



National Transportation Safety Board Aviation Accident Final Report

Location:	FLAGSTAFF, AZ	Accident Number:	LAX95FA076
Date & Time:	01/11/1995, 1805 MST	Registration:	N746FE
Aircraft:	CESSNA 208B	Aircraft Damage:	Destroyed
Defining Event:		Injuries:	1 Fatal
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

A WITNESS LOCATED NEAR THE DEPARTURE END OF THE RUNWAY SAW THE AIRPLANE INITIALLY CLIMB IN A NORMAL MANNER, THEN STAY BELOW THE CLOUDS AND MAKE A SHALLOW BANK 180-DEGREE LEFT TURN AND DESCEND BELOW A TREE LINE. TOWER TAPES REVEALED THAT THE PILOT TWICE TRANSMITTED THAT HE WAS "COMING BACK" TO THE AIRPORT DURING WHICH THE BACKGROUND SOUND OF THE "FUEL SELECTOR OFF" WARNING HORN WAS HEARD. THE PILOT THEN INFORMED THE CONTROLLER "I'VE GOT TO GET BACK", AND NO WARNING HORN WAS HEARD. THE AIRPLANE COLLIDED WITH TREES AND CAME TO REST ABOUT 6,500 FEET SSE OF THE RUNWAY'S END. PRIOR TO DEPARTURE, THE AIRPLANE WAS REFUELED WITH 40 GALS OF JET A (20 GALS PER TANK), WHICH INCREASED THE TOTAL FUEL LOAD TO 148 GALS. THE FLIGHT MANUAL REQUIRED THAT THE FUEL BALANCE BETWEEN THE LEFT AND RIGHT TANKS BE KEPT WITHIN 200 POUNDS, AND SUGGESTED TURNING OFF ONE FUEL SELECTOR TO CORRECT UNBALANCE SITUATIONS. THE CONDITION OF ONE FUEL SELECTOR TURNED OFF WILL CAUSE THE "FUEL SELECTOR OFF" WARNING HORN TO SOUND. EXAM OF THE AIRCRAFT REVEALED NO EVIDENCE OF PREIMPACT FAILURES. PROP BLADE BUTT SIGNATURES INDICATED IT WAS OPERATING IN THE GOVERNING RANGE, AND ENGINE POWER WAS BEING PRODUCED AT IMPACT.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to properly configure the aircraft fuel system prior to takeoff, and his failure maintain an adequate terrain clearance altitude while maneuvering to return to the airport. Factors in the accident were the dark night lighting conditions, low ceilings, restricted visibility conditions, and the pilot's diverted attention which resulted from activation of the airplane's fuel selector warning horn system.

Findings

Occurrence #1: MISCELLANEOUS/OTHER

Phase of Operation: TAKEOFF - INITIAL CLIMB

Findings

1. FUEL SYSTEM,SELECTOR/VALVE - SWITCHED OFF
 2. (C) FUEL TANK SELECTOR POSITION - NOT CORRECTED - PILOT IN COMMAND
 3. WARNING SYSTEM(OTHER) - ACTIVATED
 4. REMEDIAL ACTION - INITIATED - PILOT IN COMMAND
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Occurrence #2: IN FLIGHT COLLISION WITH TERRAIN/WATER

Phase of Operation: MANEUVERING - TURN TO LANDING AREA (EMERGENCY)

Findings

5. (F) WEATHER CONDITION - LOW CEILING
6. (F) WEATHER CONDITION - SNOW
7. (F) LIGHT CONDITION - DARK NIGHT
8. (C) ALTITUDE - INADEQUATE - PILOT IN COMMAND
9. (F) DIVERTED ATTENTION - PILOT IN COMMAND
10. (C) CLEARANCE - NOT MAINTAINED - PILOT IN COMMAND

Factual Information

HISTORY OF FLIGHT

On January 11, 1995, about 1805 hours mountain standard time (mst), a Cessna 208B, N746FE, operated by Empire Airlines, Inc. as flight number 7551, collided with terrain, about 1.5 nautical miles (nm) south of the Flagstaff Pulliam Airport, Flagstaff, Arizona. The accident occurred while the pilot was attempting to return to the airport after taking off from runway 21. The airplane was transporting cargo under contract with Federal Express during the dark nighttime air taxi flight. Instrument meteorological conditions prevailed, and an instrument flight plan was filed. The airplane was destroyed, and the airline transport pilot was fatally injured.

Prior to taking off on the accident flight, the airplane was partially refueled, and it was loaded with cargo. The scheduled block out time was 1800.

At 1746, the local air traffic controller cleared N746FE (using radio call sign "Empire five fifty-one") to taxi for takeoff. The pilot indicated that he desired to fly under instrument flight rules to Phoenix, Arizona. A few minutes later, the controller informed the pilot that his departure would be delayed because air traffic was busy.

At 1801:56 the controller cleared N746FE for takeoff. The controller reported to the National Transportation Safety Board that he estimated the airplane became airborne about 3,000 feet down the runway. Nothing unusual was noted.

Another pilot, who was waiting for takeoff in a Beech King Air near the approach end of runway 03, reported that when the accident airplane passed over the departure end of runway 21, it had climbed 200 to 300 feet above the runway's surface. Nothing unusual was noted except that the airplane "did not seem to be climbing very well." The Beech pilot further reported that the airplane commenced turning left approximately 1/4 to 1/2 mile beyond the end of the runway. The rate of turn "seemed normal and not excessive."

At 1803:50 the controller instructed N746FE to contact Albuquerque Center, and three seconds later the pilot acknowledged the instruction.

Then, at 1803:57 the pilot stated "Five fifty-one's coming back in," which was followed 6 seconds later with "I'm coming back to the airport."

The controller asked the pilot if he had the airport in sight. The pilot replied at 1804:12 with the following brief statement: "No but I've got to get back." The controller then stated "OK Empire five fifty-one say nature of difficulty please." The pilot's reply was unintelligible. At 1804:25 the controller stated "Empire five fifty-one your not in sight cleared to land either runway."

The Beech King Air pilot provided the following account of his observations regarding the accident airplane's flight path:

After taking off, the airplane initially flew straight ahead, but then commenced a left 180-degree turn to an approximate heading of 030 degrees to parallel the runway. "The rate of turn seemed normal and not excessive (and the airplane) . . . did not seem to be climbing and may have even been descending." The Beech pilot further reported that the airplane "did not appear to be stalled or wobbling when last seen." The Beech pilot said that he lost sight of the

airplane's lights when it descended behind trees. The crash site was located in a snow-covered hilly forest, approximately 6,500 feet south-southeast of the runway's departure end.

A Federal Express ramp agent, who was located at the airport, also observed the airplane depart. The agent indicated that the airplane passed "overhead (by) approximately 100 to 120 feet" and was climbing. The airplane then entered a left bank turn, lost altitude, and disappeared over a tree line.

PERSONNEL INFORMATION

The pilot held an airline transport pilot certificate, with single and multiengine land ratings, a multiengine sea rating, and several type ratings. The pilot also possessed a certified flight instructor certificate for single and multiengine airplanes which was last renewed in April of 1994.

Empire Airlines (the operator) hired the pilot in March of 1990. In April of 1993, the FAA approved the pilot to serve as a check airman in the Cessna 208. The pilot was authorized to give proficiency and line checks to the operator's pilots.

In March, 1994, the pilot completed recurrent academic and simulator training by Flight Safety International. In October, 1994, the pilot successfully completed a 1.4-hour-long flight competency check in the Cessna 208, which included normal and emergency procedures.

By the accident date, the pilot had logged about 10,000 hours of total flight time, of which about 2,000 hours were logged flying the Cessna 208 series airplanes. The pilot had logged about 2,000 hours of night flying time and about 800 hours of time flying in instrument weather conditions.

During the preceding 24-hour, 30-day, and 90-day period, the pilot had flown the Cessna 208 for 2, 36, and 100 hours, respectively. Also, during the preceding 90 days the pilot had flown about 25 hours at night. The operator's flight time records indicated that during the 30-day period which preceded the crash, the pilot had flown the accident airplane between Flagstaff and Phoenix over 34 times.

Family members reported that the pilot only flew airplanes for the operator, and recently he only flew Cessna 208s. The pilot resided near Flagstaff, and he was extremely familiar with the terrain which surrounded the airport.

AIRPLANE INFORMATION

Refueling.

The airplane was manufactured in 1990, and it was equipped with 2 wing fuel tanks, each having a usable capacity of 165 gallons. In preparation for takeoff, around 1730, the airplane was fueled with 40.0 gallons of jet A fuel (20 gallons per tank), which increased the total fuel load to approximately 148 gallons (1,006.4 pounds).

Weight.

The maximum certificated airplane weight for flight into known icing conditions with the cargo pod installed was 8,550 pounds. On takeoff, the airplane's estimated gross weight was 7,963 pounds which included a cargo load of about 2,211 pounds.

Takeoff Distance.

Based upon Cessna and Federal Express supplied data and calculations, projections were made to determine the takeoff distance (required runway length) and the approximate altitude the airplane could have attained upon passing the end of the runway (assuming no snow). The airplane, as loaded, was calculated to have been able to climb to between 100 and 200 feet above the surface upon passing the runway end.

Flight Path Data.

Additional calculations were performed to determine the required rate of turn (degrees per second) necessary to arrive at the accident site assuming utilization of a normal departure climb speed profile and witness described flight path. After takeoff, an airplane commencing a left turn at an approximate rate between 3 and 6 degrees per second could arrive in the vicinity of the crash site while flying in an arc consistent with the accident airplane's observed flight path.

Maintenance.

The airplane's routine maintenance records, including engine condition trend monitoring/performance data, and nonroutine records involving avionics discrepancies, engine exceedences, and repetitive write ups, etc., were reviewed by the Federal Aviation Administration (FAA). No irregularities pertinent to the accident flight were identified.

The airplane's flight record logbook was recovered from the accident site. A review of the logbook revealed no evidence of pertinent squawks or deferred items.

Fuel System Operation and Warnings.

The following statement was contained in the Cessna 208B Caravan Information Manual: "Before refueling, or when the airplane is parked on a slope, turn off one of the fuel tank selectors. . . ."

The Information Manual provided pilots with the following instructions regarding fuel unbalance situations: "Fuel unbalance should be monitored to assure it does not exceed 200 pounds. . . . If fuel unbalance approaching 200 pounds does occur, the fuel tank selector for the tank with less fuel should be turned OFF until the tanks become balanced. With one fuel tank selector OFF and fuel remaining in the tank being used less than approximately 25 gallons, the FUEL SELECT OFF annunciator will illuminate and a warning horn will be activated." The airplane is placarded with the following statement: "MAXIMUM FUEL UNBALANCE IN FLIGHT: 200 LBS."

The Information Manual stated the following regarding the Fuel Selectors Off Warning System: "A fuel selectors off warning system is incorporated to alert the pilot if one or both of the fuel tank selectors are left in the OFF position inadvertently. The system includes redundant warning horns, (and) a red annunciator light labeled FUEL SELECT OFF. . . ."

In pertinent part, the system functioned as follows: "(1) If both the left and right fuel tank shutoff valves are closed (fuel tank selectors in the OFF position), the red FUEL SELECT OFF annunciator illuminates and one of the fuel selector off warning horns is activated; (2) During an engine start operation (STARTER switch in START or MOTOR position) with either the left or right fuel tank shutoff valves closed, the red FUEL SELECT OFF annunciator illuminates and both of the fuel select off warning horns are activated; (3) With one fuel tank selector OFF and fuel remaining in the tank being used less than approximately 25 gallons, the FUEL SELECT OFF annunciator illuminates and one of the fuel selector off warning horns is

activated."

Regarding taking off with both of the airplane's fuel selectors in the off position, the Information Manual stated that "there is only enough fuel in the reservoir for approximately 1-1/2 minutes of engine operation at maximum continuous power after illumination of the RESERVOIR FUEL LOW annunciator."

Flight Into Icing Conditions.

The airplane was certificated and equipped for flight into known icing conditions. In pertinent part, the Information Manual stated the following:

"The in-flight ice protection equipment was not designed to remove ice, snow, or frost accumulations on a parked airplane sufficiently enough to ensure a safe takeoff or subsequent flight. Other means (such as . . . approved de-icing solutions) must be employed to ensure that all wing, strut, landing gear, cargo pod, tail, control, propeller, and windshield surfaces and the fuel vents are free of ice, snow, and frost accumulations, and that there are no internal accumulations of ice or debris in the control surfaces, engine intakes, pitot-static system ports, and fuel vents prior to takeoff."

Airplane Deice Program.

Empire Airlines had an FAA Approved Part 135 deice program in place for the operation of its Caravans. In brief, the program indicated that the pilot-in-command was responsible for deciding when deicing or anti-icing was necessary, and for coordinating with local facilities for its accomplishment.

In the program, deicing was defined as "a procedure by which ice, frost or snow is removed from the aircraft in order to provide clean, aerodynamically correct surfaces." Anti-icing was defined as "a procedure which provides protection against formation of frost or ice and accumulation of snow or slush on clean surfaces of the aircraft for a limited period of time. . . ."

The program indicated that ". . . when snow . . . is falling, deicing should be accomplished as close to departure time as possible. Also, when moderate-to-heavy snow is falling at departure time, it may be necessary to perform a two step procedure. After the initial deicing is accomplished, a second fluid application may need to be applied in order to maximize protection.

Regarding ice removal, the program indicated that when wet snow is falling, anti-icing solution should be applied to the entire airplane if the airplane will not depart within 15 minutes.

Empire Airlines had a policy of not deicing its Caravans with the engine running.

To additionally ensure that the airplane was free of contamination, pilots were provided with the following guidance regarding performance of a pretakeoff check: "This check of the representative surface(s) is made by the pilot from the cockpit within five minutes of takeoff any time there is a threat of contamination. If contamination is sticking to the representative surface(s) the airplane should be deiced again before takeoff. The representative surface of the Caravan is the upper surface of the wing-mounted radar pod."

METEOROLOGICAL INFORMATION

Weather Briefings.

At 1236, the pilot received a direct user access system (DUAT) weather briefing for a proposed

1 hour 10 minute flight between Phoenix and Flagstaff. The proposed departure time was 1600. At 1255, the pilot received an abbreviated weather briefing from the Prescott Flight Service Station for a proposed round trip flight between Phoenix and Flagstaff. The proposed return trip departure time out of Flagstaff was 1800. Regarding the forecast for Flagstaff weather, the briefer made the following statement to the pilot: ". . . up until four o'clock (2100 mst) they're forecasting ceilings two hundred overcast winds two two zero at ten occasional two hundred scattered ceiling seven hundred broken visibility three miles light rain light snow and fog. . . ."

At 1304, the pilot received another DUAT weather briefing for a proposed flight between Phoenix and Flagstaff.

Airplane Ice/Snow.

Several witnesses observed N746FE prior to its departure. Empire Airlines and Federal Express personnel reported that the pilot did not make a request to have the airplane deiced, and none reported observing any ice or snow on the airplane.

One of the witnesses reported that around 1730 the airplane had just finished being refueled and was parked outside on the ramp. By 1744 the cargo loading operation had been completed, and the witness moved his truck away from the airplane. A minute later, the airplane taxied away. The witness further reported "it was snowing a heavy wet snow which was accumulating on the trucks." Another witness reported that while the airplane was waiting for takeoff "the snowfall increased (wet & heavy)." Still another witness reported that while waiting for the airplane to takeoff, "the snow was coming down heavily." This witness also reported that just before the airplane departed he returned to his vehicle and observed a lot of slush on it.

The Beech King Air pilot reported that about 1800 he taxied from a warm hanger to takeoff on runway 03. The pilot made the following written report regarding his observations of the snow: "Initially it was snowing heavily with big wet snowflakes. The snow on my aircraft was accumulating only on the outboard wing panels (outboard of the prop blast and appeared to be melting and running off. It seems we waited for our clearances for a long time. I am going to estimate a 15 minute wait. Toward the end of the wait for clearance the snow fall changed to small dry snowflakes and the visibility improved."

Flagstaff Weather.

An automated surface observing system (AO2A) was installed at the Flagstaff Airport which recorded the local weather at 5 minute intervals. According to the AO2A reports, around 1715 the temperature dropped from 35 to 34 degrees Fahrenheit, and a light snow began falling. Around 1755 the temperature lowered to 33 degrees F. The snow continued until after the accident.

The local air traffic controller reported to the Safety Board that at 1746 it was snowing when he cleared N746FE to taxi for takeoff. Thereafter, the controller observed the airplane taxi past the tower and recalled that it was still snowing.

At 1801:21, the controller made the following statement to N746FE regarding the weather: "Empire five fifty-one flagstaff weather zero zero five six observation (1756 mst) measured ceiling two hundred broken one thousand overcast visibility three quarters of a mile with light snow and fog." The pilot acknowledged the report.

AIDS TO NAVIGATION, COMMUNICATIONS, AND SERVICES

According to FAA records of facility operations, all electronic aids to navigation pertinent to the airplane's route of flight were functional in the vicinity of the Flagstaff airport.

The FAA reported that all communications and services provided to the pilot were normal. There were no impairments of its ground-to-air communications.

AIRPORT FACILITIES

The Flagstaff Pulliam Airport's elevation is 7,011 feet msl. Runway 21 is 6,999 feet long.

FLIGHT RECORDERS

The airplane was not equipped with a flight recorder. However, on October 7, 1994, at an aircraft total time of 2,297.4 hours, a "Power Analyzer & Recorder" (PAR) performance computer was installed in the belly of the fuselage, and it was functionally checked and calibrated.

The PAR recorded specific parameters of normal engine and airplane operation in addition to exceedences of, for example, engine torque, interstage turbine temperature, propeller and compressor speed, and airspeed. It also recorded external data such as outside air temperature and event times. The PAR was recovered intact from the crash site, and all stored data was extracted.

An examination of the PAR data indicated that, in part, at 1745:06 the airplane's engine was started. (The PAR clock was synchronized to the airplane's instrument panel clock.) At that time, the outside air temperature (OAT) was -1 degree Celsius (30.2 degrees Fahrenheit), and the airplane's indicated airspeed (IAS) was 0 knots.

The next (and final) recorded event occurred during flight at 1803:23, when power to the PAR was interrupted (terminated), and data was automatically captured. In part, the data included the following information: OAT -2 degrees Celsius (28.4 degrees Fahrenheit); IAS 61 knots; and propeller rotational speed (NP) 1320 RPM. No exceedences were recorded during the accident flight.

WRECKAGE AND IMPACT INFORMATION

From an examination of the accident site, airplane wreckage, and witness statements, the airplane was found to have collided with trees and terrain about 1.41 nm south (165 degrees, magnetic) of the center of the Flagstaff Airport. The main wreckage was located approximately 35 degrees, 6 minutes, 54 seconds north latitude, by 111 degrees, 40 minutes, 12 seconds west longitude. The estimated crash site elevation was between 6,950 and 7,000 feet msl.

Portions of fragmented airplane structure and severed tree limbs/trunks were observed leading to the main wreckage along a magnetic track of about 050 degrees. The initial point of tree impact (IPI) was noted by the presence of a severed tree limb, and about 60 feet northeast a 4-foot-long wing section was found in a tree.

Along the initial wreckage path, the lateral distance between severed tree limbs appeared consistent with the 52-foot-long lateral distance between the airplane's wingtips. The distance was consistent with impact by the airplane in a near wings level flight attitude.

Additional wing sections, the right wing lift strut, and the radar dome were found between 99 and 306 feet to the northeast of the IPI. The main wreckage was found about 418 feet from the IPI. Over half dozen 25- to 50-foot-tall trees having 1-foot diameters were observed felled at

the site. There was no evidence of fire.

Airframe Examination.

All of the airplane's flight control surfaces, and the majority of the wing and tail structure were located in the vicinity of the main wreckage area. The cockpit was found at ground level, partially upside down, and on a magnetic heading of 045 degrees. The measured right bank angle of the fuselage was 128 degrees, and the nose-down pitch attitude was 27 degrees.

The leading edges of the wings and horizontal stabilizer bore impact signatures in an aft direction which appeared consistent with the surrounding felled trees. No evidence was observed of any preimpact failure of the flight control system.

The fuselage was observed circumferentially broken open in the area behind the cargo door and forward of the beginning of the dorsal fin. This area was in the vicinity of the attachment point for the emergency locator transmitter (ELT). The aft portion of the fuselage was found pointed in a nearly vertical downward direction, and was observed rotated about 90 degrees from the remainder of the fuselage (see photographs).

Engine Examination.

The engine was found intact, and oil was present in the main oil filter assembly. The gas generator was observed to rotate freely, and continuity was established with the accessory gearbox. No engine case penetration was observed. The propeller shaft was rotated, and continuity was established with the gear train for the power section mounted accessories.

Fuel was found in the fuel line connected to the high pressure fuel pump, and in the engine driven fuel pump. The fuel pump filter was found clean.

Propeller Examination.

The propeller assembly was located several feet below ground level, adjacent to the main wreckage, and was broken off from the engine. The propeller assembly retaining bolts were observed stripped from the mounting attachment hub and had remained with the engine propeller shaft. The three propeller blades were found attached to the hub/spinner. The blades were observed torsionally deformed, one was bent into an "S" shape, and all of the blades bore abrasions/scratches in a chordwise direction over their cambered surface.

Checklist.

The Cessna Caravan, Model 208B, "Pilot's Checklist" (booklet) was recovered from the airplane wreckage. Pages in the booklet were observed held together with a plastic spiral binder. The booklet contained major sections which were entitled: "Normal Procedures, Systems Checks, Emergency Procedures, and Performance."

The booklet, which was designed with tabs for quick opening/ reference was found opened to the red color tabbed section entitled "EMERGENCY PROCEDURES," between page numbers E-14 and E-17. Pages E-15 and E-16 were observed ripped in half, and the bottom portion of these pages were not located.

Pages E-15/16 were observed soiled. The adjacent pages (E-14 and E-17) were also observed soiled, but to a lesser degree. Other pages in the booklet were not noticeably soiled.

The following main section titles appeared in capital letters on the referenced pages:

Page E-14. Engine Malfunctions Fuel System Malfunction/Inadvertent Fuel
Flow Interruption Procedures

Page E-15. (continuation of page E-14)

Page E-16. Flap System Malfunction Procedures

Page E-17. Landing Gear Malfunction Procedures

MEDICAL AND PATHOLOGICAL INFORMATION

Family members and operator employees reported that the pilot appeared to have been in good health within several days of the accident. In particular, prior to departing from Flagstaff the pilot did not appear ill.

On January 13, 1995, an autopsy was performed on the pilot by the Office of the Coconino County Medical Examiner, 2500 North Fort Valley Road, Flagstaff, Arizona.

Results of toxicology tests performed by the FAA were negative for ethanol and all screened drugs.

SURVIVAL ASPECTS

An extensive search was initiated within minutes of the airplane's failure to return to the Flagstaff Airport. The Coconino County Sheriff's Department declared that the search effort be called a major incident, and additional resources were requested and received. Search and rescue personnel and equipment were utilized from the following additional organizations: Civil Air Patrol, Arizona Departments of Public Safety and Game & Fish, Flagstaff Police & Fire Departments, Flagstaff Airport, Federal Express, and Empire Airlines. No signal from the airplane's ELT was received.

The airplane wreckage was located around 0815 the following morning. The pilot was found inside the partially upside-down cockpit, and was restrained by his seat belt/harness assembly. The Coconino County Medical Examiner reported that the cause of death was multiple traumatic injuries due to impact.

ELT Airframe Mount Location and Failure Information.

Cessna reported that, when it manufactured the airplane, it installed the Pointer Model 3000 ELT behind the aft cabin partition wall on the right-hand side of the tailcone. The ELT was found at this location in the accident airplane.

During the wreckage examination, the ELT transmitter box was found separated from its airframe attachment mounting bracket. The ELT transmitter was located in the snow-covered hillside between 10 and 15 yards from the main wreckage. The ELT antenna remained attached to its airframe mount.

TESTS AND RESEARCH

The ELT, manufactured in 1990 by Pointer, Inc., had been installed into the Caravan along with Pointer's airframe assembly attachment mounting bracket. Pointer examined the ELT assembly. Pointer verbally reported finding no evidence that either the ELT or its airframe attachment bracket had been modified since having been factory installed.

Pointer reported finding no evidence of preimpact failure of either the transmitter box housing or the associated airframe mounting bracket. Also, no evidence was found indicating the ELT

had been improperly installed or secured to the airframe structure. Pointer opined that the ELT transmitter box had evidently departed from its mounting bracket upon being subjected to impact loads which exceeded the design strength of the bracket.

Pointer further reported that the ELT did not transmit a distress signal because of the internal failure of its 121.5 Mhz quartz crystal. The crystal's failure appeared to have been impact related.

An additional examination was performed on the ELT attachment mounting bracket. Pointer opined that the observed inward deformation (curl) to the bracket's side structure was indicative of the bracket having been impacted by an (unidentified) airframe component, or possibly by cargo or some other structure, following dislodgment of the ELT box.

Engine Teardown Examination.

The Transportation Safety Board of Canada oversaw the engine teardown examination and reported finding no discrepancies. Regarding signatures indicative of the existence of engine power, the Transportation Safety Board indicated finding sufficient rub marks with corresponding evidence of frictional heat discoloration to indicate that power was being generated at impact, but at an unknown level. The engine controls and accessories were also disassembled, and no anomalies affecting normal operation were noted.

Pratt & Whitney of Canada provided a teardown report and summary statement indicating the following findings and conclusions: The engine displayed moderate impact damage including light compressional deformation of the gas generator case. Strong circumferential rubbing and machining were displayed by the compressor turbine disc and the power turbine guide vane ring due to axial contact under impact loads and external case distortion. The power turbine disc and interstage baffle, and the power turbine blade tips and shroud, displayed strong circumferential rubbing and machining due to radial contact under impact loads and external case distortion. There were no indications of any operational distress or dysfunction to any of the engine components examined that would preclude normal operation. In conclusion, the engine displayed rotational signatures to the internal components characteristic of the engine developing power at impact, likely in a high power range.

Propeller Teardown Examination.

The FAA oversaw the propeller teardown examination conducted by the McCauley Accessory Division of the Cessna Aircraft Company. During the teardown, various damage signature marks on components were accessed to determine blade pitch settings and an indication of power at impact. McCauley reported that the impact signature marks found on the blade butts and the counterweight impact mark were indicative of the blades being at an angle of at least 15 to 17.5 degrees at impact. As designed, the low pitch (low power) blade angle on the installation was 11.1 degrees. Therefore, "if the accident aircraft were operating at a relatively low speed at impact, a blade angle finding of 15 to 17.5 degrees would indicate that the propeller was governing above the low pitch stop position and was being operated with power. . ."

In summary, McCauley reported that the overall blade bending, twisting, and impact mark signatures indicated the propeller was likely rotating under high power at impact. There were no indications of any type of preimpact propeller failure.

Annunciator Panel Examination.

The impact damaged annunciator panel was removed from the wreckage and was examined by the Safety Board's Materials Laboratory Division, Office of Research and Engineering, Washington, D.C. The examination was performed to ascertain the status of various airplane systems as reflected by the illumination of annunciator lights.

In summary, the panel was found composed of 24 indicator units, each with two light bulbs. Seven of the 24 individual indicator units were missing in their entirety. The face plates from five additional units were also missing.

The filaments from each of the light bulbs in the indicator units were examined for evidence of stretching. Evidence of stretching was noted in at least one of the bulb filaments from the following units: IGNITION ON, VOLTAGE LOW, STANDBY ELECTRICAL POWER ON, FUEL SELECT OFF, and BATTERY HOT.

No observations were made regarding the filament status of the bulbs in the Emergency Power Lever indicator unit. Neither of those filaments were located.

The Cessna Aircraft participant reported that due to an on-going service test being conducted which utilized a battery having a design different than the original battery, the electrical circuits to the annunciator panel "Battery Hot" (and "Battery Overheat") lights had been disconnected at the battery end.

Audio Tape Recording Examination.

The Safety Board's Engineering Services Division Laboratory examined background sounds recorded by the Flagstaff Air Traffic Control Tower on its communications tape between its facility and the accident pilot. The examination revealed the presence of an intermittent sounding horn during the last minute of flight when the pilot made several transmissions on the local tower frequency.

Specifically, during the pilot's transmission of "Five fifty-one's coming back in" which started at 1803:57, eight beeps, 0.2 seconds apart, at a frequency of 2,800 Hz, were detected.

At 1804:03, during the pilot's transmission of "I'm coming back to the airport," six beeps, 0.2 seconds apart, at a frequency of 2,800 Hz, were detected. No beep sounds were heard during the pilot's next transmission of "No but I've got to get back," which lasted 1.1 seconds.

Empire Airlines personnel tested a similar model Caravan at the Flagstaff Airport. During the test, they listened to the warning horns in the airplane, and compared the horns to the horn noise which was heard transmitted as a distinctive background sound on the rerecorded Flagstaff Tower tape of the accident flight. Empire Airlines opined that the background noise heard on the tape during the pilot's transmissions corresponded to the FUEL SELECTOR OFF warning horn.

Participants from Cessna verbally reported that the horn sounds, which they also heard on the tape, closely matched the prescribed frequency of the FUEL SELECTOR OFF warning horns in other similar model Caravans. Cessna further reported that the dual horn sounds on the tape matched the condition wherein both fuel selectors were set to the OFF position.

ADDITIONAL INFORMATION

The Pratt & Whitney Engine and McCauley propeller were verbally released to the operator upon completion of the teardown examinations on February 3 and 20, 1995, respectively. The main airplane wreckage was verbally released to the operator on February 10, 1995. The

cockpit annunciator panel, ELT transmitter, antenna and mounting assembly, and the PAR computer were released on December 4, 1995. No parts or records were retained.

Additional Participants.

The following additional persons/organizations participated in the investigation:

Steven E. Leeper	Federal Aviation Administration,	WP-FSDO-SDL
Paul Crosby	United Technologies Pratt & Whitney	Canada Services, P.O. Box
270,	Farmington, NM 87499	
Gregory P. Young	Pratt & Whitney	
Al L. Folsom,	Empire Airlines Thomas J. Kammers	" " Lanson Unruh " "
Francis Defelre	" "	
Walter M. Kuemmerle	Federal Express Bruce Erickson	" " Ted Elwell " " John
Musa	" " Wayne Gelfand " "	

Pilot Information

Certificate:	Airline Transport; Flight Instructor	Age:	59, Male
Airplane Rating(s):	Multi-engine Land; Multi-engine Sea; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine	Toxicology Performed:	Yes
Medical Certification:	Class 2 Valid Medical--w/ waivers/lim.	Last FAA Medical Exam:	01/24/1994
Occupational Pilot:	Last Flight Review or Equivalent:		
Flight Time:	10000 hours (Total, all aircraft), 2000 hours (Total, this make and model), 7500 hours (Pilot In Command, all aircraft), 100 hours (Last 90 days, all aircraft), 36 hours (Last 30 days, all aircraft), 2 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	Registration:	N746FE
Model/Series:	208B 208B	Aircraft Category:	Airplane
Year of Manufacture:		Amateur Built:	No
Airworthiness Certificate:	Normal	Serial Number:	208B0236
Landing Gear Type:	Tricycle	Seats:	2
Date/Type of Last Inspection:	12/02/1994, AAIP	Certified Max Gross Wt.:	8550 lbs
Time Since Last Inspection:	40 Hours	Engines:	1 Turbo Prop
Airframe Total Time:	2439 Hours	Engine Manufacturer:	P&W
ELT:	Installed, not activated	Engine Model/Series:	PT6A-114A
Registered Owner:	FEDERAL EXPRESS CORPORATION	Rated Power:	675 hp
Operator:	EMPIRE AIRLINES, INC.	Operating Certificate(s) Held:	Supplemental; On-demand Air Taxi (135)
Operator Does Business As:		Operator Designator Code:	COEA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument Conditions	Condition of Light:	Night/Dark
Observation Facility, Elevation:	FLG, 7011 ft msl	Distance from Accident Site:	2 Nautical Miles
Observation Time:	1756 MST	Direction from Accident Site:	346°
Lowest Cloud Condition:	Unknown / 0 ft agl	Visibility	0.75 Miles
Lowest Ceiling:	Broken / 200 ft agl	Visibility (RVR):	0 ft
Wind Speed/Gusts:	5 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	200°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29 inches Hg	Temperature/Dew Point:	33° C / 32° C
Precipitation and Obscuration:			
Departure Point:	(FLG)	Type of Flight Plan Filed:	IFR
Destination:	PHOENIX, AZ (PHX)	Type of Clearance:	IFR
Departure Time:	1802 MST	Type of Airspace:	Class D

Airport Information

Airport:	FLAGSTAFF PULLIAM (FLG)	Runway Surface Type:	Asphalt
Airport Elevation:	7011 ft	Runway Surface Condition:	Snow--wet
Runway Used:	21	IFR Approach:	None
Runway Length/Width:	6999 ft / 150 ft	VFR Approach/Landing:	Precautionary Landing

Wreckage and Impact Information

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

Administrative Information

Investigator In Charge (IIC):	WAYNE POLLACK	Report Date:	02/14/1996
Additional Participating Persons:	ARLAN R ALLEN; SCOTTSDALE, AZ M.E. (MEL) SPELDE; HAYDEN LAKE, ID FRANK A WALSH; MEMPHIS, TN EMILE J LOHMAN; WICHITA, KS		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinquiry@ntsb.gov , or at 800-877-6799. Dockets released after this date are available at http://dms.nts.gov/pubdms/ .		

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

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