Aviation Investigation Final Report

Location:	SPOKANE, Washington	**Accident Number:**	SEA97FA003
Date & Time:	October 5, 1996, 15:00 Local	**Registration:**	N574H
Aircraft:	Enstrom F-28C	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	2 None
Flight Conducted Under:	Part 91: General aviation		

Analysis

The pilot began the takeoff in the helicopter while giving a ride to a passenger at a local festival. About 100 feet above the ground, the engine began to run rough and quit. The helicopter, which was not insured, was damaged when the pilot initiated an emergency descent and impacted trees. The operator claimed that the fuel in the helicopter, his fuel truck, and his ground supply tank had been contaminated with jet fuel prior to the accident. Subsequent NTSB testing revealed that the fuel could not have been contaminated, and that jet fuel must have been added to the helicopter and the operator's self-tested fuel samples after the accident. The engine was examined in detail and tested by NTSB. No evidence of damage due to jet fuel contamination was found. The engine initially ran rough due to a restricted fuel nozzle, then ran within specifications (no turbocharger) after the nozzle was changed. The nozzle restriction was not found. Maintenance discrepancies such as a leaking turbocharger, improperly installed fuel nozzles, crimped fuel vent line, and a separated magneto cap were found, but no conclusive evidence associated with the accident power loss was found.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: a loss of engine power for undetermined reasons.

Findings

Occurrence #1: LOSS OF ENGINE POWER
Phase of Operation: TAKEOFF

Findings
1. (C) REASON FOR OCCURRENCE UNDETERMINED
2. MAINTENANCE - IMPROPER - COMPANY MAINTENANCE PERSONNEL
3. FUEL SYSTEM,NOZZLE - RESTRICTED
4. EXHAUST SYSTEM,TURBOCHARGER - LEAK
5. FUEL SYSTEM,LINE - MISROUTED
6. FUEL SYSTEM,NOZZLE - INCORRECT

Occurrence #2: FORCED LANDING
Phase of Operation: EMERGENCY LANDING AFTER TAKEOFF

Occurrence #3: IN FLIGHT COLLISION WITH OBJECT
Phase of Operation: EMERGENCY LANDING AFTER TAKEOFF

Findings
7. OBJECT - TREE(S)

Factual Information

HISTORY OF FLIGHT

On October 5, 1996, about 1500 Pacific daylight time, an Enstrom F-28C helicopter, operated by Custom Aviation, Inc., Spokane, Washington, impacted trees and was substantially damaged near Spokane during an emergency descent. The emergency descent was precipitated by a loss of engine power during climb. The commercial pilot and her passenger were not injured. Visual meteorological conditions prevailed and no flight plan had been filed. The sightseeing flight was conducted under 14 CFR 91.

According to a line person employed by the operator, the accident helicopter had been fueled earlier in the day from the operator's fuel truck at Felts Field in Spokane. The line person stated that on the morning of the accident, prior to 1100, he "topped off" both the accident helicopter and another helicopter owned by the operator. He stated that he was "absolutely" certain that he fueled them with 100 low lead aviation gasoline. He described the location and separation of the 100 low lead fuel hose and the jet fuel hose that were mounted on the fuel truck.

After the fueling of the accident helicopter, it was initially flown by a pilot (previous pilot) who was not involved in the accident. The previous pilot, who is a certified flight instructor and has accumulated about 2,800 hours of total rotorcraft flight time, stated (interview synopses attached) that he had difficulty starting the helicopter on the morning of the accident. He stated that the engine was "flooded" so he "pulled the mixture out and leaned it." The helicopter was then able to be easily started, and it operated normally up until the time of the accident.

The previous pilot also stated that he flew the helicopter from Felts Field to a local fairground for about 22 minutes at an altitude between 1,200 feet and 1,500 feet above the ground. After arriving at the fairground, he did not shut the engine down, nor was the engine shut down at any time during the day until the accident. The previous pilot stated that he flew about "eight to ten" sightseeing flights during the event. About six flights involved carrying one passenger, and two more involved carrying two passengers. Each flight was between five and seven minutes in length, and each involved picking up the helicopter, transitioning to climbing flight to about 1,000 feet above the ground, flying a "large oval" pattern, and then hovering to a landing.

The previous pilot stated that the helicopter had not been refueled after its initial fueling earlier in the day at Felts Field. He stated that he did not check the fuel tanks with the dip stick, but he did remember that the fuel quantity gauge indicated he had between 1/4 and 1/2 tank of fuel during his last flight. He then got out of the helicopter, left its engine running, and flew

the operator's other helicopter back to Felts Field.

The accident pilot exchanged helicopters with the previous pilot at this time. The accident pilot stated (interview synopsis attached) that she and the previous pilot gave "about five or six rides apiece." She stated that she "didn't want to trade helicopters in the beginning of the day, but then [the previous pilot] decided to fly back home because things weren't that busy at the fair."

The accident occurred during the accident pilot's first flight in the helicopter. She stated that the passenger weighed "about 270 pounds" and wanted to bring his girlfriend. The accident pilot stated that she would not allow the girlfriend on board because of weight concerns. After performing a run-up, the accident pilot and the passenger began the ride. She stated that the helicopter "felt real heavy" just after she "picked up" and began to climb up over trees. She stated that the engine suddenly "cut out" about 80 to 100 feet above the ground. The rotor revolutions per minute (RPM) gauge was "in the bottom of the green" and the fuel quantity gage was indicating "over 1/2 tank." The accident pilot stated that she force landed the helicopter and then waited for the blades to stop turning. The helicopter struck trees and was substantially damaged.

PERSONNEL INFORMATION

The accident pilot, age 34, held a Federal Aviation Administration (FAA) Commercial Pilot Certificate with ratings for airplane single-engine land, helicopter, and instrument airplane. According to FAA records, she was issued an FAA Second Class Medical Certificate on June 25, 1996, with the limitation that she "must wear lenses for distant [vision] - posses glasses for near vision." She reported that she had a total of 134 hours of helicopter flight time, including 26 hours in type.

AIRCRAFT INFORMATION

The aircraft, a 1976 Enstrom model F-28C helicopter, had been owned, operated and maintained by Custom Aviation, Inc. The helicopter is powered by a single turbocharged, fuel-injected Lycoming model HIO-360-C1A engine, which drives three main rotor blades and two tail rotor blades.

According to the helicopter's maintenance log books (excerpts attached), the helicopter underwent an annual inspection on May 18, 1996, and a 50-hour inspection on July 30, 1996, with no discrepancies noted. The helicopter had accumulated 53.2 hours of flight time since the 50-hour inspection.

According to the helicopter's engine log books (excerpts attached), the engine underwent a 100-hour inspection on August 23, 1996, and a 50-hour inspection on July 30, 1996, with no discrepancies noted. One entry, also dated July 30, stated: "removed and installed serviceable boost pump...." Another entry, dated three days prior, stated: "Installed

rebuilt and [zero] timed fuel control servo [in accordance with] Lycoming [maintenance] manual. Flow checked & cleaned fuel injectors, cleaned tanks, cleaned fuel strainer, checked injector lines and spider diaphragm.... Ops and leaked checked good."

The accident aircraft's fuel system consists of two interconnected 20 US gallon fuel tanks, which feed simultaneously to the engine. The tanks are located on the left and right side of the aircraft over the engine compartment. The tanks have a total fuel capacity of 40 US gallons, with a total of two gallons unusable fuel, one gallon unusable fuel in each tank. Each tank is gravity fed to a central distributing line which connects to the electric auxiliary boost pump and an engine driven pump. The fuel control valve is an "on-off" type and is located on the firewall next to the pilot's left shoulder.

The fuel quantity gauge continuously indicates the total quantity of fuel. It is hooked up through a liquidometer float located in the right-hand fuel tank. A translucent strip on each tank provides a direct, visual indication of fuel level while the helicopter is on the ground.

The Safety Board obtained aircraft fuel performance data from the aircraft manufacturer in an attempt to estimate the total amount of fuel consumed by the accident helicopter after it had been refueled up to the time of the engine failure. According to the data (computations attached), the helicopter would have conservatively consumed 27.4 gallons of fuel under the conditions at which is was being operated, leaving 12.6 gallons of capacity remaining.

According to the operator, the helicopter was not insured for hull loss at the time of the accident.

WRECKAGE AND IMPACT INFORMATION

The wreckage was examined at the accident site by an FAA aviation safety inspector from Spokane. The inspector arrived about two hours after the accident. According to the inspector, a piece of wreckage was found near the initial impact point about 75 feet from the final resting site of the fuselage; this piece was identified as the tail rotor drive shaft. The stabilator, a tail rotor blade, and the tail boom were separated from the fuselage and were found distributed between the tail rotor drive shaft and the fuselage.

About four inches of fuel depth was noted in the right half of the fuel tank, and about ten inches was noted in the left half of the tank. Six quarts of oil were found in the engine. The fuselage of the helicopter was leaning toward the left about 20 degrees from an axis perpendicular to the horizon. The left skid had been bent outward. All three main rotor blades remained attached to their hub. One of the blades was not damaged. Another blade received minor leading edge damage. The third blade had been bent forward and was twisted. The cockpit had been secured and the radios had been removed.

The Safety Board authorized the operator to remove the wreckage on the evening of the

accident and secure it in his facility for further examination. On October 7, 1996, FAA inspectors observed the operation of the engine, which had remained attached to the helicopter. The engine was able to be started and run up at an idle RPM. According to the inspectors, the rotor blades had been disengaged from the engine, and the engine was operated for a short period of time at idle speeds and with observed roughness.

During the engine run-up test event, the operator suggested that the fuel in the helicopter had an odor that was similar to jet fuel. The FAA inspectors agreed. The operator volunteered to take fuel samples from the helicopter and have them analyzed at a laboratory in Seattle.

An FAA inspector drained and measured the remaining fuel out of the wreckage; about 8.5 gallons of liquid were drained. Also, the Safety Board ascertained through interviews (synopses attached) that about 4.5 gallons of liquid had been drained out of the helicopter by the owner of a petroleum distributor, and about one additional gallon was drained out for smaller samples taken by an insurance adjuster, the FAA, and the operator. Based on this information, the Safety Board estimated that about 14 gallons of fuel would have remained in the helicopter at the time of the accident. However, according to the fuel consumption data previously mentioned (computations attached), only 12.6 gallons of capacity would have remained in the helicopter at the time of the accident.

TESTS AND RESEARCH

Operator's Sampling of Fuel.

The operator stated that he drew samples of fuel from the accident helicopter, his other helicopter, all of his fixed-wing aircraft, his fuel truck, his above-ground fuel tank, and his mobile pick-up truck tank, one day after the accident. The samples were not controlled by, nor ever in the custody of, the FAA or the Safety Board. The operator stated that he brought the samples to Saybolt, Inc., in Seattle, Washington, for analysis. On October 14, 1996, he received the results from Saybolt and notified the FAA and the Safety Board that jet fuel contamination was found in the samples.

The operator stated that he received a shipment (copy of invoice attached) containing 2,325 gallons of 100 low lead aviation fuel into his above-ground tank on September 23, 1997, from a local petroleum distributor. He stated that he suspected that the shipment was contaminated, and he notified the owners of about 36 airplanes (listing attached) that had been fueled by the operator since September 23, 1997, of the contamination.

The Safety Board interviewed (interview synopses attached) those persons involved in the operator's sampling of fuel. One employee stated that he was asked by the operator to obtain fuel samples on the morning of October 6, one day after the accident. The employee stated that he first sampled the operator's four fixed-wing aircraft. He stated that another employee was asked to sample the operator's helicopters. The employee then went to the

large above-ground fuel tanks and obtained a sample of jet fuel and a sample of 100 low lead aviation fuel. He stated that the fuel "seemed to come out like it usually does," and he did not notice anything unusual. He did not make any entries on the metering sheets (copies attached) when he took the samples. He distinctly remembered taking the samples, and that it took about 30 minutes. After he took the samples, he placed them in a box, brought the box into the operator's shop, and placed the box on a shelf where they were "non-conspicuous."

The employee also stated that he flew in one of the operator's Cessna 172s for about six hours on the day of the accident. The Cessna had been fueled by the operator's fuel truck on the day preceding the accident, and again on the day of the accident. The employee reported that there were "no problems" with the Cessna during the time that he flew it.

The operator's mechanic stated that he obtained a sample from the accident helicopter on the morning following the accident. He remembered that he obtained a sample from one of the tanks by pulling the tank drain off, and he obtained a sample from the other tank by draining fuel from its strainer. The mechanic also stated that he was "pretty sure" he also pulled a sample from the operator's other helicopter "... a day and a half later " in the hangar. After obtaining the samples, the mechanic labeled the jars, including date and time, and gave them to the operator.

Another employee stated that he remembered taking fuel samples, but he could not remember exactly from where. He stated: "I think I took samples from the main [above-ground] tank... but I can't remember." He also stated that he may have taken a sample from the mobile pick-up truck external fuel tank that was at the accident site, but again he could not be sure. He stated that he took the samples about 1230 on October 6, 1996, because he was asked to perform the sampling when he first started his shift. He stated that he could not remember for sure who had asked him to take the samples, and he did not remember having any conversations about the helicopter accident around the time of the sampling.

Results from Operator's Fuel Tests.

According to the data sheets (attached) from Saybolt, Inc., of the operator's fuel sample testing, the following results were found:

LABELED AS: ALLEGED SOURCE: RESULT: N-9248
Operator's Other Helicopter Contaminated N-7275J
Operator's Airplane Not Contaminated N-3409J Operator's Airplane Not Contaminated Pete Wing Operator's Tank After New Fuel Lot Not Contaminated Tank; 10/06/96 Operator's Tank Before New Fuel Lot Contaminated N-4360L Operator's Airplane Not Contaminated N-69133 Operator's Airplane Not Contaminated Left Tank; 10/06/96 Accident Helicopter Contaminated Right Tank; 10/06/96
Accident Helicopter Contaminated Chevy Dually Operator's Pick-up Truck Tank Contaminated Fuel Truck; 10/06/96 Operator's Fuel Truck

Before Purging Contaminated

The Safety Board initially requested copies of the Saybolt testing from the operator. The operator provided only those test results that indicated fuel contamination. The Safety Board later obtained all of the sample results from Saybolt, and discovered that some of the tests indicated no contamination. When the operator was asked why his fixed wing airplane samples did not disclose evidence of contamination, the operator stated that he thought the samples were taken after the fuel was purged out of the tanks and newer fuel from a later shipment was placed in them. The Safety Board attempted to verify this through interviews (synopses attached). The interviews revealed that the fuel samples were taken one day after the accident by an employee of the operator prior to any purging, and that the fuel in the airplanes would have been representative of the fuel in the operator's above-ground tank which was suspected by the operator as being contaminated.

Inspection of Above-Ground Fuel Pumps.

The Safety Board contacted the company that sold and serviced the operator's above-ground fuel tank (interview synopsis attached). Service personnel, at the Safety Board's request, inspected the tank and pump after the accident. Service personnel reported that they found no anomalies and that there was "no common way to mix fuels" in the system. It was also noted that there are no junctions in the tanks or the plumbing between the Jet A and 100 low lead fuel supplies.

Fuel Distributor Handling.

The Safety Board contacted the owner (interview synopsis attached) of the petroleum distributor that delivered the operator's fuel. The owner stated that a load of farm diesel fuel was carried in the same delivery truck used to deliver the operator's fuel on September 20, 1996. The recorded amount of this red-dyed fuel was 2,010 gallons. The truck was then flushed out with automotive fuel, and the automotive fuel was disposed of, prior to the loading of the 100 low lead fuel for the operator. The owner stated that the 100 low lead fuel load, about 2,350 gallons, virtually emptied his 10,000 gallons tank, at which time more fuel was ordered for the tank.

The distributor's truck driver (interview synopsis attached) delivered fuel from the distributor to the operator's above-ground tank on September 23, 1996. He provided a detailed account of the history of the fuel truck loading just prior to the order. He stated that he used the same truck used in the operator's delivery to deliver diesel fuel about three days prior. He remembered delivering the diesel fuel on October 20, 1996, then parking the truck all weekend. On Monday morning, he flushed each compartment of the truck with about 15 gallons of unleaded automotive gasoline, which is routine. He then loaded the truck with 100 low lead aviation gasoline. He stated he is certain of loading the 100 low lead fuel, because the pump for it is located on the opposite, or "west end of the rack" from the Jet A pump.

Fuel Tests Conducted by TEXACO, Inc.

The Safety Board requested and received all documents (attached) from TEXACO that tracked the movement and testing of the petroleum product that eventually was placed in the operator's above-ground tank. A review of the documents did not reveal any evidence of fuel contamination or mishandling from the refinery to the distributor. TEXACO also tested the 100 low lead gasoline that was delivered to other airports in the Spokane area from the lot of fuel stored at the petroleum distributor. The results of the testing (attached) did not indicate fuel contamination.

Fuel Sample Tests Conducted by the Safety Board.

After receiving notification from the operator that his fuel samples were contaminated with jet fuel, the Safety Board took custody of four of his samples from Saybolt and had them tested at the Department of the Air Force Aerospace Fuels Laboratory in Cape Canaveral, Florida. The four samples included fuel samples allegedly from the left tank of the accident helicopter, right tank of the accident helicopter, fuel truck, and mobile pick-up truck fuel supply. Results (report attached) of the testing are as follows:

Left Tank of Accident Helicopter	41.5% weight jet fuel contamination
Right Tank of Accident Helicopter	42.5% weight jet fuel contamination
Fuel Truck - 100 low lead	7.3% weight jet fuel contamination
Mobile Pick-up Truck Fuel Supply	4.0% weight jet fuel contamination

The Safety Board, assisted by an FAA inspector, also obtained fuel samples directly from the accident helicopter and had it tested at the Air Force laboratory. The laboratory results (report attached), indicated that the sample contained 13.8% weight of jet fuel. This differs by about 22% when compared with the samples that were under the custody of the operator.

According to technicials at the Air Force laboratory, 100 low lead aviation fuel and jet fuel are liquids that are completely missible. The fuels do not layer or settle upon each other, rather they mix completely and evenly.

The Safety Board was unable to obtain samples of fuel from the operator's fuel truck, above-ground tank, and mobile pick-up truck fuel tank, because the operator had either disposed of the fuel from the suspected contaminated lot and/or placed a new order of fuel into the tanks on October 7, 1996.

The Safety Board, again with the assistance of the FAA and aircraft owners, obtained fuel samples from airplanes that had been fueled by the operator since September 23, 1997, and had not completely recycled the fuel supply with refuelings after October 7, 1996. The samples were sent to the Air Force laboratory (report attached) and the following results were noted.

N7380T	Cessna 172	Fueled 10/5	Not Contaminated N704QA
Cessna 150M		Fueled 9/24, 9/27,10/4	Not Contaminated N3466K
Piper PA-28-140		Fueled 9/28, 10/4	Not Contaminated N923ST
Cessna 205	Fueled 9/27, 9/29, 10/6	Not Contaminated N4423R	
Cessna 182RG		Fueled 9/29	Not Contaminated

The Safety Board, with the assistance of the FAA, also obtained samples from three airplanes, one of which had already been tested by the Air Force laboratory, that had been fueled by the operator since September 23, and sent them to another independent laboratory, Panair Laboratory, Inc., in Miami, Florida. The results (attached) were as follows:

N4423R	Cessna 182RG	Fueled 9/29	Not Contaminated N4938L
Piper PA-28-180		Fueled 9/24,10/6	Not Contaminated N7380T
Cessna 172	Fueled 10/5	Not Contaminated	

Results of Fuel Sample Tests Conducted by Aircraft Owners.

The Safety Board also received reports from other aircraft owners who had taken samples of fuel from their airplanes and sent them in for analysis. Theses samples were never in the custody of the Safety Board. One of the samples was tested by Saybolt (results attached). The other three were tested by the Oil Analysis Laboratory in Spokane, Washington. The results of these reports are as follows:

N733MG	Cessna 172N	Fueled 9/25	Not Contaminated (Saybolt) N86320
Cessna T337	Fueled 10/6/96	Not Contaminated (Spokane) N101CT	
Cessna T210M	Fueled 10/3,10/6	Not Contaminated (Spokane) N8484D	
Cessna 172K	Fueled 9/24, 10/3	Not Contaminated (Spokane)	

Fuel Pump Test Results.

The aircraft's electrically-driven fuel boost pump was removed and sent to its manufacturer, Weldon Pump, Inc., Oakwood, Ohio, for a detailed examination and functional test. The test occurred on March 11, 1997, and was supervised by an FAA aviation safety inspector from Cleveland, Ohio. According to the FAA (letter and test results attached), the pump passed all tests except for relief pressure. It was determined that the pump relief pressure valve was improperly set, and that the improper setting would not have affected pump performance.

Engine Examination and Functional Test.

The engine was removed from the aircraft by the operator and shipped to Textron Lycoming company in Williamsport, Pennsylvania, for a detailed examination and functional test. The examination and testing (report attached) occurred on March 21, 1997, under the

direct supervision of the Safety Board. A borescope examination of each piston dome revealed evidence of combustion deposits, and no evidence of preignition and/or detonation damage. Further examination (photographs attached) of the engine revealed the following discrepancies:

1.) The dual magneto cap was received with a gap, measuring about 3/16-inch, between the magneto cap parting surface and the magneto housing parting surface. 2.) The no. 1 cylinder nozzle vent tube was not connected into the no. 1 cylinder vent hose. Instead, the hose was found to be clamped shut, as it was clamped to the outside of the no. 1 cylinder vent tube. 3.) The lower spring holders for all four fuel injector nozzle assemblies were not installed on the engine and were missing. 4.) The turbine and exhaust sections of the turbocharger were wet with oil and appeared to have been leaking.

The engine was then mounted on a test stand, without the turbocharger and associated hardware. The open magneto cap, improperly crimped vent tube, and missing nozzle spring holders remained as they were received. The engine was started in a test cell, but ran rough. The engine was shut down, and each of the four cylinder exhaust pipes were touched by hand. The no. 4 cylinder was colder than the other three cylinders. The no. 4 cylinder injector nozzle was removed and a new nozzle was installed. The engine was then re-started and ran smoothly.

During the subsequent functional test procedures, data was taken at increasing RPMs (engine test log attached). It was determined that outlet pressure from the engine-driven fuel pump was never higher than 22.8 pounds per square inch (psi). This pressure is lower than Lycoming specifications, and it was determined that fuel flow had been improperly set. No noticeable affect on engine performance was noted during the test despite this condition.

The engine was stopped and the fuel nozzles were removed and flow checked. The no. 4 cylinder fuel nozzle that was previously installed was removed and replaced by the original no. 4 cylinder fuel nozzle. The fuel nozzles were flow checked and were determined to be acceptable. The no. 4 fuel nozzle flow did not indicate any blockages. All fuel nozzles were installed back into the cylinders, including the original no. 4 nozzle. The engine was re-started, ran smooth, and accelerated normally from idle to full-rated RPM. The test was concluded, the engine was shut down, and the no. 4 cylinder fuel nozzle was removed for further examination.

Engine Fuel Nozzle Examination.

The no. 4 engine fuel injector nozzle was submitted to the Safety Board's Metallurgical Laboratory in Washington, DC, to determine if the interconnected passages were blocked with foreign material. According to the Metallurgist's Factual Report (attached):

Stereo microscopic examination of the as-received nozzle revealed the opening for the three holes contained no foreign material. A fiber optic light was illuminated on one end of the longitudinal through-hole and the opposite

end was examined with a stereo microscope. Light passed through this longitudinal hole and the smallest diameter hole and the smallest diameter hole near the center of the nozzle appeared round with no obstruction. A longitudinal saw cut that intersected all three hole passages was made through the nozzle. No foreign material was found in any of the exposed passages.

Expenditure of Time Involved in Investigation.

As a result of the allegations by the operator regarding fuel contamination, the Safety Board invested about 60 man hours of effort devoted to the investigation of the fuel contamination issue. Air safety inspectors from the FAA in Spokane estimate that they devoted about 200 additional hours of cumulative investigation, including the time spent to draft a safety recommendation for an airworthiness directive regarding the grounding of aircraft for fuel contamination. An additional 40 man hours of effort is estimated to have been spent by civil service technicians at the Air Force Aerospace Fuels Laboratory.

Pilot Information

Certificate:	Commercial	**Age:**	34,Female
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim	**Last FAA Medical Exam:**	June 25, 1996
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	696 hours (Total, all aircraft), 26 hours (Total, this make and model), 615 hours (Pilot In Command, all aircraft), 23 hours (Last 90 days, all aircraft), 15 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Enstrom	**Registration:**	N574H
Model/Series:	F-28C F-28C	**Aircraft Category:**	Helicopter
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	361
Landing Gear Type:	Skid	**Seats:**	3
Date/Type of Last Inspection:	July 30, 1996 100 hour	**Certified Max Gross Wt.:**	2350 lbs
Time Since Last Inspection:	53 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	1028 Hrs	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	HIO-360-E1AD
Registered Owner:	CUSTOM AVIATION, INC.	**Rated Power:**	205 Horsepower
Operator:		**Operating Certificate(s) Held:**	None
Operator Does Business As:		**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	GEG ,2372 ft msl	**Distance from Accident Site:**	15 Nautical Miles
Observation Time:	14:56 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	16°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:		**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	00:00 Local	**Type of Airspace:**	Class G

Airport Information

Airport:		**Runway Surface Type:**	
Airport Elevation:		**Runway Surface Condition:**	
Runway Used:	0	**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 None	**Latitude, Longitude:**	

Administrative Information

Investigator In Charge (IIC):	Guzzetti, Jeffrey
Additional Participating Persons:	WILL HICKS; SPOKANE , WA JAMES F BROWN; WILLIAMSPORT , PA
Original Publish Date:	March 31, 1998
Last Revision Date:	
Investigation Class:	Class
Note:	
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=42482