive modifications were apparent. The magnetos had been removed and replaced with two different types of electronic ignition systems. One system was mounted where the right magneto had been and fired the bottom spark plugs. The other system, labeled Direct Ignition System, was mounted on the firewall and fired the top spark plugs. All of the spark plugs and ignition harnesses were of non-standard aircraft type and there were two different types of plugs installed. The cooling fins around each spark plug had been ground away in order for the spark plugs to fit. In place of the carburetor was an Ellison Throttle Body unit. A standard engine driven fuel pump, a Facet electric fuel pump and a Bendix flow divider were attached. The flow divider was mounted upside down and all of the fuel lines were either of flexible rubber or steel braid. The injector lines from the flow divider to the injectors were flexible rubber with different types of fittings.

Before removing the spark plugs, the propeller was found to rotate easily. The top spark plugs were removed and all four cylinders were checked for compression and suction. Accessory gear and valve train continuity was established. All of the spark plugs were removed and operating signatures appeared normal. Clean oil was found in the engine.

A Pilot Logbook was found in the wreckage and reviewed. The logbook started in September 1989, and was labeled Book #2. It appears that the pilot was using this logbook to log both flight time and maintenance information. The logbook lists the dates, locations, and total time, but does not list information under make & model, aircraft flown, category of aircraft, condition of flight or type of piloting time. The last entry dated in February 1995, indicates a total flight time of 1,766 hours. It is unknown if this is the pilot's total flight time, the airplane's total time or a combination of the two.

In February 1994, a logbook entry states that an Ellison Carburetor was installed at 1,678.8 hours. On July 2-4, 1994, the logbook indicates that contaminated fuel was used after fueling at Watsonville, California. The entry further states four new cylinders, valves, V-springs, pistons and rings were installed. (note: aviation fuel contaminated with jet fuel was subject to an Airworthiness Directive (AD). This AD required that all aircraft involved with the contaminated fuel were to have the engines overhauled prior to continued flight).

During a telephone interview with a friend of the pilot, it was found that the pilot did not want to send the engine out for the factory overhaul, and that the pilot would do it himself. The logbook entry which reports the new parts, indicate maintenance consistent with a top overhaul. This friend also stated that the pilot had told him that he was having problems with the engine cooling. The pilot had ordered a cylinder head temperature gauge to try and determine where the problem was.

On January 16, 1995, the logbook entry reports a "break-in" local flight for one-half hour. The entry further states "New eng." A total of three and-a-half hours were logged prior to the accident since this entry.

The registration certificate found in the wreckage was dated August 15, 1978. The Special Airworthiness Certificate was issued on

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					March 31, 1987. The pilot held a repairman certificate for an experimental aircraft, make: Bruce Tiftt, Model: Varieze that was issued on October 28, 1980.	
					PERSONNEL INFORMATION	
					The pilot held a private pilot certificate and was rated for airplane single engine land and rotorcraft - gyroplane. The pilot logbook indicates that a biennial flight review was signed on July 11, 1992. The make and model airplane in which the flight review was accomplished is unknown, and the logbook does not indicate a flight on this date. The pilot held a third class medical certificate dated April 23, 1994, with no waivers or limitations reported. The Federal Aviation Administration Medical Division, stated that the pilot reported at the time of his medical examination, a total flight time of 900 hours, with 40 hours in the previous six months.	
					METEOROLOGICAL INFORMATION	
					A Specialist at the McMinnville, Oregon, Flight Service Station (FSS), reported that the pilot had called the FSS the night before the accident. The Specialist reported to the pilot to expect low morning overcast conditions along his route of flight.	
					On the morning of the accident, the Roseburg, Oregon, area was reporting an estimated ceiling at 6,000 feet with overcast and 20 miles visibility. Further south at the Sexton Mountain Pass, located just north of Grants Pass, Oregon on Interstate 5, was reporting one and a quarter miles visibility and fog.	
					The Specialist reported that it was common for pilots to divert to the east of the mountain range that runs north/south, to avoid adverse weather along Interstate 5. The pilot did not call for weather on the morning of the accident, nor was a flight plan filed.	
					MEDICAL AND PATHOLOGICAL INFORMATION	
					The Oregon Deputy State Medical Examiner, James N. Olson, reported that the cause of death to the pilot was due to severe blunt head, chest, pelvic, and musculoskeletal trauma.	
					Toxicological samples were sent to the Civil Aero Medical Institute, Oklahoma City, Oklahoma for analysis. The results of the analysis were negative.	

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HISTORY OF FLIGHT						
On February 22, 1995, about 0937 eastern standard time, a Eurocopter, AS-350-B, helicopter, N20SP, operated by the Massachusetts State Police (MSP), was destroyed when it collided with a boat house during a forced landing near Cambridge, Massachusetts. The two pilots and two passengers were fatally injured. Visual meteorological conditions prevailed, and no flight plan had been filed for the passenger flight conducted under 14 CFR Part 91.						
The pilots, Troopers James Mattaliano and Paul Perry, worked from 1500 until 2300, on February 21, 1995. The pilots reported to work the morning of February 22, 1995, about 0700. Their mission that morning was to pick-up two AT&T employees at the Nashua Street Heliport, and transport them to the MSP Headquarters in Framingham, Massachusetts. Trooper Mattaliano was the senior pilot; therefore, he was considered the pilot-in-command.						
The MSP rented hangar space from Wiggins Airways, at the Norwood Memorial Airport (OWD), in Norwood, Massachusetts. The hangar was shared with another helicopter operator. At 0750, the pilot/manager of this operator reported that he observed Trooper Perry enter the hanger, and walk around N20SP. He saw Trooper Perry approach the right side of N20SP where the tail joins the main fuselage, touch the helicopter, and then walk aft and visually inspect the tail rotor area. Trooper Perry then opened the hangar doors and moved N20SP outside, where the two troopers boarded N20SP and started the engine. He estimated that the run-up lasted about 10 minutes, and the helicopter departed to the northeast.						
NYC95GA060	N20SP	2/22/1995	EUROCOPTER	AS-350-B	According to OWD Air Traffic Control Tower (ATCT) records, N20SP departed OWD, about 0922. Using the call sign of State Police One, N20SP contacted Boston ATCT, at 0924, and requested clearance into the Boston Class B airspace to land at the Nashua Street Heliport. The helicopter was cleared into the airspace and, at 0930, the pilot of N20SP reported landing assured at the heliport. At 0936:16, N20SP contacted Boston ATCT and requested clearance out of the Class B airspace, at 800 feet.	
The Boston ATCT granted the request, and the pilot of N20SP stated "thanks," at 0936:29. That was the last transmission received from N20SP.						
Boston ATCT Radar plotted N20SP reaching an altitude of 600 feet mean sea level, at 0937:00, before beginning a decent below radar coverage.						
Over 20 witness statements were taken from personnel who observed the helicopter after it departed from the Nashua Heliport. The witnesses observed the helicopter flying westbound over the Charles River. A puff of smoke was seen coming from the helicopter in the vicinity of the engine. The helicopter then turned to the right and descended toward the north bank of the river. The witnesses estimated the angle of descent was between 45 and 70 degrees. Most of the witnesses observed smoke trail from the engine exhaust area. Eleven witnesses stated that the main rotor blades were turning slowly, or not at all.						
The helicopter struck two metal structures extending from the Harvard Sailing Pavilion and came to rest on the roof.						
The accident occurred during the hours of daylight approximately 42 degrees, 22 minutes north latitude, and 71 degrees, 00 minutes west longitude.						

A MASSACHUSETTS STATE POLICE (MSP) HELICOPTER DEPARTED A HELIPORT WITH TWO CREWMEMBERS & TWO PASSENGERS, & CLIMBED TO ABOUT 600' OVER A RIVER. WITNESSES REPORTED SEEING A PUFF OF "SMOKE" (OR VAPOR) FROM THE ENGINE EXHAUST. THE HELICOPTER WAS OBSERVED TO TURN TOWARD THE RIVER BANK & DESCEND AT AN ANGLE BETWEEN 45 & 70 DEGREES. WITNESSES STATED THAT THE MAIN ROTOR BLADES WERE EITHER TURNING SLOWLY OR HAD STOPPED PRIOR TO THE HELICOPTER COLLIDING WITH A BOAT HOUSE ROOF. NO PREIMPACT FAILURE OF THE MAIN ROTOR OR TRANSMISSION WAS FOUND. EXAMINATION OF THE ENGINE REVEALED THAT FIVE OF THE SIX FUEL INJECTION PORTS WERE CLOGGED. SAMPLES FROM THE HELICOPTER FUEL SYSTEM CONTAINED IRON OXIDE & WATER. THE MSP HAD A 6,000 GALLON IN-GROUND FUEL STORAGE TANK HAD NOT BEEN MAINTAINED OR SECURED IN 14 YEARS (EXCEPT FOR A FILTER CHANGE BETWEEN 1984 AND 1986). FUEL SAMPLE FROM THE STORAGE TANK CONTAINED HIGH LEVELS OF RUST & WATER, AS WELL AS DEGRADED THERMAL PROPERTIES. FURTHER INVESTIGATION REVEALED THAT THERE WAS A LACK OF OVERSIGHT IN THE MSP AIR OPERATIONS & NO TRAINING, SAFETY, OR FUEL MANAGEMENT PROGRAM. RECORDS SHOWED THAT IN THE PAST FIVE YEARS, THE MSP PROVIDED THE PILOT WITH ONLY ONE TRAINING SESSION THAT CONSISTED OF A TWO DAY GROUND SCHOOL & ONE FORMAL TRAINING FLIGHT.

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PILOT INFORMATION

Trooper James Mattaliano held a Commercial Pilot Certificate with a rating for rotorcraft helicopter, and a Private Pilot Certificate with a rating for airplane single engine land. He was not instrument rated.

His most recent Federal Aviation Administration (FAA) Second Class Medical Certificate was issued on April 6, 1994.

Trooper Mattaliano's total flight time was estimated at 1,150 hours, of which approximately 900 hours were in this make and model.

Trooper Paul Perry held a Private Pilot Certificate with ratings for airplane single engine land, and rotorcraft helicopter. He was not instrument rated.

His most recent Federal Aviation Administration (FAA) Second Class Medical Certificate was issued on January 4, 1995.

Trooper Perry's total flight time was estimated to be about 340 hours, of which approximately 180 hours were in this make and model.

The Safety Board made several requests for Trooper Mattaliano's and Trooper Perry's pilot logbooks. They were not provided to the Safety Board.

Additionally, the Safety Board made requests to the Massachusetts State Police to obtain copies of the remaining Air Wing pilot's log books, to review flight hours and training. The requested information was not provided.

WRECKAGE INFORMATION

An NTSB Investigator examined the helicopter wreckage on February 22, 1995, at the accident scene, and on February 23 and 24, 1995, after the wreckage was moved to a facility in Boston, Massachusetts.

The examination revealed that all major components of the helicopter were accounted for at the scene. The helicopter main fuselage came to rest on a boat house roof, on an approximate magnetic bearing of 360 degrees. The tail boom was separated from the fuselage and submerged in water next to the boat house.

The main fuselage and cabin were destroyed. The pilot's instrument and caption panel were intact. Examination revealed that caption chips for the generator, bleed air valve, and engine oil pressure contained broken or deformed light bulb filaments.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The yellow and blue star arms of the main rotor head were fractured on the leading edge. The fractures continued aft and inboard, at a 45 degree angle, and the star arms were bent opposite the direction of rotation. The red star arm was not fractured.

The pitch change rods, and the main rotor collective and cyclic servos remained connected. Except for the fore and aft cyclic servo, the servo piston rods moved freely and pumped fluid. The fore and aft servo was damaged from impact with the main transmission. The main transmission support rods were separated, and the transmission was shifted forward.

The three main rotor blades (MRB) were attached to their respective star arms of the main rotor head. The three MRBs displayed black marks on the bottom of each blade tip. The roof area under the MRBs was covered with black tar.

The yellow and red blades were intact, and displayed chord wise scratches on the lower leading edges. The red blade also displayed chord wise scratches on the lower skin surface. The blue blade was broken about 3 feet from the root, and the tip cap was peeled upward. Trailing edge debonding was observed on the red and blue blades.

The tail boom was bent in the vicinity of the number two bearing support. The right side tail boom mount was torn, and the left side was separated along the rivet line. The tail rotor drive shaft was uncoupled at the point of separation from the fuselage.

The tail rotor gear box, hub, and blades where intact. These components remained attached to the tail boom and were not damaged. When the tail rotor drive shaft was rotated, the gear box output shaft turned the tail rotor.

Flight control continuity was verified from the mixing unit to the servo controls.

Rotation of the main rotor mast confirmed drive train continuity from the transmission to the engine, and to the tail rotor drive shaft. The free-wheeling capability of the transmission was also confirmed.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Examination of the transmission revealed lubrication through out the transmission, and the gears rotated freely. A bore scope inspection of the upper and lower chip detector areas revealed no internal damaged. The upper and lower chip detectors were absent of debris.

The fuel tank was ruptured and destroyed. The airframe fuel filter was intact and a fuel sample was taken from the filter for further examination.

The power turbine and the freewheel section of the engine rotated freely. The compressor section would not rotate. Examination of the engine chip detector revealed that it was absent of debris. The engine was removed for further examination.

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies were performed on Troopers James Mattaliano and Paul Perry, on February 23, 1995, by Dr. Richard Evans of the Chief Medical Examiners Office, Cambridge, Massachusetts.

The toxicological testing report, from the FAA toxicology Accident Research Laboratory, Oklahoma City, Oklahoma, was negative for drugs and alcohol for Troopers Mattaliano and Perry.

TESTS AND RESEARCH

Engine Examination

On March 13 and 14, 1995, the engine was examined at the Turbomeca facility, Grand Prairie, Texas, under the supervision of a Safety Board Investigator. Parties to the investigation were also present during the examination.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The examination revealed that the P2 air fitting, which supplied pressurization to the rear bearings, was not secured and was safety-wired backwards.

The axial compressor would not rotate while attached to the gas generator. After Module Two and Three were separated, the axial compressor rotated freely. A rub mark was observed on the compressor cover, and on the turbine nozzle envelope, at the second stage turbine blade path. A build-up of a reddish-brown substance was observed on the fuel injection manifold, labyrinth ring and labyrinth envelope assembly. It was determined that this reddish-brown substance was preventing the axial compressor from rotating. Samples of the substance were removed for further examination.

The fuel control unit (FCU) was placed on a test stand. The FCU filter was replaced, due to the visible debris on the original filter. The FCU was run through all parameters with no discrepancies. The fuel injection manifold (wheel) was placed on a test bench and flow checked. Five of the six manifold ports were clogged, and produced a zero fuel flow. The 6th port delivered 16 liters per hour (LPH) of fuel. Specifications required the 6 ports to deliver 230 to 260 LPH.

During the disassembly, fuel samples were obtained from the engine inlet hose and the fuel control unit. These samples were sent to the Atomus Laboratory, Arlington, Texas, for analysis.

Fuel and Filter Testing

The fuel control unit and several filters were removed from the helicopter for testing. This included the Michigan Filter, which was designed to capture ice particles, and eliminate the requirement for anti-ice additives in the fuel system. Also, fuel samples were taken from the MSP Framingham fuel tank and the Wiggins fuel truck for laboratory analysis.

Samples from the helicopter fuel system were analyzed by the Atomus Laboratory. This analysis revealed that the Michigan Filter contained a two phase fuel sample. The upper portion of the sample was a clear, light colored fuel. The lower sample was a dark heavy substance. The lighter sample contained 90 parts per million of water, and the dark brown sample contained 84 percent



NTSB	N-No	Date	Make	Model	Factual water. The laboratory report stated:	Released Narrative
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...when placed on a microscope slide, it [the dark brown heavy sample] dries to a white/gray solid, with red to red brown inclusions. The deposit contains an iron compound, most probably iron oxide from corrosion of iron in the fuel or the handling system.

The Michigan Filter element also contained white/gray deposits.

Additionally, the report stated:

...Water is present, but evaporates into a heavy brown, brittle, but transparent film. The physical appearance of this film is identical, even to the inclusions of the red to red brown material recovered from the lower phase of the sample..."

The report also stated that an infrared analysis of the fuel deposit film indicated that the material had properties consistent with polyamide polymers.

The red to red brown inclusions were also observed in the airframe fuel filter, the fuel control unit (FCU), FCU filter, and FCU inlet hose.

The analysis of the fuel samples for water revealed the following:

SOURCE	WATER IN FUEL PARTS PER MILLION (PPM)
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NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					Michigan Fuel Filter.....90.0FCU Filter.....30.5Airframe Filter-Fuel Control.....25.4FCU Inlet Hose #1.....55.7FCU Inlet #2.....less than 35.0FCU B040B.....less than 35.0	

MSP Framingham Fuel Tank Testing

Fuel samples from the MSP Framingham fuel tank were analyzed by the Atomus Laboratory, and Saybolt Inc., Boston, Massachusetts.

Atomus Laboratory testing reveled that fuel samples from the bottom of the tank contained water and a collection of hydrous iron oxide and rust. No polymer particles were observed in the samples from the tank or the tank pump. The report stated, "The heavy phase, containing the iron oxide is water, 100%."

The analysis of the fuel samples for water revealed the following:

TEST FACILITY	SOURCE	WATER IN FUEL PPM
Atomus Laboratory.....	Tank bottom.....	510.0
Atomus Laboratory.....	Tank Pump.....	57.0
Saybolt Inc.....	Tank Pump.....	7,800.0

According to the Eurocopter Standard Practices Manual, Chapter 20.07.03, page 2, the maximum allowable concentration of water in fuel was 10 ppm. The United States Army Field Manual 10-68, also stated that 10 ppm of water in jet fuel was the maximum acceptable.

Jet Fuel Thermal Oxydation Tests (JFTOT) were conducted by Saybolt Inc., of fuel samples from the MSP Framingham tank, and the Wiggins Airways Jet Fuel truck, that refueled N20SP. The maximum fuel pressure drop allowed for the test was 25 mm/Hg, for a test

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The fuel sample from the Wiggins Airways truck tested with a zero pressure drop. After 30 minutes of testing, the MSP tank sample experienced a pressure drop greater than 25.0 mm. The JFTOT machine shut down at 62.8 minutes into the test of the MSP fuel.

Two samples from the Michigan Filter were sent to the NTSB Materials Laboratory for examination. The Metallurgist's Factual Report stated that both samples were submitted to ARTECH Corporation for analysis.

The ARTECH Corporation report stated:

...The spectrum from the acetone dry film lacks the absorption at 3200 cm which is characteristic of oxygen-hydrogen bonds, indicating that this part of the sample may be due to waters of hydration rather than a bound part of the compound. The remainder of the spectra are characteristic of the cellulose derivative, cellulose acetate. Cellulose acetate is used as a blending compound in thermoplastics. Cellulose pentaacetate is soluble in alcohol. It is thus possible that a thermoplastic was in contact with the fuel in this incident and dissolved due to an alcohol additive in the fuel...

ADDITIONAL INFORMATION

Air Wing Organization

\* NOTE: In order to protect the anonymity of the law enforcement officers still performing police functions, names will be substituted with capitol letters.

The Massachusetts State Police (MSP) Air Wing was a "Public Use" organization. The helicopters and airplane assigned to the Air

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The MSP Air Wing had existed for over 20 years. The investigation revealed that the only written document relating to the operation of the Air Wing, was MSP General Order TOP-06. The purpose of the three page General Order (GO) was to establish guidelines for the utilization of MSP Aviation. The GO described the type of missions the Air Wing would support, and how flights were requested. The only specific direction provided to the Air Wing personnel was paragraph 4.1.3, that stated, "There will be a pilot and co-pilot for all night and instrument rated flights."

The last section of the GO referred to Unit Qualification and Training. This section dealt with the selection process for assignment to the Air Wing, and listed the types of associated training that could be involved. Paragraph 4.3.6 stated, "Air Wing officers are required to periodically demonstrate acquired abilities and continued proficiency to the Air Wing Leader and/or Special Operations Commander." The last paragraph of the GO stated that at least one officer within the Air Wing would be an FAA certificated flight instructor.

The Air Wing aviation personnel consisted of a Lieutenant (Lt.) Air Wing commander, a Sergeant (Sgt) chief pilot, a Sgt designated as the operations officer, another Sgt designated as the maintenance officer, and four line trooper (TRP) pilots. A MSP Major, in charge of the Special Operation/Tactical Division, was the immediate supervisor over the Air Wing.

Procedures

The MSP Air Wing did not possess standard operating procedures (SOP), or operation specifications. The wing did not have a documented description of the Wing structure, or a statement of it's mission.

During interviews with wing pilots, specific missions such as high intensity spotlight, search and rescue, and surveillance were identified; however, there were no documents that identified the aircraft equipment requirements, the conditions in which the missions could be performed, the standard expected during the missions, and a description of how to perform the missions. Additionally, pilot prerequisites, qualifications, and training requirements to perform the missions, were not identified.

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The wing personnel had different opinions about who was a senior pilot, or pilot-in-command (PIC), in the Air Wing. The wing did not publish a roster of designated PICs. There was no formal program to identify PIC selection, training, evaluation, or their duties and responsibilities.

The Eurocopter Flight Manual stated that the minimum crew for the AS-350 was one pilot in the right, "starboard," seat. The Air Wing PICs occupied either pilot station at random. The PIC of the accident helicopter was occupying the left seat.

The Air Wing Operations did not record nor track pilot flight hours flown, duty hours worked, or bi-annual flight reviews completed. The chief pilot stated that these items were monitored, "through personal knowledge."

The Air Wing had no minimum weather requirements published for the conduct of missions. During interviews, the chief pilot stated that he "thought" there was a hand written, weather minimum policy. The other pilots interviewed stated that they were not aware of such a policy, and each had developed their own minimums.

The wing did not possess a formal or documented training program. There was no training program published for new personnel, and no guidelines for the conduct of night, instrument, refresher, or annual training for Air Wing pilots.

Although missions were flown both day and night over water, the helicopters were not equipped with floats, personal floatation devices, or rafts. The wing personnel had not received water survival training.

The wing lacked a formal or informal safety program. A safety officer was not designated, and safety meetings and surveys were not conducted. The wing also did not participate in a crew resource management (CRM) program.

Air Wing Training

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During the period, 1985 to 1988, several MSP troopers were assigned to the Air Wing. The newly assigned pilots possessed FAA Private Pilot Certificates, with ratings in single engine airplanes. None of the pilots were instrument rated.

Pilot training was conducted locally by the Air Wing Commander, Lt A, who was also an FAA Helicopter Certificated Flight Instructor (CFI). During interviews with Air Wing personnel, they stated that the training was conducted in a Robinson R-22 and a Bell 206, and included touch down autorotations. Through the MSP training program, the trooper pilots obtained a helicopter rating on their Private Pilot Certificates. After additional experience and flight training within the wing, the troopers obtained their helicopter Commercial Pilot Certificates. The training conducted for these ratings was not formally documented, and followed no specific training program or syllabus.

Interviews with wing personnel revealed that during Lt A's tenure as commander, separate flights were not scheduled to conduct training or evaluations. Although the commander did not conduct formal annual evaluations, training was conducted regularly during scheduled missions. Lt A conducted no-notice emergency procedure training, which included forced landing practice, and touch down autorotations, which were performed in the wing's Bell 206. The wing's chief pilot stated that touch down autorotations were not performed in the AS-350 with Lt A, only power recoveries.

Lt A was transferred from the Air Wing, in 1990. His departure left the wing absent an FAA Certificated Flight Instructor, until the assignment of the current commander, Lt C.

At the time of Lt C's assignment, in 1993, he had less than 10 hours of turbine engine helicopter experience, and had only instructed in the Robinson R-22. At the time of the accident, Lt C had not instructed in any of the wing's helicopters, and was not considered a PIC.

In August, 1991, Sgt C was transferred out of the Air Wing back to road patrol. In October, 1992, after a union grievance was settled, Sgt C was reassigned back into the Air Wing. The trooper had not flown for 14 months, and was assigned to fly co-pilot duties by Lt B, the wing commander. After a month of co-pilot flying, Sgt C was given an evaluation flight by Lt B, and released to fly as a PIC. Lt B was not a CFI, and no touch down autorotations were performed during this evaluation.

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In March, 1994, a new trooper pilot, Trp A, was assigned to the Air Wing. Trp A possessed a helicopter Commercial Pilot Certificate and was helicopter instrument rated. At the time of his assignment, he also possessed a current helicopter CFI, which was due to expire at the end of April, 1994. Trp A had accumulated over 2,000 hours of helicopter flight experience prior to his assignment to the wing, and was a current turbine helicopter instructor pilot in the Massachusetts Army National Guard. The MSP Air Wing allowed Trp A's CFI to expire, and continued to operate without a turbine qualified helicopter CFI.

In May, 1994, the MSP Air Wing hired American Eurocopter to conduct AS-350 training, at the wing facility in Norwood, Massachusetts. A ground school was conducted for all of the Air Wing pilots on May 16 and 17, 1994. The Eurocopter outline stated that the ground school consisted of 14.7 hours of instruction.

On May 18-20, 1994, an American Eurocopter CFI conducted flight training with eight Air Wing pilots. The individual sorties and hours flown were as follows:

PILOT		SORTIES		TOTAL	
		FLOWN		HOURS	
Lt. C.....		2	.....	3.0	
Sgt A.....		1	.....	1.1	(Chief Pilot)
Sgt B.....		1	.....	1.0	
Sgt C.....		1	.....	0.9	
Trp A.....		2	.....	3.0	
Trp B.....		1	.....	1.0	
Trp Mattaliano...		1	.....	0.9	
Trp Perry.....		3	.....	4.0	

An American Eurocopter flight training sheet was completed for each of the eight pilots. All areas were initialed as completed by the pilot and the CFI, except for autopilot operations. A review of the training sheet, and the Eurocopter AS-350 Flight Training Syllabus, revealed that the following items were completed for each of the pilots:

\* Preflight - A minimum of two starts and two shutdowns.

NTSB

N-No

Date

Make

Model

Factual

Released Narrative

\* Cruise - During cruise flight the student pilot was to perform a best rate of climb, fast cruise, economic cruise and VNE maneuvers. Also required was an engine condition check and simulated engine failure.

\* Other Maneuvers - Hovering turns and taxi, hovering autorotation, confined area landing and takeoff, slope operation, quick stop, normal takeoff and landing. Also required were a maximum performance takeoff and a steep approach, running landing, simulated hydraulic servo-control system failure in flight and at a hover, simulated governor malfunction, and simulated tail rotor malfunctions to a landing and a go-around.

\* Autorotations - As a part of the training, straight-in autorotations and autorotations with turns were required. Note number four in the AS-350 syllabus stated, "A minimum of 10 autorotations shall be performed by each student pilot, which includes two 180 degree autorotations."

To complete the listed maneuvers, a minimum of 18 takeoffs and landings were required, in addition to the cruise flight maneuvers. Five of the pilots accomplished the listed training events in .9 to 1.1 hours of flight time.

After Lt A's departure from the Air Wing, in 1990, through the date of the accident, in 1995, the Air Wing did not conduct any formal or informal helicopter training, except the May, 1994, American Eurocopter training.

During that 5 year period, no touch down autorotation practice or training was accomplished, and there was no flight training or evaluations conducted by a CFI. Except for the May, 1994 training, none of the pilots attended any organized pilot standardization or training program.

AS-350 Training

During an interview with the chief pilot, he stated that the Air Wing received the first AS-350 in March, 1987. The purchase of the



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					AS-350 entitled the Air Wing to two pilot transitions at the Eurocopter facility in Grand Prairie, Texas. Lts A and B attended these transitions. Upon his return from Eurocopter, Lt A conducted transitions for three of the Air Wing pilots, Sgts A, B, and C.	
					The initial ground and flight training for the AS-350 was conducted at the MSP facility. The flight training included hydraulic-off running landings, oral anti-torque procedures, hovering autorotations, and power recovery autorotations. According to Sgt A, no touch down autorotations were performed. At the completion of the training, the three pilots then flew the AS-350 as PIC.	
					In November 1988, the Air Wing purchased another AS-350, and Sgts A, B, and C, attended the AS-350 pilot transition training at American Eurocopter. During this training, Sgt A performed his first touch down autorotations in the AS-350.	
					Two of the three Sgts interviewed did not recall performing touch down autorotations in the AS-350 with Lt A. Sgt B recalled "doing some" touch down autorotations with Lt A. Three of the four pilots interviewed, stated that a CFI was a required crewmember to perform power recovery autorotations in the AS-350, due to the location of the throttle. The same Sgt who recalled "doing some" touch down autorotations with Lt A, stated that only another qualified pilot was required to perform power recovery autorotations in the AS-350.	
					Trooper Mattaliano	
					Trooper Mattaliano transferred into the MSP Air Wing, in 1988. At the time of the transfer, he possessed a Private Pilot Certificate with a rating for airplane single engine land. He received his initial helicopter flight training with the Wing Commander, Lt A. Trooper Mattaliano received his initial training in the Air Wing's Bell 206. He received his AS-350 training from Lt A, in 1988, and he obtained his helicopter Commercial Pilot Certificate, in 1990. Trooper Mattaliano was designated a PIC by Lt A.	
					During his assignment in the Air Wing, the only formal flight training that Trooper Mattaliano received was during May, 1994, with the American Eurocopter CFI. During that training flight, all maneuvers were completed during a single flight period which consisted of 0.9 of an hour. This was the only documented flight in the AS-350, where Trooper Mattaliano performed touch down autorotations.	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Trooper Perry

Trooper Perry transferred into the MSP Air Wing during March, 1994. Prior to his arrival, he obtained his initial helicopter Private Pilot Certificate, at a civilian flight school in Beverly, Massachusetts. His flight training had been predominately in the Robinson R-22. Trooper Perry flew as a co-pilot in the wing helicopters.

Trooper Perry received his only formal training in the Air Wing during May, 1994, with the American Eurocopter CFI. During that training, all maneuvers were completed during three flight periods totaling 4.0 hours.

Helicopter Refueling

During the 10 days preceding the accident, N20SP was refueled on five separate occasions with a total of 180 gallons of Jet A fuel. During that time frame, N20SP refueled once from the MSP fuel tank in Framingham, Massachusetts. On February 17, 1995, N20SP was refueled with 45 gallons of Jet A from the Framingham tank. The next refueling occurred on February 18, 1995, with 35 gallons of Jet A from Wiggins Airways, in Norwood, Massachusetts. The last refueling was also at Wiggins on February 21, and consisted of 30 gallons of Jet A. At the time of the accident, it was estimated that N20SP had approximately 100 gallons of fuel on board.

During an interview with the Wiggins Air Service line person who refueled N20SP on February 21, 1995, he stated he had been assigned to refuel an airplane and had selected the fuel truck's Prist valve to the [on] position. Prior to reaching the airplane, he was rerouted to fuel the State Police helicopter. He proceeded to fuel N20SP without turning off the Prist valve, and the helicopter was refueled with 30 gallons of Jet A containing Prist.

The additives section of the AS-350 Flight Manual stated:

Anti-ice additives. If the fuel does not contain fuel system icing inhibitor, the use of such an additive is compulsory at O.A.T. below 0 degree C. The additive shall conform to French Specification Air 3652... MIL-I-27686...Maximum concentration: 0.15%

NTSB	N-No	Date	Make	Model	Factual by volume.      Minimum concentration: 0.08% by volume...	Released Narrative
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N20SP was equipped with the optional Michigan Dynamic Fuel Filter System, in accordance with STC Number SH6022SW-D. The Michigan filter was designed to capture ice particles and eliminate the requirement for anti-ice additives in the fuel system. The STC specifically stated fuel anti-ice additives were not required for use with the basic fuel system through out the certified temperature envelope.

As described by the manufacturer, Prist is a microbiocidal and anti-icing aviation fuel additive, which inhibits bacterial and fungal growth in jet fuel and controls icing in aircraft fuel by depressing the freezing point of water. The primary ingredient of Prist is ethylene glycol monomethyl ether (2-methoxyethanol).

Framingham Fuel

The MSP operated an aviation jet fuel dispensing system at their headquarters in Framingham, Massachusetts. The system consisted of a 6,000 gallon in-ground tank, pump, and hose dispenser. The aviation tank was installed in conjunction with motor vehicle fuel tanks about 1979. A review of MSP construction data revealed that the helicopter pad and pump were installed in the Spring of 1981.

The specifications for the installation of the equipment listed full flow filters for the vehicle fuel tanks; however, it did not list, or specify, any filter for the aviation tank, which was equipped with a single in-line filter.

The last fuel delivery to the Framingham tank was made on September 9, 1992. At that time, 5,473 gallons of aviation jet fuel were delivered by Costal Oil New England, Inc. After the refueling of N20SP on February 17, 1995, the tank contained approximately 2,900 gallons of jet fuel.

During an interview, the Framingham Supervisor of Building Maintenance stated that the Air Wing ordered their own fuel, and he had never observed an actual delivery. The main tank filler caps, which were located adjacent to the road, were never locked. The

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					only aviation pump filter change that the supervisor was aware of, occurred about 7 years ago, by the ZECCO Company.	
					The ZECCO serviceman who performed the work on the MSP aviation pump filter w	

NTSB	N-No	Date	Make	Model	Factual HISTORY OF FLIGHT	Released Narrative
					<p>On March 26, 1997, approximately 1010 mountain standard time, a Cessna 172P, N97527, registered to and being operated by Brentco Aerial Patrol, Inc., and being flown by a commercial pilot, was destroyed during impact with terrain following a loss of control in flight approximately 11 nautical miles (nm) south-southwest of Burlington, Wyoming. The pilot was fatally injured. Visual meteorological conditions existed and no flight plan had been filed. The flight, which was an aerial pipeline patrol, was to have been operated under 14CFR91, and originated from Worland, Wyoming, approximately 0950.</p> <p>According to personnel stations at the operator's base at Durango, Colorado, the pilot departed Bridger, Montana, where he based the aircraft, and commenced an aerial pipeline patrol flight sometime early on the morning of Wednesday, March 26, 1997. Several credit card receipts were found showing fuel purchased at the fixed base operator at the Worland, Wyoming airport. These receipts provided the following information:</p> <p>Monday (03/24/97) 07:48AM 28.6 gallons 100LL avgas Tuesday (03/25/97) 10:18AM 39.0 gallons 100LL avgas Wednesday (03/26/97) 09:48AM 34.7 gallons 100LL avgas</p> <p>The fueler at the Worland airport reported that he was accustomed to seeing N97527 stop for fuel. He also reported that on the morning of Wednesday, March 26, he topped off the wing fuel tanks after which the aircraft immediately departed (note the time of the credit card transaction shown at 0948).</p> <p>The operator reported that the pilot was contractually required to patrol each of the designated pipeline routes a minimum of once per week. The pilot was given flexibility as to when to conduct the various patrol flights and in what order.</p> <p>The aircraft's emergency locator transmitter (ELT) operated subsequent to the accident and signals were reported to Seattle Air Route Traffic Control Center at 1135. The aircraft was subsequently visually located at 1544.</p> <p>The aircraft was found at a point 32 nm west-northwest of the Worland airport, and on a direct line toward the Cody airport (refer to</p>	<p>Before flight, both wing fuel tanks were 'topped off' with 50 gallons of usable fuel. At about 0950 MST, the pilot departed Worland, Wyoming, en route to Cody, Wyoming, to commence the second half of an aerial pipeline patrol route. After an estimated 20 minutes of flight, the aircraft crashed in an area of uneven, sage covered, terrain. The flaps were found extended 8 degrees, the ignition had been switched to 'LEFT,' and there was evidence that the pilot had slowed the aircraft before it impacted uneven terrain. No evidence was found to indicate that the engine was developing power when impact occurred; aft bending of the propeller was noted with minimal abrasion and chordwise scratching. Extensive hydraulic effect was noted on both main fuel tanks, as well as on one of the brass floats within the carburetor float chamber. An engine teardown revealed no preimpact mechanical malfunction, and no anomalies were found with the aircraft's fuel, air, or ignition systems. Postcrash testing of the aircraft's auxiliary fuel system revealed no mechanical malfunction. Temperature and dew point at Worland were 54 and 32 degrees; according to icing probability charts, the conditions were conducive for carburetor ice; however, carburetor icing was not verified.</p>

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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CHART I). Documentation found at the crash site showed a series of patrol routes, of which one was observed to begin at a point named Silver Tip (arrow A on CHART I) and continue southeast past the Worland airport and thence southwest and west to a point named Gooseberry (refer to CHART I). An intermediate point on this route named Slick Creek was observed to lie just east of the Worland airport (refer to arrow B on CHART I, and CHART II). Additionally, a separate portion of this route was observed to begin just east of the Cody airport at Cody Booster (refer to arrow C on CHART I, and CHART II) and terminate approximately 10 nm southeast of the airport at Oregon Basin (refer to CHART II). This termination point was approximately 25 nm north of Gooseberry (refer to ATTACHMENT I which names the patrol route points for the entire route).

PERSONNEL INFORMATION

No pilot logbooks were located and the flight time entered into the core report were provided by the Operator. The pilot was hired by the Operator on February 6, 1996, and began flying pipeline patrol flights in the Southwest (Texas-New Mexico) shortly thereafter. He was transferred to pipeline routes in Wyoming on January 29, 1997, and moved to Bridger, Montana (refer to CHART I).

N97527 was, according to the Operator, assigned to the pilot after he was hired. According to the airframe log, the aircraft accrued approximately 1,109 hours for flight time between February 18, 1996, and the date of the accident.

AIRCRAFT INFORMATION

N97527, a Cessna 172P, was equipped with two 27 gallon metal fuel tanks, one located in each wing root area. Of the 27 gallons available in each tank, all but 2 gallons were usable. The fuel is fed by gravity from the wing tanks through a four position selector valve and on to the carburetor. The selector valve positions are (from the 6 o'clock position clockwise) OFF, LEFT, BOTH, and RIGHT.

Additionally, the aircraft had been modified per Supplemental Type Certificate SA615NE, dated 10/18/88, to include an 18 gallon aft baggage compartment fuel tank. The aluminum tank was serviced through a filler port on the right side of the fuselage (refer to photograph 4). Fuel within the tank was transferred via an electric pump into the right wing tank. The tank was equipped with both a sump drain and vent line.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The transfer pump was operated via a control panel located immediately aft of the fuel selector valve on the floor of the cockpit and between the front seats. The control panel was equipped with a round, analog fuel gauge located in the center with marked positions showing "E" (empty), "1/2" and "F" (full). A three position switch controlling the electric pump was located to the left of the gauge and a single, small incandescent light was located to the right of the gauge.

The axis of the toggle switch, which in its mid position, was normally parallel to the aircraft's vertical axis, could be moved aft to the OFF position, or forward to the START position. THE START (forward) position was spring loaded such that the switch, when released, would return to the mid position, marked RUN. The OFF (aft) position was not spring loaded (refer to photograph 19).

Operating procedures for the fuel transfer system were to:

1. "Operate on main tanks until right fuel gauge reads 2/3 full."
2. "Move transfer switch to momentary position and hold for 10 seconds. Light should illuminate and remain illuminated when switch is released."
3. "If light does not stay illuminated, repeat step 2."
4. "Transfer while operating on right main tank in straight and level flight only."
5. "Transfer is in progress when transfer light is illuminated." (refer to ATTACHMENT M pages 1-4)

METEOROLOGICAL INFORMATION

The aviation surface weather observation taken at Cody, Wyoming at 0855 on the morning of the accident reported winds from 220 degrees magnetic at 13 knots with gusts to 17 knots. One hour later (0955) the station reported winds from 260 degrees magnetic at 13 knots with gusts of unreported intensity.

The aviation surface weather observation taken at Worland, Wyoming, at 0855 on the morning of the accident reported winds from 310 degrees magnetic at 3 knots. One hour later (0958) the station reported winds from 300 degrees magnetic at 3 knots. Winds remained light throughout the day with no gusts reported.

NTSB	N-No	Date	Make	Model	Factual WRECKAGE AND IMPACT INFORMATION	Released Narrative
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The ground impact site was established at 44 degrees 17.078 minutes north and 108 degrees 33.262 minutes west latitude and longitude respectively using a hand held global positioning unit. The elevation of the site was approximately 5,850 feet above mean sea level. The terrain at the site was characterized by uneven, sage covered terrain with numerous moderate slope changes (refer to CHART III).

According to personnel responding from the Big Horn County Sheriff's office, the aircraft was observed by search and rescue personnel at the accident site in a nose low, nearly vertical attitude with respect to the terrain. During the night following the accident strong winds reportedly blew the aircraft over onto its back.

The investigative team observed the aircraft in an inverted attitude with the longitudinal axis oriented along a 091/271 degree magnetic bearing line (tail east). The slope at the initial impact site was measured at -35 degrees towards the east-northeast. The crush along the underside of the aircraft's engine/forward fuselage was measured to be approximately 27 degrees. The left wing was observed to be displaced aft somewhat of the aircraft's lateral axis, whereas the right wing was displaced forward to the same approximate degree. The left main landing gear displayed greater aftward deformation compared to the right main landing gear. The auxiliary fuel tank cap was observed hanging loose by its attach cable. No paint abrasions, scarring, or fuel stains were observed in the vicinity of the auxiliary fuel filler port (refer to photographs 1 through 5 and CHART III).

All of the aircraft (control surfaces, powerplant and airframe) was located at the crash site. Additionally, there was no evidence of any discontinuity within any of the three flight control systems, nor between the throttle and mixture control cables and the carburetor.

The initial ground impact site was observed several feet west of the final resting place of the aircraft's engine (refer to photograph 5). A faint ground impact impression was observed oriented along a 166 degree magnetic bearing line. This impression extended from an area approximately 20 feet from the center of the initial ground impact site north, and small fragments of red wingtip navigation lens and plastic wingtip fragments were noted at its terminus (refer to photograph 6). The initial ground impact site was also characterized by three prominent impact depressions, the largest of which was a crater containing small engine and plastic nose cowl fragments. Upslope to the west and roughly equidistant from this crater were two smaller impact craters containing fragments associated with the left and right wheel fairings. Numerous large pieces of forward cockpit windscreen were observed lying on the ground at this site (refer to photograph 7).



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The left wind strut was buckled somewhat near the fuselage. The wing was observed to be twisted approximately 30 degrees (leading edge up) at the tip, and the wing was deformed upwards approximately 36 inches progressing from root to tip. The flap was observed to be partially extended. Additionally, the tip cap was absent, there was noticeable aftward accordion like deformation at the leading edge, and a distinctive "bulge" deformation was noted on the underside in the vicinity of the fuel tank consistent with a hydraulic impact effect from an impact of a fuel tank containing substantial fuel (refer to photograph 8).

The right wing strut was buckled near its midpoint. The wing was observed to be deformed upwards from mid-span towards the tip. The flap was observed to be partially extended. Additionally, the tip cap was in place, there was little aftward accordion like deformation at the leading edge, and the distinctive "bulge" deformation was noted on the underside in the vicinity of the fuel tank consistent with a hydraulic impact effect from an impact of a fuel tank continuing substantial fuel (refer to photograph 9).

The engine was observed to have been displaced aftward into the forward cockpit area. The propeller remained attached and one blade displayed aftward bending deformation of approximately 80 degrees. This blade also displayed light leading edge abrasion of paint, minimal chordwise scratching and multiple abrasions of the white tip paint along a line perpendicular to the chord line (refer to photograph 10). The opposing blade displayed only a few degrees of aftward bending deformation along with light leading edge abrasion of paint and minimal chordwise scratching (refer to photograph 11).

A blue stain characteristic of 100 low lead aviation fuel was observed at the leading edge of the right wing (low point) emanating from the wing strut attach point outboard towards the tip (refer to photograph 12).

The empennage, vertical and horizontal stabilizers, and their associated control surfaces, sustained minimal damage. The plastic cap at the top of the vertical stabilizer was observed to be broken. The left horizontal stabilizer displayed light upwards bending deformation mid span (refer to photograph 13). The right horizontal stabilizer was undamaged and the elevator trim tab was observed to be positioned approximately 15 degrees tab up (refer to photograph 14).

Additionally, the aircraft's mechanical clock was observed to have stopped at 10:09:30. The fuel selector within the cockpit was observed midway between "BOTH" and "RIGHT" tanks, and the auxiliary transfer pump switch was observed in the "RUN" position with the associated fuel gauge reading just under one-half tank. Approximately 1-2 ounces of blue aviation fuel were drained from

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					the line connecting the gascolator to the carburetor with trace amounts of fuel within the carburetor. The aircraft's electrically driven flap jackscrew unit was examined and fount to be extended to a position corresponding to 8 degrees of flap extension. The magneto switch was observed in the "LEFT" position. The tachometer hour meter was observed to read 84.81 hours.	

A spiral bound notebook clipped open to a specific page was found at the accident site. The notebook contained a series of hand written notes consisting of alpha numeric characters with numbers beneath them. The first and last of the three references were annotated "WRL" which is the three letter identifier for the Worland, Wyoming airport. The intermediate reference was annotated "7V6" which is the identifier for the Guernsey, Wyoming airport, where the aircraft had fueled on March 25, 1997. The number beneath 7V6 was 79.9 and the number beneath the WRL entry was 84.4.

MEDICAL AND PATHOLOGICAL INFORMATION

Post mortem examination of the pilot was conducted at the Michelotti Sawyer's Nordquist mortuary, Billings, Montana, on the afternoon of March 27, 1997. Toxicological evaluation of samples taken from the pilot was conducted by the FAA's Toxicology and Accident Research Laboratory. All findings were negative (refer to attached Toxicology report).

TEST AND RESEARCH

The aircraft was re-examined at the facilities of Arlin's Aircraft Services, Bozeman, Montana, on April 16 and 17, 1997. The following areas and associated results were as follows:

The aircraft's ignition switch was checked and found free of any electrical discontinuity. Likewise, both magnetos were checked and found to be capable of producing a spark at each of their four leads. The timing was found to be 26-27 degrees before top dead center for the left magneto and 25 degrees before top dead center for the right magneto. All eight spark plugs were examined. The top plugs for numbers two and four cylinders displayed an oil coating. The remaining six plugs displayed a gray coloration with no evidence of excessive wear or improper gapping. The airframe fuel vent system was examined and no discrepancies were found. Additionally, the vent check valve was tested and found to be unblocked.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The Lycoming O-302-D2J was examined and then disassembled. Continuity of both the crank and cam shafts, as well as appropriate rocker arm movement, was verified as was compression on each cylinder. A small amount of metal contamination was found within the oil suction screen. The oil filter, which had several small magnets affixed to its external canister, was cut open and examined and found to contain very small slivers of metal. The engine case was split and the pistons, pins crankshaft, cam shaft, bearings and connecting rods and valve tappets were examined. The only discrepancy noted was a wear down of approximately 7/32 of an inch on two of the cam shaft lobes, and spalling of the tappet face on the four associated tappets (refer to photographs 15 and 16).

The carburetor, which had broken free of the engine, was examined. The throttle and mixture control cables remained attached and the throttle setting was observed to be approximately 3/4 open, while the mixture arm was observed in the mid-range position. Examination of the gascolator bowl revealed less than one-half ounce of water and a small amount of corrosion and sediment at the bottom of the bowl. The carburetor heat valve was observed in the closed (cold) position. The carburetor housing was free of crushing deformation (refer to photograph 17). The housing was opened and the internal mechanics of the carburetor were examined. There was no evidence of any mechanical malfunction within the carburetor, however, one of the floats was observed to have implosive type "hydraulic" deformation (refer to photograph 18).

The auxiliary fuel transfer system was removed from the aircraft, examined and tested. The spring loaded switch was found to function normally as did the transfer light when a replacement bulb was inserted in place of the shattered bulb (refer to photograph 19). A container of cleaning solvent was used as a fluid source and the pump system was tested using an aircraft battery. After several seconds of priming with the switch in the START position, the transfer light burned steady and fluid flowed at a rate of 0.321 gallons per minute at 1 pound per square inch pressure (psi). When the outflow line from the pump was blocked fluid flow ceased and the pressure rose to 4.4 psi.

A telephone conversation with an engineer on the staff of Textron Lycoming revealed that the acceptable flow rate of fuel to the Facet MA-4 SPA carburetor for the O-320-D2J engine ranged from a minimum of 0.5 to a maximum of 8.0 psi.

The test run of one of the Operator's Cessna 172 aircraft equipped with a Lycoming O-320-H2AD engine and 18 gallon auxiliary fuel system was conducted on February 20, 1998. The test was conducted at approximately 3,000 feet above sea level with the engine operating at 2400-2450 RPM. The left and right wing fuel tanks had been filled and, subsequent to engine start, and with the engine drawing fuel from the left tank, the auxiliary fuel transfer pump was activated. The aircraft was operated for a period of approximately 45 minutes with the intent of transferring fuel from the auxiliary tank into the right tank and with the left tank selected for the duration. When the right tank was unable to accept any additional fuel, and with a head pressure from the auxiliary transfer pump, fuel was expected to begin transferring into the left tank via the tank vent interconnect line (refer to DIAGRAM I).

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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When the left tank was unable to accept any additional fuel, the fuel was then expected to pressurize the spring loaded vent line value to the closed position. The test was to determine, if at this point, the fuel within the pressurized fuel system would then transfer entirely to the carburetor at such a rate as to flood the engine. The test resulted in a continuously running engine with no degradation or loss of power. The auxiliary transfer pump light was observed "ON" for the duration of the flight and approximately 11 gallons of fuel was transferred out of the tank by the end of the flight. The left and right wing tanks remained full upon landing. The pilot reported that he was accustomed to seeing the auxiliary transfer system move all 18 gallons of fuel out of the tank in approximately one hour's time (0.30 gallons per minute flow rate). Subsequent to the flight test, the aircraft was inspected with no evidence of any fuel leaks.

ADDITIONAL INFORMATION

On site examination of the wreckage was conducted on the afternoon of March 27th and the wreckage, which remained at the site, was verbally released on a conditional basis for removal only to Mr. Chuck Carstensen, representative of AVEMCO. Itemized aircraft logs and records as well as associated paperwork found at the site by the Big Horn County Sheriff's Department in a brown leather navigation bag were retained by the IIC. Original pipeline route maps (red binder, manila folder, and stapled topographic charts were copied and the originals were sent via US Overnight Mail to Mr. Rick Vincent, in care of Marathon Pipeline, Powell, Wyoming, on Saturday afternoon, March 29th.

The wreckage was released to Mr. Carstensen subsequent to the engine and airframe examination, and written wreckage release was documented on NTSB form 6120.15 (attached). All retained records, logs and paperwork were returned to Brentco Aerial patrol via Federal Express on August 25, 1997, and some incidental paperwork was returned on February 18, 1998.

NTSB	N-No	Date	Make	Model	Factual
					<p>On June 24, 1997, about 1301 central daylight time, a Piper PA-28-181, N3692M, registered to the Midwest Air Service, Inc., was substantially damaged during a forced landing near Walls, Mississippi. Visual meteorological conditions prevailed at the time and a VFR flight plan was filed for the 14 CFR Part 91 personal flight. The private-rated pilot and two passengers were not injured. The flight originated at 1000 eastern daylight time from the Savannah International Airport, Savannah, Georgia.</p> <p>The pilot received a standard weather briefing via telephone and when filing a VFR flight plan, she stated that the estimated time en route was 5 hours with 5 hours of fuel on board. The briefing specialist questioned this and the pilot replied that the flight would refuel at an airport en route.</p> <p>Before departure she confirmed that fuel in the left fuel tank was into the filler neck area and the fuel in the right tank was even with the bottom of the filler neck. The flight departed at 1000 and climbed to 5,000 feet where the pilot was asked to level off momentarily, then, 4 minutes 12 seconds later, the flight was cleared to climb to 8,500 feet. At 1029, the pilot reported to the controller that the flight was level at 8,500 feet, and she leaned the fuel/air ratio until the engine began to run rough then enriched the mixture. The flight continued and when about 12 nautical miles east of the Holly Springs VORTAC, which in straight line distance is 49 nautical miles southeast of the destination airport, she requested to descend from 8,500 to 3,500 feet. She was advised that the flight would be vectored south of the Memphis International Airport (MEM). The flight continued and about 3 hours 45 minutes into the flight while flying at 1,800 feet mean sea level, the left and right fuel quantity gauges indicated 5 gallons and 2 gallons respectively. About 14 minutes later, when the flight was immediately south of the MEM airport with the fuel selector positioned to the right fuel tank, the engine sputtered. She immediately positioned the fuel selector to the left tank and advised the controller that, "ah sir we just had a problem with the right fuel tank we're only on the left and thats reading just about zero i think we'll have to come down ah before mike zero one [destination airport]." The controller advised the pilot that the nearest airport was located about 6 miles west of her present position. At 1300.51, which was 4 hours after takeoff, the pilot advised the controller that, "all right we're looking um im gliding at the moment ...." At 1301.43, the pilot advised the controller that she spotted a field and was planning on landing in the field. While descending for a forced landing in the field, the airplane collided with the tops of trees then landed hard and remained upright. She further stated that the hand held Global Positioning System (GPS) receiver indicated that the average ground speed for the flight was 125 knots.</p> <p>Examination of the airplane by an FAA inspector revealed no remaining fuel in the fuel tanks which were not ruptured. The FAA inspector also stated that there was no evidence of fuel siphoning. According to the crew who recovered the airplane, a total of about 1/3 cup of fuel was drained from the left wing fuel tank and no measurable fuel was found in the right wing fuel tank. The recovery crew removed the aft seat and carpeting and noted that there was no evidence of fuel stains. The carburetor was removed from the engine and sent to the manufacturer's facility for further examination.</p>

Released Narrative

The flight departed with full fuel tanks for the planned 4 hour 33 minute flight. Three hours 36 minutes into the flight about 49 nautical miles from the destination airport, the pilot requested to descend to 3,500 feet. The performance chart indicates the descent to begin 41.5 nautical miles. About 9 minutes later the pilot noted that the fuel gauges were indicating low and the flight descended to 1,800 feet. The flight continued and about 14 minutes later, the engine sputtered. The pilot repositioned the fuel selector, advised the controller of this who vectored the airplane toward a nearby airport, and shortly after, about 4 hours after takeoff, the engine quit. Unable to land at the vectored airport the pilot selected a field with a resulting hard landing. Postcrash examination of the airplane revealed fuel exhaustion. The carburetor was tested, and near the power setting set by the pilot during the cruise portion the fuel flow was found to be 3.0 pounds-per-hour high due to a failed spring inside the carburetor. The carburetor was 20 years old and was never overhauled since manufacture although there is no mandatory requirement. Examination of the carburetor revealed evidence of a fuel leak due to 1 loose carburetor bowl to body screw. The airplane was last inspected 5 days 12 hours earlier in accordance with a 100-Hour inspection but the carburetor was not further examined.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>The carburetor was determined to be manufactured in February 1977. A lead seal on the outside of the carburetor was identified with the letters M-S stamped into it. The carburetor was manufactured by the Marvel Schebler division of the Borg Warner Corporation. Visual examination of the carburetor revealed evidence of fuel stains beneath a carburetor bowl to body screw which was determined to be loose; however, two of the tabs on the associated washer were contacting the flats of the screw head. Additionally, the idle jet was determined to be partially blocked by contaminants. According to the manufacturer, this would result in the finding that the fuel flow in terms of pounds per hour (pph) was unable to be adjusted to specification at the idle setting.</p>	
					<p>The carburetor was bench tested for comparison with certification standards for a master carburetor of the same model and the fuel flow in pounds per hour was determined to be above the specification limits at three of the four test points. A copy of the examination and bench test reports are an attachment to this report.</p>	
					<p>Disassembly of the carburetor revealed in part that the air metering pin return spring, Part No. 24-A30, was failed. Metallurgical examination of the spring revealed evidence of fatigue in three areas on the spring. No corrosion was noted.</p>	
					<p>According to the carburetor manufacturer, the master carburetor was previously placed on a production engine of the same model with a test club propeller and at the same test points of 162, 208, and 230 cubic feet per minute airflow, the recorded rpm was 2352, 2549, and 2615 rpm respectively. The pilot stated that during the flight she set the rpm to between 2525 and 2550. The bench test results from above at the test point closest to the rpm selected by the pilot indicate that the fuel flow in pph was about 3.0 higher than specified.</p>	
					<p>Review of the maintenance records by an FAA inspector revealed that there was no record that the carburetor had been overhauled since manufacture. Additionally, the engine logbook contained an entry dated October 3, 1989, which indicated that the engine received a major overhaul at a total time of 1,962 hours. According to a Service Bulletin by the Facet Aerospace Products, Co., dated September 9, 1986, pertaining to time between overhaul periods of all Marvel Schebler carburetors, the factory recommended time between overhauls is not to exceed the engine TBO. According to the engine manufacturer, the recommended TBO for the engine is 2,000 hours or 12 years. Compliance with the carburetor manufacturer service bulletin and engine manufacturer recommended TBO is not mandatory for 14 CFR Part 91 operators. At the time of the accident the engine had accumulated 1,846 hours since overhaul in 1989.</p>	
					<p>The maintenance records also indicated that a 100-hour inspection had been accomplished 5 days and 12 hours earlier. According to the Director of Maintenance who performed the inspection, he partially removed both wing fuel tanks to check each flexible fuel</p>	

NTSB	N-No	Date	Make	Model	Factual line for condition. After installation of both fuel tanks he added 1 gallon of fuel to each tank which is the unusable capacity and verified that each fuel gauge indicated empty.	Released Narrative
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Review of the airplane best power range chart revealed that based on the information provided by the pilot, the maximum range at the planned power setting with a 45-minute reserve at 55 percent power was 530 nautical miles. The total distance of the planned flight as documented by the pilot was 515 nautical miles. One of the notes in the performance chart indicates that the mixture is leaned to 100 degrees rich of peak. The pilot stated that she did not adjust the fuel/air ratio using the EGT gauge but rather adjusted the fuel/air ratio until the engine ran rough then enriched it. Review of the time/fuel/distance to descend chart revealed that the distance to descend from the cruise altitude of 8,500 feet mean sea level to the airport traffic pattern altitude of 1,000 feet mean sea was 41.5 nautical miles. The pilot began the descent a minimum of 49 nautical miles from the destination airport.

The wreckage minus the retained carburetor was released to Mr. Bruce Fox, the Director of Maintenance for the Weiss Aviation Center on August 5, 1997. The retained carburetor was also released to Mr. Fox on December 23, 1997.

NTSB

N-No

Date

Make

Model

Factual  
HISTORY OF FLIGHT

On January 30, 1999, at 1543 hours Pacific standard time, a McDonnell Douglas 369E, N992SD, collided with the ground after experiencing a loss of engine power near Lake Elsinore, California. The helicopter was destroyed. The pilot and observer suffered serious injuries. The public-use helicopter was being operated by the Riverside County Sheriff's Department for routine law enforcement patrol at the time of the accident. The flight originated at the Hemet-Ryan Airport in Hemet, California, at 1505, and a company flight plan was filed. Visual meteorological conditions prevailed.

LAX99GA083

N992SD

1/30/1999

McDonnell  
Douglas

369E

The pilot reported that she and the non-pilot rated observer were responding to a routine dispatch call and were flying about 550 to 650 feet agl. She stated that the engine chip light (amber) became illuminated. She reported that she intended to head back to the airport, but changed her mind and began looking for a landing site. The observer radioed the dispatch center and notified them that they had "engine problems." He reported that about 30 seconds later he heard a grinding noise and heard the rpm decreasing. The pilot reported that the engine-out light (red) became illuminated and the engine-out horn came on. A few seconds later the engine quit. She saw an open field to her left (northwest) and turned toward it. She entered an autorotation by fully lowering the collective. She stated that she didn't roll off the throttle. The observer called dispatch and gave them a position report. The pilot reported that she didn't notice her airspeed in the turn, but remained focused on the landing site. She remembered that the tachometer gauge reflected that the rotor and engine rpm indicator needles were split and she recalled that the rotor rpm indicator needle reflected 420 to 430 rpm. The pilot stated that the angle of descent was good but was slightly steeper than normal. She reported that she initiated the landing flare about 100 feet agl.

The helicopter landed hard. Neither the pilot nor the observer recall the helicopter bouncing or having any forward movement after the landing. The pilot unfastened the observer's seat belt, then undid her own. She reported that the fuel shutoff valve handle was jammed and she was unable to turn it to the "off" position. She further reported that both cockpit doors were also jammed shut and they were not able to egress on their own. Rescue personnel arrived within minutes of the accident and forced the doors open.

Two witnesses reported seeing the helicopter circling overhead prior to impact. They stated that the main rotor blades were turning slowly; they could see each individual blade. There was no engine sound. They observed the helicopter descend at approximately a 45-degree nose-down attitude. The witnesses reported that the helicopter was descending about 50 to 60 mph; they felt that it was moving "too fast for landing." Their last view of the helicopter was at the tree line.

PERSONNEL INFORMATION

Released Narrative

While the pilot was maneuvering about 550 to 650 feet agl, the engine chip light illuminated followed by a complete loss of engine power. She performed an autorotation to a large, open field, flared high about 100 feet agl, then collided with the ground. The skids were found spread outward with the belly touching the ground. Two of the main rotor blades displayed evidence of coning. Post-accident investigation revealed that all components of the lubrication system were intact and functional. When the turbine was disassembled, bearings 6 through 8 were found destroyed and displayed evidence of heat distress and oil starvation. The number 5 bearing evidenced heat distress. The nos. 1 through 5 bearings and the gearbox were lubricated, but there was no visual evidence of oil present downstream from the number 5 bearing. There was scoring and debris present in the oil pump scavenge chamber. Over a period of about 72 flight hours and 1 1/2 months, there were 10 reported engine chip light activations. After three chip lights were reported, the turbine, gear box, and compressor assembly were replaced. Engine chip lights were reported six more times. The number 5 bearing and snap ring were found spinning; a new number 5 bearing was installed. The day of the accident, the chip light came on during a maintenance ground run, then came on again before the engine quit. According to the Allison Engine Operation and Maintenance Manual, 'a maximum of four occurrences of magnetic chip warning lights encountered within any 50 hours of engine operation requires removal of the engine for shipment to an Allison Authorized Maintenance Center (AMC).'



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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According to the Federal Aviation Administration (FAA) airman certification database, the pilot held a commercial pilot certificate with rotorcraft-helicopter rating and an instrument helicopter rating. The pilot indicated that at the time of the accident she had about 4,817 total hours of flight time, all in helicopters. She had 2,900 hours in the McDonnell Douglas 369E, including 200 hours in the last 90 days and 73 hours in the last 30 days. According to the FAA aeromedical certification database, the pilot held a second class medical, dated July 8, 1998, with no waivers or limitations.

The Sheriff Department's records reflected that the pilot had completed her last biennial flight review on March 29, 1998, which included emergency maneuvers. She was given satisfactory marks in all categories.

The observer was not a rated pilot. He had been performing duties as an observer since 1993.

AIRCRAFT INFORMATION

The aircraft maintenance records were reviewed. A review of the aircraft daily flight logs did not reveal any unresolved squawks, other than a history of 10 engine chip light activations over a period of approximately 72 flight hours. The records indicated compliance with all Manufacturer Service Notices and all applicable Federal Aviation Administration (FAA) Airworthiness Directives. The records revealed that at the time of the accident, the airframe had a total time of 4093.4 hours. The maintenance department adhered to an Annual and Manufacturer's Inspection Maintenance Program.

The maintenance records revealed that engine chip lights were reported on December 18, 1998, at approximately 4021 hours, and again on December 21, 1998. In both cases, the maintenance department removed and replaced the chip detectors, drained, flushed and replaced the engine oil, and performed a 30-minute ground run/leak check. No discrepancies were noted during either ground check. Following another reported chip light on December 29, the maintenance personnel replaced the turbine assembly, gear box and compressor assembly with overhauled parts. The records reflected that the gearbox and compressor assemblies were installed with "zero hours since overhaul," and the turbine assembly had 2389 hours since overhaul. A ground run, leak check and power assurance check were performed with no noted discrepancies. An engine chip light was reported again on December 30, 1998, and the mechanic reported that he found a small sliver on the bottom chip plug. He cleaned the plug and performed a ground check. Engine chip lights were reported again on January 21 and January 22, 1999. The aircraft did not fly until after a 100-hour inspection

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>was performed on January 28, 1999, during which both chip detectors were examined. The bottom chip detector displayed fuzz. The engine oil was drained and flushed and a leak check was performed again with no reported abnormalities. On January 29, 1999, a pilot reported that the engine chip light came on twice during a 1.5-hour flight. The mechanics discovered a small metallic sliver on the bottom chip plug and removed the turbine assembly. The number 5 bearing spacer and snap ring were found spinning and a new number 5 bearing was installed. The mechanics reported that they reinstalled the turbine, as per the Allison Maintenance Manual. They purged the oil system and replenished it with 5 quarts of oil. The mechanic and pilot then completed a 0.8-hour maintenance flight, during which time the engine chip light became illuminated. The mechanic cleaned the plugs, then returned the engine to service after a ground run and leak check were performed with satisfactory results.</p>	
					<p>Both the pilot and the mechanic who performed the ground run reported that they visually checked the oil quantity level in the sight gauge before the accident flight and the level appeared adequate.</p>	
					<p>WRECKAGE AND IMPACT</p>	
					<p>The wreckage was located in a furrowed field of dry, loose dirt. The fuselage was in an upright position at a 45-degree angle to the furrows. The aircraft skids were spread outward to the point that the belly was touching the ground. Four of the five main rotor blades remained attached to the rotor head. The white blade had separated at the blade doubler. Two of the main rotor blades exhibited upward bends, and one blade tip had impacted the ground and displayed a break a few inches from the hub. A portion of the tail boom and tail rotor driveshaft were located forward of the fuselage. The tail rotor blades remained attached to the tail rotor gearbox and were also located forward of the aircraft. The tail boom stinger was the only aircraft component not located.</p>	
					<p>The exterior surface of the aircraft fuselage was wrinkled. The underside of the fuselage was cracked and torn, with much of the damage concentrated around the cargo hook attachment area. The lower canopy glass was fractured on both sides of the aircraft. The cockpit and cabin doors were intact but exhibited deformation. No plexiglass was broken from either cabin door. Both engine access doors were warped and twisted. The rescue personnel reported that the engine access doors were found open and they sprayed the interior with water and foam. There was no oil or residue noted on the engine itself or in the engine compartment.</p>	
					<p>The left and right extended landing gear were spread with both aft struts fractured approximately 12 inches outboard of the damper. The left forward strut elbow and damper assembly were pushed up into the seat support structure.</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The tail boom was fractured and damaged at a point inside the plane of rotation of the main rotor blades. Three of the five main rotor blades displayed paint transfer the same color as the tail boom. The separated section of the tail boom remained attached to the upper and lower vertical and horizontal stabilizers.

The cockpit structure was compromised only on the right side floor where the SX-5 searchlight and FLIR pod mounts were pushed upward and had penetrated the lower cockpit structure. Both crew seats displayed deformation of about 1 1/2 inches in the seat pan structures. The seatbelt system remained intact. The crew seats were made of a mesh material and no foreign objects were noted under either seat.

The aircraft was configured for left seat command and was not equipped with dual flight controls. Continuity was established for the cyclic, collective and anti-torque flight control linkage. The collective stick would not move; the left front strut damper had been pushed upward and was contacting the collective interconnecting torque tube. Rescue personnel noted the collective in the full up position at the accident site and had pushed it down during the crew extraction. The N1 and N2 collective linkage continuity was confirmed back to the engine compartment where the control tubes and associated rod end bearings were fractured.

TESTS AND RESEARCH      External Engine Examination

External engine examination revealed that N2 rotated, continuous to the output shaft. The compressor would not rotate, but appeared to be absent of debris or foreign object damage (FOD). All pneumatic lines were intact and secure except the Power Turbine Governor PR line, which was found to be only finger-tight at the B-Nut fitting at the governor. All the connections for the oil supply and scavenge lines were secure and there was evidence of oil in the lines at the connections. The oil supply tank was found empty, with no oil or metal residue. The engine oil "IN" line from the oil tank to the engine was fractured through the mid-point of the rigid adapter to engine fitting. The engine oil "OUT" line was intact to the facet filter and contained traces of oil. The oil tank vent line was fractured through the metal tube portion. The facet oil filter contained oil and traces of carbon and metal. The filter housing was approximately 1/2 full of oil and there was pasty residue in the bottom. The oil pump strainer was clean and unobstructed. The oil cooler contained oil and metallic flakes. A pressure test was performed on the oil line which connects from the pump to the facet oil filter and no leaks were detected. There was no oil noted in the two oil lines that run between the scavenge oil pump and the external sump and oil outlet.

There was no evidence of oil splash on the engine or anywhere inside the engine compartment, including the engine doors and

NTSB	N-No	Date	Make	Model	Factual surrounding structure.	Released Narrative
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The engine is equipped with two magnetic chip detector plugs. The top plug attracts metal from the nos. 6, 7, 8 and 1 bearings, and the bottom plug attracts metal from the gearbox, number 5 bearing and forward. Both chip detectors are routed to a single amber warning light in the cockpit. The top plug was found covered in small, metallic flakes, particulate, and oil residue. The bottom plug displayed oil residue and fewer metallic flakes than the top plug. About 1/4 pint of oil was drained when the lower chip plug was removed.

A vacuum check was performed on the fuel system. The system would not maintain vacuum pressure from the fuel pump to the shutoff valve. There was fuel present in the fuel line from the fire shield to the fuel spray nozzle and other supply lines. The fuel spray nozzle was clean and unobstructed. The fuel pump filter bowl contained fuel and the filter was clean.

The "Diamond J" reporting instrument for the turbine outlet temperature gauge was removed and placed in another Hughes 369E. It reported that the highest recorded engine temperature during the accident flight was 982 degrees for 4 seconds.

Engine Disassembly and Inspection

The engine was disassembled and examined by the Safety Board at National Airmotive Corporation in Long Beach, California, on February 3, 1999.

The compressor assembly was disconnected from the gearbox and was found to rotate smoothly. The spur adapter gear shaft showed evidence of heat distress and internal coking.

The gearbox was disconnected from the turbine; the N2 gearing rotated freely and the N1 gearing rotated, but with some drag. The gearbox case halves were opened. The interior of the gearbox was clean with no abnormal gear tooth wear. There was lubrication throughout the gearbox. The nos. 2, 2.5, 3 and 4 bearings appeared undamaged and lubricated and no anomalies were noted with the oil delivery system. The oil pump rotated, but with drag. Upon disassembly, the pressure and scavenge gears were found to be

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					intact and lubricated. There was minor scoring and debris present in the scavenge chamber.	
					The turbine modules were separated and disconnected from the exhaust support. The compressor to turbine shaft (pea shooter) was frozen in the gas producer module and evidenced heavy coking and heat distress; N1 would not rotate via the shaft. The outer combustion case and liner appeared normal and undamaged.	
					Disassembly of the turbine revealed that the nos. 6 and 7 bearings were both destroyed, and would crumble if touched. The internal sump for the nos. 6 and 7 bearings displayed evidence of metal spray and the external sump was dry with carbon flakes remaining inside. The number 8 bearing appeared to be approximately 80 percent destroyed and displayed evidence of oil starvation and heat distress. The bearing balls were flattened and out of round. The internal sump showed no sign of oil. The number 5 bearing displayed a violet-bluish color, but had not failed. The Allison representative attributed the discoloration to heat distress. The turbine shaft exhibited a bluish heat discoloration, with a pattern of decreasing discoloration moving from the nos. 6 and 7 bearings to the number 1 bearing. There was no visual evidence of oil present downstream from the number 5 bearing. The oil line check valve for the nos. 6, 7 and 8 bearings appeared normal and lubricated on both ends. The check valve was functionally tested and found to be within the specifications required by Rolls-Royce Allison Engine Company, with zero leakage at 3 psi.	
					Samples of oil from the oil cooler and facet oil filter were retained by the Safety Board for metallurgical analysis. Oil filtration revealed iron, magnesium and silver particles in the oil, but no abrasives such as sand, glass or dirt were noted.	
					The debris from both magnetic chip detector plugs was removed in layers and tested by semi-quantitative X-ray Energy Dispersive Analysis (XEDA) methods. The composition of each layer analyzed was identified as type M50 bearing material.	
					Metallurgical Analysis	
					The disassembled engine and accessories were shipped to Rolls-Royce for further examination and metallurgical analysis. The examination was conducted under the supervision of the Federal Aviation Administration (FAA).	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>The oil pump was inspected and flow tested. The pump met internal tolerance and flow test specifications. The oil tubes and valves were also tested and were found to function properly. The engine oil nozzles were uncollapsed and absent of any residue or debris. All engine oil pressure lines were found to be unobstructed and free to flow.</p>	
					<p>The inside surface of the oil sump nut cover was dry; no liquid oil residue was present.</p>	
					<p>The gas producer section components were examined. Inspection of the number 8 bearing showed that the balls were severely distorted and several had separated from the cage. The inner race exhibited metal transfer from the ball pathway. No liquid oil residue was found on any of the bearing components. The Allison metallurgist reported that the metallographic examination through the outer race revealed that the ball pathway had been severely overheated during the bearing failure, typical of an oil starvation event.</p>	
					<p>The metallurgist opined that the engine failure was due to oil starvation of the nos. 6, 7, and 8 bearings. He stated that the nos. 6 and 7 bearing failures resulted in severe secondary damage to the power turbine shafts and seals, while the number 8 bearing failure led to the gas producer section forward movement, causing heavy rub damage to the wheels and nozzles.</p>	
					<p>According to the Allison Engine Operation and Maintenance Manual, 10W2, reference 72-00-00, page 336, paragraph 11.G, (3) (d), "a maximum of four occurrences of magnetic chip warning lights encountered within any 50 hours of engine operation requires removal of the engine for shipment to an Allison Authorized Maintenance Center (AMC)." A copy of this directive is appended this file. Extracted data from the maintenance records revealed a total of 10 engine chip light activations in a period of approximately 72 hours. The first chip light occurred about 4021 hours, and the accident occurred at 4093 hours.</p>	
					<p>ADDITIONAL INFORMATION</p>	
					<p>The wreckage was released to the Riverside County Sheriff's Department on October 5, 1999.</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>On May 19, 2002, at 1750 eastern standard time, a Piper PA-28-236, N8442A, piloted by a private pilot, sustained substantial damage during a forced landing following a loss of engine power near Angola, Indiana. Visual meteorological conditions prevailed at the time of the accident. The air medical flight (Angel Flight) was operating under the provisions of 14 CFR Part 91 on an instrument flight rules (IFR) flight plan. The pilot reported no injuries and his two passengers reported minor injuries. The flight departed the Wayne County Airport (BJJ), Wooster, Ohio, at 1702 eastern daylight time.</p>	
					<p>According to the pilot's written statement, prior to departure the airplane was fueled with 26.3 gallons, which completely filled both wing fuel tanks. The pilot reported he departed on an IFR clearance and upon reaching 8,000 feet above mean sea level (msl), he leveled off and set the engine power to 2,200 rpm and 20.5 inches of manifold pressure. The pilot noted he engaged the autopilot for navigation and altitude hold modes.</p>	
CHI02LA137	N8442A	5/19/2002	Piper	PA-28-236	<p>The pilot stated that while in cruise flight he noticed "a slight shaking in the yoke as well as a loss of power." The pilot reported, "I disengaged the autopilot and the [airplane] nose made a sudden drop. I recovered to level flight and then immediately turned on the [electrical] fuel pump and switched to the right fuel tank. Noticing that the [engine tachometer] was around 1,500 rpm, I trimmed the aircraft for an airspeed of 85 knots (best glide). I then engaged [carburetor] heat, increased the mixture and moved the throttle. The throttle had been virtually all the way forward, but I moved it back and then forward again to determine if it would change the rpm which it did not." The pilot stated, "When I [noticed] no improvement with the [carburetor] heat on, I shut it off in hopes of obtaining any increase at all in [engine] rpm. The engine seemed to be running at a low idle."</p>	<p>While in cruise flight, the engine experienced a loss of power, and the pilot performed a forced landing on a soft agricultural field. The pilot reported the landing gear sank into the soft terrain and was torn from the airplane during touchdown and landing. The pilot stated that prior to departure, the airplane was fueled with 26.3 gallons, which completely filled both wing fuel tanks. Adequate amounts of fuel were found in both wing tanks at the accident site. No anomalies were found with the engine or its associated components that would prevent the normal operation of the engine.</p>
					<p>The pilot stated he informed Kalamazoo approach control of the loss of engine power and was given radar vectors to the Tri-State Stueben County Airport (ANQ). The pilot reported the airplane descended into visual meteorological conditions (VMC) at approximately 6,500 feet msl and approach control cleared him for a visual approach to runway 28 at ANQ.</p>	
					<p>The pilot reported, "I was on a long final for [runway] 28 at ANQ when I noticed that the runway was starting to move up in my windshield indicating that I was falling short of the runway on my current glide path. From my position, I could only see trees between the runway and my current position. I spotted an open field to my right and elected to make a controlled landing there rather than risk ending up in the trees." The pilot continued, "The aircraft touched down in a level attitude in as much of a flair as possible. The landing gear touched first, but the soft sandy soil caused the wheels to sink and the [landing] gear were torn off. The aircraft slid in a straight line for a short distance on its belly and then came to rest."</p>	
					<p>Federal Aviation Administration inspectors conducted the on-scene portion of the investigation. The fuel quantity of both wing tanks</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					was considerably more than unusable fuel. A cursory inspection of the engine failed to reveal any anomalies. The National Transportation Safety Board (NTSB) investigator-in-charge requested the electrical fuel pump, engine driven fuel pump, carburetor, and dual-magneto be removed from the engine and sent to the NTSB for additional examination and testing.	
					The electric fuel pump was identified as Facet part number (P/N) 480 543. The end-cap was removed to inspect the screen, which was free of debris. Electrical power was applied and the pump delivered a steady, strong fluid stream. No anomalies were found with the electric fuel pump.	
					The engine driven fuel pump was identified as an AC brand diaphragm pump, P/N 15472 9408. The pump was secured to a bench and when the actuating arm was cycled the pump functioned as designed. No anomalies were found with the engine driven fuel pump.	
					The carburetor was identified as a Precision MA-4-5, serial number (S/N) 75035522. The carburetor appeared to be undamaged. The float bowl was disassembled and the metal floats were in a serviceable condition. The float level was measured to be 13/64". The gasket material, located between the upper and lower portions of the carburetor, was flexible and provided a continuous seal. The gasket material was torn during the disassembly of the float bowl. The accelerator pump seal was in a serviceable condition. The actuating arm hinge pin was installed correctly and was safetied. The inlet screen was removed, and it contained a few pieces of small debris.	
					The dual-magneto was identified as Teledyne Continental model D6L-3000, S/N H259817GR. The magneto was mounted on a test-bench and an electric motor turned the magneto input drive shaft. When the drive shaft was rotated the magneto produced spark on all leads and no anomalies were noted with the operation of the impulse coupling. The magneto was heated to a surface temperature of 200 degrees Fahrenheit over a period of 25 minutes, which yielded no change in the operation of the magneto. No anomalies were found with the dual-magneto.	



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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NTSB	N-No	Date	Make	Model	Factual HISTORY OF FLIGHT	Released Narrative
					<p>On July 17, 2002, at 0805 central daylight time, a Cessna 150G, N3400J, registered to and operated by Pearson Aviation LLC, collided with terrain while maneuvering near Duncanville, Alabama. The instructional flight was operated under the provisions of Title 14 CFR Part 91, and visual flight rules. Visual meteorological conditions prevailed and no flight plan was filed. The certificated flight instructor and student pilot received fatal injuries, and the airplane was destroyed. The flight departed Fairhope Municipal Airport in Fairhope, Alabama, at 0630 on July 17, 2002.</p>	
					<p>A pilot-rated witness stated that he and his wife planned to meet their son, the pilot-in-command of the accident airplane, at the Tuscaloosa Airport for a family reunion. While he was traveling westward on U.S. Highway 82, enroute to the airport, he saw the Cessna 150, also westbound, flying parallel to the highway on his left side. He estimated the airplane's altitude as 50 to 100 feet above ground level (AGL), in level flight. The airplane was about one-quarter of a mile ahead of the car when he saw it climb steeply, and then turned left and descended straight down disappearing behind a stand of trees. The mother and father of the pilot stopped their car and ran to the accident site to see if they could assist any survivors.</p>	<p>A witness stated that while traveling westward on U.S. Highway 82, en route to the airport, he saw the Cessna 150, also westbound, flying parallel to the highway on his left side. He estimated the airplane's altitude as 50 to 100 feet above ground level (AGL), in level flight. The airplane was about one-quarter of a mile ahead of the car when he saw it climb steeply, and then turned left and descended straight down disappearing behind some trees. Examination of the airplane found that the leading edges of both wings were crushed aft at approximately a 55-degree nose down angle relative to level flight. Both wings were bulged outward (ballooned) in the area of the fuel tanks. Examination of the airframe and engine failed to disclose any pre-existing structural or mechanical malfunctions</p>
ATL02FA143	N3400J	7/17/2002	Cessna	150G	<p>Additionally, the pilot's father stated that on previous visits the pilot would circle their house to alert them to pick him up at the airport. Their house is about one-mile east of the accident site. The pilot's father stated that he was sure his son recognized their car from the air. The pilot's father did not know there was a student pilot in the left seat, but believes he was one of his son's flight students.</p>	
					<p>PERSONNEL INFORMATION</p>	
					<p>A review of information on file with the FAA Airman's Certification Division, Oklahoma City, Oklahoma, revealed the pilot was issued a Airline Transport Pilot certificate on March 1, 2002, with ratings for airplane single engine land, multiengine land, and instrument airplane, and was a certified flight instructor for airplane single engine land, multiengine land, instrument airplane. A review of the pilot's logbook revealed his last recorded biannual flight review was conducted on February 24, 2002, at Flight Safety International. A review of records on file with the FAA Aeromedical Certification Division revealed the pilot held a first class medical certificate issued on April 1, 2002. The pilot reported he had accumulated 7,500 total hours.</p>	

NTSB	N-No	Date	Make	Model	Factual AIRCRAFT INFORMATION	Released Narrative
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A review of the airplane's maintenance records revealed the last recorded annual inspection was completed on June 13, 2002, at 3488.88 hours. The airplane had accumulated 15.0 hours since the annual inspection. On January 10, 2002, it was noted in the beginning of the logbook that all of the previous maintenance had been lost and that the airplane times were determined using Teledyne Continental Motors Maintenance records and airplane flight activity logs.

METEOROLOGICAL INFORMATION

The nearest weather reporting facility at the time of the accident was Tuscaloosa Municipal Airport (TLC). The 0853 surface weather observation was: wind calm, visibility 10 statute miles, sky clear, temperature 27-degrees Celsius, dew point 23 degrees Celsius, altimeter 30.18 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The wreckage was located in essentially one piece on undeveloped level rural terrain, which had small trees and brush. The airplane was found upright at a 55-degree nose down attitude as measured from the engine orientation and the wing leading edge damage facing 250-degrees magnetic. Some discolored vegetation was observed below the fuel tanks. The elevation at the site was 253 feet per the topographical map. The distance from the site to the Tuscaloosa Municipal Airport was 14.1 Nautical miles at a heading of 319-degrees magnetic. The site was within the Talladega National Forest and was about 250 feet from the northern boundary of the national forest. Trees of approximately 100 feet height were located about 300 feet east of the site. The trees near and west of the site were about 10 to 20 feet in height.

Examination of the airplane found both wings including the center section broken loose from the cabin and rescue personnel had opened the top of the cabin. The lower forward fuselage had been crushed aft. The leading edges of both wings were crushed aft at approximately a 55-degree nose down angle relative to level flight. Both wings were bulged outward (ballooned) in the area of the fuel tanks. The flap actuator was not extended and the flaps were found in the retracted position. The tail section was broken off forward the horizontal stabilizer leading edge and was retained by the flight control cables. The tail section otherwise had relatively minor damage. The elevator and rudder could be moved to their respective travel stops with no binding or other restrictions. Flight

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					control system examination was confirmed as follows; from the elevators to the control column; from the rudder to the rudder pedal attachments; and from the ailerons to the damaged cabin area. The elevator trim tab was found in a neutral position. The airplane was equipped with the standard 26-gallon fuel system, 22.5 gallons usable. No fuel samples were available during the examination. The fuel strainer (gascolator) on the firewall was intact. No debris was observed in the fuel strainer bowl and the filter screen was clean. The on-off selector valve in the cabin was not readily accessible and was not observed. Examination of the airframe failed to disclose any structural malfunctions.	
					The engine and propeller assemblies remained attached to the airframe. Examination of the propeller found it to be a two-blade fixed pitch McCauley: Model MCM-6950, 1A100, N/S F5207. Blade No. 1, was bent aft about 45-degrees from the hub outward; Blade No. 2 was bent forward about 5-degrees on the outer 6 inches. No significant twisting or leading edge gouging was observed. The propeller-mounting flange was bent and had started to separate from the crankshaft. A bubble protractor was placed on the crankcase upper parting surface at the site. The protractor showed a 55-degree nose down attitude.	
					Examination of the engine found the oil sump crushed, the vacuum pump broken off, the left magneto and alternator separated from the engine. All four top spark plugs were removed and visually inspected. The spark plug electrodes were light gray with some service wear. The No. 2 upper spark plug electrode was bent toward the center post. The engine could be turned with normal manual force. Mechanical rotation was confirmed throughout the engine. A field compression check was confirmed on all cylinders. No internal damage was apparent within the magnetos. Damage to the magnetos precluded operational testing. The carburetor was a Facet Aerospace MA-3SPA, Model 10-4894, and was separated from the engine. The carburetor bowl drain plug was broken off and no fuel was observed in the carburetor bowl. The interior of the carburetor bowl was clean. The fuel inlet screen was clean. Both of the metal floats were deformed inward. The float needle and seat operated normally. The engine induction air filter was in place and appeared to be in serviceable condition. The induction air inlet duct was crushed. The carburetor heat valve was in the normal (cold) position. The oil filter was cut open and the filter media was examined and no particles were found. The muffler assembly sustained crush damage.	
					MEDICAL AND PATHOLOGICAL INFORMATION	
					Postmortem toxicology of specimens from the pilot was performed by the Forensic Toxicology Research Section, Federal Aviation Administration, Oklahoma City, Oklahoma. The results were negative for carbon monoxide, cyanide, ethanol and basic and acidic drugs. The Tuscaloosa Medical Examiners in Tuscaloosa, Alabama, conducted a postmortem examination of the pilot on July 19, 2002. The cause of death was reported as "multiple blunt force trauma".	

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ADDITIONAL INFORMATION

The wreckage was released to Atlanta Air Recovery Griffin, Georgia, on July 18, 2002.

NTSB	N-No	Date	Make	Model	Factual HISTORY OF FLIGHT	Released Narrative
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On September 14, 2002, at 0955 mountain daylight time, a Beech B19, N5119R, owned and operated by Sid Hall Enterprises, Inc., d/b/a Southern Aircraft Sales of Albany, Georgia, was destroyed when it impacted terrain and burned 2 miles north of Delta, Colorado. The private pilot, the sole occupant aboard, was fatally injured. Day visual meteorological conditions prevailed, and no flight plan had been filed for the ferry flight being operated under Title 14 CFR Part 91. The flight originated at Delta at 0953, and was en route to Albany with unknown intermediate stops.

DEN02FA106	N5119R	9/14/2002	Beech	B19
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The airplane had recently undergone a pre-purchase annual inspection and, according to Sid Hall Enterprises, they had purchased the airplane from a private individual in Delta. The pilot, whom they had used on previous occasions, intended to ferry it to Albany to accumulate flight time. According to the airport manager, the previous owner flew the airplane the day before the accident. After the uneventful flight, the airplane was serviced with 31.1 gallons of 100-octane low lead aviation grade gasoline. This filled it to its 60-gallon capacity. The next morning, the pilot --- carrying a flight bag and an overnight kit --- arrived at the airport and boarded the airplane. There is no record of the pilot obtaining a weather briefing or filing a flight plan. Witnesses said the pilot "seemed to be in a hurry" and made a "quick" preflight inspection. After starting the engine, the pilot taxied to the end of runway 03 and performed the pretakeoff checks. The airport manager said the magneto checks sounded normal, but the checks were brief --- "He didn't even have adequate oil temps yet." As soon as the pilot added takeoff power, the airport manager "knew something was wrong." The engine "began to pop," "stutter," and "sputter," and "continued to do so the entire length of the runway. The engine was "producing less than full power, about 1,700 to 1,800 rpm, like he had a fuel problem, water in the fuel, or a leaning problem," and the airplane was "not accelerating." The airport manager kept thinking to himself, "Abort, abort!" The airplane lifted off near the end of the 5,600-foot runway (1.5 percent uphill grade), flew in ground effect and barely cleared sagebrush and a barbed wire perimeter fence. The left wing dipped and the airplane disappeared below the mesa and into a valley. Shortly thereafter, a plume of smoke was observed.

A flight student said he overheard the pilot tell the airport manager that "he had never flown in the mountains before." He watched the pilot start the engine, taxi to the end of runway 03, and perform "a short run up, only checking the magnetos." When the pilot applied full power, "I knew that the engine was not running right because of the roughness we heard. We were thinking that he would abort but he kept rolling down the runway.

Another witness at the airport, an accident reconstructionist with the Colorado State Patrol, recalled the airport manager telling the pilot that "at this altitude, the 180 horsepower engine does not have as much power." The airport manager's wife "was concerned about how much rest [the pilot] had received, because he told her that he had "flown into Grand Junction approximately 11 p.m. on Friday," and that "he was planning to fly all the way to Georgia, and arrive there about 2 a.m. Sunday morning" (it was estimated the pilot got no more than 6 hours of sleep.) She said that during the takeoff roll, the airplane "was not accelerating as it should."

The airplane had recently undergone a pre-purchase annual inspection. The operator had purchased the airplane from a private individual, and the pilot had volunteered to ferry it to its new owner as a means of accumulating flight time. The previous owner the airplane the previous day and reported no discrepancies. The airplane was then serviced to its 60-gallon capacity. On the morning of the accident, the pilot taxied to the end of the runway and performed pretakeoff checks. Witnesses said the magneto checks sounded normal, albeit brief. As takeoff power was applied, the engine "began to pop, stutter, and sputter," and "continued to do so the entire length of the runway." The engine was "producing less than full power, about 1,700 to 1,800 rpm," and the airplane was "not accelerating." The airplane lifted off near the end of the 5,600-foot runway (1.5 percent uphill grade), flew in ground effect and barely cleared sagebrush and a barbed wire perimeter fence. The left wing dipped and the airplane disappeared below the mesa into a valley. The airplane struck the ground next to a golf course, exploded, and burned. A family relative said that the pilot had flown into or out of high elevation airports, and was unsure of what to expect. The pilot's toxicology was positive for diazepam, a tranquilizer. Valium, its generic name, is a tranquilizer and may cause drowsiness. It is contraindicated for flying.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Tournament attendees at Delta Golf Course, adjacent to the accident site, said the engine was "sputtering" when the airplane struck the ground near the 4th hole, and it immediately exploded and erupted into flames.

PERSONNEL INFORMATION

The 46-year old pilot held a private pilot certificate with airplane single-engine land and instrument ratings, dated March 7, 2000. His third class airman medical certificate, dated May 16, 2002, contained the restriction, "Must wear corrective lenses while operating an aircraft." When the pilot applied for medical certification, he estimated his flight time to be 427 hours, of which 9 hours were accumulated during the previous 6 months. His most recent flight review was dated March 26, 2002. A family relative said he had spoken with the pilot on the evening before the accident. He said the pilot had never flown into or out of high elevation airports, and was unsure of what to expect.

According to the FAA and a Scottsdale, Arizona, aviation insurance company, the pilot had been involved is a landing incident in Boise, Idaho, on May 23, 2002. He was ferrying a Beech B24R, N6604R. During the landing roll on runway 28L, the nose landing gear collapsed, damaging the propeller, lower nacelle, exhaust stack, and nose wheel fork. The investigation was still open at the time of this writing. The insurance company conducted its own investigation and provided a copy of excerpts from the pilot's logbook. Dated from March 7, 2000, to August 6, 2002, the logbook reflected the following flight hours:

Total time: 564.8

Pilot-in-command: 443.7

Solo: 445.3

Airplane, single-engine: 544.0

Airplane, multiengine: 15.9

Actual instruments: 9.5

NTSB

N-No

Date

Make

Model

Factual

Released Narrative

Simulated instruments: 37.3

Instruction received: 117.2

Cross-country: 390.7

Night: 56.2

AIRCRAFT INFORMATION

N5119R (s/n MB-654), a model B19, was manufactured by the Beech (now Raytheon) Aircraft Corporation and given FAA certification on July 26, 1974. It was equipped with a Textron-Lycoming O-360-A4J engine (s/n L-19136-36A), rated at 180 horsepower, and a Sensenich 78EM85-0-60, 2-blade, all metal, fixed-pitch propeller (s/n13630K).

A briefcase, containing the aircraft maintenance records, was ejected from the airplane and undamaged by the postimpact fire. According to these records, the airplane underwent an annual inspection on August 22, 2002, at a tachometer time of 1,382:69. Total airframe hours was 8,983:69. At a total time of 5,845.0 hours, the engine was overhauled on December 19, 1984, then reinstalled in N5119R. At the time of the most recent annual inspection, the engine had accrued 787.79 hours since the overhaul.

Between the time of the annual inspection and the day of the accident, the airplane had made two flights, totaling 3.5 hours. The first flight was a test flight made by the airport manager right after the annual inspection, and the airplane's previous owner made the second flight. No anomalies were reported.

METEOROLOGICAL INFORMATION

The following ASOS (Automated Surface Observing System) weather observations were recorded Montrose, Colorado, Regional Airport (MTJ), and Walker Field (GJT), Grand Junction, Colorado, located 25 miles southeast and 39 miles west-northwest of Delta, respectively:



NTSB

N-No

Date

Make

Model

Factual

Released Narrative

MTJ (0953): Wind, calm; visibility, (greater than) 10 statute miles; sky condition, clear; temperature, 15 degrees C. (59 degrees F.); dew point, 6 degrees C. (43 degrees F.); altimeter, 30.31.

GJT (0956): Wind, 130 degrees at 10 knots; visibility, (great than) 10 statute miles' sky condition, clear; temperature, 17 degrees C. (63 degrees F.); dew point, 8 degrees C. (46 degrees F.); altimeter, 30.25

AERODROME INFORMATION

Blake Field (1V9), located 3 miles north of Delta, is situated on a mesa at an elevation of 5,193 feet msl (mean sea level). It has one asphalt runway: 03-21/5,600 feet x 50 feet. According to the airport manager, runway 03 has a 1.5 percent uphill grade.

WRECKAGE AND IMPACT INFORMATION

The accident site was at a location of 38 degrees, 47.798' north latitude, and 108 degrees, 03.140' west longitude, and at an elevation of 4,765 feet. According to a hand-held GPS (Global Positioning System) receiver, the approach end of runway 03 is at 38 degrees, north latitude, and 108 degrees, 03.354' west longitude, and at an elevation of 4,887 feet. The departure end of the runway is at 38 degrees, 47.529' north latitude, and 108 degrees, 03.430' west longitude, and at an elevation of 4,888 feet.

Examination of the accident site revealed a crater and ground scar in the earth, the latter ending at the airplane's right wing tip. The crater sides sloped 45 degrees. The ground scar, when measured with the crater, indicated the right wing was about 60 degrees down. The nose and tail were aligned on magnetic headings of 111 and 150 degrees, respectively. Both wing fuel tanks were breached and empty. The fuel selector was positioned on the right tank. The flaps on the fixed gear airplane were retracted. Flight control continuity was established from the various control surfaces to the cockpit area. One propeller blade was about straight and relatively undamaged; the other blade was bent aft slightly. The Larago LELT-1005-AF emergency locator transmitter (s/n 7864) was found armed and activated. It was turned off and the antenna cable disconnected. The ELT battery expiration date was September 2004.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Although the cockpit was gutted, two instruments were recovered, to wit: vertical speed indicator, 1,600 feet per minute, down; altimeter, 4,760 feet msl, set to 30.34 in. Hg.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy was performed on the pilot at the Montrose Community Hospital, Montrose, Colorado. In addition, FAA's Civil Aeromedical Institute (CAMI) in Oklahoma City, Oklahoma, performed a toxicological screen on various specimens. According to CAMI's report (#200200274001), diazepam, a tranquilizer, was detected in the blood (0.079 ug/ml, ug/g), and nordiazepam, its metabolite was detected in the blood (0.079 ug/ml, ug/g), lung, and kidney (0.106 ug/ml, ug/g). According to a CAMI toxicologist, diazepam (the generic name is Valium) is a tranquilizer and may cause drowsiness. It is contraindicated for flying.

TESTS AND RESEARCH

On September 17, 2002, the engine was disassembled and examined at the facilities of Beegles Aircraft Service, Inc. Greeley, Colorado. After accessory removal, power train continuity was established and good thumb compression was found on all four cylinders. The Facet HA-6 carburetor (s/n CH-8-980) was destroyed. The throttle valve was at the mid-travel position, but the mixture control was destroyed. The engine driven fuel pump was destroyed. Both Bendix S4LN series magnetos were destroyed. All spark plugs exhibited grayish combustion color. The top number 1 spark plug was slightly darker. All electrodes appeared new with proper gaps, and the ignition wiring was securely attached. The oil screen contained no metal or other contaminants. The vacuum pump was disassembled; no anomalies were noted. The Electrosystems MZ 4222R starter gear was found forward and meshed with the starter ring gear teeth.

ADDITIONAL INFORMATION

In addition to the Federal Aviation Administration, parties to the investigation included Raytheon (Beech) Aircraft Corporation and Textron-Lycoming Engines.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					The wreckage was released to the owner's insurance company's adjuster on September 16, 2002.	

NTSB	N-No	Date	Make	Model	Factual HISTORY OF FLIGHT	Released Narrative
					<p>On November 8, 2002, at 1633 central standard time, a Cessna 152 single-engine airplane, N4835B, was destroyed upon collision with terrain following a loss of control during approach near Justin, Texas. The airplane was registered to and operated by Prop Holdings, Inc., Justin, Texas, under 14 Code of Federal Regulations Part 91. The airline transport rated pilot, who was the sole occupant, received fatal injuries, and the airplane sustained substantial damage. Visual meteorological conditions prevailed for the flight, and a flight plan was not filed. The personal flight departed the Fort Worth Meacham International Airport (FTW), near Fort Worth, Texas, at 1617.</p>	
FTW03FA037	N4835B	11/8/2002	Cessna	152	<p>A witness, traveling west in a vehicle on County Road (CR) 1384, reported the airplane flying from the south, flew "low across CR 1384, then started go straight up very quickly, then curved and flew straight down." Another witness, traveling in a vehicle on CR 1384, observed the airplane "go straight up, just before it stalled out. It broke over nose down and spiraled." A witness, driving on a lease road west of the accident site, observed the airplane "go straight upward maybe 1/4-mile high and made a over the hill type move and then the airplane came straight down and made a slight turn clockwise." A witness, approximately 1/4 mile west of the accident site, observed an airplane flying south to north approximately 250-300 feet agl, and "all of a sudden the airplane started upwards straight as an arrow and then it just stalled kind of like and headed straight downwards and it turned 1/4 of the way around clockwise and it was coming down." A witness, approximately 1/2 mile west of the accident site, observed an airplane "go straight up about 1,000 to 2,000 feet," when "it flipped and headed straight down. It made 1/2 spiral." Witnesses called 911.</p>	<p>The airplane impacted the terrain in a right wing low, nose low attitude during an uncontrolled descent approximately 2,000 feet northwest of the pilot's private grass airstrip following a local flight to a nearby airport. Witnesses, in the vicinity of the private grass airstrip, observed the airplane fly straight up, nose down, and turn in a clockwise direction prior to impact. The airplane came to rest at the approximate pattern downwind to base position for the private grass airstrip. During the post-accident examination of the aircraft, no discrepancies were found that would have prevented operation of the airplane prior to the accident.</p>
					<p>During personal interviews, conducted by the National Transportation Safety Board investigator-in-charge (IIC), acquaintances reported, the original flight departed the pilot's private airstrip (GPS latitude 33 degrees 07.69 minutes North; longitude 097 degrees 21.64 minutes West) near Justin, Texas. The pilot was flying the airplane to FTW to pick up a battery.</p>	
					<p>The following information summarized the activity of the airplane on the day of the accident. At 1511, the pilot requested and was cleared by the local controller at the Fort Worth Alliance Airport (AFW), Fort Worth, Texas, for the flight to transition the AFW airspace from north to south. The controller issued the altimeter setting of 29.81 inches of Mercury to the pilot. At 1514, the pilot reported that the engine was failing, and he declared an emergency. The controller cleared the airplane for landing on runway 16R. Airport and ARFF personnel responded to the Alert II. At 1516, the airplane was on the ground at AFW without further incident. The pilot cancelled the emergency, at 1519. At 1522, the pilot requested and was cleared to shut down the engine.</p>	
					<p>The manager of AFW airport operations, who is a pilot, reported that the engine was running rough after the airplane landed.</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
Subsequently, the engine stopped, and the pilot, who was in the right seat, exited the airplane. The pilot used a sampler cup and drained fuel from the fuel tank sumps and the fuel strainer. Subsequently, the pilot probed each fuel tank. The pilot then entered the right seat of the airplane and started the engine. At 1528, the pilot requested and was clear to taxi the airplane to the ramp.						

On the AFW airport operations report, the pilot indicated 5 gallons of fuel on board at the time of the emergency. The pilot's description of the incident stated "primer became unlocked causing engine to surge from full power to cut-off - 3 miles west of Alliance headed straight for 16R and landed without incident-strained all fuel no water found engine ran fine."

The pilot requested that 5 gallons of 100 LL fuel be added to each wing fuel tank on the airplane. The operations specialists at the Fixed Base Operations (FBO), who fueled the airplane, observed "a very miniscule amount of fuel" in each fuel tank. On the day of the accident, the FBO fueling log indicated that 11 other airplanes had been fueled from the fuel truck and no discrepancies had been reported.

At 1547, the pilot requested and was issued a taxi clearance. At 1557, the airplane was cleared for takeoff on runway 16L, wind 160 degrees at 15 knots, and the altimeter setting 29.77 inches of Mercury. At 1600, the pilot requested and the controller approved a frequency change.

The airplane landed at FTW and taxied to parking at a south hangar. Subsequently, the pilot obtained a battery from the mechanic, who had serviced the battery. The mechanic observed the pilot load the battery in the baggage compartment from the left side of the airplane. The pilot boarded the right seat of the airplane and closed the door. Subsequently, the mechanic observed the left door open, and "a mouse hit the ground and ran off." The door was closed, the engine started, and the airplane was taxied from the hangar.

At 1620, the pilot requested and was cleared by the local controller at AFW for the flight to transition the airspace from south to north. The controller issued the altimeter setting of 29.67 inches of Mercury, and the pilot reported a flight altitude of 1,500 feet msl for the airplane. There were no further communications with N4385B.

PERSONNEL INFORMATION

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The FAA records, reviewed by the NTSB IIC, showed that the airline transport rated pilot held type ratings in the Boeing 727, 757, 767, and DC-9 aircraft. The pilot held the following FAA certificates: commercial pilot certificate with the airplane single-engine land rating; flight engineer certificate with the jet rating; mechanic certificate with the airframe and power plant rating. The pilot held an expired FAA flight instructor certificate for the airplane single-engine land, multiengine land, and instrument rating. The pilot held an aerobatic competency rating for the Pitts S2B aircraft with an altitude limitation of 500 feet agl.

According to personnel at American Airlines, Inc., the pilot's accumulated flight time was 6,799.5 hours. The pilot was issued a first class medical certificate, without limitations, on November 4, 2002. On the medical application the pilot reported 13,000 hours total flight time and 300 hours in the previous 6 months.

AIRCRAFT INFORMATION

To date, the NTSB IIC has not received the maintenance records showing the history of the aircraft. The FAA registration certificate was issued to the current owner on February 14, 2002. Acquaintances reported to the NTSB IIC that the aircraft maintenance was performed on the aircraft by the owner/pilot.

WRECKAGE AND IMPACT INFORMATION

The Global Positioning System (GPS) location of the accident site was latitude 33 degrees 08.08 minutes north; longitude 097 degrees 21.66 minutes west, in a furrowed field with sparse vegetation. The main wreckage came to rest upright at an elevation of 731 feet on a measured magnetic heading of 095 degrees, approximately 2,000 feet northwest of the destination airport.

Ground scars and aircraft deformation was consistent with a right wing low, nose low impact. The airplane came to rest at the approximate pattern downwind to base position for the private grass airstrip (1,800 feet long by 90 feet wide). The wreckage distribution path was along a measured magnetic heading of 265 degrees for a distance of 29 feet from the initial impact point to the center of the fuselage. Portions of fiberglass from the outboard right wing tip were found in and adjacent to the initial ground scar. The initial ground scar measured approximately 16 feet, and the width of the ground scar was consistent with the right wing leading

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					edge. At the west end of the initial ground scar, was a crater, approximately 6 1/2 feet by 5 1/2 feet. Portions of fiberglass and the nose landing gear were found in the crater. Extending outward from the crater were two ground scars approximately 6 feet long and the distance between the ground scars was consistent with the distance between the main landing gear of the airplane.	
					Initial examination of the aircraft, engine, and propeller was conducted at the accident site on November 9, 2002, under the supervision of the NTSB IIC. The airplane was recovered to a hangar at the Northwest Regional Airport (52F), Roanoke, Texas, for further examination under the supervision of the NTSB IIC.	
					The cockpit and instrument panel was compressed aft and twisted toward the left side. The mixture and throttle levers in the cockpit were found in the full forward position, respectively. The master switch was in the "ON" position and the magneto switch on the "BOTH" position. The altimeter read 1,250 feet with a Kollsman window (altimeter) setting of 29.76 inches Mercury. The attitude indicator read level attitude and a 30-degree right bank. The directional gyro read 130 degrees, and the vertical speed indicator read 775 feet per minute climb. The transponder squawk read 1200 and the unit was set on altitude (ALT). The hobbs meter read 4,135.2 hours. The tachometer read 5,473.5 hours. The circuit breakers were found destroyed. The cabin air and cabin heat were in the "OFF" position, respectively. The carburetor heat was in the "OFF" position. The flap indictor was in the retracted position, and the flap indicator handle was bent to the left. The FAA inspector, who responded to the accident site, reported the emergency locator transmitter (ELT) a Dorne & Margolin model DM 6.1, serial number 49251, was found in the "ON" position.	
					The front left seat (#1) was found separated from the seat track, and the seat legs were bent toward the left side of the cockpit. The right front seat (#2) base was compressed and the seat track was bent upward and to the left. The occupant restraint system (shoulder harnesses and lap belts) was found not fastened.	
					The McCauley propeller (model 1A013, serial number 770372) was found attached to the flange with the propeller spinner crushed, and the propeller flange bent aft approximately 10 degrees. Scoring was observed inside the spinner. One propeller blade was bent approximately 5 degrees forward, and a gouge (1 1/2 inch long; 3/4 inch deep) was observed approximately midspan of the blade. One propeller blade exhibited leading edge gouges, and approximately 15 inches of the outboard portion of the blade was twisted approximately 45 degrees.	
					Flight control continuity was confirmed. According to the manufacturer's representative, the "flap actuator indicated the flaps were in the retracted position." The stall warning indicator at the wing was removed and tested. According to the manufacturer's representative, the stall warning "functioned." Impact deformation precluded a determination for the rigging of the stall warning	

NTSB	N-No	Date	Make	Model	Factual system	Released Narrative
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The fuel primer was found in the locked position. The fuel primer ferrule was found separated from the primer body. Both fuel caps were vented and the seals were intact. Approximately 2 1/2 gallons of fuel was drained from the right and left wing fuel tank, respectively. A fuel sample, from the right main fuel tank, was visually examined and the fuel was a "blue color" with no contaminants noted. The integrity of the fuel system was compromised, and the physical deformation of the separated lines was consistent with overload. The vented fuel caps were secure and there was no evidence of fuel leakage at the filler cap. During examination, air passed through the fuel vent line, fuel lines, tanks, and all portions of the fuel system to the fuel gascolator. No fuel was found in the gascolator. When air passed through the fuel lines to the fuel selector valve, fuel was expelled from the inlet line to the fuel gascolator. The gascolator filter screen contained foreign material (white powdery in appearance) over approximately 40 percent of the screen area. Foreign material, similar in appearance, was also noted on the aft fuel outlet fitting from the left fuel tank. Visual examination of the fuel tanks did not reveal foreign material in the fuel tanks, and the fuel screens were clear of debris.

Fuel samples from the refueling operator at AFW was tested by the manufacturer, and the fuel tested was within the manufacturer specifications for the aviation 100LL grade. A fuel sample (approximately 400 ml) from the right wing fuel tank was tested by Petroleum Specialist Lab, Floresville, Texas. The laboratory test results indicated that, the fuel "did not meet Aviation Gasoline Specifications D910." According to laboratory specialists, the "amount of fuel in the tank, the age of the fuel, and exposure of the fuel to the air and sunlight contributed to the fuel not meeting the specifications." Approximately 300 ml of the fuel sample was centrifuged, and the debris retained for examination at Material Analysis, Inc., Dallas, Texas.

The fuel gascolator, carburetor and aft fuel tank fitting were retained by the NTSB for further examination and testing. No anomalies were found that could have contributed to the accident.

The engine, a Lycoming L-235-L2C, serial/number L-15287-15, was found crushed against the firewall. The tachometer reading was 5,473.5 hours. The carburetor, a Facet MA3-SPA, serial number CR1-5315 was found separated from the engine crankcase at the oil sump. The air box, the throttle plate and arm, and a portion of the drain plug were found separated from the carburetor. No debris was found on the carburetor inlet fuel screen.

The continuity check was performed on the Lycoming engine by manually rotating the crankshaft. Continuity was confirmed from the crankshaft flange to the rear accessory case gears, and thumb compression was obtained on all the cylinders. The engine timing was found to be at 20 degrees BTC. The magnetos (left magneto, Slick model 4391, serial number 91050063; right magneto, Slick



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					model 4381, serial number 92090045) were rotated by the crankshaft and sparks were produced at the respective engine lead and/or the magneto post.	
					The engine's oil filter was removed and opened, and the filter was free of debris.	
					The vacuum pump, Airborne, serial number 11 AL 4531, drive was rotated by hand, and the pump produced compression and suction.	
					MEDICAL AND PATHOLOGICAL INFORMATION	
					The autopsy was conducted by the Office of Chief Medical Examiner, Tarrant County, Texas. The FAA Civil Aeromedical Institute's (CAMI) Forensic Toxicological and Accident Research Center examined the pilot's specimens taken by the medical examiner. According to CAMI, the pilot's toxicology showed no indication of alcohol or performance-impairing drugs at the time of the accident.	
					ADDITIONAL INFORMATION	
					The airplane wreckage was released to the Estate.	

NTSB

N-No

Date

Make

Model

Factual  
HISTORY OF FLIGHT

Released Narrative

On July 17, 2004, approximately 0930 central daylight time (CDT), a Bell 206L-1 single-engine turbine powered helicopter, N1078C, registered to and operated by Rotorcraft Leasing Company L.L.C. (RLC) of Broussard, Louisiana, as Apache 51, was destroyed when it impacted water in the Gulf of Mexico during a forced landing near Cameron, Louisiana. The airline transport rated pilot, sole occupant of the helicopter, was fatally injured. Visual meteorological conditions prevailed, and a company flight plan was filed for the 14 Code of Federal Regulations (CFR) Part 91 positioning flight. The flight originated from the offshore platform West Cameron (WC) 645 at 0838, and was destined for the company's Cameron onshore operations base (CAM), near Cameron, Louisiana.

On the first flight of the day on July 17, 2004, the pilot departed CAM at 0643 and arrived at High Island (HI) 350 at 0745. Apache 51 departed HI 350 at 0755 and arrived at WC 544 at 0804, where the helicopter was refueled. The pilot reported the fuel-on-board to be 2 hours and 30 minutes, with an estimated time of arrival at CAM to be 0940. At 0814, Apache 51 departed WC 544 for WC 645. Apache 51 arrived at WC 645 at 0830. At 0838, Apache 51 departed WC 645, reporting two hours of fuel-on-board and a distance of 105 nautical miles to CAM with an estimated arrival time of 0940. While en route, Apache 51 made position reports every 15 minutes as required by RLC to the company's communications center. These reports included the remaining miles to the intended destination, which were at 85, 59, and 27 nautical miles from CAM. At 0928, the pilot reported to RLC's communication center on frequency 129.8 that he was 10 miles south of CAM. The pilot then switched to the local area common traffic advisory frequency (CTAF) of 123.05. A representative from RLC stated that 10 miles out from CAM is the last standard call to RLC, and the standard arrival altitude is 500 feet.

Approximately 0930, another pilot who was flying in the vicinity reported hearing on local area common traffic advisory frequency, 123.05 mhz, the following: "Mayday, mayday, mayday, Apache (garbled), I'm going down, I'm going down, 10 miles south of Sabine... I mean 10 miles south of Cameron." The commercial pilot tried to confirm Apache 51's location, and heard "10 miles south of Cameron, 10 miles south of Cameron." No further radio transmissions were received from Apache 51, and there were no reported eyewitnesses to the accident.

PERSONNEL INFORMATION

The 66-year old pilot had been employed by RLC since December 28, 1999, and was assigned to CAM. He began his seven-day work schedule on July 16, 2004, by driving from his home in Nederland, Texas, about one hour away, before reporting for duty at 0545. The pilot departed on the first flight of the day on July 16, 2004, at 0637, and returned to the CAM base at the end of the day at

The 18,056-hour pilot made a mayday distress call on the common traffic advisory frequency stating that "he was going down." No further radio transmissions were received from the pilot. The helicopter impacted the water about 8 miles short of it intended destination. The positioning flight was scheduled from an offshore oil platform to the company's on-shore operations base. Signatures of the recovered wreckage were consistent with an uncontrolled impact with the water. There were no reported eyewitnesses to the accident, and no significant weather was reported in the area at the time of the accident. No mechanical anomalies were found with the airframe or the engine during the course of the investigation. The engine teardown examination the engine manufacturer's factory did not reveal any anomalies that could have prevented normal operations. Several helicopter components and parts were further examined at the helicopter manufacturer's laboratory. No anomalies or pre-existing faults were found with any of the examined parts.

NTSB	N-No	Date	Make	Model	Factual 1805, logging 8.0 hours of flight time. The next morning on July 17, 2004, the pilot reported for duty at 0545, before departing on the first flight of the day.	Released Narrative
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Two co-workers (flight follower and pilot), who also work for RLC and knew the pilot, noted uncharacteristic behavior on the day before and the day of the accident. Both witnesses observed that an otherwise focused, precise, and cheerful pilot exhibited confusion and agitation, which resulted in numerous flight-communication errors that were made by the pilot during the two-day period.

The pilot held an airline transport certificate with a rotorcraft helicopter rating. The pilot was issued his most recent first-class medical certificate on December 29, 2003, with the restriction of "must wear lenses that correct for distant vision and possess glasses that correct for near vision."

According to company records, the pilot had accumulated 18,056 hours total flight time, all in helicopters, of which 10,530 hours were in the accident make/model helicopter. In the preceding 90 days, the pilot had logged 226 hours of flight time, and in the preceding 30 days, he had logged 85 hours of flight time.

On January 26, 2004, in accordance with 14 CFR Part 135 recurrent and proficiency check training requirements, the pilot satisfactorily completed RLC's Bell helicopter 206 series annual recurrent training course and check ride. The pilot had also completed RLC's Bell Helicopter 407 training requirements on April 13, 2004.

AIRCRAFT INFORMATION

The 1980-model Bell 206L-1, serial number 45392, was powered by a 650-horspower Rolls-Royce Allison 250-C30P turbo shaft engine, serial number CAE 898015, driving a two-bladed main rotor system and a two-bladed tail rotor. There was no flight data recorder or cockpit voice recorder installed on the helicopter, nor was there a requirement for one.

The Bell model 206 helicopters are maintained in accordance with Aircraft Type Certificate Data Sheet number H2SW and the

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>appropriate Bell model Maintenance Manual. The Bell model 206 series of RLC's Approved Aircraft Inspection Program (AAIP) requirements (regardless of model) are:</p> <ol style="list-style-type: none"><li>1. 200-hour tail rotor gearbox and transmission oil change.</li><li>2. 600-hour hydraulic and facet filter bypass.</li><li>3. 7-day airframe inspection.</li><li>4. 3-month emergency equipment inspection.</li><li>5. 6-month float inspection.</li><li>6. 12-month main rotor mast internal inspection.</li><li>7. 24-month flight control bolt inspection.</li></ol> <p>In addition, RLC's Bell 206L-1, L-3, and L-4 accomplish the following inspections:</p> <ol style="list-style-type: none"><li>1. Daily preflight inspection.</li><li>2. 100-hour airframe inspection.</li><li>3. 300-hour airframe inspection.</li><li>4. 1200-hour airframe inspection.</li></ol> <p>The AAIP requires that the Allison Model 250-C30 engine be maintained in accordance with Engine Type Certificate Data Sheet number E1GL, and engine life-limited parts be replaced in accordance with Allison Operation and Maintenance Manual 16W2. Engines parts that require overhaul are to be overhauled in accordance with Allison Overhaul Manual 14W3.</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>The original 250-C28 engine was removed from the helicopter and converted to a 250-C30P engine in accordance with Allison Commercial Engine Bulletin (CEB) 72-3120 authorization, and returned to service on April 5, 2004. The conversion was listed under RLC's work order 2369, with engine total time of 2,734.7 hours. The engine was reinstalled on N1078C on May 3, 2004, in accordance with Air Services International, Supplemental Type Certificate (STC) SH296NM.</p>	
					<p>On May 12, 2004, N1078C was released for service after being refurbished (paint, windows, interior, wiring harness, and several avionic and component changes). The 100-hour airframe, 300-hour airframe, and the 1,200-hour airframe inspections were also accomplished. The engine had 2,734.7 hours and the airframe had 22,469.8 hours.</p>	
					<p>On July 4, 2004, the Allison 250C30 150-hour engine inspection was accomplished. The airframe total time was 22,612.5 hours and the engine total time was 2,869.4 hours.</p>	
					<p>On July 11, 2004, the 7-day airframe inspection was accomplished. The airframe total time was 22,641.1 hours.</p>	
					<p>On July 14, 2004, the 100-hour airframe inspection was accomplished. The airframe total time was 22,658.5 hours.</p>	
					<p>On July 15, 2004, the 200-hour tail rotor gearbox and transmission oil change was accomplished. The airframe total time was 22,666.4 hours.</p>	
					<p>RLC's component status report dated July 15, 2004, was reviewed for verification of component serial numbers and times.</p>	
					<p>Bell Helicopter Service Bulletins and Airworthiness Directives were reviewed for compliance, with no noted discrepancies.</p>	
					<p>N1078C's maintenance logbook was reviewed from June 1, 2004 to July 16, 2004, including corrective actions for all discrepancies. No anomalies or unusual events were noted, and no open discrepancies or deferred items were listed in maintenance records at the</p>	

NTSB	N-No	Date	Make	Model	Factual time of the accident.	Released Narrative
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Maintenance training records for the two maintenance technicians assigned and working at the Cameron onshore base were reviewed, and no discrepancies were noted.

A weight and balance form sheet was computed for the NTSB's investigator-in-charge (IIC), with estimated weight for crew, cargo, and fuel for determining center of gravity (CG). The result of the computation was that the aft, forward, and lateral CG ranges were within the gross weight limits.

Fuel samples were taken by RLC from WC 544 (last location the helicopter was fueled) at 1119 on July 17, 2004. The fuel sump and filters were checked and found absent of visual debris and fungus. The fuel samples were clear and bright with no anomalies noted.

From RLC's maintenance records, N1078C was estimated to have had a total of 22,676.7 hours at the time of the accident, and the engine had accumulated a total of 2,931.30 hours, with 53.9 hours since the last inspection and 196.6 hours since the last overhaul.

METEOROLOGICAL INFORMATION

The Petroleum Helicopters Inc. (PHI) weather facility at Cameron Heliport (K7LA5), near Cameron, Louisiana, reported at 1012 CDT, wind 250 degrees at 9 knots, visibility 7 statute miles, few clouds at 4,000 feet, few clouds at 12,000 feet, broken clouds at 25,000 feet, temperature 30 degrees Celsius, dew point 23 degrees Celsius, and an barometric pressure of 29.94 inches of Mercury.

A pilot for RLC that was in the Cameron area at 0930 reported: "clear skies with unlimited visibility, temperature 80-85 degrees, wind out of the southwest at about 10 knots, and no smoke or haze."

A pilot for another company that heard the mayday radio transmission stated that the "weather was very good, with some haze, but

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					good visibility and no rain in the area. The wind was light and variable, and nothing in the area that would give low visibility, lightning, or turbulence."	

An employee working on platform WC 61, (about five miles west of the wreckage site) saw a line of thunderstorms, oriented east to west, move through the area earlier in the morning. He also reported a brief period of intense rain and recalled seeing a number of waterspouts on the eastern end of the storm.

Visible satellite imagery showed a broken line of cumulus and towering cumulus clouds extending from approximately 10-12 nautical miles southeast of Galveston, Texas, east-northeastward to near Grand Chenier, Louisiana. The broken line of clouds was generally stationary, but cloud elements within the line moved east northeastward during the time of the accident. In addition, satellite imagery showed that the line of cumulus was diffused in the area just south of the accident location.

The visible satellite imagery (with a nominal resolution of one kilometer) did not indicate any clouds within about 3 nautical miles of the accident site. A cellular cloud mass located about 4-5 nautical miles southwest was the only prominent cloud feature near the accident.

Lake Charles (KLCH) Weather Surveillance Radar-1988, Doppler (WSR-88D) reflectivity data for 0924:44 and 0932:30 did not indicate any radar echoes in the vicinity of the accident. The cloud mass shown in the satellite imagery southwest of the accident site was depicted in the reflectivity data as diminishing in intensity during the six minute period. Maximum radar tops were shown as decreasing from about 8,000 feet to about 4,000 feet.

A Meteorological Factual Report by a senior meteorologist from the NTSB is included in the docket of this report as supporting documentation.

COMMUNICATIONS

There are statements from two pilots from different companies that heard the emergency mayday radio transmission. Both of these

NTSB	N-No	Date	Make	Model	Factual pilots stated that the pilot from Apache 51 sounded professional and calm. His voice was clear with no background noise, however, there was no reason given by the pilot for the emergency distress call.	Released Narrative
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AERODROME INFORMATION

The Gulf of Mexico is divided into block areas (three statute miles long and three statute miles wide), for oil/gas lease identification, and according to information from Helicopter Association International (HAI), there are over 5,500 offshore production platforms along the coastline of several states and into the Gulf.

WRECKAGE AND IMPACT INFORMATION

The wreckage was located about 12 miles south of Cameron, Louisiana, at latitude 29 degrees 38.015 minutes North, longitude 93 degrees 18.470 minutes West. The main body of the fuselage was recovered approximately 1440 on July 21, 2004. The depth of the water is 30-40 feet in the area. The recovered wreckage was moved onto a boat and transported to shore. The wreckage was then hauled by truck to RLC facilities at Broussard, Louisiana, for examination by the NTSB investigator-in-charge (IIC), with representatives from the Federal Aviation Administration (FAA), RLC, Bell Helicopter, and Rolls-Royce.

The helicopter was broken into four main sections: the main cabin section, aft vertical fin and tail rotor gearbox/assembly, the cabin roof with main transmission and rotor assembly to the aft end of the passenger compartment, and tail boom and fuselage aft of the main fuel cell.

The front of the cabin section and cockpit interior was mostly intact, with the left windshield, lower cabin chin bubble, and upper green house broken. The left side of the fuselage sustained inward crushing along its entire length. The left front door was distorted. Front and right-side cabin damage was less than the left side. The right front portion of cabin structure, including the windshield, lower cabin chin bubble, and upper green house were relatively intact. The cockpit controls and instruments, including cyclic and anti-torque pedals were intact. Rod end connections for flight controls from the cockpit to the main and tail rotor system were connected. The fuel bladders were intact, and an estimated 63 gallons of fluid (48 gallons of turbine fuel and 15 gallons of sea water) was removed when the fuel bladders were drained.



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The landing skids remained attached to the fuselage. Both the forward and aft cross tube skid attach brackets on the left skid were fractured, however both remained attached. RLC recovery personnel discharged the float inflation bottle prior to being transported to the RLC facility.

The top portion of the central area of the aircraft, comprising the main beam, nodal beam assemblies, transmission and mast, the rotor head, and inboard portions of the main rotor blades were separated as a unit. Another section consisted of the engine, engine deck, lower aft fuselage, most of the tail boom, and tail rotor drive shafting. All of the engine mounts were fractured, but the attaching legs were securely attached to the engine. The engine remained attached by various oil and fuel lines. The lower aft fuselage exhibited upward left to right damage. The tail boom was significantly damaged, including being twisted and bent approximately one foot aft of its attach point. There was longitudinal twisting along its entire length.

The tail rotor drive-train remained partially mounted atop the tail boom. The number four tail rotor drive shaft was separated at a point coincident with an upward bend in the tail boom. The number five hangar bearing and associated coupling were separated from the tail boom. The aft section of the number seven and the entire number eight sections of the tail rotor drive shaft, including the spline coupling that drives the 90-degree gearbox, were missing.

The aft portion of the tail boom was separated, and consisted of the vertical fin, tail rotor 90-degree gear box, mounting attachment for the gearbox, tail rotor assembly, and cowling. One tail rotor blade was separated approximately two inches outboard of the blade grip. The other tail rotor blade was coned outward.

The main transmission remained intact and attached to the upper cabin assembly of the fuselage. The drive shaft was fractured at the aft flex coupling, with circumferential scoring noted on the shaft.. The mast and drive shaft rotated freely when rotated by hand. The roots of both main rotor blades remained attached to the main rotor head. Both blades exhibited downward bending. One blade was fractured approximately 30 inches outboard of the blade retaining bolt, and the fracture surface of the portion remaining attached to the head exhibited a downward bend of approximately 90 degrees. The other blade exhibited damage to the blade body aft of the leading edge spar. The leading edge spar was all that remained of the outboard eight feet of the blade.

Examination of the engine revealed that the fourth stage turbine wheel and compressor rotor would not rotate. The throttle linkage was found secured to the fuel control arm. The fuel control arm traveled freely between both stops. Two first stage compressor

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					rotor blades were bent. One was bent approximately 30 degrees between approximately mid span and the tip of the blade opposite of the direction of rotation. The second, four blades clockwise from the first, exhibited a similar bend and in the opposite direction of compressor rotation. Another blade located near the first two was found missing a portion of the outboard leading edge. Light scoring was visible on the inside of the compressor case halves, in the area of the blade tracks of the first stage compressor rotor blades.	
					The upper and lower magnetic chip detectors were removed from the accessory gearbox. Both detectors were covered in a gray paste-like material, but did not exhibit any metal particles. Approximately two teaspoons of fuel was drained from the fuel line between the check valve in the horizontal fire shield and the fuel nozzle. The engine oil filter in the accessory gearbox was removed and found absent of debris.	
					MEDICAL AND PATHOLOGICAL INFORMATION	
					On July 22, 2004, an autopsy was performed on the pilot at the Calcasieu Parish Coroner's Office and Forensic Facility, Lake Charles, Louisiana, with one of the findings being "drowning." The report indicated "no evidence of injuries or significant natural disease."	
					Toxicological testing on the pilot was performed by the FAA's Civil Aeromedical Institute (CAMI) Forensic Toxicological and Accident Research Center, Oklahoma City, Oklahoma, for carbon monoxide, cyanide, volatiles, and drugs.	
					SURVIVAL ASPECTS	
					The helicopter skid mounted emergency floatation system was not activated.	
					Divers had to sever the pilot's seat belt to remove the deceased pilot from the wreckage. There was no shoulder harness installed in the helicopter, however, the pilot was wearing a life vest.	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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FIRE

There was no evidence of an in-flight fire aboard the helicopter.

TESTS AND RESEARCH

After the initial field examination of the helicopter wreckage by the NTSB IIC and party representatives at RLC's maintenance facilities in Broussard, Louisiana, pieces of the tail boom, tail rotor hub and blades, tail rotor 90-degree gearbox attachment casting, and horizontal and vertical stabilizers were sent to Bell Helicopter's engineering laboratories in Fort Worth, Texas, for further examination. The engine (serial number 898015) was sent to Rolls-Royce in Indianapolis, Indiana, for further examination.

The engine teardown examination occurred at the Rolls-Royce facility in Indianapolis, Indiana, on August 18, 2005, with a representative from the NTSB and Rolls-Royce present. No evidence of component failure was identified. Some of the observations are as follows: the spur adapter gear shaft was installed and secure to the compressor impeller, the number one bearing oil pressure line and oil scavenge line were fastened to the compressor front support, the inside of the front impeller exhibited heavy scoring through an approximate 270-degree arc, beginning at 3 o'clock through 12 o'clock to approximately 6 o'clock.

The examination at Bell Helicopter occurred on August 19, 2004, with the NTSB IIC and representatives from RLC and Bell Helicopter present. All fractured surfaces seen during the inspection were found to be fractured in overload. No fatigue fractures or cracks were found, and no anomalies were found with any of the parts, except for the fractures.

ADDITIONAL INFORMATION

The main wreckage of the helicopter, except for the engine (serial number 898015), tail boom assembly/parts, and vertical/horizontal stabilizers was released to the owner's representative on July 24, 2004.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The tail boom assembly/parts and vertical/horizontal stabilizers were released to the owner's representative on August 19, 2004.

The engine (serial number CAE898015) was released to the owner's representative on October 13, 2004.

ORGANIZATIONAL AND MANAGERIAL INFORMATION

Rotorcraft Leasing Company L.L.C. was formed in July 1994, and initially dry-leased helicopters to other operators. Key management personnel were hired, and the company obtained FAR 135 on-demand air taxi certification in November 1998. The Air Carrier Certificate (YTRA264L), which included the standards, terms, conditions, and limitations contained in the approved Operations Specifications (Parts A, B, C, D, E, and H) were reviewed. The company has operational onshore bases established in Venice, Fourchon, Patterson, Intracoastal City, and Cameron, Louisiana. In February 2005, the company operated 26 Bell helicopters in support of the offshore petroleum industry.

Rotorcraft Leasing Company L.L.C. also was issued an Air Agency Certificate (YTRR264L) as an approved Repair Station. The initial date of issue was June 21, 1991. The certificate was reissued on February 25, 2004. The repair station has FAA authorization for the following ratings: limited airframe, limited power plant, limited accessories, and limited nondestructive inspection.

NTSB

N-No

Date

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Model

Factual  
HISTORY OF FLIGHT

Released Narrative

On December 17, 2004, at 1522 mountain standard time, a Cessna 421, N421FR, registered to and piloted by a commercial pilot, was destroyed when it impacted terrain 0.5-mile south-southwest of Centennial Airport (APA), Englewood, Colorado. Visual meteorological conditions prevailed at the time of the accident. The instructional flight was being conducted under the provisions of Title 14 CFR Part 91 without a flight plan. The pilot, flight instructor, and pilot certificated-passenger were fatally injured. The flight was originating at the time of the accident, and was en route to the Fort Collins-Loveland Airport (FNL), Fort Collins, CO.

The airplane arrived at Centennial Airport between 1330 and 1400, and the three occupants had lunch at the airport restaurant. The airplane was not refueled. According to a Denver Jet Center East employee, approximately 1500 a "pretty" female boarded the airplane and sat in the left seat. She was followed by "two older gentlemen, the one wearing a baseball cap, [who] sat in the right seat." She said that after both engines were started, the right engine quit, followed by the left engine. Her first impression was that the pilot had retarded the mixture handles. After some effort, the engines were restarted, but they quit one after another shortly thereafter. "It took many cranks to get them going again," she said. "They messed with the engines for at least 10 minutes." As the airplane taxied out for takeoff, she noticed a puff of black smoke but she could not be sure "which engine it was coming from."

DEN05FA038

N421FR

12/17/2004

Cessna

421

According to the pilot's father, his daughter called him from the airport and told him they were having "engine problems" or "fuel problems," and that something had been "hooked up backwards." She asked that he notify the repair facility that they were returning the airplane for repairs. That was the last contact he had with his daughter.

The airplane was cleared for takeoff on runway 17L at 1521:41. At 1522:30 a female reported, "centennial tower four two one foxtrot romeo we're having engine trouble just to let you know." (See Transcript of Radio Communications, EXHIBITS). At 1522:43, there was a garbled transmission from the pilot. The airplane was seen to drift right across the median and runway 17R, then roll abruptly to the right and descend in a steep nose-low attitude. The airplane struck the ground, cartwheeled, and came to rest 1,017 feet southwest of the departure end of runway 17R (251° magnetic).

There were numerous witnesses to the accident (see EXHIBITS). One (witness #1) of two linemen working outside the Signature Flight Support facility, located near the intersection of runways 17L and 11, said that as the airplane passed his position, it did not appear to be climbing. "The aircraft appeared to be using right rudder as the nose of the aircraft had yawed to the right." His co-worker (witness #2) agreed that there was "full right rudder deflection." He then observed the airplane bank right "at a rapid rate . . . very steep bank angle . . . 90 degrees or more . . . [It] began to sink very fast . . . The aircraft hit the ground without changing its bank

The pilot's father had just purchased the airplane for his daughter, and she was receiving model-specific training from a contract instructor. Her former flight instructor was aboard as a passenger. The engines were started and they quit. They were restarted a they quit again. They were started a third time, and the airplane was taxied for takeoff. Shortly after starting the takeoff roll, the reported an unspecified engine problem. The airplane drifted across the median and parallel runway, then rolled abruptly to the struck the ground, and cartwheeled. The landing gear was down. Neither propeller was feathered. Disassembly of the right engine turbocharger revealed no anomalies. Disassembly and examination of the left engine and turbocharger revealed the mixture shaft throttle valve in the throttle and fuel control assembly were jammed in the idle cutoff and idle rpm positions, respectively. Manifold valve and fuel injector line flow tests produced higher-than-normal pressures, indicative of a flow restriction. Disassembly of the manifold valve revealed the needle valve in the plunger assembly was stuck in the full open position, collapsing the needle valve spring. A scribe was used to free the needle valve, and the manifold valve and fuel injector lines were again flow tested. The result was a lower pressure. Plunger disassembly revealed the threads had been tapped inside the retainer and metal shavings were found between the retainer and spring. The Teledyne Continental Motor (TCM) retainer has no threads. GPS download showed that 2,600 feet had been covered between the start of the takeoff roll and the attainment of rotation speed. Maximum speed attained was 100 mph. Computations indicated distance to clear a 50-foot obstacle was 2,000 feet, distance to clear a 50-foot obstacle (single engine) was 2,600 feet, and accelerate-stop distance was 3,000 feet.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					angle." Another employee (witness #3) inside the building said the airplane was crabbing "significantly to the right . . . The left wing would dip (in the down position) and the pilot would recover. This action continued 3 or 4 more times . . . The aircraft did not seem to gain or lose altitude . . . The aircraft's landing gear was extended."	

Another witness (#4) who was driving home saw the airplane bank to the right and slowly descend. "I noticed the gear were still in transit mode coming up slow." He did not hear any unusual engine sounds, or notice any smoke or windmilling propellers.

Two flight instructors observed the accident. One instructor (witness #5) was on landing approach. He said the airplane "appeared to be aligned with its axis along the runway (17L) centerline, and about the same altitude as I was (250 feet agl) . . . It began to drift slowly to the right. The axis always was parallel to the departure runway, with wings level, no turn was initiated. The plane continued to drift over the grass between runways 17L and 17R, with no apparent climb or descent . . . Rather suddenly, the left wing rose, and in a continuing descending arc to the right, the aircraft made ground impact, followed by a cartwheel." The other instructor (witness #6) was departing on the downwind leg. He said the airplane "flying very slowly and pointed in a southwesterly direction. The left wing came up and the airplane did what appeared to be a Vmc roll."

The accident occurred during the hours of daylight at a location of 39 degrees, 33.367' north latitude, and 104 degrees, 51.249' west longitude. The accident site was at a GPS (Global Positioning System) elevation of 5,916 feet msl.

PERSONNEL (CREW) INFORMATION

First Pilot

The first pilot held an airline transport pilot certificate with an airplane multiengine land rating, and commercial privileges in airplanes single-engine land, dated October 8, 1986. He also held a flight instructor certificate with airplane single/multiengine and instrument ratings, dated May 30, 2003, and a ground instructor certificate with an advanced rating, dated January 14, 1987. His second class airman medical certificate, dated May 6, 2004, contained the restriction, "Must wear corrective lenses." He was the owner and chief executive officer of Aircraft Training Resources. According to his most recent application for medical certification, he

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					estimated he had logged the following flight time (in hours):	
					Total Time: 11,000	
					Last 6 Months: 250	
					Two pages of the pilot's logbook (which was kept on a computer, were provided by his daughter. The first page contained entries from March 31, 2003, to December 5, 2003, and the second page contained entries from January 1, 2004, to July 26, 2004, to wit (in hours):	
					Total Time: 222.7 197.5	
					Single-engine: 5.4	
					Multiengine: 217.3 197.5	
					Turboprop: 66.4 143.7	
					Night: 11.2 13.8	
					Actual Instruments: 20.9 18.3	
					Simulated Instruments: 0.5 87.5	
					Solo: 1.2	
					Pilot-in-Command: 224.7 197.5	
					Instruction Received: 1.5	
					Instruction Given: 205.8 187.7	
					Cessna 421: 74.7 5.5	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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According to his sister, the pilot's resume, updated in November 2004, showed the following flight time (in hours):

Total Time: 12,000

Multiengine: 7,850

Turboprop: 4,900

Total Instruments: 2,120

Pilot-in-Command: 11,700

Instruction Given: 3,500

His last biennial flight review, 1.5 hours duration, was dated May 30, 2003, and was taken in a Cessna 172.

Second Pilot

The second pilot, age 20, was a student at Metropolitan State College of Denver, majoring in aviation technology, and aspired to become an airline pilot. She held a commercial pilot license with airplane single/multiengine land and instrument ratings, dated July 12, 2004. Her third class airman medical certificate, date January 2, 2003, contained no restrictions or limitations. According to her logbook, containing entries from November 14, 2002, to December 4, 2004, she had accrued the following flight time (in hours):

Total Time: 414.6

Single-engine: 180.8

Multiengine: 247.1

Pilot-in-Command: 303.3



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Instruction Received: 212.0

Night: 32.1

Actual Instruments: 8.7

Simulated Instruments: 53.5

Simulator: 14.0

Cessna 421: 31.9

Her commercial single/multiengine practical tests, taken in a Cessna 182 and a Piper PA-23-250 on July 12, 2004, respectively, constituted her biennial flight review.

Third Pilot

The third pilot held a commercial pilot certificate with airplane single/multiengine land and instrument ratings, dated February 15, 1974. He also held a flight instructor certificate with airplane single/multiengine land and instrument ratings, dated December 8, 2002. He was the second pilot's former flight instructor. His second class airman medical certificate, dated August 10, 2004, contained the restriction, "Must wear corrective lenses and possess glasses for near and intermediate vision." He was a retired General Electric and Woodward Governor engineer. According to his logbook, he had accumulated the following flight time (in hours):

Total Time: 3,928.2

Single-Engine: 3,766.5

Multiengine: 164.0

Pilot-in-Command: 3,759.9

NTSB

N-No

Date

Make

Model

Factual  
Instruction Received: 163.7

Released Narrative

Instruction Given: 663.0

Night: 333.7

Actual Instruments: 490.4

Simulated Instruments: 173.5

Simulator: 8.6

Cessna 421:4.0

His last biennial flight review/instrument proficiency check, taken in a Piper PA-28C-180, was dated June 30, 2003.

AIRCRAFT INFORMATION

N421FR (s/n 421-0069), a model 421, was manufactured in 1968 by the Cessna Aircraft Corporation. It was powered by two Continental GTSIO-520-D engines (s/n 188137-7-D, left; 219426R, right), each rated at 375 horsepower, driving two McCauley 3-blade, all-metal, constant speed propellers (m/n 3AF34C92-R; s/n 800799, left; 799841, right).

According to the aircraft maintenance records, the last airframe annual/engine 100-hour inspections were accomplished on August 26, 2004. At that time, the airframe and both engines and propellers had accrued 2,666.2 total hours. The left engine and right engines which were overhauled on September 21, 1998, and October 24, 1994, respectively, and had since accrued 804.2 and 822.7 hours, respectively. Both propellers were overhauled on March 6, 2001, and each had since accrued 251.7 hours. The last pitot-static and altimeter checks and transponder/encoder systems checks were accomplished on October 27, 2004.

During the last annual inspection, both engine oil filters and induction air filters were replaced and the fuel filter screens were

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					cleaned. The fuel injectors were removed, inspected and cleaned, and replaced with new seals and O-rings. The spark plugs were cleaned, gapped, and rotated, and the left engine air/oil separator was removed "for weld repair due to chaffing." On November 2, 2004, the left fuel transfer pump and left landing light circuit breaker were replaced because the circuit breaker, which controls the transfer pump and landing light, kept opening. These were the only recent maintenance items accomplished.	

METEOROLOGICAL INFORMATION

The following APA AWOS (automatic weather observation station) observations was recorded at 1536 (see EXHIBITS): Wind, 210 degrees at 3 knots; visibility, 10 statute miles (or greater); sky conditions, few clouds at 9,000 feet, scattered clouds at 11,000 feet; ceiling, 14,000 feet broken, 22,000 feet broken; temperature, 6 degrees C.; dew point, -6 degrees C.; altimeter, 30.27 inches of mercury; remarks: altocumulus standing lenticular clouds distant southwest.

COMMUNICATIONS

According to the tower communications transcript, the second pilot called for taxi clearance at 1514:54. Takeoff clearance was give at 1521:41. At 1522:30 the second pilot reported, "centennial tower four two one foxtrot romeo we're having engine trouble just to let you know." The airplane was cleared to land one any runway. At 1522:43 the pilot said, "we'll let . . ." (unintelligible, broken transmission). This was the last transmission from the airplane.

AERODROME INFORMATION

Centennial Airport (APA) is an IFR-certified airport, situated at an elevation of 5,883 feet msl, and located at coordinates 39 degrees, 34.21' latitude, and 104 degrees, 50.96' west longitude. The Denver Automated Flight Service Station (AFSS) is located on the field. At

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					the time of the accident, the control tower was in operation. N421FR took off on runway 17L-35R, which is 10,002 ft. x 100 ft., made of asphalt and grooved.	

WRECKAGE AND IMPACT INFORMATION

The on-scene investigation was conducted on December 18, 2004. The wreckage path was aligned on a magnetic heading of 240 degrees. There was a 27-foot long ground scar, consistent with the right wing, followed by a crater containing pieces of the right propeller and engine. A crater, containing nose dome Fiberglass, was 12 feet beyond, next to the main body of wreckage.

The main body of wreckage was aligned on a magnetic heading of 310 degrees. Underneath the cockpit area were both wings. The left engine remained attached to the wing. The cockpit and cabin areas were destroyed by fire. The empennage sustained impact damage but not severely burned. Fifteen feet beyond the main wreckage was another crater, containing pieces of the left propeller and some engine parts.

Most of the cockpit instruments were destroyed by fire. Engine instruments and controls that were discernible were: left/right tachometers, 600/400 rpm; left/right fuel flow, 0/0; left/right manifold pressure, 31/49 inches; left/right throttle, full forward/retarded 1.5 inches; left/right mixture controls, retarded 1.5 inches; left/right propeller controls, retarded 2.0 inches, respectively. The landing gear bellcrank was extended. Measurement of the flap chain and sprockets were consistent with the flaps being retracted.

The upright right engine came to rest 40 feet to the left of the main wreckage and was 130 feet along the wreckage path. The right propeller was 70 feet up and 20 feet to the right of the wreckage path, near the engine. The spinner was crushed, torn, and sustained some thermal damage. Blade A (arbitrarily labeled) was relatively undamaged. Both blades B and C bore chordwise scratches on the cambered surface near the tips. In addition, blade C had leading edge damage gouges and was twisted about 30 degrees back and bowed about aft about 25 degrees.

The left propeller was partially buried along the wreckage centerline. The spinner was crushed and torn. Blade A was relatively

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					undamaged. Blade B was bowed back about 20 degrees and bore some chordwise scratches on the cambered surface near the tip. Blade C was bowed aft about 25 degrees, was slightly twisted, and had some leading edge damage.	

On December 20, 2004, the airframe and powerplants were examined at the facilities of Beegles Aircraft Services in Greeley, Colorado. The left engine had sustained thermal damage. All cylinders had compression when the crankshaft was turned, and there was continuity from the accessory section to the propeller shaft. The top leads of both magnetos sparked. There was some thermal damage to the fuel control unit (FCU), but the screen was clear of foreign debris. The throttle was closed and the mixture control arm was at the midpoint position. The fuel pump was thermally damaged and the top of the swirl chamber was broken off. Although the coupler was intact, it would not turn freely. Numbers 1 and 5 top spark plugs were oil-soaked, and there was corrosion on the electrode of the number 4 top spark plug. The left turbocharger turned freely. There was leading edge damage to six of the turbine blades, but there was no scoring on the housing. The wastegate was jammed in the closed position.

The right engine had sustained impact but no thermal damage. The oil pump drive shaft turned with difficulty. The fuel pump coupler was intact and turned freely. All cylinders had compression when the crankshaft was turned, and there was continuity from the accessory section to the propeller shaft. The top leads of both magnetos sparked. The top leads of both magnetos sparked. The fuel manifold valve diaphragm was intact, the screen was clear of debris, and the chamber contained fuel. Although the fuel pump was broken into four pieces and scattered along the wreckage path, the coupler was intact, and the drive turned with difficulty. The upper deck pressure line had a ½-mm hole in the backside, just aft of the right magneto. It did not appear to be due to chaffing, but was more consistent with two chisel marks. The top spark plugs were clean and showed normal wear but needed changing. The electrodes were dark in color. The right turbocharger could not be turned. There was scoring on the compressor case, and two blades were bent opposite the direction of rotation. There was no scoring on the turbine case. The wastegate was almost fully closed.

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies were performed on all three occupants by the Douglas County Coroner's Office. In addition, FAA's Civil Aeromedical Institute (CAMI) conducted toxicological screenings (see EXHIBITS). According to the CAMI reports, no carbon monoxide, cyanide, ethanol, or drugs were detected in the first and second pilots, but the third pilot tested positive for an unspecified amount of quinine and Ibuprofen.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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TESTS AND RESEARCH

Engines and Turbochargers

The engines and turbochargers were shipped to Teledyne Continental Motors (TCM) in Mobile, Alabama, where on, March 29-31, they were disassembled and examined under the auspices of NTSB. Disassembly and examination of the right engine revealed no anomalies. Manifold valve and fuel injector line flow tests produced pressures within manufacturer-recommended parameters.

Disassembly and examination of the left engine revealed the mixture shaft and throttle valve in the throttle and fuel control assembly were jammed in the idle cutoff and idle rpm positions, respectively. Manifold valve and fuel injector line flow tests produced higher-than-normal pressures, indicative of a flow restriction. Disassembly of the manifold valve revealed the needle valve in the plunger assembly was stuck in the full open position, collapsing the needle valve spring. TCM was of the opinion that this was not the result of the accident. A scribe was used to free the needle valve, and the manifold valve and fuel injector lines were again flow tested. The results was a lower pressure. Plunger disassembly revealed the threads had been tapped inside the retainer and metal shavings were found between the retainer and spring. The TCM retainer has no threads. Other anomalies noted were the oil sump drain plug was not safetied, and the oil pressure relief valve was set at the maximum limit. The accessory case squirt plug was missing. According to TCM, this could cause an "internal leak" within the engine, and would explain why the oil pressure relief valve was set at the maximum limit. Additionally, the silk gasket between the crankcase halves was double strung and had been routed outside, not inside, the bolt holes, contrary the TCM overhaul procedures. This produced fretting on the upper front portion of the crankcase halves. A magneto bushing retainer, bearing gear teeth chewing signatures, was found in the left engine oil pan. All bushing retainers were found in place. It was TCM's opinion that this bushing had been "lost" during a previous maintenance event, and had fallen through the accessory case.

Both left and right magnetos from both engines were intact and turned freely, producing a 7 mm spark when bench tested. Examination of the left and right turbochargers was unremarkable. There was evidence that both turbochargers were rotating at impact.

Propellers

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Both propellers were shipped to McCauley Propellers in Wichita, Kansas, where, on February 28 and March 1, they were disassembled and examined under the auspices of NTSB. According to McCauley's report, there was no evidence of preimpact failure/malfunction, and all damage observed was due to impact. Both propellers were rotating at low power and at, or near, low pitch blade angles (high rpm).

Fuel Pumps and Fuel Selector Valve

On March 2, the fuel transfer pumps, auxiliary boost pumps, and fuel selector valve were taken to B&S Aircraft Parts and Accessories, Inc., in Wichita, Kansas, for flow checks. The pumps produced rated pressures, and both fuel selector valves were determined to be positioned at the main tank positions.

The faulty fuel transfer pump that had been replaced was retrieved from the repair facility and sent to the manufacturer for testing. According to Facet-Purolator, one of three legs on the clip retainer had broken, preventing the inlet valve from centering and sealing the cup. Upon replacement of the inlet valve assembly, the pump operated normally and produced new product delivery specifications: 32 gph free flow, 23 gph at 2 psi, and a zero delivery pressure of 6.65 psi.

Airport Security Surveillance Video

A video of the accident was recovered from airport security cameras. Although the airplane and its flight path were not discernible, the video captured a fireball at 1509:21. The fire department arrived on scene at 1517:51 and the paramedics arrived at 1519:40. Water was applied on the burning wreckage at 1519:45. (Note: The foregoing times do not coincide with the times recorded by air traffic control. ATC times are considered official and are used throughout this report).

Sound Spectrum Study

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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A tape recording of voice communications between N421FR and Centennial Tower was sent to NTSB headquarters for audio spectrum analysis. The propellers have a certificated maximum rotation speed of 2,275 rpm. According to the specialist's factual report, "No sounds could be identified as coming from either the engines or rotating propellers" when the aircraft was on the ground. However, when the pilot reported they were having engine trouble, the primary blade passing frequency and the 2nd and 3rd harmonic frequencies of the rotating propellers were identified. During this transmission only one propeller sound signature could be identified, and it was rotating at 2,234 rpm. The report said, "It is not known if two propellers rotating at the same speed caused the observed frequency or if it was only one propeller creating the signature. No background aircraft warning tones or alarms were heard."

Global Positioning System

A hand-held Garmin GPS was recovered from the wreckage. Stored data was downloaded into a computer, then printed on a spreadsheet and plotted on a satellite photograph (see EXHIBITS). The data showed the taxi route from the ramp to the runup area at the end of the runway. At a GPS time of 1521:46 (point 17), the airplane began to accelerate on a magnetic heading of 178 degrees and at an elevation of 5,819 msl. At 1521:35 (point 21), the airplane was at 118 mph. It reached a maximum speed of 132 mph at 1522:18 (point 22). Eight seconds later, at 1522:26 (point 23), the airplane reached an altitude of 5,947 feet msl, but the speed dropped to 127 mph and the heading drifted right to 184 degrees. At 1522:57 (point 27), speed had dropped to 104 mph and heading had turned to 196 degrees true.

The Cessna Aircraft Corporation commissioned a private consultant to analyze the same data. According to his printout, the airplane accelerated to 115 knots in 29 seconds and used 1,552 feet of runway. Thereafter, speed started to decay as the airplane drifted right.

Performance Study

A performance study was performed. N421FR's licensed empty weight was 4,785 pounds. Medical certificate weights of the three pilots were 182, 115, and 197 pounds, respectively. If both engines were full of oil (26 quarts), the oil would weigh 49 pounds. Assuming little, if any, baggage and approximately 100 gallons of fuel on board, the airplane would weigh approximately 5,731 pounds at takeoff. According to the Cessna 421 Owner's Manual, the published rotate speed is 115 mph (120 mph is the "blue line" or best single engine rate of climb speed). The temperature at Centennial Airport was 6 degrees C. (42.8 degrees F.) The airport elevation was 5,883 feet msl and the altimeter was 30.27 inches of mercury, yielding a pressure altitude of 5,533 feet msl (30.27 -



NTSB

N-No

Date

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Model

Factual

Released Narrative

29.92 = .350, or 5883 - 350 = 5,533). The 3-knot headwind was negligible. According to the Normal Takeoff Distance chart, a distance of 2,000 feet would be required to clear a 50-foot obstacle. According to the Single Engine Takeoff Performance chart, a distance of 2,600 feet would be required to clear a 50-foot obstacle (this assumes an engine failure at takeoff, and feathering the propeller and retracting the landing gear during climb). According to the Accelerate Stop Distance chart, a distance of 3,000 feet would be required to accelerate to takeoff speed and bring the airplane to a stop (this assumes an engine failure at takeoff speed, followed by heavy braking). The distance between GPS points 17 and 21 was 2,698 feet.

ADDITIONAL INFORMATION

The pilot's father purchased the airplane for his daughter and registered it in her name. Reportedly, she planned to log time in the pressurized airplane, and then sell it. The airplane had previously been registered to a company in Prescott, Arizona.

On December 14, 2004, three days before the accident, the airplane was ferried from Greeley to Firewall Forward, a repair facility at the Fort Collins-Loveland Airport. The ferry pilot said the airplane was typical of an older Cessna 421. He said the engines could be difficult to start but if you knew the airplane, it was no problem. During his preflight, he noticed the fuel sumps drain valves were new and the fuel samples were clean. He had a little difficulty locating the right fuel selector detent because there was some looseness. He said when you pressed the prime button to start the engines, it automatically placed the boost pumps on HIGH. When you released the button, the boost pumps would revert to LOW BOOST. He said the right engine idled high approximately 1,000 rpm. You took off with the fuel selectors on the main tanks, and you never took off with the boost pumps on high. On takeoff, there was about 6 pounds per hour fuel flow difference between the engines.

According to the repair facility, the airplane was on an extended work order that was opened on November 2, 2004. The left fuel transfer pump was inoperative and the circuit breaker, which controls both the transfer pump and landing light, kept opening. Both were replaced. The mechanics that worked on the airplane told an FAA airworthiness inspector that it was a simple maintenance procedure, they followed the Cessna maintenance manual, and it was impossible for anything to be hooked up backwards. At th same time, the left main tire and the pilot's seat stop were replaced, and the tail deice boot pressure line was repaired. Both engine oil and filters were changed and replaced.

Approximately 0800 on the morning of the accident, a lineman towed the airplane from the repair facility to a refueling ramp, but

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>the airplane was not serviced. The three pilots arrived approximately 1030, preflighted the airplane, and boarded. The lineman said a female occupied the left seat. He noticed an access panel hanging from beneath the empennage and brought it to the pilot's attention. She asked that he secure the panel. He agreed, but asked that one of the pilots get out and check its security. They did not comply with his request.</p>	
					<p>A witness, who was working on his airplane, said the pilot tried starting the left engine for about 10 minutes without success. The right engine was started, and then the pilot tried for another 10 minutes to start the left engine but to no avail. The pilot then shut down the right engine and waited. The witness said it seemed like the engine had no compression. The pilot was able to start both engines eventually, and the airplane taxied away for departure. The airplane was seen doing touch and go landings in the traffic pattern and then departed the area.</p>	
					<p>In addition to the Federal Aviation Administration, parties to the investigation included the Cessna Aircraft Corporation and Teledyne Continental Motors.</p>	
					<p>The wreckage was released to the insurance company on May 2, 2005.</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					On May 11, 2005, about 1915 eastern daylight time, a homebuilt RV-6A, N42RZ, experienced a loss of engine power while in cruise flight, and was substantially damaged during a forced landing near Kennett Square, Pennsylvania. The certificated private pilot was not injured. Visual meteorological conditions prevailed and no flight plan was filed for the personal flight conducted under 14 CFR Part 91.	
NYC05LA081	N42RZ	5/11/2005	Zeidman	RV-6A	<p>The pilot reported that on the day prior to the accident, he experienced difficulty restarting the engine and suspected a vapor lock problem. He installed a blast tube to aid the cooling of the engine fuel pump and conducted a test flight the following day. During the test flight, while the airplane was at 2,000 feet, it experienced a loss of engine power, after the pilot cycled the auxiliary fuel pump switch. The pilot turned toward a nearby airport, switched fuel tanks, placed the mixture control to full rich, and confirmed that the fuel pump was in the "on" position. The airplane continued to descend and the pilot performed a forced landing to a field. During the landing, the airplane struck a ditch, and flipped over.</p> <p>Examination of the engine by a Federal Aviation Administration inspector did not reveal pre-impact malfunctions. The airplane was equipped with a facet cube-style electric auxiliary fuel pump. The pilot reported that subsequent troubleshooting of the fuel pump revealed that it operated intermittently and restricted fuel flow to the carburetor.</p>	<p>The homebuilt airplane was in cruise flight when it experienced a loss of engine power, after the pilot cycled the auxiliary fuel pu switch. The pilot turned toward a nearby airport, switched fuel tanks, placed the mixture control to full rich, and confirmed that fuel pump was in the "on" position. The airplane continued to descend and the pilot performed a forced landing to a field. Durin landing, the airplane struck a ditch, and flipped over. Initial examination of the engine did not reveal any pre-impact malfunction. However, the pilot reported that subsequent troubleshooting of the electric auxiliary fuel pump revealed that it operated intermittently and restricted fuel flow to the carburetor.</p>

NTSB	N-No	Date	Make	Model	Factual HISTORY OF FLIGHT	Released Narrative
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On March 14, 2006, about 0740 central standard time, a single-engine Bell 206L-1 helicopter, N370RL, was destroyed when it impacted terrain following a loss of engine power while in cruise flight near Patterson, Louisiana. The commercial pilot and one passenger were fatally injured and the two remaining passengers sustained minor injuries. The helicopter was registered to and operated by Rotorcraft Leasing Company (RLC), LLC, of Broussard, Louisiana. Visual meteorological conditions prevailed and a flight plan was not filed for the 14 Code of Federal Regulations Part 135 on-demand passenger flight. The 75-nautical mile cross-country flight originated from the Harry P Williams Memorial Airport (PTN) near Patterson, Louisiana, at 0735 and was destined for offshore platform Ship Shoal 216, located in the Gulf of Mexico.

According to a passenger who had been seated in the left rear seat of the helicopter, the pilot performed a preflight engine check before takeoff. The passenger stated that the takeoff appeared normal and they departed south from the airport at an approximate altitude of 500-700 feet above ground level (agl).

DFW06FA083	N370RL	3/14/2006	Bell	206L-1
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The passenger reported that as they began their flight to the south, the helicopter "dropped" several times. Each time the helicopter regained the lost altitude; however, it appeared to do so slowly as if "he, [the pilot], didn't have the power to keep it up." Moments later while over a wooded area, the front seat passenger looked back and said, "brace yourself." The pilot then made a descending right turn, of approximately 90 degrees, towards an open field. As they approached the ground, the pilot brought the nose of the helicopter up as if he was attempting to "slow down." The helicopter impacted the ground on the front left side and came to an abrupt stop in an upright position.

The passenger further reported that he unbuckled his lap belt and exited the left aft door of the helicopter into vegetation that was 7-8 feet tall. Once out of the helicopter he observed a small fire by the baggage compartment. A brief time later the helicopter was fully engulfed in flames. The passenger further reported that before ground impact "everything sounded normal and he didn't smell anything unusual."

The second surviving passenger was not available for an interview and did not provide a statement to the NTSB investigator-in-charge (IIC).

Approximately 5 minutes after departing on a Title 14, CFR Part 135 air taxi cross-country flight, the helicopter had a loss of engine power while in cruise flight. The commercial helicopter pilot subsequently made a hard forced landing at an off-airport site composed of tall vegetation and soft terrain. The helicopter came to rest in an upright position, and the two rear seat passengers were able to egress unassisted. Moments later, the helicopter was engulfed in flames. The wreckage path was oriented on a magnetic heading of 225 degrees, and the wind was reported as from 020 degrees at 12 knots. An examination of the engine at the accident site revealed that the fuel line to fuel nozzle "B" nut could be turned by hand, and did not contain a lock wire as required. All other fittings and connections on the engine were found to be secure. A review of the helicopter's maintenance records revealed that a 50-hour fuel nozzle inspection was performed the evening prior to the accident flight. This inspection required the removal, disassembly, cleaning, inspection, reassembly, and reinstallation of the fuel nozzle. An interview with maintenance personnel revealed that fuel nozzle installation procedures found in the engine manufacturer's maintenance manual had not been followed. A tear down examination of the engine was performed. The engine examination revealed no preimpact anomalies. Investigators conducted operational tests on an engine of the same make and model. The tests were performed in an effort to determine what effect a loose fuel nozzle "B" nut would have on the engine's operation. The test revealed that the engine would experience a substantial loss of power that could not conclude in a flame out. Testing further revealed that conditions would have been conducive for an in-flight fire. Investigators could not determine if the fire originated in-flight, or during the ground impact.

NTSB	N-No	Date	Make	Model	Factual PILOT INFORMATION	Released Narrative
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The pilot held a commercial pilot certificate with ratings for airplane single-engine land, helicopter, instrument airplane, and instrument helicopter ratings. His last Federal Aviation Administration (FAA) second-class medical was issued on September 19, 2005, with the limitation of "MUST HAVE AVAILABLE GLASSES FOR NEAR VISION."

The operator submitted a Pilot/Operator Aircraft Accident Report (NTSB Form 6120.1/2). This report indicated the pilot had accumulated a total flight time of 12,545 hours. The pilot accumulated 213 hours in the last 90 days, and 91 hours in the last 30 days. He had 11,070 hours in this make and model of helicopter. His last recorded flight review was completed February 11, 2006.

AIRCRAFT INFORMATION

The 1980-model Bell 206L-1, serial number 45370, was powered by a 650-shaft horsepower Rolls-Royce Allison 250-C30P turbo shaft engine, serial number CAE 860171, driving a two-bladed main rotor system and a two-bladed tail rotor. There was no flight data recorder, cockpit voice recorder, or fire detection system installed on the helicopter, nor was there a requirement for them.

The helicopter was maintained in accordance with Aircraft Type Certificate Data Sheet number H2SW and the appropriate Bell model Maintenance Manual. The Bell model 206 series of RLC's Approved Aircraft Inspection Program (AAIP) requirements were:

1. 200-hour tail rotor gearbox and transmission oil change.
2. 600-hour hydraulic and facet filter bypass.
3. 7-day airframe inspection.
4. 3-month emergency equipment inspection.
5. 6-month float inspection.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					6. 12-month main rotor mast internal inspection.	
					7. 24-month flight control bolt inspection.	
					In addition, the following airframe inspections were to be accomplished on RLC's Bell 206L-1:	
					1. Daily preflight inspection.	
					2. 100-hour airframe inspection.	
					3. 300-hour airframe inspection.	
					4. 1200-hour airframe inspection.	
					The AAIP further required that the Allison Model 250-C30P engine be maintained in accordance with Engine Type Certificate Data Sheet number E1GL, and engine life-limited parts be replaced in accordance with Allison Operation and Maintenance Manual 16W2. Engines parts that require overhaul were to be overhauled in accordance with Allison Overhaul Manual 14W3.	
					The engine inspections consisted of the following:	
					1. 50-hour fuel nozzle inspection	
					2. 150-hour engine inspection	
					3. 300-hour engine inspection	
					4. 300-hour engine oil change.	
					The maintenance records for N370RL were reviewed by the accident investigation team. No anomalies or unusual events were	

NTSB	N-No	Date	Make	Model	Factual noted, and no open discrepancies or deferred items were listed in maintenance records at the time of the accident. From maintenance records, the airframe was estimated to have accumulated a total of 10,622 hours at the time of the accident, and the engine had accumulated a total of 20,614 hours.	Released Narrative
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The weight and balance was computed for the NTSB's investigator-in-charge (IIC), with estimated weight for crew, cargo, and fuel for determining center of gravity (CG). The result of the computation was that the aft, forward, and lateral CG ranges were within the limits.

Fueling records at Harry P Williams Memorial Airport established that the helicopter was last fueled on March 14, 2006, with the addition of 25 gallons of Jet A aviation fuel. A fuel sample was taken from the helicopter before the accident flight. Investigators found the fuel to be clear and bright with no anomalies noted. The fuel tested negative for water.

METEOROLOGICAL INFORMATION

At 0755, the weather observation facility at PTN, reported wind from 020 degrees at 12 knots, visibility 10 statute miles, clear of clouds, temperature 61 degrees Fahrenheit, dew point 37 degrees Fahrenheit, and a barometric pressure of 30.16 inches of Mercury.

COMMUNICATIONS

There were no reported radio communications from the pilot after he departed PTN.

WRECKAGE AND IMPACT INFORMATION

On site documentation of the wreckage was conducted by investigators from the National Transportation Safety Board, Federal Aviation Administration, Bell Helicopter, Rolls Royce, and Rotorcraft Leasing Company.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The wreckage was located in a soft field of tall "Roosevelt Cane", approximately three miles south of PTN. The Global Positioning System (GPS) coordinates recorded at the accident site were 29 degrees 39.625 minutes north latitude and 091 degrees 19.473 minutes west longitude, at a field elevation of approximately -12 feet mean sea level (msl). All major components were accounted for at the accident site.

The wreckage path was about 125 feet long, approximately 20 feet wide, and oriented along a measured heading of 225 degrees. The first point of ground impact was about 150 feet west of a line of deciduous trees. About five feet beyond the first impact scar was a six inch deep ground imprint, which resembled the shape of the helicopter's lower fuselage. Within this imprint were stubs of cane that were pushed over in the westerly direction. The partially burned remains of a landing gear cross tube and the right skid tube were found in this area.

The tail rotor blades, tail rotor gear box, tail cone, vertical stabilizer and various small pieces were found along the wreckage path in the area between the first ground impact and the main wreckage.

The main wreckage, consisting of the fuselage, engine, main rotor head, mast, transmission pylon, and the surviving sections of the main rotor blades, came to rest about 80 feet beyond the first point of ground contact. The main wreckage, which had been nearly consumed by the post impact fire, was found oriented on a heading of 310 degrees. The main rotor (M/R) head was found attached to the mast and sections of both main rotor blades were found attached to the M/R head.

The horizontal stabilizer came to rest about 45 feet west, and sections of the tail rotor drive train and aft tail boom were located approximately 90 feet north, from the main wreckage. Due to the extent of thermal damage to the helicopter, flight control continuity could not be established.

The engine exhibited thermal damage. An examination of the engine at the accident site revealed that the fuel line to the fuel nozzle "B" nut could be turned by hand and did not contain a lockwire. All other fittings and nuts on the engine were found to be secure. An off site tear down examination of the engine was performed.



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The detailed engine tear down examination revealed rotational scoring on the compressor shroud and correlating rub on the compressor impeller. All four turbine wheels were found complete and could be rotated by hand. All bearings were found to be complete and each engine shaft to spline adapter was found connected. The engine's accessory gearbox case, fuel pump, fuel control unit, and the power turbine governor were consumed by the post impact fire. All gears from the accessory gearbox were found complete. The engine examination did not reveal any pre impact anomalies.

A review of the helicopters maintenance records revealed that a 50-hour fuel nozzle inspection was performed the evening prior to the accident flight. This inspection required the removal, disassembly, cleaning, inspection, reassembly, and reinstallation of the fuel nozzle.

The 50-hour fuel nozzle inspection was performed by a certificated airframe and powerplant (A&P) mechanic. Once completed, the fuel nozzle installation was inspected by an inspector and the appropriate logbook entries were made. Training records for the mechanic and inspector were reviewed, and no discrepancies were noted.

A representative from the Safety Board conducted separate telephone interviews with the mechanic who performed the 50-hour fuel nozzle inspection and the inspector.

The mechanic stated that following the fuel nozzle inspection, he reinstalled the fuel nozzle into the engine combustion chamber, torque it with a special tool, and lockwired it. He then attached the fuel nozzle hose and tightened it with a 9/16 inch wrench. He then asked an inspector to inspect the installation. The mechanic further stated that an engine run-up was not performed upon the completion of the inspection.

The inspector stated that he performed a visual inspection of the fuel nozzle installation. During the inspection the inspector asked the mechanic "did you tighten the line?" to which the mechanic responded in the affirmative.

According to Rolls-Royce 250-C30 Series Operation and Maintenance Manual, dated December 15, 1997, section 73-10-03, PARA 1.B, (4), (5), the following procedure should be followed once the fuel nozzle has been installed:

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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"(4) Connect the fuel nozzle hose. Tighten hose coupling to 80-120 lb in. (9.0-13.6 N.m). Secure with lockwire.

NOTE: Early production fuel nozzle hoses do not incorporate means to accommodate installation of lockwire. These early hoses do not require lockwire. [The fuel nozzle hose installed on N370RL did incorporate a means to lockwire.]

(5) Check run the engine after fuel nozzle replacement."

Additionally, the following warning was given:

"WARNING: FAILURE TO PROPERLY INSTALL, ALIGN, AND TORQUE FUEL, OIL, AND AIR FITTINGS AND TUBES COULD RESULT IN AN ENGINE FAILURE."

MEDICAL AND PATHOLOGICAL INFORMATION

The Jefferson Parish Forensic Center, located in Harvey, Louisiana, performed an autopsy on the pilot on March 15, 2006.

The FAA, Toxicology Accident Research Laboratory, located in Oklahoma City, Oklahoma, conducted toxicological testing on the pilot. The results of analysis of the specimens were negative for carbon monoxide, cyanide, volatiles, and tested drugs.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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TESTS AND RESEARCH

On December 12, 2006, at the facilities of Rolls Royce, the NTSB IIC with representatives from Rolls Royce and Bell Helicopter conducted tests on a new 250-C30P turbo shaft engine. The tests were performed in an effort to determine what effect a loose fuel nozzle "B" nut would have on the engine's operation.

Initial testing was performed by placing a "T" fitting and ball valve in the fuel supply line upstream of the fuel line to fuel nozzle "B" nut. The ball valve allowed a controlled test to simulate a leak at the fuel nozzle "B" nut. The engine was then started and allowed to stabilize at idle. When the ball valve was opened to simulate a small leak at the "B" nut, the engine immediately flamed out.

Investigators then removed the "T" fitting and ball valve and connected the fuel line in a typical installation configuration. The engine was started, and while at idle, the fuel nozzle "B" nut was loosened to simulate how the fuel nozzle "B" nut was found at the accident site. The engine continued to run; however, fuel began to leak out at a steady drip. As the engine power was increased, the fuel began to run and then spray in a steady stream aft of the engine to a distance of approximately seven feet.

The fuel flow and N1 (gas producer) rpm from this test were compared to values obtained from an engine run without a fuel leak. The comparison revealed that as a result of the fuel leak, a fuel flow of 35 pph greater than the allowable limit for the Bell 206 produced a N1 rpm that was 3,200 less than what the engine would produce at takeoff power.

The test further revealed that conditions would have been conducive for an inflight fire.

ADDITIONAL INFORMATION

The wreckage of the helicopter was released on March 17, 2006, and the engine was released on July 15, 2006, to a representative of

NTSB	N-No	Date	Make	Model	Factual the operator.	Released Narrative
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NTSB	N-No	Date	Make	Model	Factual HISTORY OF FLIGHT	Released Narrative
					<p>On September 22, 2006, at 0958 central daylight time, a Beech 95-B55, N4JV, collided with the terrain in North Sioux City, South Dakota. The airplane was in cruise flight at 9,000 feet above mean sea level (msl) prior to radar and radio contact being lost. The pilot was fatally injured. The airplane was substantially damaged. The 14 Code of Federal Regulation Part 91 business flight was operating in instrument meteorological conditions. The pilot had filed and activated an instrument flight rules (IFR) flight plan. The flight originated from the North Platte Regional Airport (LBF) North Platte, Nebraska, at 0853 with an intended destination of La Crosse, Wisconsin.</p>	
					<p>Personnel at the fixed base operator (FBO) at LBF stated the airplane arrived at their airport on September 19, 2006. The pilot instructed line personnel to fill up the main fuel tanks. The FBO reported they filled the main fuel tanks with 74.7 gallons of fuel. The airplane was then tied down until it departed on the accident flight.</p>	
CHI06FA264	N4JV	9/22/2006	Beech	BE-95-B55	<p>At 0944, the pilot of N4JV contacted Sioux City approach control stating that he was at 9,000 feet. At 0954, the approach controller informed N4JV that the Crypt military operations area (MOA) to his east was active. The controller stated that he could either go 5 miles to the north or he could descend to 7,000 feet to avoid the MOA. The pilot did not respond to this radio call. At 0955, the controller again called N4JV at which time the pilot responded with his call sign. The controller repeated his earlier call about the MOA. The pilot did not respond to numerous attempts by the controller to contact him.</p>	<p>The airplane was in cruise flight at 9,000 feet above mean sea level (msl) when it entered a descending left turn. The altitude data then went into coast mode with the groundspeed being reported as 204 knots. Four seconds later, radar data shows the airplane turning to the right with a ground speed of 50 knots at an altitude of 7,400 feet. The airplane then enters another descending left turn. The altitude data then shows the airplane at 5,200 feet with a ground speed of 29 knots. The altitude data then once again entered the coast mode. Witnesses reported seeing the airplane spinning as it descended out of the clouds. The airplane impacted the terrain in a relatively flat attitude. Post accident examination of the airframe, engines, and associated systems and components failed to reveal any preimpact failure/malfunction. Weather conditions at the time of the accident consisted of instrument meteorological conditions with rain. A weather study showed the airplane was operating in an area of instrument meteorological conditions with rain showers and turbulence.</p>
					<p>According to the Sioux City Approach Radar the first radar contact they had with the airplane was at 0940:38 when it was at a reported altitude of 8,800 feet. The airplane then climbed to an altitude of 9,000 feet where it remained until 0955:56 when it began a descending left turn. At 0956:26, the altitude data went into coast mode and the ground speed was reported as being 204 knots. Four seconds later, radar data shows the airplane turning to the right with a ground speed of 50 knots at an altitude of 7,400 feet. At 0956:34, the airplane enters another left turn and is still descending. At 0956:48, the altitude was recorded as being 5,200 feet with a ground speed of 29 knots. The altitude data then once again entered the coast mode.</p>	
					<p>A witness reported seeing the airplane spinning slowly as it descended in a nose down attitude. Other witnesses reported seeing the airplane spinning as it descended out of the clouds with variations in the engine sounds.</p>	

NTSB	N-No	Date	Make	Model	Factual PERSONNEL INFORMATION	Released Narrative
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The pilot, age 55, held an airline transport pilot certificate with a multi-engine rating and commercial pilot privileges for single-engine land airplanes. This certificate was issued on November 30, 1979. The pilot also held a flight instructor certificate with multi-engine, single-engine, and instrument ratings, which was renewed on July 29, 2006. The pilot was issued a second-class medical certificate on June 5, 2006. This certificate contained the limitation that the pilot must have glasses available for near vision.

The pilot's family provided a computerized printout of flight time records that the pilot maintained. The printout began on March 16, 1999, with flight times carried over from prior logbooks. According to these records the pilot had a total of 6,698.6 hours of flight time of which 4,115.7 hours were in multi-engine airplanes. The printout showed the pilot had flown a total of 107.5 hours in the accident airplane. It is unknown if he had additional flight time in the same make and model airplane prior to what was logged on the printout. The most recent record of the pilot's instrument flight time was his application for renewal of his flight instructor certificate, which was dated August 2004. This application showed the pilot had in excess of 560 hours of instrument flight time.

AIRCRAFT INFORMATION

The accident airplane was a 1973 Beech 95-B55, serial number TC-1583. It was a multi-engine, low wing, six-place airplane with retractable landing gear. A review of the maintenance logbooks indicated the most recent annual inspection was completed on September 11, 2006, at a total airframe time of 3,292.1 hours.

The airplane was equipped with two 260-horsepower, fuel injected, Continental IO-470-L (21) engines. The left engine, serial number 454091CS, was overhauled and installed on the airplane on November 24, 1993. The right engine, serial number 454092 CS, was overhauled and installed on the airplane on November 4, 1999. Both engines received an annual inspection on September 11, 2006. Total time since overhaul on the left and right engines at the annual inspection was 1,623.5 hours and 582.1 hours respectively.

METEOROLOGICAL CONDITIONS

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The pilot received a Direct User Access Terminal System (DUATS) weather briefing for the flight on September 21, 2006, at 2225. He then received a Flight Service Station weather briefing at 0802 on the morning of the accident. The pilot was provided with the current and forecast weather conditions, freezing levels, and Airman's Meteorological Information (AIRMETs) along the route of flight.

Weather conditions recorded at the Sioux City Gateway Airport (SUX), Sioux City, Iowa, located about 9 miles southeast of the accident site, at 0952, were: Wind from 220 degrees at 7 knots; visibility 10 statute miles; ceiling 1,300 broken, 3,800 overcast; temperature 14 degrees Celsius; dew point 12 degrees Celsius; altimeter 29.30 inches of mercury.

The Safety Board prepared a Meteorology Factual Report for this accident. The report stated the accident site was located south-southwest of a low-pressure system and a trough of low pressure, and between an occluded and secondary cold front. The surface analysis chart depicted a cyclonic wind circulation pattern into the low-pressure system. Winds reported just south of the accident site were from the southwest and the winds reported just north of the accident site were from the north.

The Meteorology Factual Report continued to state, "Station models immediately north and east of the accident site indicated IFR conditions with visibility 4 to 5 miles in rain with ceilings overcast at 500 feet agl [above ground level], with MVFR [marginal visual flight rules] conditions immediate south and west over northeastern Nebraska and central Iowa." The report also states that light to moderate rain showers were depicted in the vicinity of the accident site and the Freezing Level Chart implied a freezing level below 9,400 feet near the accident site. The radiative cloud top temperature near the accident site indicated the tops of the clouds were near 17,000 feet.

The airplane was operating within an area that was covered by AIRMET Tango update 2 which called for occasional moderate turbulence below 10,000 feet and AIRMET Zulu update 2 which advised of occasional moderate rime to mixed icing in clouds and in precipitation between the freezing level and 24,000 feet.

Witnesses reported rain in the area at the time of the accident. Witnesses also reported they did not see any visible ice on the airframe after the accident.

NTSB	N-No	Date	Make	Model	Factual WRECKAGE AND IMPACT INFORMATION	Released Narrative
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The accident site was located in a field between Interstate 29 and South Derby Lane. The wreckage came to rest 20 feet west of the Gunderson Fireworks building and 5 feet north of a storage trailer. There was no evidence that the airplane had contacted either of the structures. The airplane came to rest on a magnetic heading of 002 degrees on top of a pile of discarded wood and aluminum. A Sheriff's Deputy reported there was a strong odor of fuel in the area when he arrived just after the accident.

The entire airplane was present in one location. Ground scars indicated very little movement of the airplane once it contacted the terrain. The bottom of the engine nacelles and wings, and the fuselage were compressed evenly. All of the flight control surfaces remained attached to the fuselage. Although not continuous due to impact damage, flight control continuity was established to all of the flight control surfaces. Both the flaps and landing gear were in the retracted position. Examination of the airframe and flight control system revealed no evidence of a preimpact mechanical failure/malfunction.

Both engines remained attached to the airframe although the engine mounts sustained impact damage. One propeller blade on the right engine was slightly bent aft at mid-span on the blade. The other blade had a slight rearward bend. Both blades were covered with mud/dirt. The right engine had one propeller blade that was undamaged and relatively free of dirt. The other blade was bent aft about 90 degrees at the mid-span of the blade and covered with dirt. None of the blades exhibited chordwise scratches or gouges. Thumb compression and suction were achieved on all cylinders on both engines when the crankshafts were rotated by hand. Spark was achieved on all spark plug leads or magneto terminals. No contamination was noted within the fuel system. Both vacuum pumps were intact and rotated freely. Examination of the engines and related system components revealed no evidence of a preimpact failure/malfunction.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy of the pilot was performed on September 23, 2006, at the St. Luke's Regional Medical Center, Sioux City, Iowa. The final autopsy report listed the probable cause of death as "Multiple acute blunt force traumatic injuries."

The FAA's Civil Aerospace Medical Institute performed forensic toxicology on specimens from the pilot. The report stated Metoprolol was detected in the blood and urine, and Naproxen was detected in the urine.



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The pilot reported the use of Metoprolol during his last two FAA medical certificate examinations.

TESTS AND RESEARCH

Autopilot Servos

The aircraft owner stated that he and the accident pilot normally flew the airplane with the autopilot engaged. The autopilot servos were tested at Century Flight Systems under the supervision of the FAA. The servos tested to be functional and they operated normally.

Fuel System Components

There was a lack of residual fuel in the left engine fuel manifold and in the fuel lines from the manifold to the engine. The fuel pump, throttle and control assembly, fuel manifold valve, fuel nozzles from the left engine were bench tested at Teledyne Continental Motors under the supervision of the Safety Board. All of the components functioned normally.

Aileron Control Chain

The aileron control chain was sent to the Safety Board's metallurgical laboratory in Washington, D.C., for examination. The report prepared by the laboratory stated the inner and outer edges of the links adjacent to the fractured area were covered with corrosion pits. Examination of the fracture faces on each link revealed they were clean with no discoloration to indicate a pre-existing condition. The report continued to stated, "The outer edge of each link contained rounded depressions consistent with the corrosion pitting... . The fracture surface adjacent to the outer edge of the link displayed a shiny facetted surface that changed to a duller surface, inclined at approximately 45-degrees to the facetted surface, that grew wider as it approached the rivet hole."

Aileron Push-Pull Tube

The aileron push-pull tube was examined under a microscope and it exhibited features consistent with an overload failure.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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ADDITIONAL INFORMATION

On September 2004, Raytheon Aircraft issued a Safety Communique regarding Spin Avoidance and Spin recovery Characteristics for all Beech Baron airplanes. This communique states:

"Failure to lower the nose and retard power immediately when a stall is encountered - and especially allowing power to remain on during spin entry or in a developed spin - tends to raise the nose (increase the angle of attack) and result in a spin from which recovery is far more difficult and sometimes impossible."

"All Baron Models tested have good spin avoidance characteristics. At the point of stall - even with asymmetric power - if the control column is immediately and briskly moved forward, lowering the nose to regain flying speed, and the power is simultaneously retarded, the airplane will recover immediately, reliably and smoothly. There is sufficient time to execute this control input even at the point of stall. A multi-engine pilot of ordinary skill can easily avoid an unintended spin."

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>On June 10, 2007, approximately 1500 Pacific daylight time, a Piper PA-28-161 airplane, N130RJ, sustained substantial damage following an engine fire during the landing roll at the Redlands Municipal Airport (L12), Redlands, California. The certificated flight instructor and his student pilot were not injured. The airplane was registered to and operated by Rainbow Air Academy, Inc., of Long Beach, California. Visual meteorological conditions prevailed for the instructional flight, which was operated in accordance with 14 CFR Part 91, and a flight plan was not filed. The flight originated from Daugherty Field, Long Beach, California, at 1400.</p> <p>According to a statement submitted on June 13, 2007 to the NTSB investigator-in-charge (IIC), the flight instructor reported that on the cross-country flight the airplane performed normally, with all engine indications being normal and functioning properly, "...although the fuel pressure seemed slightly low to me, it was still within the green arc." The flight instructor stated that upon arriving at L12 and turning from base leg to final approach he noticed a power loss, at which time he took over the controls from the student pilot. The flight instructor further stated, "...I immediately pulled the power to idle in an attempt to prevent further damage and performed the landing. Upon touchdown and rollout the motor became very rough and quit, at which time [the student pilot] witnessed flames coming from his side of the aircraft cowling." The flight instructor reported that he didn't see any flames but did observe smoke coming out of the cowling, which appeared to be light gray in color,"...so I assumed a possible fuel or intake fire and attempted a 'hot start' after rolling safely off the runway surface onto taxiway A3." The pilot further reported that he performed the "hot start" procedure [again] in an attempt to "pull the fire back into the motor," but "...that did not seem to remedy the situation, as smoke began to build and I saw flames then coming from my side of the cowling as well." The flight instructor stated that he then elected to perform the emergency shutdown procedure, turning off the fuel supply and all electrical before evacuating the airplane.</p>	<p>On approach to landing the flight instructor, who occupied the right pilot seat, observed a loss of engine power. After landing and during the rollout the engine quit, followed by the left seat student pilot observing flames coming from his side of the engine cowling. The instructor pilot subsequently noticed smoke and flames coming from his side of the cowling, prompting the instructor and his student to evacuate the airplane. An examination of the airplane revealed thermal damage to the firewall and all four engine mounts. Two days after the accident an FAA inspector observed the operation of the electric fuel pump to be "normal." The inspector also reported that while observing the operation of the electric fuel pump he observed the carburetor leaking a steady stream of fluid. A subsequent examination of the airplane's carburetor revealed that prior to flow testing, the unit did flood before being tapped, at which it held fuel pressure. An examination/teardown of the carburetor revealed that the carburetor float was restricted due to a misadjusted retractor clip, which allowed fuel to pass the needle valve before being expelled from the carburetor and ignited by an undetermined source. It was also revealed by an FAA inspector that 2 days prior to the accident flight an incorrect electric fuel pump had been installed on the airplane during a 100-hour inspection, with a designation "FOR EXPERIMENTAL USE ONLY."</p>
SEA07LA170	N130RJ	6/10/2007	Piper	PA-28-161	<p>On July 12, 2007, two days after the accident, a Federal Aviation Administration (FAA) airworthiness inspector assigned to the FAA's Riverside Flight Standards District Office, Riverside, California, reported to the IIC that the firewall and all 4 engine mounts had sustained structural damage as a result of heat distress. The inspector further reported that he observed the operation of the electric fuel pump, which resulted in "fuel pouring out the bottom of the carburetor. The electric fuel pump operated normally."</p>	
					<p>On September 6, 2007, under the supervision of the NTSB IIC, the carburetor was flow tested and disassembled at the facilities of Precision Airmotive, Marysville, Washington. The Precision engineer conducting the tests revealed the following in his Flow Test Results: "Unit was initially installed on a flood rack to test for float and float valve function. The unit did flood and drain fluid through the throat until tapped lightly, then it would hold fuel pressure. The unit was then tested on the flow bench. See attached flow sheet." The engineer reported under the Float section of the report: "Height: .245 inches both sides, drop: approximately .3 inches. Brass float, P/N CF 30-766, retractor clip holding needle tightly against float tab. Hinge pin has very little wear/slop in float hinge." The engineer also reported in the carburetor Throttle Body/Bowl was charred/blackened, and in the Additional Observations section that the carburetor was blackened inside and out. (Refer to the attached Precision Airmotive report for a detailed description of the examination.)</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The FAA Principal Maintenance Inspector assigned to the Flight Standards District Office located in Long Beach, California, who provides oversight of the operator, reported to the IIC that on June 8, 2007, two days prior to the accident, a company certificated airframe and powerplant mechanic had installed an incorrect electric fuel pump on the aircraft. The mechanic installed a Facet 478360E electric fuel pump; the correct fuel pump should have been a Facet 478360 electric fuel pump. The inspector further stated that the electric fuel pump installed had a statement on the purchase invoice that stated, FOR EXPERIMENTAL AIRCRAFT USE ONLY. The statement was dated June 5, 2007.

NTSB	N-No	Date	Make	Model	Factual HISTORY OF FLIGHT	Released Narrative
					<p>On April 21, 2008, about 0950 central daylight time, an experimental amateur-built Dragon Fly Aviation GT-500, N101GP, was substantially damaged when it impacted trees and terrain near Paris, Tennessee. The certificated commercial pilot was fatally injured. The local aerial application flight was being operated under the provisions of 14 Code of Federal Regulations (CFR) Part 137. Visual meteorological conditions prevailed at the time of the accident, and no flight plan was filed.</p>	
					<p>According to witnesses, about 0800 on the day of the accident, the pilot departed from his private home airstrip, flew to a wheat field approximately 5 miles to the southwest, and completed one aerial chemical application flight. The pilot then returned to his airstrip. About 0845, a witness saw the pilot depart from the airstrip the second time, and awaited the pilot’s return. About 0915 the pilot returned for refueling and chemical replenishment. According to the witness, the pilot was concerned about the engine oil pressure, and stated that it was approximately "20 pounds less than it should be." The pilot and the witness checked the oil quantity, and confirmed it was "full." The pilot began loading the chemical, and the witness left the airstrip.</p>	<p>The certificated commercial pilot was the first registered owner of the amateur-built light sport airplane, but he did not build the airplane. On the day of the accident, after two aerial application flights, he returned to his airport to replenish the application chemical for a third trip to the same agricultural field. About 30 minutes later, a witness heard the engine "sputter" during a spray application and observed the airplane begin a climbing right turn back towards the airport. The engine stopped and restarted, and the airplane began another climb in the direction of the airport. The engine stopped a second time, and two witnesses saw the airplane descend without engine power into a wooded area. The airplane was substantially damaged, and the pilot was fatally injured. Autopsy results indicated that the pilot had diabetes, coronary artery disease, an enlarged heart, and gallstones. In addition, he was taking a medication commonly prescribed for neurological pain, and another for smoking cessation, both of which had the potential to cause distraction or impairment. It was not clear what role, if any, the medical conditions or medications played in the accident. He did not note any medications or medical conditions on his most recent application for medical certificate, but it is possible that the medications were initially prescribed since that application. At the time of the accident, the airplane and engine had accumulated approximately 89 hours since new. The pilot had previously experienced engine stoppage problems, and had conducted at least one forced landing due to an engine stoppage. Subsequent to that forced landing, and in the weeks just prior the accident, the pilot installed an electric fuel pump, which was in addition to the existing engine-driven fuel pump. Post-accident examination of the airplane indicated that the engine fuel system was not configured or equipped in accordance with the engine manufacturer's published guidance. Differences included fuel lines that were not thermally shrouded, lack of a fuel pump bypass circuit, lack of a return line, and pump output pressure which exceeded the engine manufacturer's limits. The engine manufacturer's guidance contained multiple statements that such differences could result in engine problems and/or stoppage.</p>
NYC08LA165	N101GP	4/21/2008	Dragon Fly Aviation	GT-500	<p>About 0930 the airplane returned to the wheat field and resumed the aerial application. According to another witness located west of the wheat field, about 0950, the airplane was flying south, when the engine "sputtered" approximately mid-way through a spray run. The chemical spray stopped, and the airplane began a climbing right turn to the north. The engine stopped when the airplane was approximately 800 feet above the field on a northerly heading. The engine restarted, and the airplane began to climb, still on its northerly heading. When the airplane was at approximately 900 feet, the engine "sputtered" and stopped a second time. The airplane descended while it continued on the northerly heading, which took it over a wooded area.</p> <p>Another witness located north of the wheat field also heard the engine stop, restart, and stop a second time. She and the previous witness both saw the airplane disappear from view when it was in an engine-out glide over the wooded area, and heard the sounds of impact shortly thereafter.</p>	
					<p>First responders to the accident indicated that the pilot occupied the front seat, and that he was not wearing a helmet. His five-point restraint harness was buckled, but the shoulder straps were found behind/under his arms and shoulders.</p>	
					PERSONNEL INFORMATION	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The accident pilot held commercial pilot, flight instructor, and 14 CFR Part 137 (Private) operating certificates, and he had accumulated approximately 9,000 total hours of flight experience. His most recent Federal Aviation Administration (FAA) second-class medical certificate was issued in December 2006.

AIRPLANE INFORMATION

FAA records indicate that the airplane serial number was 397. The airplane was equipped with a Rotax 912 ULS non-certificated engine, and the engine serial number was 5644471. FAA documents indicate that the airplane was first registered to the accident pilot in December 2005, and that the initial airworthiness certificate, also in the accident pilot's name, was issued in February 2006. As of the date of the accident, the airplane and engine had accumulated a total time in service of about 89 hours.

METEOROLOGICAL INFORMATION

The 0955 weather observation at an airport located approximately 47 miles northeast of the accident location reported winds from 100 degrees at 5 knots, 7 miles visibility, clear skies, temperature 18 degrees C, dew point 11 degrees C, and altimeter setting of 30.08 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

According to information provided by the FAA and local law enforcement personnel, the accident site was located in a wooded area approximately 1 mile north of the subject wheat field. The accident site was located between the wheat field and the accident pilot's home airstrip.

There was no significant horizontal dimension to the wreckage path; the wreckage was tightly contained, and the surrounding trees

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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exhibited minimal damage. The trees were spaced approximately 20 to 30 feet from one another, and were approximately 30 feet tall. The pilot was seated in the front seat, and the chemical hopper was located where the rear seat was normally located. All airplane components were found at the site. The fuselage was oriented on its left side, approximately 20 degrees nose down. The forward portion of the fuselage was partially fractured and crushed. The wings and tailboom exhibited significant impact damage. The fuel system was not compromised, and there were no fuel leaks. FAA and recovery personnel estimated that approximately 2 gallons remained in each fuel tank. The engine and propeller did not exhibit any impact damage. The flap handle had four positions, and was in the aft-most position, corresponding to the full flap deflection of 30 degrees. The flaps were also in the full-down position. The Hobbs meter installed in the airplane indicated a time of 88.6 hours. Residual chemical remained in the hopper. There were no indications of pre- or post-impact fire.

MEDICAL AND PATHOLOGICAL INFORMATION

The Henry County Medical Examiner, Tennessee Department of Health and Environment, conducted an autopsy on the pilot. The cause of death was cited as "multiple blunt force injuries." The medical examiner’s report noted that the pilot had a "history of diabetes and a cardiac history of unknown etiology, an enlarged heart, severe coronary artery disease, and gallstones." Toxicological testing of the pilot's tissue samples was conducted by the FAA Civil Aero Medical Institute, and gabapentin, varenicline and atenolol were detected.

The pilot’s most recent application for 2nd class Airman Medical Certificate, dated 12/27/2006, noted “No” to “Do You Currently Use Any Medication,” and to all conditions under “Medical History,” including specifically “Heart or Vascular Problems,” “Diabetes,” “Neurological disorders,” and “Mental disorders of any sort; depression, anxiety, etc.” “Total Pilot Time” was noted as “Approx. 9000” hours “To Date” and 45 hours in the “Past 6 Months.”

ADDITIONAL INFORMATION

Registration and Airworthiness Documentation

According to one FAA Form 8050-2, "Aircraft Bill of Sale," the initial sale was from Quicksilver Manufacturing to Dragon Fly Aviation. The form had the pre-printed word "Aircraft" struck out, and the word "Kit" typed in front of "Aircraft." The sale date on the form

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>was listed as February 28, 2005, and the "In testimony whereof" date was listed in as July 7, 2005. The form also bore a stamped notation in the "For FAA Use Only Block" of "Dec 13 2005."</p>	
					<p>According to another FAA Form 8050-2, "Aircraft Bill of Sale," the airplane was sold from Dragon Fly Aviation to the accident pilot. The pre-printed word "Aircraft" was not struck out or overwritten on this form. Both the sale date and the "In testimony whereof" date on the form were listed as July 8, 2005. The form also bore a stamped notation in the "For FAA Use Only Block" that stated "Conveyance Recorded 2005 Dec 13."</p>	
					<p>According to an Affidavit of Ownership (FAA Form 8050-88), the builder and owner of the airplane were both cited as "Dragon Fly Aviation," and the box accompanying the statement "More than 50% of the above-described aircraft was built from a kit (prefabricated parts) and I am the owner" was selected. The form was notarized on July 14, 2005. The form also bore a stamped notation "Conveyance Recorded 2005 Dec 13."</p>	
					<p>Wing Washout Adjustments</p>	
					<p>Wing washout is a deliberate twist in both wing panels which provides the outboard wing sections with a lower angle of incidence than the root sections. Wing washout primarily affects airplane stall characteristics by enabling the wing root section to stall prior to the outboard section, thereby retaining lateral controllability further into the stall. Asymmetric washout can result in objectionable roll consequences, such as wing drop or loss of roll control, in the stall regime.</p>	
					<p>Threaded rods that screwed into the lift struts were used to independently adjust the washout of each wing. The adjustment rods for the left and right lift struts were not set so that an equal number of threads were exposed on each rod, which was indicative of the possibility of dissimilar washout angles for the left and right wings. The Quicksilver Installation Instructions (QII) specified that jam nuts were to be used to secure the strut adjustments, but the jam nut on the left wing strut rod was loose.</p>	
					<p>Engine General</p>	



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					Preliminary visual inspection of the engine did not reveal any obvious external damage, and the throttle and choke cables were intact and functional. Impact damage to the throttle quadrant prevented full travel of the throttle.	
					The FAA inspector reported that shortly after the accident, he checked the oil cap at the accident site. He stated that it was securely attached, and when he removed it to check the oil quantity, oil started to leak out, so he re-installed the cap. Several days after the accident, an oil film was observed on the same side of the engine as cylinder numbers one and three, but no oil leaks were found on the engine. The dry sump oil system was found to be overfilled, and the observed oil film was consistent with oil being vented from the vent line due to an overfilled oil tank. The engine was fitted with an aftermarket thermostatic oil by-pass valve. This component was not specified in, or required by, either the Rotax Installation Manual (IM) or the QII.	
					Rotax Maintenance and Servicing Guidance	
					On December 22, 2006, Rotax issued Service Instruction (SI) 912-017, which specified installation of air filters equipped with provisions for safety-wiring, and inspection of certain air filter installation orientation. The SI stated that improper air filter installation "may lead to problems in fuel distribution and may damage the engine," and that air filters had to be safety wired to prevent inadvertent separation. The SI applied to the accident engine. The air filters that were installed on the engine were not secured by safety wire, but did remain securely installed during the flight and impact sequence. The air filters were not subject to the "orientation" portion of the SI.	
					On April 13, 2007, Rotax issued Mandatory Service Bulletin (SB) 912-053UL, which specified replacement of the engine fuel pump. The accident airplane engine was not subject to SB 912-053UL, by virtue of its serial number.	
					On May 29, 2007, Rotax issued Mandatory SB 912-054UL, entitled "Checking or Replacement of Flexible Fuel Line." The accident airplane engine was not subject to SB 912-054UL, by virtue of its serial number.	
					On April 15, 2008 (6 days prior to the accident) Rotax issued Service Letter SL 912-014 R1, entitled "Use of Rotax Unapproved Engine Components or Accessories for Rotax Aircraft Engines." The SL specifically stated that a "non-genuine Rotax" oil filter which lacked a bypass feature that "could lead to a completely blocked oil system." The SL applied to the accident engine, but the investigation did not determine whether the installed oil filter was approved by Rotax.	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Fuel System Configuration

According to the Quicksilver GT500/912 Airplane Flight Manual (AFM), the total fuel quantity was 16 gallons, contained in two 8 gallon tanks. The total unusable fuel quantity was cited as 2.25 gallons. Each fuel tank was equipped with a shutoff valve mounted at the tank outlet. The fuel lines from each shutoff valve were routed to a fuel selector valve, and from there, a single fuel line was routed to the fuel pumps and engine.

One fuel line was routed from each fuel tank to a "T" fitting, from which a single line was routed to the electric fuel pump. Downstream of the electric fuel pump, a line was routed across the top of the engine to the engine-driven pump. An output line was routed from the engine-driven pump to the fuel manifold, and from there one line was routed to each of the two carburetors. Examination of the engine and airplane revealed that all the fuel lines were clear, flexible plastic material. The only fuel lines that were sleeved were the two lines from the fuel manifold to the carburetors. The fuel lines from the fuel manifold to the each of the carburetors were routed within approximately 1/2 inch of the exhaust pipes.

The Rotax IM and the Illustrated Parts Catalog (IPC) for the 912 series engines both specified a fuel return line from the fuel manifold to the fuel tank(s). The Rotax Operator's Manual stated that "the fuel return line serves to avoid formation of vapour lock." Neither the Quicksilver QII nor the AFM fuel system schematic depicted the fuel return line. The airplane was not equipped with the required fuel return line from the fuel manifold to either of the fuel tanks.

The Rotax IM defined a "caution" as "an instruction which, if not followed, may severely damage the engine or other component." The Rotax IM contained the following caution: "For prevention of vapour locks, all the fuel lines on the suction side of the fuel pump have to be insulated against heat and fire in the engine compartment and routed at distance from hot engine components." The QII also specified that sleeving was to be installed on the fuel line. The fuel line from the electric fuel pump to the engine-driven fuel pump was not in compliance with the published guidance.

The installed fuel filter utilized a paper element, which was contrary to the Rotax IM. No fuel contamination was noted. Both carburetor float bowls were clean. The wing tank fuel shut-off valve was function-checked. While the stops permitted a handle travel of 90 degrees, the valve completely shut off fuel flow after handle travel of 35 degrees.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The Quicksilver GT500/912 AFM specified that the engine was to use either "premium grade" or "Euro-Super RON 95" automotive gasoline. It also approved the use of 100LL aviation gasoline, but with an advisory to "Only use aviation fuel when the listed automotive fuels are not available." The actual fuel type in the airplane was not determined.

Electric Fuel Pump

According to the pilot’s sons, the airplane was originally equipped with only an engine-driven fuel pump, but the pilot later fitted an additional electric fuel pump. The pilot had previously experienced engine stoppage problems, and had conducted at least one forced landing due to an engine stoppage. Subsequent to that forced landing, and in the weeks just prior the accident, the pilot installed the electric fuel pump.

The Rotax IM specified an electric fuel pump in series with, and prior to the engine-driven pump. The IM stated that the electric pump was required "in case of a malfunction or defect" of the engine-drive pump, and was also required to preclude vapor lock of the fuel supply to the engine-driven pump. The IM installation diagram depicted a fuel bypass circuit around the electric pump, but the accident airplane was not plumbed in accordance with this diagram. Neither the Quicksilver QII nor the AFM contained any references to an electric fuel pump.

The Rotax IM defined a "Warning" as "an instruction which, if not followed, may cause serious injury, including the possibility of death." Section 14.2 of the Rotax IM cited the minimum, normal, and maximum fuel pressure limits as 2.2, 4.4 and 5.8 pounds per square inch (psi), and that the pressures were to be measured at the fuel manifold. The IM contained the warning that fuel pressure in excess of the stated limit can lead to an override of the float valve, and "subsequent engine stop." The IM also noted that "If an electrical auxiliary pump is installed, the whole fuel system has to be designed to warrant engine operation within the specified pressure limits." Finally, the IM contained the caution that "the fuel pressure of an additional auxiliary fuel pump should not exceed... 4.4 psi." The airplane was not equipped with a fuel pressure gauge.

The electric fuel pump was plumbed in series with, and prior to, the engine-driven pump. The new pump was a Facet brand model 674A, and was placarded as "Automotive Electronic Fuel Pump." According to the pump manufacturer, the pump had an output capability of 15 gallons per hour, a minimum output pressure of 3.5 psi and a maximum output pressure of 5 psi. The maximum

NTSB	N-No	Date	Make	Model	Factual pump pressure was 0.6 psi above the limit specified in section 14.2 of the Rotax IM.	Released Narrative
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Engine Test Runs

The airplane was examined by FAA and Rotax personnel at a storage facility several days after the accident. The battery was intact and retained a charge. The electric fuel pump was able to be driven by the battery. Investigators then temporarily installed a fuel tank in order to attempt to run the engine. The electric pump was used to prime the fuel system, and the engine started and appeared to run normally. However, due to the throttle quadrant deformation, the throttle could not be fully advanced. The engine was allowed to warm up to normal operating temperature, and then shut down. It restarted readily, and ran "smoothly," with no noticeable problems.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>On October 5, 2009, at 1200 central daylight time, a twin-engine Temco D-16A (“Twin Navion”), N124N, sustained substantial damage when it impacted tress and terrain near Eden Prairie, Minnesota, after a loss of power in one engine. A post impact fire consumed part of the airplane. The pilot, the sole occupant, was seriously injured. The 14 Code of Federal Regulations Part 91 personal flight departed Anoka, Minnesota, at 1140 and was en route to Flying Cloud Airport (FMC), Eden Prairie, Minnesota. Visual meteorological conditions prevailed at the time of the accident. No flight plan was filed.</p>	
					<p>The pilot reported that the airplane had just undergone its annual maintenance inspection, and that he was flying it back to FCM. He reported that about 8 miles from FCM, the left engine stopped producing power. He completed the shutdown checklist for the left engine and feathered the propeller. He applied full power to the right engine, but the airplane continued to lose altitude. There was no suitable landing area so he executed a forced landing to a large wooded area away from houses. He lowered the gear during the forced landing and pulled the right engine to idle upon impact with the trees. A small fire on the right side of the airplane ensued but was extinguished.</p>	
CEN10LA004	N124N	10/5/2009	Temco	D-16A	<p>Numerous witnesses reported that they heard and/or saw the airplane as it flew overhead at a low altitude. All reported hearing a loud engine noise without any sputtering. One witness reported that the left propeller was not turning. Witnesses who rushed to the accident site reported that they had to break the airplane’s canopy glass in order to get it open. Then they assisted the pilot in exiting the airplane.</p> <p>A Federal Aviation Administration (FAA) airworthiness inspector interviewed the pilot and examined the airplane. The pilot reported that he departed with 80 – 85 gallons of fuel on board with the center tank full. During cruise flight, the fuel selector was positioned on the center fuel tank. The pilot reported that he was cruising at 1,500 feet above mean sea level (FCM field elevation is 906 feet). When the airplane lost left engine power, he attempted to reestablish fuel flow to the left engine by turning on the electric fuel pump, and then switching fuel tanks. The inspection of the airplane revealed the electric fuel pump switch was in the ON position. The fuel selector valve was found between tank positions. The right propeller exhibited impact signatures consistent with a high engine power setting. The left propeller blades were straight with no power signatures exhibited.</p> <p>The FAA airworthiness inspector tested the airplane’s fuel system utilizing Navion Service Bulletin No. 106A. The service bulletin is not applicable to the Temco (“Twin Navion”) aircraft, although many of the same components are used on both aircraft. The inspection revealed that the Bendix/Facet electric fuel pump found in the left engine nacelle exhibited blue staining on the top surface of the pump, which was consistent with a fuel leak. The inspector reported that the test of the electric fuel pump revealed that the end cap gasket had failed, which allowed air to be drawn into the system by both the electric and engine driven fuel pumps. The install date and total time of the pump and end cap gasket could not be determined from the maintenance records.</p>	<p>The airplane had just undergone its annual maintenance inspection. The pilot reported that he was in cruise flight in the twin-engine airplane about 600 feet above ground level when the left engine stopped producing power. He completed the shutdown checklist for the left engine and feathered the propeller. He applied full power to the right engine, but the airplane continued to lose altitude. He executed a forced landing to a large wooded area away from houses. Numerous witnesses reported that they heard and/or saw the airplane as it flew overhead at a low altitude. All reported hearing a loud engine noise without any sputtering. One witness reported that the left propeller was not turning. The inspection of the airplane revealed that the electric fuel pump found in the left engine nacelle exhibited blue staining on the top surface of the pump. The blue staining was consistent with a fuel leak. The test of the electric fuel pump revealed that the end cap gasket had failed, which allowed air to be drawn into the system by both the electric and engine-driven fuel pumps, thus starving the engine of fuel.</p>

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The airplane was a twin-engine Temco D-16A, serial number TTN-60 that was issued its airworthiness certificate on July 19, 1956. It was equipped with two 170-horsepower Lycoming O-340-A1A engines. The last annual maintenance inspection was conducted on October 1, 2009. The airplane had a total time of 3,587 hours at the time of the inspection.

The Navion Service Bulletin No. 106A was issued on May 1, 2007. This service bulletin was applicable to Navion aircraft, but not the Temco D-16A. The subject of the service bulletin was: Fuel system – Inspection of the fuel system continued safe operation. This is due to several recent Navion accidents caused by improper inspection and maintenance of the fuel system and related components.

The FAA issued Airworthiness Directive (AD) 2008-05-14 on April 16, 2008. This AD was applicable to Navion aircraft, but not the Temco D-16A. The AD required a one-time inspection of the entire fuel system and repetitive functional tests of certain fuel selector valves. The AD resulted from reports of airplane accidents associated with leaking or improperly operating fuel selector valves. The AD was issued to detect and correct fuel system leaks or improperly operating fuel selector valves, which could result in the disruption of fuel flow to the engine.

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>On April 17, 2012, at 1600 central daylight time, an experimental amateur-built Heiser Pulsar XP, N912RV, sustained substantial damage during a hard landing after a loss of power during takeoff from runway 17 at the Ducote Air Park (TS65), San Angelo, Texas. The sport pilot, the sole occupant, received minor injuries. The airplane was registered to and operated by the pilot under the provisions of the 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed at the time of the accident, and no flight plan was filed. The airplane was departing TS65 on a local flight.</p>	
					<p>The pilot reported that he and the airplane had not flown in four months, so he wanted to fly and get current in order to carry passengers. He reported that he pulled the airplane out of the hangar and completed a detailed preflight inspection. He added fuel to the right tank bringing the total fuel in the right tank to 6 gallons and 3 gallons in the left tank. The fuel tanks held 9.5 gallons each. The engine start, taxi, and run-up were normal. After checking the ignition systems, he increased engine speed to 4,000 rpm to raise the oil temperature to 120 degrees Fahrenheit. About 4 minutes after engine start, he taxied onto the runway and departed. He reported that the airplane climbed to about 50 feet above ground level when the engine started to lose power. He started a right turn to make a short traffic pattern and land, but the engine had a total loss of power after the airplane had turned about 30 degrees. He executed a forced landing to a flat wheat field and the airplane landed hard, which resulted in substantial damage to the wings and fuselage.</p>	
CEN12FA249	N912RV	4/17/2012	HEISER ROBERT C JR	PULSAR XP	<p>The fuel tanks, fuel lines, and fuel strainer were checked for debris and water contamination but none was observed. The engine driven mechanical fuel pump was tested and it operated normally.</p> <p>Air was blown through the fuel system to determine if there was a blockage in the system. When air was blown into the right fuel tank and through the fuel system, no blockage was noted. When air was blown into the fuel line that attaches to the engine driven fuel pump back through the fuel system, the air was blocked. It was determined that air could pass through the Facet 12V electric fuel pump in the direction of flow from the fuel tanks to the engine, but not from the engine back to the fuel tanks. When the electric fuel pump was removed from the airframe, air could travel through the electric fuel pump in both directions.</p> <p>The Facet 12V electric fuel pump was removed from the airframe and was tested at an airplane component repair facility. The pump was tested on a fuel bench and it operated normally, pumping between 110 to 130 pounds per hour.</p> <p>The 100-horsepower Rotax 912 XP engine was shipped to a Rotax distributor for examination. The engine was placed on the engine run stand, and it operated normally delivering takeoff power.</p>	<p>The sport pilot reported that the airplane had not been flown in 4 months. Six gallons of fuel were in the right tank, and three gallons were in the left tank; right wing tank was selected during the accident flight. The engine start, taxi, and run-up were normal. About 4 minutes after engine start, the pilot taxied onto the runway and departed. He reported that the airplane climbed to about 50 feet above ground level when the engine had a total loss of engine power. The airplane landed in a field and sustained substantial damage. During postaccident examination, the fuel tanks, fuel lines, and fuel strainer were checked for debris and water contamination, but none were observed. The engine-driven mechanical fuel pump, the electric fuel pump, and the engine all were tested and operated normally. However, the outboard section of right wing fuel vent line was blocked by debris. The blockage was removed from the vent line; it measured about ¼-inch wide at its widest and about ½-inch long. The blocked fuel vent line likely created a vacuum, which resulted in fuel starvation to the engine.</p>

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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					The examination of the airplane revealed that the outboard section of right wing fuel vent was blocked by debris. About a 4 inch section of the blocked fuel vent line was removed and sent to the component repair facility for examination. Fuel was introduced into the line and a minimal amount of fuel flowed through the line. The blockage was removed from the line, which measured about 1/4 inch wide at its widest and about 1/2 inch long.	
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NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>On August 18, 2012, about 1700 eastern daylight time, a Piper PA-28-140, N1845J, impacted trees and terrain during initial climb from Donner Field Airport (OH28), Leesburg, Ohio. The private pilot and a passenger were uninjured. The airplane sustained substantial damage to the fuselage. The airplane was registered to and operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91 as a personal flight. Visual meteorological conditions prevailed and a flight plan had not been filed for the local flight that was originating at the time of the accident.</p>	
					<p>A witness, who also had given the pilot a recent biennial flight review in the accident airplane, stated that the airplane's performance was 'anemic'. The witness questioned the pilot prior to the accident takeoff whether he should attempt to depart from the airport given the density altitude, grass runway, and airplane weight.</p>	
					<p>Another witness stated that the airplane seemed "too slow," and its climb was "slow". The airplane attained an altitude of 40-50 feet above the ground, and from his view, it was level with the trees on the side of the runway and slightly above the trees at the end of the runway.</p>	<p>The pilot was taking off on a 2,100 foot grass runway with a quartering tailwind. The pilot stated that the airplane lifted off and climbed normally until it passed the end of the runway, at which time the engine "coughed" and lost power. A witness stated that the airplane's speed during the takeoff and climb was slow and that the airplane reached an altitude of about 40-50 feet above the runway end. A review of the airplane's takeoff performance data from a hard surface runway showed that the airplane's takeoff distance over a 50-foot obstacle was nearly equal to the runway length for the density altitude at the time of the accident. However, the soft grass runway surface, runway slope, and quartering tailwind present during the accident takeoff would have further lengthened the airplane's takeoff distance. Because of these considerations, the pilot should not have attempted to takeoff on the runway in those conditions.</p>
CEN12LA569	N1845J	8/18/2012	PIPER	PA28	<p>The pilot stated that prior to departing, he performed a preflight inspection and engine runup, all of which were "normal." He set 20 degrees of flaps and used a short/soft field takeoff technique with a best angle of climb from runway 09 (2,100 feet by 120 feet, turf). He said that the airplane was climbing "normally" when it 'coughed' over the end of the runway. The airplane "quickly" lost engine speed, and the propeller was turning. He leveled the airplane in time to hit the trees at the departure end of the runway.</p> <p>According to the pilot's logbook, he accumulated a total flight time of 523.5 hours as of the last flight entry, which was dated August 12, 2012. The last flight was in the accident airplane and was 1.0 hours in duration from "REED-OH28-REED". The preceding flight was dated June 7, 2012, which was the pilot's recent biennial flight review. The flight review was conducted in the accident airplane for a flight that was 1.1 hours in duration from "MGY-I74-MGY." The entry for the flight review includes "...short/soft t/os + landings... ."</p> <p>The 1968 Piper PA-28-140, serial number 28-24280, airplane was powered by a Lycoming O-320-D2A engine. The airplane was registered to the pilot on March 14, 2012.</p> <p>A logbook entry dated June 19, 1998, stated that the engine was overhauled and installed on the airplane on November 15, 1998, at a tachometer time of 2,333.3 hours. Lycoming Service Instruction No. 1009AS states, "...all engines that do not accumulate the hourly</p>	<p>The airplane's most recent annual maintenance inspection was completed about 5 months (about 7.8 flight hours) before the accident. However, the engine had not been overhauled within the manufacturer's recommended overhaul time of 12 years. Postaccident examination of the airplane revealed a leak from the fuel selector and evidence that one of the magnetos had a preexisting grounding anomaly; both conditions should have been discovered during the annual maintenance inspection. Additionally, the grounded magneto should have been evident to the pilot during the engine run-up. However, these anomalous conditions would not have had a significant effect on the airplane's performance. Examination did not reveal any preimpact mechanical malfunctions or anomalies that would have precluded normal operation.</p>

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					period of time between overhauls specified in this publication are recommended to be overhauled in the twelfth year.	
					Logbook entries for the last annual inspections of the airplane and engine were dated March 7, 2012, at a total time of 3,230.6 hours. The entry for annual inspection for this dates stated that time since major overhaul was 897 hours and the total time since new was 1,962.3 hours.	
					The tachometer at the accident site indicated 3,238.37 hours.	
					The Piper Cherokee 140 Owner's Handbook provided a Take-off Distance vs. Density Altitude chart for hard surfaced runways for airplane gross weights of 1,950 lbs and 2,150 lbs. At a density altitude of about 2,524 feet and gross weight of 1,950 lbs, the takeoff ground run was about 1,000 feet, and the distance over a 50-foot obstacle was 2,050 feet. At a density altitude of 2,524 feet and gross weight of 2,150 feet, the ground run was about 1,100 feet, and the distance over a 50-foot obstacle was 2,300 feet.	
					According to the airplane weight and balance form, the airplane had an empty weight of 1,301 lbs. The pilot reported that there was 30 gallons of fuel on board at the time at takeoff. The pilot's airman medical certificate indicated his weight was 220 lbs. The weight of the passenger was estimated by a witness as 180 lbs. Another witness estimated the passenger weight as 190-200 lbs.	
					The Wilmington Air Park (ILN), Wilmington, Ohio, automated weather observing system located about 10 miles northwest of OH28 recorded at 1654: wind - 150 degree at 5 knots; temperature - 25 degrees Celsius; dew point - 9 degree Celsius; altimeter - 29.92 inches of mercury.	
					Based upon the field elevation of OH28, which was 990 feet, and the ILN temperature and altimeter, the density altitude was about 2,524 feet.	
					According to a Federal Aviation Administration inspector, the airplane came to rest at the northwest corner of a field located about 700 feet from the departure end of runway 09. The airplane's left wing initially contacted a tree yawing the airplane left into another tree, which impacted the right side of the fuselage just behind the aft seats. Photos show that the cockpit flap control and the flaps	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					were in the 0 degree flap position.	
					The fuel selector was in the off position, the magneto switch was in the off position, and the keys for magneto key switch had been removed and were hanging on the altimeter's post light. The cockpit engine throttle control was in the full forward position, the carburetor heat control was in off position, the master switch in the off position, the electric driven fuel pump switch was in the off position, and the mixture control was in the full aft position.	
					Both wing fuel tank caps were secure, and when they were opened, 100 low lead fuel poured out. The engine firewall fuel sump bowl was unseated from its mount due to impact damage and contained fuel. Fuel was present in the carburetor bowl.	
					The propeller displayed S-shaped bending on one of the two propeller blades. The other propeller blade did not exhibit impact damage. A severed tree limb consistent with a propeller strike was near the airplane. The tree limb was estimated to be several inches in diameter.	
					Examination of the engine confirmed throttle and mixture control continuity. The engine sump contained about 5 quarts of oil. The top spark plugs were removed and none of the spark plugs exhibited fouling. The engine was rotated and compression from all cylinders was confirmed. Engine continuity was also confirmed. The air induction system was unobstructed.	
					The carburetor, both magnetos, and the cockpit fuel selector were tested and examined under the supervision of the National Transportation Safety Board Investigator-In-Charge.	
					The left magneto was a Bendix magneto with a "Teledyne Continental Motors – Orig Mfr" data tag showing model "S4LN-21," part number "10-51360-37," serial number "A192644," and overhaul date "4/98." Examination and testing of the left magneto revealed that the magneto flange gasket was red in color and had annotations of "PMA" and "L62224." The gasket had two holes at one edge and one hole at the opposite edge. The P-lead and its internal spring, part number 10-20-90, had evidence of arching consistent with a preexisting partial/intermittent grounded/ungrounded condition.	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					<p>The left magneto was placed on a magneto test stand and operated at about 4,500 rpm. A spark of at least 0.25 inch test gap was noted from each lead from the distributor. The impulse coupling also was tested and functioned without any anomalies. The magneto was not able to be grounded using the P-lead during the test.</p>	
					<p>The right magneto was a Bendix magneto with a Teledyne Continental Motors – Orig Mfr” data tag showing model “S4LN-20,” part number “10-51360-29, serial number “A194869,” and overhaul date “4/98.” The P-lead and its internal spring, part number 10-20-90, had no evidence of arching.</p>	
					<p>The right magneto was placed on a magneto test stand and operated at about 4,500 rpm. A spark of at least 0.25 inch test gap was noted from each lead from the distributor. The impulse coupling also was tested and functioned without any anomalies that would have precluded normal operation. The magneto was able to be grounded using the P-lead during the test.</p>	
					<p>The carburetor was a Facet Aerospace Products model “4SPA,” part number “10-5135,” serial number “CK 4 8686,” and original manufacture “MF V A1 92.” Examination of the carburetor revealed that the heat box to carburetor gasket had a smaller inside diameter than that of the carburetor inlet and the incorrect gasket. The gasket was similar in size to the carburetor manifold gasket. The correct heat box to carburetor gasket had a part number of 649974. Both carburetor screens did not contain debris and were unobstructed. The carburetor bowl did not contain debris or corrosion. The carburetor float was intact, moved freely, and had the correct drop. All of the carburetor linkages were intact and secure.</p>	
					<p>The electric driven fuel pump was a Facet with no model, part, or serial number. The pump was connected to a 12 volt source of electrical power and was noted to operate with no anomalies that would have precluded normal operation. The pump could not be bench tested due to impact damage to the inlet tube base.</p>	
					<p>The engine driven pump, AC, part number “154729210,” serial number “AA7477,” was operated using hand pressure. No anomalies were revealed that would have precluded normal operation.</p>	
					<p>The fuel selector was examined and tested using a test bench. The fuel selector cover had blue staining, and the fuel selector had black colored residue near the fuel selector stem consistent with a preexisting fuel leak. The fuel selector was operated from right, to off, to left supplies using test fluid. A small intermittent leak was noted at the selector valve stem. The fuel selector operation did not</p>	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					reveal any anomalies that would have precluded normal operation.	
					The Airplane Flying Handbook, FAA-H-8083-3A states, in part:	
					Takeoffs and climbs from soft fields require the use of operational techniques for getting the airplane airborne as quickly as possible to eliminate the drag caused by tall grass, soft sand, mud, and snow, and may or may not require climbing over an obstacle. The technique	
					makes judicious use of ground effect and requires a feel for the airplane and fine control touch...	
					After becoming airborne, the nose should be lowered very gently with the wheels clear of the surface to allow the airplane to accelerate to VY, or VX if obstacles must be cleared. Extreme care must be exercised immediately after the airplane becomes airborne and while it accelerates, to avoid settling back onto the surface. An attempt to climb prematurely or too steeply may cause the airplane to settle back to the surface as a result of losing the benefit of ground effect. An	
					attempt to climb out of ground effect before sufficient climb airspeed is attained may result in the airplane being unable to climb further as the ground effect area is transited, even with full power. Therefore, it is essential that the airplane remain in ground effect until at least VX is reached. This requires feel for the airplane, and a very fine control touch, in order to avoid over-controlling the elevator as required control pressures change with airplane acceleration.	

NTSB

N-No

Date

Make

Model

Factual  
HISTORY OF FLIGHT

Released Narrative

On May 31, 2014, about 1620 Pacific daylight time, a single-engine experimental Nebert Vans RV-10, N62DN, experienced a loss of power and departed controlled flight while the pilot was maneuvering for a forced landing in Toledo, Oregon. The airplane was substantially damaged. The private pilot and four-year old passenger were fatally injured; the adult passenger sustained serious injuries. The airplane was registered to and being operated by the pilot under the provisions of 14 Code of Federal Regulations Part 91. The personal cross-country flight departed Newport Municipal Airport, Newport, Oregon, with a planned destination of Seattle, Washington. Visual meteorological conditions prevailed and no flight plan had been filed.

Numerous witnesses located in Toledo reported observing the airplane flying at a low altitude from the north. The witnesses reported hearing no sound from the airplane's engine and saw it progressively descend in altitude. The airplane approached the Georgia Pacific paper mill and made a steep turn to the left. The airplane subsequently made a rapid descent and impacted terrain in a nose-low, near-vertical attitude.

The pilot, who was also the builder of the experimental kit airplane, departed for a cross-country flight from his home airport. The passenger reported that, following a normal departure, the airplane continued the takeoff climb through some cloud wisps and ascended above a lower cloud cover with an overcast layer above. Suddenly, the engine experienced a total loss of power. The pilot maneuvered the airplane toward the closest airport, but, when he realized that the airplane would not be able to glide to the airport, he attempted to make an off-airport landing. The airplane stalled and then collided with terrain in an open area of a paper mill. Ground scar analysis and wreckage fragmentation revealed that the airplane descended in a steep, near-vertical, nose-down, left-wing-down attitude before it impacted terrain.

WPR14FA218

N62DN

5/31/2014

NEBERT

VANS RV-10

The surviving passenger recalled the flight, although was heavily medicated during the recounting of the events that transpired. She stated that she was in the aft right seat and her daughter was buckled in a car seat positioned in the aft left seat. Luggage was strapped in the front right seat in an effort to compensate for the aft weight. The departure seemed normal and the pilot commented that the engine sounded better than it had in awhile. The airplane continued the takeoff climb through some cloud wisps and ascended above a lower cloud cover, with an overcast layer above.

The pilot installed a fuel flow transducer about 2 to 3 weeks before the accident and used heavy applications of room temperature vulcanization (RTV) silicone to seal the fuel lines. A friend of the pilot, who was also a mechanic, reported that he had observed the pilot about a year earlier using heavy applications of RTV silicone to seal parts during a condition inspection and that he had mentioned to the pilot that this was an improper practice. A bead of RTV silicone was found in the fuel line, and it is likely that it blocked the inlet of the transducer and starved the engine of fuel. Additionally, subsequent to the loss of engine power, the pilot failed to maintain sufficient airspeed while maneuvering to locate a suitable off-airport landing site and flew the airplane beyond critical angle-of-attack, which resulted in a stall and loss of airplane control.

The passenger further stated that suddenly the engine experienced a total loss of power, which she described as the airplane stopping forward motion, and there was no engine sound. An alarm sounded, and shortly thereafter all of the airplane's electrical system failed. She recalled observing the screen in front of the pilot flickered and then went blank. The pilot was busy pressing buttons and maneuvering levers, and indicated that they were going to land at the closest airport [which was the Toledo State Airport]. The airplane descended through clouds heading toward the airport. The pilot stated that they were going to make it to the airport, and that he was looking for a place to land. The airplane made an alert sound, which she thought indicated the airplane was moving too slow. The pilot made a left turn and tried to pull up, but the airplane spiraled down harder to the ground.

PERSONNEL INFORMATION

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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A review of the airmen records maintained by the Federal Aviation Administration (FAA) disclosed that the pilot, age 51, held a private pilot certificate with airplane rating for single-engine land, which was issued in March 2008. He additionally held a Repairman Experimental Aircraft certificate. His most recent third-class medical was issued on January 04, 2013, with no limitations.

According to the pilot's flight logbook he had about 785 hours of total flight experience, of which about 375 was amassed in the accident airplane. Based on the airport identifiers listed in the logbook for flight origin and destination points, the pilot accumulated the majority of his flying hours around Newport, his home airport and where the airplane was based. The pilot recorded having flown 6.4 hours in the preceding 30 days, which was accumulated over 6 different flights.

The pilot was a member of the Experimental Aircraft Association (EAA) since August 1991, and had numerous EAA technical counselor visits during the building process.

AIRCRAFT INFORMATION

The Vans RV-10 is an amateur-built experimental airplane that is sold as a kit. The low-wing airplane was equipped with four seats, fixed tricycle landing gear, and traditional flight control surfaces. The accident airplane, serial number (s/n) 40546, received a special airworthiness certificate in the experimental category for the purpose of being operated as an amateur-built aircraft in August 2010; the pilot purchased the kit in October 2009. The airplane was equipped with a Lycoming O-540-B4B5 engine, s/n L-7862-40C, and, according to the manufacturer, is rated at 235 shaft horse power (SHP). The powerplant contained a data tag labeling it as a Lycoming O-540-B1AB, which contained the vibropeened identification next to the stamp of "B4B5."

The airplane's test flight hours were completed in September 2010. Thereafter, the logbooks indicated that the pilot estimated that the airplane's stalling speed in the landing configuration (Vso), at a weight of 1,858 lbs and a CG of 108.5 inches aft of datum, was 58 knots.

Fuel System Design

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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The airplane's fuel system was a gravity-fed design where fuel flowed from the metal tanks in the inboard section of each wing, through a selector valve, and continued to a fuel filter. From the filter, the fuel was routed to an electric fuel pump and then to a transducer where it was plumbed through the firewall to the gascolator. Thereafter, the fuel was directed to the engine-driven fuel pump, and finally enter into the carburetor.

The Van's Aircraft build manual states in section 37, Fuel System, "When installing fluid fittings with pipe threads do not use Teflon tape. Use instead, fuel lube or equivalent pipe thread sealing paste."

Maintenance

According to the aircraft maintenance records and the recording tachometer in the cockpit, the airplane had accumulated a total time in service of 375.4 hours. The most recent condition inspection was recorded as completed by the pilot on October 4, 2013, 71.5 hours prior to the accident. Examination of the logbook revealed that the last maintenance that had occurred was an oil change and the tightening of the left magneto on February 09, 2014 at a total time of 354.2 hours.

From the pilot's photographs on his website blog, the original build, the pilot did not install the fuel transducer.

A friend of the pilot, who was also a FAA certified mechanic, stated that about two to three weeks prior to the accident, the pilot had installed the fuel transducer. The pilot commented to him that he had not installed the unit previously because it needed a certain amount of space (needed to be about seven to nine inches from the filter) and he would have to bend some of the fuel lines to make it fit. The pilot borrowed a flaring tool from him to complete the installation. The friend noted that earlier in the year, when the pilot was performing a condition inspection and the airplane's cowling was removed, he observed that the pilot had used heavy applications of red/orange RTV(room temperature vulcanization) silicone to seal everything, including the area around the airbox (oval-shaped) where it attaches to the carburetor (square-box-shaped). He mentioned to the pilot that this was an improper practice.

Another friend of the pilot stated that the pilot had installed a fuel transducer about one to two weeks prior to the accident flight, and noted at the time that the unit did not have a bypass. The friend also observed that the pilot had not connected the electrical wires for the transducer to be operational, but had installed the unit.



NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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Lycoming Manual

According to the engine's maintenance manual, the rated horsepower was 235 at 2,575 rpm. To obtain the maximum recommended service life of the engine, the manual recommends that the cylinder head temperature be maintained below 435 degrees Fahrenheit (F) during high-performance cruise operation, with a maximum temperature of 500 degrees F. The Lycoming manual additionally stated that the fuel pressure requirements were a minimum pressure of .5 psi and a maximum of 8 psi.

METEOROLOGICAL INFORMATION

A routine aviation weather report (METAR) generated by an Automated Surface Observation System (ASOS) in Newport reported that at 1635 there was an overcast cloud layer at 1,900 feet above ground level (agl) with 5 miles visibility. It recorded the temperature at 52 degrees Fahrenheit; dew point 50 degrees Fahrenheit.

COMMUNICATIONS

No record exists of the pilot, or a pilot using the airplane's registration number, contacting any Air Traffic Control tower, or Common Traffic Advisory Frequency, during the duration of the flight.

WRECKAGE AND IMPACT

The accident site was located in the paper mill adjacent to the Yaquina River in Toledo, Oregon, with the debris confined to the immediate area near the main wreckage. The Global Positioning System (GPS) coordinates for the main wreckage were approximately 44 degrees 36 minutes 53 seconds north latitude and 123 degrees 56 minutes and 14 seconds west longitude, at an elevation about 10 feet mean sea level (msl). A complete pictorial of the wreckage location and surrounding terrain is contained in

NTSB	N-No	Date	Make	Model	Factual the public docket for this accident.	Released Narrative
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The closest airport to the accident was in Toledo, Oregon and was located 0.7 nm from the accident site on a heading of 192 degrees. The wreckage came to rest in a flat area, which was a portion of dirt road on the perimeter of the mill. Surrounding the site were 20 foot (ft) high stacked bales of crushed cardboard boxes, and a railroad track with parked train cars. Additionally, a northwest-southeast oriented 12 ft-diameter tubular conveyer was observed near the accident site that was about 70 feet high and 1,625 feet long. The airplane departed from Newport, Oregon which was located 5.6 nautical miles (nm) from the main wreckage on a heading of 248 degrees.

The main wreckage, which consisted of nearly the entire airplane, came to rest on a heading of 310 degrees. The initial point of impact consisted of a ground scar and disrupted dirt located about 25 feet and on the heading of 220 degrees from the cockpit section of the main wreckage. Embedded in the dirt were fragments of red lens and shards of paint and fiberglass, consistent with the left wing impacting first.

From the red lens fragments there was disrupted dirt and ground scars up to blue paint rub marks on an adjacent woodpile. On an exposed yellow pipe embedded in the ground were numerous blue paint transfer marks, which at 16 feet from the red lens, was consistent with being a signature of the undercarriage contacting it (the airplane's wingspan was about 32 feet). In a ditch just below the pipe was a 7-ft section of the inboard left wing from the leading edge at to about the spar. From the pipe, on a heading of about 020 degrees, was engine casing debris and lower engine pieces, including the oil drain plug.

MEDICAL AND PATHOLOGICAL INFORMATION

The Lincoln County Medical Examiner completed an autopsy of the pilot and passenger. The FAA Civil Aeromedical Institute (CAMI) performed toxicological screenings on the pilot. According to CAMI's report (#201400089001) the toxicological findings were negative for carbon monoxide and tested drugs.

TESTS AND RESEARCH

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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A detailed examination report with accompanying pictures is contained in the public docket for this accident.

Airframe

The main wreckage cockpit area was open, with the engine and firewall twisted toward the right wing. Most of the upper cabin area had broken free from the airframe; the section that remained attached consisted of fiberglass on the aft right side about four feet forward of the bulkhead.

The throttle, propeller, and mixture control levers were bent in their respective control quadrant, which was consistent with them being in the full-forward position at the time of impact.

The right wing remained attached to the fuselage at all attach points, and the flap and aileron control surfaces remained attached to their respective hinges. The right wingtip aft section and fragments of a blue/green lens were located just below the right wing adjacent to a concrete divider. Around the divider was evidence of blithe, and numerous areas of vegetation had been crushed, which was consistent with fuel exposure. The right wing sustained major skin deformation crushing from the aft outboard tip to about three feet inboard; this was consistent with the size and orientation of the concrete divider that was located immediately below it. The wing sustained aft crush deformation, with the bottom leading edge skin folded into itself, giving it an accordion-type appearance. The crush was nearly uniform through the entire length of the wing. The leading edge displayed characteristics consistent with hydrodynamic deformation. Control continuity was confirmed in the right wing up to the crush deformation in the cockpit area.

The left wing was attached to the fuselage at all attach points, and the flap and aileron control services remained attached to their respective hinges. The left flap was attached to the two inboard respective hinges and creased at the center hinge in an upward crush. The left aileron was found wedged underneath the main wreckage cockpit area. The leading edge displayed characteristics consistent with hydrodynamic deformation. Control continuity was confirmed in the left wing up to the crush deformation in the cockpit area.

The right and left horizontal stabilizers and elevator remained intact with creasing noted on some of the surfaces; continuity to the cockpit was established. The vertical stabilizer and rudder remained intact with a slight crease on the rudder control surface about six inches from the top and consisted of a four inch bend. The rudder was attached to its control cables and continuous to the rudder

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					pedals and secured. The elevator was attached to the push-pull tube, which was continuous up to the cockpit area. Both control sticks were attached and safetied.	
					Powerplant	
					The engine mount support tubes were severed by investigators between the engine and firewall, which essentially separated the engine from the airframe. An external visual examination of the engine revealed that it had sustained crush damage to the bottom of the crankcase, with the majority of damage to the left side. There were dark stains to the left of the upper spark plug holes, which was consistent with oil staining.	
					The spark plugs were removed and no mechanical damage was noted; the electrodes and posts exhibited a light ash white coloration, which according to the Lycoming representative was consistent with a very lean operation(s). The ignition harnesses were attached from both magnetos to their respective spark plugs. The right magneto was secured to its respective mounting pad. Upon rotation, investigators observed spark produced at all posts. The left magneto sustained varying degrees of damage that rendered the unit inoperative and therefore, could not be functionally tested.	
					The crankshaft was rotated by hand utilizing the propeller. The crankshaft was free and easy to rotate in both directions. "Thumb" compression was observed in proper order on all six cylinders. The complete valve train was observed to operate in proper order, and appeared to be free of any pre-mishap mechanical malfunction. Normal in uniform "lift action" was observed at each rocker assembly. Clean, uncontaminated oil was observed at all six rockerbox areas. Mechanical continuity was established throughout the rotating group, valve train and accessory section during hand rotation of the crankshaft.	
					The cylinders' combustion chambers were examined through the spark plug holes utilizing a lighted borescope. The combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion. The valves were intact and undamaged. There was no evidence of valve to piston face contact. The chambers and valve faces all displayed little combustion signatures and there was a whitish light ash coloration; the exhaust valve faces were slightly darker, exhibiting a white-orange-coloration. This white residue/soot was additionally seen throughout the remainder of the exhaust system.	
					The Hartzell propeller, model HC-C2YK-1BF, serial number 40546, remained attached to the engine crankshaft. All propeller	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
					mounting bolts remained in the hub and exhibited no signatures consistent with shear stress. The propeller blades remained attached at the hub. The spinner was displaced from the propeller hub. The propeller blades were straight and did not show any evidence of rotational forces applied at the crankshaft at the time of impact. Removal of the propeller governor disclosed that the screen was free of contaminants.	
					Fuel System	
					The fuel selector was found with the handle pointing to the "LEFT" tank position. Later, it was confirmed by a friend of the pilot that the handle was installed with the handle giving a reverse indication, which meant that the fuel would be selected in the "OFF" position. The position of the fuel selector valve, manufactured by Andair, LTD, was off with both lines shut off. The selector was found in several pieces: the handle (which was still attached to the airframe), the extender (which was located loosely in the wreckage adjacent to the pilot seat), the upper coupling (which had broken free from its remaining core and was found loosely in the wreckage), the valve (which was found loosely in the wreckage near the firewall). There was no evidence that the extender had been safetied to either couplings.	
					The fuel filter, manufactured by Airflow Performance, was disassembled and the screen was found to be clean. Investigators located a Facet automotive electric fuel pump within the wreckage and upon supplying power source the pump was found to activate. The transducer, a FloScan 201 A-6 flow sensor (s/n 179922), was found in the wreckage. The fuel line from the electric fuel-pump to the transducer was separated at the pump's B-nut fitting as a result of post impact forces. An approximate one-inch portion of the line remained attached on the inlet side of the transducer and the end was crimped tightly together and bent. Investigators pried open the crimped section and found an oval bead of red/orange RTV that measured about 0.25 inches in length. According to the manufacture, the inlet hole (metering orifice) is reamed to approximately 0.114 to 0.116 inches. Removal of both the inlet and outlet fittings revealed that RTV was in the threads of both the nipples and the surrounding casing.	
					The upper cap section and mounts of the gascolator remained attached to the firewall; the metal bowl was located under the right wing and there was no evidence it had been secured/safetied to its attachment arm/ thumb-tightening screw; the screen was additionally found loose under the right wing and was clean. The engine-driven fuel pump was displaced from the engine. Disassembly of the fuel pump revealed that is was free of internal mechanical malfunction and obstruction to flow; the diaphragm was intact. Liquid contained in the body was collected and tested for water; there is no indication water was present.	
					The carburetor was not attached at its forward mounts; it had remained attached to the aft mounts, coming to rest bent aft with the	

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					body flush against the case, and partially embedded in the oil sump casing. The casing of the carburetor had been broken apart and the plastic floats were in pieces.	
					Seats	
					All occupants appeared to have had both their lap and shoulder belts secured during the accident sequence. The child passenger was seated in Graco booster seat, model 1781044 (s/n 0784129). According to the manufacture, the seat is designed to sustain g-loading as specified in Federal Safety Standard 213. This includes a space envelope of 32 inches for the head and 36 inches for the knees. The seat's manual specifically prohibits usages in aircraft, which states is due to the limitation of no shoulder harnesses available.	

NTSB	N-No	Date	Make	Model	Factual	Released Narrative
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