NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety

Western Pacific Region

October 15, 2018

AIRFRAME & ENGINE EXAMINATION REPORT

WPR17FA066

This document contains 6 embedded photographs.

Riverside, California

February 27, 2017

1641 PST

Cessna T310Q; N1246G

EXAMINATION PARTICIPANTS

Stephen Stein
Air Safety Investigator (IIC)
National Transportation Safety Board
Federal Way, Washington

Ricardo Asensio
Senior Air Safety Investigator
Textron Aviation
Wichita, Kansas

Howard Plagens
Senior Air Safety Investigator
National Transportation Safety Board
Federal Way, Washington

Michael Council
Air Safety Investigator
Continental Motors, Inc.
Mobile, Alabama

Jack Vanover
Air Safety Investigator
National Transportation Safety Board
Federal Way, Washington

Anthony Wood
FAA Aviation Safety Inspector
Federal Aviation Administration
Riverside, Arizona

Katherine Chisom
Victim Services Coordinator
National Transportation Safety Board
Washington, D.C.

Ricardo Hernandez
FAA Aviation Safety Inspector
Federal Aviation Administration
Riverside, Arizona

HISTORY OF FLIGHT

On February 27, 2017, about 1641 Pacific standard time, a Cessna T310Q, N1246G, was destroyed after it collided with multiple residences after its departure from Riverside Municipal Airport (RAL), Riverside, California. The airline transport pilot and three passengers were fatally injured; two passengers received serious injuries. The personal flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91. Instrument meteorological conditions prevailed and an instrument flight rules flight plan was filed for the cross-country

flight that departed RAL at 1640 and was destined for Norma Y Mineta Airport San Jose International Airport (SJC), San Jose California.

PERSONNEL INFORMATION

The pilot, age 83, held an airline transport certificate with a rating for airplane single-engine land and commercial privileges for multi-engine land. He additionally held a flight instructor certificate with ratings for airplane single and multi-engine, and instrument airplane that was issued on October 18, 2016. The pilot's most recent second-class medical certificate was issued on October 13, 2016 and included one restriction; must wear corrective lenses. At the time of the exam, the pilot reported that he had accumulated 9.600 total flight hours; 21 hours of which were in the previous 6 months.

A purchase receipt showed that the pilot purchased multiple instrument charts on February 25, 2017. The charts included L1, L2, L3, and L4 terminal instrument procedure charts and two instrument enroute low altitude charts.

AIRCRAFT INFORMATION

According to Federal Aviation Administration (FAA) records, the airplane was manufactured in 1974 and registered to Nouri and Dana Hijazi on September 25, 2007. An aircraft bill of sale indicated that the airplane was purchased by the registered owners on August 13, 2007. The airplane was powered by two Continental TSIO-520 J, turbo charged, direct drive, air cooled, 310 hp engines. Copies of the original aircraft logbooks were retrieved by the FAA from the pilot’s hangar at SJC. A review of the aircraft logbooks revealed that the airplane's most recent annual inspection was completed on February 1, 2017 at an accumulated flight time of 4,830 total hours. According to the logbook records, both the left and right engines had accrued about 1,265.1 flight hours since their most recent overhauls, which were completed on April 5, 1989 at 3,565 total time in service.

Right propeller (propeller A) serial number was 757839. The left propeller (propeller B) is referenced in the aircraft logbooks; however, the serial number of the propeller does not match the serial number recorded in the logbook.

A fuel receipt furnished by RAS Jetport indicated that the pilot purchased 54 gallons of 100 LL aviation grade gasoline on February 25, 2017. A fuel sample taken by the FAA from RAS Jetport did not show any evidence of water or debris contamination.

COMMUNICATIONS

A preliminary review of air traffic control (ATC) audio showed that the RAL controllers issued taxi instructions to the accident pilot twice before he acknowledged the direction correctly. Further, the controllers issued the IFR clearance three times before the pilot read back the authorization correctly. Prior to the pilot’s departure, a controller read the RAL obstacle departure procedure to the accident pilot verbatim to ensure he received the correct information.

The ATC facility manager stated the accident airplane departed runway 09 normally. He observed the airplane's radar target on the tower radar display as the airplane departed the field. Shortly after takeoff the target went into COAST track seconds before a plume of smoke was observed off in the distance from the departure end of runway 09. The audio recording indicated that the pilot did not make any distress calls on the airport tower frequency prior to the accident.

Airport operations did not find any foreign object debris on the runway and taxiways used by the accident airplane.

A request for radar data was submitted to the FAA Quality Control group and is awaiting receipt.

METEOROLOGICAL INFORMATION

The 1637 recorded weather observation at RAL included calm winds, visibility 2 statute miles in light rain and mist, scattered clouds at 600 feet above ground level, overcast ceiling at 4,200 feet, temperature 11 degrees C, dew point 11 degrees C, and an altimeter setting of 29.82 inches of mercury.

WITNESS REPORTS

Witness interview statements were collected from the FAA and the RAL airport manager's office.

Witness #1 – FAA Inspector

An FAA aviation safety inspector reported that he observed the airplane from his office window at the RAL Flight Standards District Office at approximately 1550 on the day of the accident. According to his recount, the pilot made multiple attempts to start the right engine. After 10 minutes, the right engine started successfully, which was immediately followed by a large amount of black smoke that exited the right engine exhaust. He subsequently started the left engine and then ran both engines up to a high power setting. The aircraft jerked forward and the engine power decreased to a lower power setting, which the witness reported as "idle." He observed the engine power cycle to a high power setting and then a low power setting again.

Witness #2 – Airport Café Patron

Another witness was in the airport café around 1600 on the day of the accident. She observed an airplane with white and green paint on the airport tarmac outside of the café. According to her recount, the airplane was parked with the engines running for an "unusual" amount of time. The airplane caught her attention because the "door" appeared to be ajar about 20 inches. The airplane then taxied from its parked position to a westerly heading, then turned to a southerly heading and then back to a westerly heading. The witness stated that about 20 minutes had elapsed between the time the airplane left its parked position and the moment it turned to its final westerly heading.

Witness #3 – Fixed Based Operator - Fueler

An aircraft fueler reported that his first contact with the accident pilot was on Friday, February 24, 2017 when he approached him from the ramp of the Fixed Based Operator (FBO). The fueler noted that the pilot was hunched over and appeared to be in pain. He appeared nervous and tired as he requested assistance in obtaining a rental car. After the pilot received the keys to his rental car he drove towards the terminal. As the fueler subsequently walked the flight line he observed 3 people at the airplane and about 4 pieces of luggage on the ground next to the airplane.

On Saturday, February 25, 2017, the fueler observed the accident pilot wandering about the flight line while he was fueling a separate aircraft. The pilot approached the fueler and asked for directions to the Philips 66 self service station. After an unsuccessful attempt to locate the self service station, the accident pilot returned to the fueler. The fueler then walked the accident pilot to the self service station, at which point the pilot stated to the fueler, "I can't do that." He subsequently provided the fueler with the tail number of the accident airplane and asked him to top the fuel tanks off. The fueler serviced the airplane with 54.2 gallons of fuel. During a conversation with the accident pilot, he first reported to the fueler that he had been flying for over 40 years and then later told him he had been flying for over 50 years. The fueler noted that the pilot appeared "unsure of himself" and "lacking confidence."

On the day of the accident, the accident pilot returned the rental car to the FBO and the fueler gave him a ride to the airport terminal.

Witness #4 – Employee of AIA Flight School

The witness reported that he sold NACO approach plates and an IFR low altitude en-route chart to the pilot on Saturday, February 25, 2017. He did not observe anything unusual about the pilot's behavior.

On the day of the accident the witness observed the accident pilot and 4 passengers inside the airport terminal. A few hours later the accident pilot bumped into an item rack as he approached the witness who was seated at his work computer. The witness noted that the pilot appeared "rushed." He asked the witness if he knew how to file an IFR flight plan. The witness directed the pilot to a list of telephone numbers posted on a wall at the flight school. He further instructed the pilot to contact a briefer at 1-800-WXBRIEF. As the witness was speaking, the passengers entered the store and the pilot told them to return to the terminal. The pilot recorded the telephone number on a post-it note and exited the store to the airport ramp. The witness then walked to the hallway to greet the passengers. They told the witness they were anxious to return to their home in San Jose and one witness remarked that she had to work the following morning. He subsequently overheard a passenger who appeared to be making ground transportation arrangements and stated they had luggage. At a later time, the witness observed the pilot attempt to start the left engine of the accident airplane. The pilot experienced some trouble starting the engine and didn't appear patient. He made multiple attempts to start the engine; at some intervals it appeared that he "held it" for approximately 10 seconds. The engine eventually started.

The witness stated that he heard "red flags" as he listened to the pilot's communications with the ground controller. He remarked that the pilot seemed unfamiliar with the departure procedure

and taxi instructions. As the pilot read back the IFR clearance his speech was intermittent, which the witness attributed to the pilot's thumb repeatedly depressing the microphone key. After the takeoff clearance was issued, the witness observed the airplane depart normally.

Witness #5 – Airport Operations Employee

According to the airport representative, he observed the pilot and 4 occupants board the accident airplane. During the radio transmission that followed, he heard the air traffic controller cancel the pilot's VFR clearance and instructed him to file an IFR clearance. The witness watched 5 people exit the airplane and return back to the airport terminal. While the witness was talking to an employee of AIA Flight School, the pilot entered the office and requested assistance filing an IFR flight plan. The airport operations employee then left the area.

The occupants then boarded the airplane and the pilot started the right engine. The left engine took approximately 3-5 minutes to start. According to the witness, who listened to the pilot's conversation with an air traffic controller, the pilot told the controller to "hold on" after he struggled to read back his IFR clearance. The controller then gave the pilot progressive taxi instructions to runway 09, and was subsequently coached through his read-back of the taxi instructions. The controller then read the airport departure procedure to the pilot, verbatim. It took the pilot a few minutes to proceed to the departure runway after he was received his takeoff clearance. Another few minutes elapsed before he eventually departed. The airplane's wheels departed the runway near taxiway D and the airplane began a climb and slight turn to the North. The witness then heard a large explosion, which was followed by a large plume of smoke.

Witness #6 – Airport Administration Employee

According to the witness, a blonde Caucasian woman with a group of three other women requested the contact information to a local rental car company.

Witness #7 – Airport Operations Employee

The witness reported that he first observed an older male and two females loading baggage from the back of a sport utility vehicle into the airplane before noon on the day of the accident. He recalled two large red suitcases, similar in size to checked bags on a commercial airline flight, and some smaller black suitcases that were loaded into the airplane as well. The female individuals were passing the red suitcases to an older male who was loading them into a baggage compartment located in the fuselage aft of the wings. None of the occupants appeared to struggle with the bags.

Around 1pm the witness heard the pilot's communication with an air traffic controller while the airplane was taxiing. The pilot requested an IFR to VFR on top clearance. After the controller issued the clearance, the pilot appeared to read back the instruction slowly, but without any difficulty. The witness was away from his radio as he subsequently performed some tasks on the airport, but later noticed that the airplane had returned to the transient parking area and was tied down. He estimated that approximately 20 minutes of time had elapsed between the time he

heard the clearance and the moment he observed the airplane in transient parking as he returned to the airport office.

At approximately 4pm the witness noticed that the occupants had re-boarded the accident airplane and the pilot was attempting to start the engines. The “first” engine started up successfully, but the pilot immediately ran the engine to a run-up power setting. He left the “first” engine at this power setting while he attempted to start the “second” engine. Once he started the “second” engine he reduced the throttle of the “first” engine to an idle power setting. The witness then left the area to return home for the day.

WRECKAGE AND IMPACT INFORMATION

The airplane came to rest in a residence approximately 1 nautical mile northeast of RAL. The initial impact point (IIP) was identified by a broken chimney and a section of airframe located on the roof of house no. 1. Multiple airplane fragments were found along the debris path, which was oriented on a heading of about 345 degrees magnetic. An intermediate impact point was marked by house no. 2 approximately 50 feet from the IIP, which was consumed by fire. The main wreckage was found in a bedroom on the southwestern end of house no. 3 about 100 feet from the IIP, and had also been consumed by the postcrash fire. Portions of the empennage, fuselage, and wings found along the debris path from the IIP to the main wreckage. The main wreckage was comprised of the aircraft cabin, both engines, a portion of the left and right wings, and the left propeller, which was underneath the main wreckage. Left wing fragments were distributed throughout the front lawn of house no. 3. and house no. 4, located 75 feet forward of the main wreckage. The left main tank fuel cap was found approximately 50 feet forward of the main wreckage near the front entrance to the north side yard of house no. 3. The left auxiliary tank and a portion of the left main tank came to rest 100 feet beyond the main wreckage on the lawn of house no. 4. The fuel cap to the left auxiliary tank was secured. A portion of the left main tank was found 200 feet forward of the main wreckage and co-located with the left aileron, which was intact.

COCKPIT/CABIN OBSERVATIONS

The cockpit and cabin areas were consumed by postcrash fire. A total of 5 cabin seats were recovered from the accident site; the front two seats were located in the main wreckage and the remaining three were located a few feet aft of the main wreckage, but in the debris path. One seatbelt latch buckle was found near the main wreckage.

The following table reflects the weights from both the occupants and property found at the accident site that were presumed to have been onboard the airplane.

Location/Item	Weight
Row 1 L Seat	168 lbs
Row 1 R Seat	125 lbs
Row 2 L Seat	130 lbs
Row 3 L Seat	120 lbs
Row 2 R Seat	140 lbs

2 black trash bags of personal effects	76 lbs

AIRFRAME

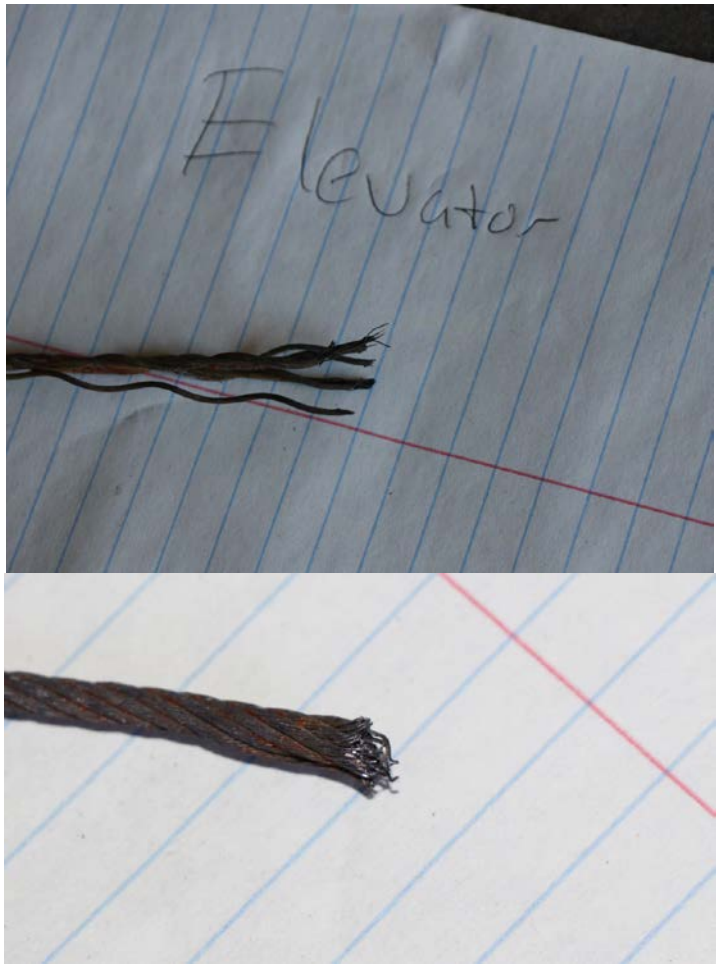
Postaccident Airframe Examination

The wreckage diagram below shows the wreckage energy path and the location of various aircraft parts that separated during the accident sequence.

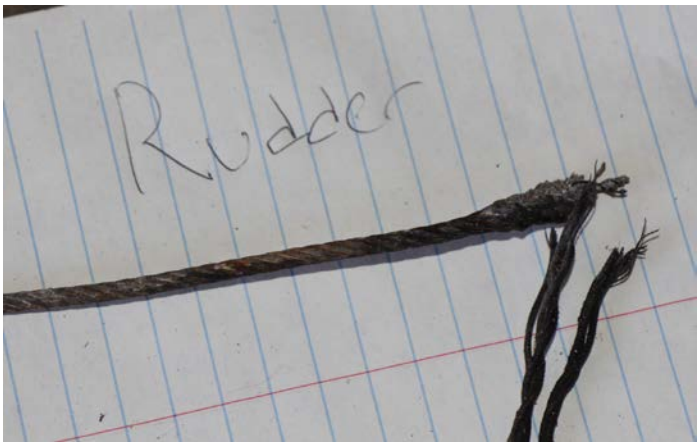
Empennage

The vertical stabilizer and rudder were thermally damaged, but remained attached to the empennage through the vertical stabilizer spar. Both elevators were recovered; the left elevator was separated about midspan, but remained attached to the horizontal stabilizer and displayed a large depression. The right elevator separated from the empennage and right horizontal stabilizer, which was not recovered. The elevator trim tab was secured to the right elevator, but separated from the trim tab actuator, which displayed continuity to the forward empennage through the elevator trim tab cables, which exhibited broomstrawing. A measurement of the elevator trim tab actuator showed that approximately 1.75 inches of the rod was exposed, consistent with 5 degree tab up deflection. Rudder trim tab continuity was verified from the trim tab to the forward empennage. Both rudder trim cables were cut by recovery personnel. The rudder trim tab actuator measured 1.23 inches, consistent with 21 degrees of right deflection. Rudder cable continuity was traced from the bell crank to the forward empennage. Both rudder cables were cut by recovery personnel; one cable was melted and the other cable displayed broomstrawing (see photograph 2). Continuity of the elevator was confirmed from the aft end of the elevator

push/pull tube to the forward empennage through the elevator cables, which were secured to the bell crank. One elevator cable displayed polishing at the cable tip, consistent with being severed. The other elevator cable exhibited broomstrawing (see photograph 1).



Photograph 1: View of Elevators Cables at Empennage



Photograph 2: View of Rudder Cables at Empennage

Cabin/Fuselage

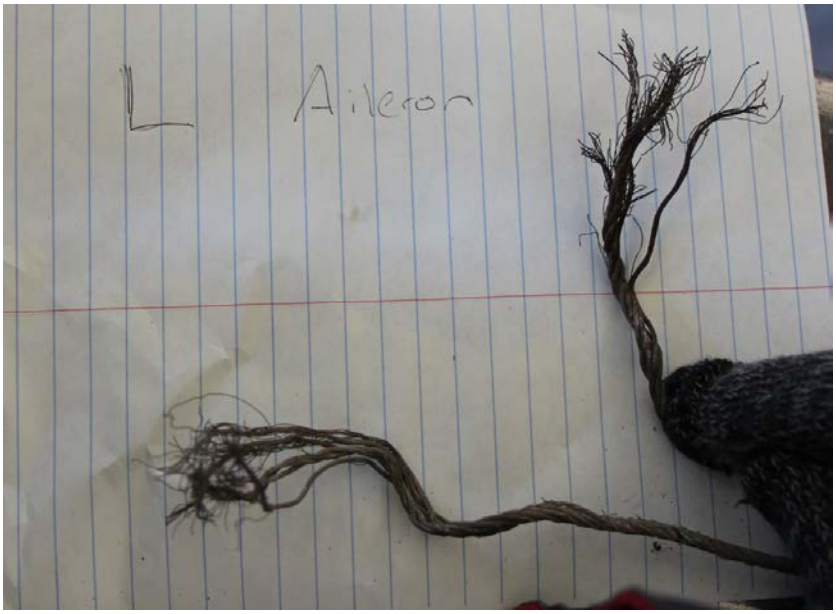
The cockpit and cabin were consumed by postcrash fire. The emergency manual gear extension pin and gear handle were in the extended position. However, the gearbox arms indicated that the nose landing gear was in the up position. Elevator control was traced from the aft fuselage to the cockpit through the forward bell crank (see photograph 3). The elevator cable ends at the aft fuselage were cut by recovery personnel. Aileron control was confirmed from the control column to the right wing through the forward bell crank. The left aileron cable was traced from the control column to the left wing root. The flap cable was continuous from the chain to the bell crank at both the right and left wings. Rudder control authority was traced from the rudder pedals to the aft fuselage. One cable displayed broomstrawing and the other was molten, but both cables exhibited some polishing at the cable strand tips.

Photograph 3: View of Cockpit Elevator Bell Crank

Wings

The right and left wings were fragmented; the right wing was consumed by fire and both left wing fuel tanks were thermally damaged. Control continuity of the aileron balance cable was confirmed from the outer bell crank to the left wing root. The left wing bell crank stops were unremarkable; however, the aileron push/pull tube had fractured and separated from the bell crank (see photograph 3). The left aileron control and balance cables displayed broomstrawing at the wing root (see photograph 4). The cables separated from the bell crank and were not recovered. Examination of the right aileron bell crank revealed that the stop was secured and the aileron push/pull tube remained attached to the bell crank at the rod end (see photograph 5). The left and right ailerons displayed evidence of buckling, but remained intact.

Photograph 4: View of Left Aileron Bell Crank Push/Pull Tube Rod End



Photograph 5: Left Aileron Control and Balance Cables at Left Wing Root

Photograph 6: View of Right Aileron Bell Crank

Fuel System

The airplane was equipped with two main tank transfer pumps, which were both recovered from the accident site. The left main transfer pump, manufactured by Facet, was connected to a 12 volt battery. The unit was tested multiple times and the results were unremarkable. Disassembly of the fuel pump did not reveal any contamination to the unit's filter. The test was repeated for the right main transfer pump, which was manufactured by Airborn, but the unit failed to run. Further examination of the pump revealed extensive fire damage to the internal screen and components. One auxiliary fuel pump was recovered from accident site; the unit's motor ran when connected to a 12 volt battery. The left and right fuel selector valves were thermally damaged and partially melted. The fuel selector handles were not recovered from the accident site. Two gascolators were recovered; one unit could not be disassembled due to fire damage. Disassembly of the other unit showed thermal damage to the gascolator screen.

Propeller Examination

The right and left propellers were examined at the manufacturer's facility in Wichita, Kansas. Both the right and left propellers displayed bending, twisting, paint scuffing, and leading edge nicks consistent with a medium amount of rotational energy absorption during the impact sequence. The right propeller displayed a sheared latch screw arrowhead and the left propeller exhibited a dent in the cylinder near the feather end. Both these signatures were consistent with the blades operating on or near the low pitch stop position at impact.

Engine Examination

Left Engine

The left engine was a Continental Motors Inc. TSIO-520-J (2B), serial number 218690.R

The crankcase half numbers were 70533, and there was a TCM quality stamp on them with the number 96 in a circle.

The propeller flange fractured and separated through 180 degrees circumferentially; the fracture surface was granular and uneven.

Investigators placed the engine on a table. They manually rotated the crankshaft with a tool in the remaining portion of the propeller flange. The crankshaft rotated freely, and the valves moved approximately the same amount of lift in firing order except for the exhaust valve on cylinder number six. A lighted borescope inspection revealed that the exhaust valve did not fully close. Upon removal of the cylinders, it exhibited impact damage. The gears in the accessory case turned freely. Investigators obtained thumb compression on all cylinders in firing order except cylinder number six; the exhaust valve.

Investigators removed the spark plugs; all were Champion RHB-32E. All center electrodes were elliptical, which corresponded to worn out normal according to the Champion Aviation Check-A-Plug AV-27 Chart. The electrodes were clean with no mechanical deformation. The spark plug electrodes were gray, which corresponded to normal operation according to the Champion Aviation Check-A-Plug AV-27 Chart.

A borescope inspection revealed no mechanical deformation on the valves, cylinder walls, or internal cylinder head.

Both magnetos sustained thermal damage; the left was more damaged than the right. Investigators disassembled the left magneto. The inside of the left magneto was charred; two posts were partially consumed and charred. Investigators rotated the right magneto with a drill, and observed spark at all posts.

The wet vacuum pump was a Pesco 207, serial number DG64395. It turned freely by hand. All vacuum pump vanes were whole, in position, and moved freely.

The alternator was a Prestolite ALT9422, serial number 1H000657.

The starter rotated freely. One brush was displaced from its retainer, but the tension spring was in position.

The oil sump was crushed up flush to the bottom of the crankcase. The oil pickup tube in the sump was crushed up, but was clean and open. The governor screen was clean. The oil filter sustained thermal damage; the element was charred, but there appeared to be no contamination within the folds. The oil pump gears and internal housing were unremarkable.

The engine driven fuel pump drive gear was undamaged, and the pump rotated freely. Investigators disassembled the unit, and the internal components were unremarkable. The rubber diaphragm in the fuel distribution valve was thermally damaged, and remnants were in the

cavity; the screen was clean. The fuel nozzles were open for cylinders one and three; debris was visible in number four; two, five, and six were not open.

The left exhaust path was lighter colored than the right. Both exhausts exhibited ductile bending. The left turbocharger exhibited some deformity. The compressor and turbine blades were unremarkable; they rotated about a quarter turn, but were stiff.

Investigators removed the cylinders; they were unremarkable except the exhaust valve for cylinder number six, which exhibited impact damage. The piston faces' combustion deposits were unremarkable.

The crankshaft forge number was 629587F. The crankcase main bearings were slightly worn, but otherwise unremarkable. Part numbers for the bearings were SA-642839; above that were the numbers 112 to the left and 8-8 to the right. The counterweights moved freely, and the circlips were in place. The crankshaft number was R76872-2. The thrust bearings were FAA PMA part number SA-64628.

The connecting rod bearings were unremarkable. The bearings were part number SA630826; above that were the numbers 6-8 on a top line and 112 on a center line.

The lobes on the camshaft were unremarkable. One hydraulic valve lifter had a small area of corrosion spalling; the rest were unremarkable. The camshaft part number was 629726-J.

Right Engine

The right engine was a Continental Motors Inc. TSIO-520-J (1B), serial number 218675.R.

The propeller separated from the flange, which was deformed.

Investigators slung the engine from a hoist. They manually rotated the crankshaft with a tool in the propeller flange. The crankshaft rotated freely, and the valves moved approximately the same amount of lift in firing order. The gears in the accessory case turned freely. Investigators obtained thumb compression on all cylinders in firing order except cylinder number six, which sustained crush damage.

Investigators removed the spark plugs; all center electrodes were elliptical and clean with no mechanical deformation. The spark plug electrodes were gray, which corresponded to normal operation according to the Champion Aviation Check-A-Plug AV-27 Chart.

A borescope inspection revealed no mechanical deformation on the valves, cylinder walls, or internal cylinder head.

Both magnetos sustained thermal damage, and could not be tested.

The wet vacuum pump was a Pesco 207, part number 3P207JA, serial number PEJ6636. It turned freely by hand. All vacuum pump vanes were whole, in position, and moved freely.

The oil sump was not breached, and investigators drained a black viscous fluid from it. The sump had sludge in the bottom that contained visible magnetic particles. When the sludge was hanging from a nonferrous tool, the sludge moved to and attached to a magnet. The oil sump screen appeared undamaged. The governor screen was clean. The oil filter element was charred, but no visible contaminants were within the folds.

The engine driven fuel pump drive gear was undamaged, and the pump rotated freely. Investigators disassembled the unit, and the internal components were unremarkable. The fuel distribution valve was thermally damaged, and partially consumed. The rubber diaphragm was partially consumed; the portions of the screen that were visible were clean. The fuel nozzles were not clear for cylinders three and five; the rest were open.

Both exhausts exhibited ductile bending. The right turbocharger exhibited some deformity. The compressor and turbine blades were unremarkable; they rotated about a quarter turn, but were stiff.

Investigators removed the cylinders; cylinder number six had crush damage, and was cracked across the cylinder head. Cylinder number two's barrel had a fractured surface appearance that appeared similar to cylinders that had been chrome treated, but there were no paint markings to indicate that the cylinder had been chrome treated. The piston faces' combustion deposits were unremarkable. The ring gap top for the two piston rings on cylinders one and two were only a few degrees apart. The CMI Overhaul Manual specifies that the rings gaps should be 180° apart.

The crankshaft forge number was 629587F. The two case half numbers were J9P-848-B. The crankcase main bearings were worn, but otherwise unremarkable. Part numbers for the bearings were SA-642839; above that were the numbers 112 to the left and 8-8 to the right. The counterweights moved freely, and the circlips were in place. The crankshaft number was R6964-1. The thrust bearings were FAA PMA part number SA, and then the numbers were not distinguishable.

The connecting rod bearings were worn but unremarkable. The bearings were part number SA630826; above that were the numbers 6-8 on a top line and 112 on a center line.

The lobes on the camshaft were unremarkable. All hydraulic valve lifters exhibited areas of light spalling. The camshaft part number was 629726N.

EMERGENCY LOCATOR TRANSMITTER (ELT)

The ELT was not recovered.