Aviation Investigation Final Report

Location:	West Creek, New Jersey	**Accident Number:**	NYC08FA184
Date & Time:	May 17, 2008, 12:45 Local	**Registration:**	N5382S
Aircraft:	Cessna 337A	**Aircraft Damage:**	Substantial
Defining Event:	Fuel starvation	**Injuries:**	2 Fatal, 2 Serious
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

The multi-engine airplane was one of several owned and operated by the pilot, who flew many of the missions, and conducted most of the maintenance. The three passengers were employees of an environmental services company that was contracted to conduct aerial surveys of marine mammals. Each month, the pilot re-positioned the airplane from his base in Massachusetts to New Jersey to conduct the survey flights. The previous month, the survey personnel documented concerns with the pilot's performance, and the condition of the airplane. For the accident flight series, the pilot arrived 1 1/2 days late, and one surveyor documented the passengers' concerns about the pilot's performance and fatigue. About 90 minutes into the accident flight, the pilot informed the passengers that he "was having some fuel problems," terminated the survey, and diverted for a precautionary landing. One passenger saw the front propeller stop and begin rotation more than once. The airplane impacted trees and terrain approximately 400 feet to the side of the runway threshold. Several witnesses saw the airplane descend, heard it crash, and notified authorities, but the unsuccessful search efforts were terminated about 2 hours after the accident. A surviving passenger used his mobile phone to call for assistance, and the wreckage was located about 2 hours after that, which was about 4 hours after the accident. The pilot and a passenger were killed, and two passengers survived. Autopsy results indicated that the pilot incurred a transected aorta, which is a non-survivable injury. The fatally-injured passenger incurred a cervical fracture and a transverse basilar skull fracture. Though such injuries are commonly fatal, it is possible that appropriate and more immediate medical treatment would have increased the chances of the passenger’s survival. Post accident examination. Post accident examination revealed that the battery for the emergency locator transmitter bore a "replace by" date that was four years prior to the accident. Neither propeller exhibited evidence of rotation during impact. While all fuel tanks were intact, the main tanks were empty, one auxiliary tank contained 11 gallons, and the other one contained 2 gallons. Records indicated that the airplane was not refueled between the previous flight and the accident flight. The manufacturer's Owner's Manual indicated that the engines can only be primed from the main tanks, and the "Engine-Out During Flight"

checklist specified that the fuel selector valve should be set to the main tank for an engine restart attempt. Both engines were successfully test-run after the accident.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's departure with insufficient fuel for the planned flight, and his improper in-flight fuel management, which resulted in a total loss of power in both engines due to fuel starvation. Contributing to the accident was the pilot's fatigue, which was precipitated by his work activities during the days just prior to the accident flight.

Findings

Personnel issues	Fatigue due to work schedule - Pilot
Personnel issues	Preflight inspection - Pilot
Aircraft	Fuel - Fluid management
Personnel issues	Use of equip/system - Pilot

Factual Information

History of Flight

Prior to flight	Aircraft servicing event
Enroute	Fuel starvation (Defining event)
Enroute	Loss of engine power (total)
Emergency descent	Off-field or emergency landing
Emergency descent	Controlled flight into terr/obj (CFIT)

HISTORY OF FLIGHT

On May 17, 2008, about 1245 eastern daylight time (EDT), a Cessna 337A, N5382S, was substantially damaged when it impacted trees and terrain while attempting to divert to Eagles Nest Airport (31E), West Creek, New Jersey. The certificated commercial pilot and one passenger were fatally injured, and the other two passengers were seriously injured. The pilot was the owner of Ambroult Aviation, which operated the marine mammal survey flight under the provisions of 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed for the flight, and no flight plan was filed.

A Texas-based environmental services company was contracted to provide marine mammal survey information for a study by the New Jersey Department of Environmental Protection, and the environmental services company contracted with the operator to conduct the survey flights. The three passengers were employees of the environmental services company. The pilot and airplane were based at Chatham Municipal Airport (CQX), Chatham, Massachusetts, but temporarily relocated to Millville Airport (MIV), Millville, New Jersey each month for the survey flights. According to an environmental services company representative, the survey flights with the accident pilot and airplane began in January 2008, were conducted on a monthly basis, and were scheduled for completion by July, 2008.

According to the environmental services company documentation, the survey area extended approximately 80 miles north-south along the New Jersey shoreline, and extended approximately 20 miles east over the Atlantic Ocean. Each monthly survey consisted of flying 30 numbered course lines, called transects, to cover the entire survey area. Each transect was to be flown at 750 feet above mean sea level (MSL).

According to the environmental services company personnel, the pilot and airplane were scheduled to arrive at MIV on May 14, in order to begin the survey at 0700 on May 15. At some point on May 14, the pilot advised the company that he would not arrive at MIV until May 15.

According to personnel and records from the Millville Jet Center at MIV, the airplane arrived about noon on May 15, and the pilot requested that the "mains be topped off." The airplane

was serviced with 55 gallons of 100LL avgas about 1210. No records of any subsequent fuel servicing could be located.

The passengers had planned to complete the full survey grid on May 15, but the pilot arrived too late to accommodate their plan. The pilot provided different explanations for his delay to the passengers and to a mechanic at CQX. According to information obtained from passenger interviews, passenger survey notes, and a handheld global positioning system (GPS) unit recovered from the wreckage, the May 15 survey flight began when it departed from MIV at 1244. Due to the lateness of the day and the passengers' concern about the pilot being tired, only half the survey grid was completed. The airplane returned to MIV, and the engines were shut down at 1721.

The surveyors intended to complete the grid the next day, May 16, but the weather conditions were unacceptable for the survey, and the flight was rescheduled for Saturday, May 17. The weather conditions on May 17 were improved, but the passengers were concerned about the wind, since wind affected their ability to conduct the survey. After some delay, they decided to try, and the airplane departed on the accident flight from MIV about 1104. The day's survey began with transect 14, which was approximately 60 miles from MIV. Transect 14 was started at 1147, and was finished at 1159. Transect 15 was started at 1201, and was finished at 1226. Transect 16 was started at 1228.

All four individuals on board could hear and talk to one another, and the passengers could hear all the pilot's radio calls. According to the passenger in the right rear seat, at some point "after finishing the third survey line," the pilot remarked that he would have to "break off" the survey because the airplane "was having some fuel problems," and that he needed to "go back." The passenger also saw the pilot repeatedly manipulating the fuel selector valve handles. The passenger stated that he observed the front propeller cease and resume rotation several times. The passenger stated that according to the pilot, they would divert for landing to the "closest airstrip." One passenger asked how far it was to the nearest airstrip, and the front seat passenger replied "about 10 minutes." No-one specifically mentioned any particular airport.

During the diversion, the right rear passenger did not hear the pilot communicate with anyone on the radio about the problem or his intentions. The passenger had the impression that the airplane was in a continuous descent, and stated that the engines continued to make unusual noises, as if they were running roughly. At some point, the pilot mentioned to the passengers that there was "another [airport] close," and he requested their assistance in visually locating the airport. Shortly thereafter the left rear passenger visually located 31E, and he informed the pilot that it was off to the left at their "nine-o'clock position." The right rear passenger then visually located the airport, but the airplane "started falling," and impacted trees. The right rear passenger stated that the landing gear remained extended for the duration of the flight on May 15, and also on the accident flight.

The GPS-derived flight path showed that at 1239, the end of transect 16, the airplane turned south along the shoreline and then climbed to a GPS altitude of approximately 1,000 feet. The

airplane continued a climb, and about 1241, turned inland and to the north. About 1244, at a GPS altitude of approximately 1,200 feet, the airplane began tracking over New Jersey State Route 72. One minute later, the airplane turned to the southwest, towards 31E, and about 1247 it crossed over the runway at a GPS altitude of approximately 250 feet.

Three witnesses, who lived in two separate houses approximately 1/2 mile east of the approach end of 31E runway 32, heard and saw the accident airplane heading for the airport. All three witnesses stated that they were familiar with the sounds and traffic patterns of airplanes using the airport, and that their attention was drawn to the airplane because of its low altitude and unusual sounds. All three stated that the airplane was descending, and that the engine(s) stopped and restarted at least two times. All three heard the sounds of impact. One of the witnesses searched the airport herself for about 10 minutes, but then called 911 about 1302. Personnel from the New Jersey State Police (NJSP) responded, and initiated a search of the local area. According to NJSP records and statements, they did not locate the airplane, and there were no other reports of a missing aircraft, so they abandoned their search about two hours after the initial notification.

According to the Texas-based project manager of the Marine Sciences division of the environmental services company, he received a telephone call from the right rear passenger informing him that the airplane had crashed. The passenger told the project manager that he was still in the airplane and that he was injured. The passenger did not know where the accident site was, but he thought that they had just completed transect "12 or 13." Telephone records indicated that this call was made at 1401 central daylight time, which was 1501 EDT, or approximately 2 hours after the accident. The call lasted 4 minutes. The project manager then began attempting to notify various emergency services to inform them of the approximate location of the wreckage, based on the survey transect coordinates. At 1517, the passenger called the project manager again, and the call lasted 2 minutes. Between 1529 and 1616, the project manager attempted to call the passenger seven times, and the passenger attempted to call the project manager once, but no calls were answered.

United States Air Force Rescue Coordination Center (RCC) records indicated that they were first notified of the accident at 1542, via a series of telephone calls that were initiated by the environmental services company project manager. The RCC telephoned the passenger, and instructed him to call 911. At 1546 the RCC contacted telephone service providers and requested a trace on the passenger's call, in order to determine which cell phone tower(s) were being used for the call, and thereby obtain a geographic fix on the accident location.

According to NJSP dispatch records, the passenger was connected to the NJSP by telephone at 1604. At 1615, a telephone company provided the geographic coordinates of the cell phone tower closest to the accident location, and that, plus correlation of siren and helicopter sounds heard by the passenger with known NJSP activities, enabled the NJSP to narrow the search area. At 1656, a helicopter located the wreckage. The two survivors, both of whom were seated on the right side of the airplane, were extricated and airlifted separately to Atlantic City for medical treatment.

PERSONNEL INFORMATION

The pilot held a private pilot certificate with airplane single engine land rating, a commercial pilot certificate with an instrument airplane rating and a rating for airplane multiengine land that was limited to aircraft with centerline thrust. He also held a mechanic certificate with airframe and powerplant ratings, and an inspection authorization (IA). The pilot's logbooks were not located. According to documentation that the pilot provided to his insurance company in November 2007, he reported 3,775 total hours of flight experience, 2,810 hours of multiengine flight experience, and 285 hours in the accident airplane make and model. FAA records indicated that the pilot's most recent second-class medical certificate was issued in December 2007. According to documentation provided by a certificated flight instructor, the pilot's most recent flight review was successfully conducted on February 24, 2008.

None of the three passengers held any pilot certificates.

AIRCRAFT INFORMATION

The accident airplane was manufactured in 1966, and was first registered to the pilot in March 1998. It was a six place, high wing airplane of all metal construction, with retractable, tricycle configuration landing gear. It was equipped with two Teledyne Continental Motors (TCM) IO-360 piston engines, one each at the front and rear of the fuselage. Each engine was equipped with a full-feathering, two-bladed McCauley propeller.

The fuel system consisted of three metal tanks in each wing. Two interconnected tanks in the outboard section of each wing comprised each main tank. Each main tank had a total capacity of 46.5 gallons, of which 46 were usable. One auxiliary tank was located in the inboard section of each wing, each with a total capacity of 19 gallons, 18 usable. Total airplane fuel capacity was 131 gallons, of which 128 were usable. Either main tank could provide fuel to either engine, but the left auxiliary tank could only provide fuel to the front engine, and the right auxiliary tank could only provide fuel to the rear engine.

METEOROLOGICAL INFORMATION

The 1254 weather observation at an airport located approximately 20 miles south of the accident airport, reported winds from 250 degrees at 11 knots with gusts to 16 knots, clear skies, 10 miles visibility, temperature 21 degrees C, dew point 7 degrees C, and an altimeter setting of 29.61 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The majority of the wreckage was tightly contained in a wooded area approximately 400 feet south of the approach end of runway 32. The main wreckage consisted of the entire airplane, with the exception of the outboard third of the left wing. The fuselage was lying on its left side,

and oriented on a magnetic heading of approximately 140 degrees. The right wing was standing on its leading edge, and partially attached to the fuselage. The inboard two-thirds of the left wing was right side up, and partially attached to the fuselage. The outboard third of the left wing was located approximately 120 feet north of the main wreckage.

The front engine was completely separated from the airplane, and was right side up. The front engine exhibited significant impact damage on its lower side. The propeller remained fully attached to the hub, and the hub was fully attached to the engine. One propeller blade was straight, and the other blade exhibited significant bending. Neither of the blades displayed any chordwise scratching. The forward spinner had a 6 inch by 10 inch dent, and this dent contained linear material transfer marks which were oriented parallel to the longitudinal axis of the engine. The engine was able to be hand-rotated through approximately 270 degrees. There was fuel in the fuel pump, the fuel pump drive was intact, and the pump rotated freely. The fuel strainer was full of fuel. The upper spark plugs exhibited normal wear characteristics and coloration.

The rear engine was inverted, displaced forward and to the left of its design location, but partially attached to the fuselage. The propeller remained fully attached to the hub, and the hub was fully attached to the engine. One propeller blade was straight, and the other blade exhibited significant bending. Neither of the blades displayed any chordwise scratching. The aft spinner was undamaged. The engine hand-rotated freely, and valve train continuity and thumb compressions on all cylinders were confirmed. Functionality and continuity of the ignition system for the upper spark plugs was confirmed. There was a trace amount of fuel in the fuel pump, the fuel pump drive was intact, and the pump rotated freely. The fuel strainer was devoid of fuel, and there were no contaminants in the strainer. The upper spark plugs exhibited normal wear characteristics and coloration.

All six fuel tanks were found intact and unbreached, with their caps properly installed. A total of approximately 13 gallons of fuel were recovered from the tanks. The main tanks contained either trace amounts, or were completely devoid, of fuel. The right auxiliary tank contained approximately 11 gallons, and the left auxiliary tank contained approximately 2 gallons. The recovered fuel was clear and bright, with no visible contaminants. Tests with water-detection paste were negative, which indicated that no water was present in the fuel.

The two fuel selector valve handles, one for each engine, were located in the cockpit ceiling along the airplane centerline. Each valve handle was connected by a push-pull cable to a fuel valve in one of the wing roots. The fuel selector valve handle for the front engine was found in the "Left Aux" position, and the corresponding fuel selector valve was found set to the port from the left auxiliary tank. The fuel selector valve handle for the rear engine was found in the "Right Main" position, and the corresponding fuel selector valve was found set to an unused port, which was the "off" position. The fuel gauges on the instrument panel were found with the following approximate indications: Left Main, off scale low; Left Aux, 0 gallons; Right Aux, 0 gallons; Right Main, 20 gallons. All master, generator, and fuel pump switches were found in the OFF position.

The landing gear handle and the landing gear were found in their respective "gear extended" positions. The flap handle was at the flaps one-third extended position, and flap actuator extension was measured to be 1.8 inches, which corresponded to flaps one-third extended. The elevator trim tab actuator extension was measured as 2.2 inches, which equated to a deflection greater than the 15 degree trailing edge down tab travel limit.

The airspeed indicator indicated approximately 85 miles per hour, and the Kollsman window in the altimeter was set to 29.66 inches of mercury. The vertical speed indicator indicated a descent of 825 feet per minute. The artificial horizon indicated approximately level pitch and roll attitudes, and the directional gyro registered approximately 085 degrees. The first two digits on the transponder were missing, and the last two were "70."

The emergency locator transmitter (ELT) was a Larago Electronic Manufacturing Inc model LELT-1005-BF. The ELT and its attached battery pack were intact. The ELT switch was found in the "ON" position. The 9 volt battery pack carried a "replace by" date of May 2004. The residual battery voltage was measured to be 0.4 volts. A field test of the ELT with a new 9 volt battery did not produce a detectable signal, but the reason for this was not determined.

MEDICAL AND PATHOLOGICAL INFORMATION

The pilot occupied the front left seat for the flight and the accident. After the accident, the seat was found in the airplane cabin, and the pilot was found in his seat. Toxicological test results on the pilot by the FAA Civil Aero Medical Institute were negative, and the autopsy report from the Ocean County, New Jersey medical examiner listed the cause of death as "multiple traumatic injuries." Under “Pathologic Findings,” the autopsy report on the pilot noted:

1. MULTIPLE TRAUMATIC INJURIES -
A. EXTRENSIVE RIB CAGE FRACTURES with LACERATIONS OF INTERCOSTAL MUSCLES.
B. DISPLACED FRACTURE OF THORACIC VETERBRAL COLUMN WITH SPINAL CORD INJURY.
C. TRANSECTION OF THORACIC AORTA with BILATERAL HEMOTHORACES.
D. CONTUSIONS and LACERATIONS OF LUNGS.
E. MULTIPLE EXTERNAL CONTUSIONS, ABRASIONS, and LACERATIONS

The fatally-injured passenger occupied the rear left seat for the flight and accident sequence. After the accident, the seat was found in the airplane cabin, and the passenger was found in his seat. The Ocean County, New Jersey medical examiner autopsy report listed the cause of death as "multiple traumatic injuries." Under “Pathologic Findings,” the autopsy report on the passenger noted:

1. MULTIPLE TRAUMATIC INJURIES -
A. HEAD INJURY WITH BASILAR SKULL FRACTURE.
B. CERVICAL FRACTURE.
C. FRACTURE OF STERNUM.

D. RIB FRACTURES.
E. DISPLACED FRACTURES OF LEFT FEMUR AND RIGHT TIBIA.
F. MULTIPLE EXTERNAL ABRASIONS/CONTUSIOSN/LACERATIONS.

Under “Neck” is noted, in part, “Examination of the cervical vertebrae exhibits bony crepitus indicative of cervical fracture at the level of C4-C5.”

ADDITIONAL INFORMATION

The Operator

Ambroult Aviation was based at CQX, and was wholly owned by the accident pilot. According to a pilot/employee who flew for the operator since 2005, Ambroult Aviation was a "one man operation." As of the date of the accident, the operator had a total of six airplanes, including the accident airplane. These included three Cessna 337s, one Cessna 336, and one Cessna 152 at CQX, and one Cessna 337 in Carlsbad, California. Another Cessna 337 was also at CQX, but was in non-flying status. In addition to running the business, the accident pilot conducted most of the maintenance, and flew many missions as well. Most missions were various types of survey flights. The operator did not formally advertise its services; instead, customers were typically made aware of the services by word-of-mouth from other customers. An executive of the environmental services company stated that that was how his company originally was made aware of the operator. According to local media reports, the operator's "frequent customers included scientists from private organizations...as well as state and federal agencies," and this was substantiated in the contract between the environmental services company and the State of New Jersey.

FAA Findings Regarding the Operator

The contract between the environmental services company and the State of New Jersey required that the FAA be contacted "to determine flight restrictions in the area" of the survey, and that the survey flights were to be conducted at an altitude of 500 feet. While 14 CFR Part 91.119 permitted operation at altitudes less than 500 feet over open water, a waiver was required for the operator to fly less than 500 feet from any person, vessel, vehicle, or structure. No records of the operator contacting the FAA for flight restrictions were located, and the operator did not contact the FAA for any waivers. Consequently, this reduced the likelihood that the operator's aircraft, records or personal qualifications would be inspected or reviewed by the FAA.

There were no surveillance records regarding the operator in the FAA Program Tracking and Reporting Subsystem database. Searches of other FAA databases did not reveal any records associated with the operator; the only records that were found were in the name of the owner/pilot, and consisted of four IA renewal records, and one pilot certificate practical test. The FAA inspector also conducted a weight and balance calculation for the most recent survey flights, and concluded that "the pilot likely operated the aircraft [at weights] higher than [the]

published limits." FAA inspectors also examined several other of the operator's airplanes and "found them to be in various states of disrepair, and not airworthy." The inspectors also reviewed the maintenance records for those airplanes, and "found similar issues" to deficiencies observed with the maintenance records from the accident airplane.

Accident Pilot's Schedule and Activities

Attempts to reconstruct the pilot's schedule and activities in the days prior to the accident were only partly successful. According to a mechanic who assisted him, on either Monday or Tuesday, May 12 or May 13 respectively, the pilot replaced the alternator on the front engine of the accident airplane, and the replacement precipitated additional maintenance activity due to interference problems with a fuel line. After the maintenance was completed, the airplane experienced electrical and intercom problems. It was not determined whether the pilot either attempted or succeeded in rectifying these two issues, but he did not fly the airplane to MIV on May 14 as he was scheduled to do.

On May 15, the pilot departed CQX in the airplane at about 0700, but returned for a problem he variously described as either mechanical or a bird strike. He was again observed to depart CQX in the same airplane about 0900, and arrived at MIV about 1200. The first survey flight began about 45 minutes later, and lasted about 5 hours. The pilot did not fly on May 16, but he spoke several times by telephone that evening to a pilot/employee about the airplane problem the preceding day. On Saturday May 17, after a weather-related delay, about 1104 the pilot and passengers departed from MIV on the accident flight.

Pilot/Operator Commitments

The investigation did not reveal what other flight or maintenance commitments the pilot/operator had immediately before and after the May 2008 survey at MIV, so no determination of schedule-induced pressures on the pilot/operator could be made. Examination of the operator's contract with the environmental services company revealed that each survey was expected to require 5 flight hours of transit time to re-position the airplane, and 8 hours of survey flight time per month. The contract also contained provisions for compensating the operator for weather delays, and other occasions where the airplane was re-positioned, but was not being utilized.

Pilot Fatigue

A pilot safety brochure produced by the FAA's Civil Aerospace Medical Institute entitled "Fatigue in Aviation, Medical Facts for Pilots (OK-07-193)" stated that "Fatigue leads to a decrease in your ability to carry out tasks…significant impairment in a person's ability to carry out tasks that require manual dexterity, concentration, and higher-order intellectual processing. Fatigue may happen…in a relatively short time (hours) after some significant physical or mental activity…" The brochure also provided recommendations on how pilots could combat fatigue.

FAA Advisory Circular 60-22

Portions of FAA Advisory Circular (AC) 60-22, entitled "Aeronautical Decision Making," provided pilots with information about stress, and to a lesser extent, fatigue. The AC defined stress as the body's nonspecific response to demands placed on it, and notes that numerous physical and physiological conditions in a pilot's personal and professional, life, as well as the nature of flight itself, can hamper a pilot's ability perform at his/her optimum level, and make decisions to the best of his/her ability. It also states that "performance of a task will peak and then begin to degrade rapidly as stress levels exceed a pilot's adaptive abilities to handle the situation."

The AC noted that stress is insidious, and can be well established before becoming apparent; a pilot may think that he is handling everything quite well, when in fact the pilot is beyond his/her ability to respond appropriately. Stress is also cumulative, and if the stress becomes too great, the pilot's performance begins to decline, and judgment deteriorates. The indicators of excessive stress often show as three types of symptoms; emotional, physical and behavioral. The AC suggested that the pilot should preflight himself as well as the aircraft, and that he should ask multiple questions about his fitness for flight, including "Am I tired? Did I get a good night's sleep last night? and Am I under undue stress?"

The AC presented a "personal checklist of basic principles that cannot be compromised" by any pilot. In part, the checklist stated that that "Flight with less than the required minimum fuel is never reasonable" and that "Casual neglect of any applicable checklist is never justified." Finally, the AC presented an "I'M SAFE" checklist which included questions that the pilot should ask himself, including "Am I under psychological pressure from the job?" and "Am I tired and not adequately rested?"

Flight Plans and Other Precautionary Measures

According to a pilot/employee of the operator, the accident pilot/operator did not have any formalized procedures regarding survey flights, and the survey flights were typically conducted with the VFR code of 1200 set on the transponder. He also stated that both he and the accident pilot typically filed flight plans for their survey flights. The pilot/employee noted that some customers regularly, and of their own volition, notified the Coast Guard about their departure, routing, and return intentions. He stated that some passengers also arranged for regular (e.g. every 30 minutes) radio "check-ins" with the Coast Guard, in order to provide them with some measure of security in case a problem arose with the airplane, particularly if a ditching was required. No such arrangements for the accident flight were discovered.

Examination of the wreckage revealed that the airplane was equipped with two aircraft communications transceivers, as well as a Uniden MC1020 "VHF Marine Radio." This radio was required by the environmental services company contract with the operator. According to Uniden information, the radio operated in the frequency range of 156 to 163 megahertz, had the capability to transmit on 54 discrete channels, and to receive 77 marine channels, and 10

weather channels. No distress communications were transmitted by, or received from, the accident airplane.

Environmental Services Company Pre-Accident Observations and Communications

On April 18, 2008, personnel from the environmental services company documented their concerns about a just-completed survey flight with the accident airplane and pilot. The documentation stated that "radio communications are not acceptable...and there was electronic smoke in the aircraft today. Also the pilot was not on his best game with regards to flying." The personnel were told by the pilot that "the smoke was not an issue and it only affects the fuel gauges."

On May 16, after the first May survey flight and which was the day prior to the accident flight, the lead surveyor reported to her company that the "aerial survey crew had serious concerns about [the pilot's] behavior while up in the air. It seemed as though he was incredibly overtired, to the point that [she] passed a note back to the other two observers questioning if [they] should continue" the flight.

Accident Airplane Maintenance Records

Searches of the operator's facility at CQX, and also other locations, produced an incomplete set of maintenance records for the accident airplane. On two separate occasions, FAA inspectors examined two different sets of maintenance records for the accident airplane. In both cases, the inspectors determined that the records were incomplete and exhibited multiple deficiencies. Virtually all the entries in the maintenance records from 1998 forward bore the signature and certificate number of the accident pilot.

The oldest airframe records were from August 1966, and the most recent were from March 2003. The most recent annual inspection entry was dated June 25, 2002, and the records indicated an aircraft total time (TT) in service of 4,745.5 hours. According to the records, the front engine was installed on the airplane in March 1988, and the rear engine was installed in February 1998. The records indicated that each engine had a time of "0.0" hours since major overhaul at the time of its respective installation. Since front engine lacked a data plate, its serial number was established by researching TCM records for the specific crankshaft and crankcase halves; the resulting engine serial number matched the number in the maintenance records. The most recent airframe and engine maintenance entries were dated March 11, 2003, and indicated a TT of 4,763.1 hours. Examination of the Airworthiness Directive (AD) compliance records revealed that numerous records were missing for the airplane, engines and accessories.

C-337 Fuel Management

According to the Cessna 337 Owner's Manual (OM), for airplanes equipped with auxiliary fuel tanks, the electric pumps are not plumbed to the auxiliary fuel tanks, and therefore the engines

can only be primed from the main tanks. This necessitates that the fuel selector valves be set to the main tanks for engine start and takeoff. For the same reason, the "Engine-Out During Flight" checklist in the OM specified that the fuel selector valve should be set to the main tank for an engine restart attempt. Finally, the OM specified that the main tanks should be used for 60 minutes prior to switching to the auxiliary tanks, and this information also appeared as a placard on the fuel selector panel.

Accident Airplane Fuel Quantity Gauges

The airplane's four fuel quantity gauges were examined. All showed signs of burning and overheating on their coils. Overhaul guidance documentation specified that the electrical resistance "across the disconnected stud terminals" on each fuel gauge was to be between 200 and 250 ohms. Resistance measurements yielded a value of 0 ohms for each gauge, denoting that the coils were shorted, and therefore would not function properly. The pre-accident condition of the gauges could not be positively determined.

Accident Airplane Fuel Quantity Sending Units

The airplane was equipped with a total of six float-type fuel quantity sending units, one in each tank. Maintenance records indicated that three (right main outboard, right main inboard, and one auxiliary) sending units were overhauled and returned to service between May 1998 and May 1999. No records were located for the other three units. Post accident examination of the units revealed that five of the six had fractured resistor coils, and three of the six had burned resistor coils. Only one unit (right auxiliary tank) had an intact and unburned resistor coil. According to a technician at the facility that overhauled these units, a burned resistor coil is a common failure signature on the sending units installed on the accident airplane model, and could occur pre- or post-accident. Electrical resistance testing of the sending unit coils revealed that none of the coils were in compliance with the design values, but the pre-accident condition of the coils could not be determined.

Accident Airplane Electric Fuel Pumps

The airplane was equipped with two identical-model electric fuel pumps. The pump mounted in the right wing was plumbed to provide fuel from the right main tank to either engine, and the pump mounted in the left wing was plumbed to provide fuel from the left main tank to either engine. When provided with an external power supply of 28 volts, no input head, and no output resistance, the right wing pump provided a flow of approximately 69 gallons per hour (gph), and the left wing pump provided a flow of approximately 62 gph. Each pump bore a placard that stated "35 GPH at 24 PSI Duty - Continuous."

Accident Airplane Engine Test Runs

On July 22 and 23, 2008, the engines were examined, impact-damaged components were replaced as necessary, and the engines were then test run at the TCM facility under FAA

supervision. According to the TCM test reports, which are contained in the NTSB docket, the front engine "accelerated normally without any hesitation, stumbling or interruption in power and demonstrated the ability to produce rated horsepower," and the rear engine "accelerated normally without any hesitation, stumbling or interruption in power and demonstrated the ability to produce rated horsepower" throughout all test phases.

Pilot Information

Certificate:	Commercial	**Age:**	60,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Unknown	**Last FAA Medical Exam:**	December 12, 2007
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 24, 2008
Flight Time:	(Estimated) 3775 hours (Total, all aircraft), 285 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N5382S
Model/Series:	337A	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	337-4082
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	June 25, 2002 Annual	**Certified Max Gross Wt.:**	4200 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	4745 Hrs as of last inspection	**Engine Manufacturer:**	Teledyne Continental
ELT:	Installed, not activated	**Engine Model/Series:**	IO-360
Registered Owner:	John A Ambroult	**Rated Power:**	180 Horsepower
Operator:	John A Ambroult	**Operating Certificate(s) Held:**	None
Operator Does Business As:	Ambroult Aviation	**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	ACY	**Distance from Accident Site:**	20 Nautical Miles
Observation Time:	12:54 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	11 knots / 16 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.61 inches Hg	**Temperature/Dew Point:**	21°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Millville, NJ (MIV)	**Type of Flight Plan Filed:**	None
Destination:		**Type of Clearance:**	None
Departure Time:	11:10 Local	**Type of Airspace:**	

Airport Information

Airport:	Eagles Nest 31E	**Runway Surface Type:**	
Airport Elevation:	35 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal, 2 Serious	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal, 2 Serious	**Latitude, Longitude:**	39.661109,-74.305557(est)

Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	Fred Blauth; FAA/FSDO; Philadelphia, PA Jason Lukasik; Teledyne Continental Motors; Mobile, AL Andrew Hall; Cessna Aircraft Company; Wichita, KS Gerard Leipfinger; New Jersey Department of Aeronautics; Trenton, NJ
Original Publish Date:	April 22, 2010
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=68030