Aviation Investigation Final Report

Location:	New Smyrna Beach, Florida	**Accident Number:**	ERA13FA131
Date & Time:	February 13, 2013, 13:14 Local	**Registration:**	N2576S
Aircraft:	Cessna T337C	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of engine power (partial)	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

Shortly after taking off on the test flight, the pilot transmitted "mayday mayday" over the control tower's radio frequency. According to eyewitnesses, the airplane was in a left-wing-down attitude when it impacted a tree, power lines, and then another tree before coming to rest in a pasture. A review of data downloaded from the engine data monitor revealed that the rear engine exhibited erratic fuel flow beginning 2 days before the accident and continuing through the accident flight. Further, the engine data monitor indicated that the rear engine's propeller was under low-to-no power with a low pitch angle at the time of impact. The front engine exhibited no abnormalities or malfunctions, and the investigation found no other anomalies that would have precluded normal operation of the airplane.

During postaccident examination, the engine-driven fuel pump was removed and bench tested where it exhibited fuel flow higher than manufacturer guidelines with low fuel pressure. In order to meet bench test standards, an adjustment equal to three turns of the adjustment screw was made. The fuel pump then operated normally and was placed back on the engine; however, the engine still did not attain full power. Further examination revealed potential debris between the throttle assembly's brass and stainless steel plates. After removal of the debris and reassembly of the throttle assembly, it operated within the normal range. Although the source of the debris could not be definitively determined, it likely originated in either in the fuel or a fuel tank.

Maintenance records indicate that two days before the accident, the fuel pump was removed, repaired, and reinstalled after work was completed on the rear fuel selector valve. After the pump was reinstalled, the mechanic adjusted the continuous flow fuel injection system using the airplane's JPI engine monitor system and an external low pressure gauge to set the takeoff fuel flow; he then refueled the plane from containers in which he had stored the fuel in order to service the fuel pump. The following day, the pilot and the mechanic again adjusted the fuel pump's fuel flow after conducting an unsatisfactory engine run-up . After the adjustment, the run-up appeared to be normal. Directives from the engine's manufacturer recommended using a Model 20 ATM-C Porta Test Unit or equivalent to ensure the fuel injection system meets all pressure and flow specifications. Using a JPI engine monitor and an external gauge

would have given inaccurate results without a properly calibrated fuel pump, and the mechanic's recalibration of the engine-driven fuel pump's adjustment screw would have only masked the debris issue within the throttle assembly.

Further, review of the manufacturer's approved engine-out emergency procedures indicated that with a rear engine failure, the propeller should be immediately feathered and the landing gear retracted after obstacle clearance. Therefore, even with a loss of rear engine power, the airplane's operating manual indicated that the airplane would have been able to climb at least 275 feet per minute with one engine, assuming the required pilot inputs were made. Had those single-engine climb performance conditions been met, the airplane likely would have been able to, at a minimum, maintain altitude until a safe landing could have been accomplished. However, as the rear propeller was found with a low pitch angle and the landing gear was found in the down and locked position after the accident, the airplane had not been configured for maximum single-engine performance as outlined in the engine-out procedures.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

Maintenance personnel's failure to follow procedures and published directives in calibrating the continuous flow fuel system and failure to accurately diagnose debris in the throttle assembly, resulting in a loss of power in one engine. Contributing to the accident was the pilot's failure to comply with published engine out procedures, which resulted in an off-airport landing and subsequent impact with a tree and the ground.

Findings

Aircraft	Fuel control/carburetor - Malfunction
Personnel issues	Installation - Maintenance personnel
Personnel issues	Incorrect action performance - Maintenance personnel
Aircraft	Fuel distribution - Incorrect service/maintenance
Personnel issues	Use of policy/procedure - Maintenance personnel
Personnel issues	Use of checklist - Pilot
Environmental issues	Tree(s) - Contributed to outcome

Factual Information

History of Flight

Initial climb	Loss of engine power (partial) (Defining event)
Emergency descent	Off-field or emergency landing
Emergency descent	Collision with terr/obj (non-CFIT)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On February 13, 2013, at 1314 eastern standard time, a Cessna T337C, N2576S, was destroyed when it impacted the ground in a farm pasture shortly after departure from New Smyrna Beach Municipal Airport (EVB), New Smyrna Beach, Florida. Day visual meteorological conditions prevailed and no flight plan was filed for the local maintenance test flight. The airline transport pilot was fatally injured. The local flight was conducted under the provisions of Title 14 Code of Federal Regulations Part 91.

According to transcripts of voice recording from the FAA contract Air Traffic Control tower at EVB, the airplane was issued a takeoff clearance with a left turn approved at 1312:40. At 1314:06, the pilot transmitted "mayday mayday" over the tower frequency. The flight was subsequently cleared to land on any runway but no further communication was received from the flight.

According to two eyewitnesses, the airplane was observed in a left wing down bank when it impacted a tree, powerlines, and then another tree prior to coming to rest. The witnesses further stated that they heard the engine producing power; however, they could not determine if both engines were operating or producing power.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	56
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	August 23, 2012
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	August 1, 2012
Flight Time:	4186 hours (Total, all aircraft)		

According to Federal Aviation Administration (FAA) records, the pilot held an airline transport

pilot certificate with a rating for airplane multiengine land, a commercial pilot certificate with ratings for airplane single-engine land, airplane single-engine sea, and airplane multiengine sea. He also had a flight instructor certificate for airplane single-engine, multiengine, and instrument airplane. He held a second-class medical certificate which was issued on August 23, 2012, and had two restrictions of "not valid for any class after" and "must wear corrective lenses." At the pilot's most recent medical he had reported 4,186 total flight hours and 50 of those flight hours were in the 6 months preceding the medical application.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N2576S
Model/Series:	T337C	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	337-0876
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	March 5, 2011 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	1350 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	C91A installed, not activated	**Engine Model/Series:**	TSIO-360-A
Registered Owner:	On file	**Rated Power:**	300 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

According to FAA and airplane maintenance records the airplane was issued an airworthiness certificate on June 1, 1968 and was registered to RoyalAir Aviation, Inc. on April 24, 2007. It was equipped with two engines. The front engine was a Continental Motors TSIO-360A3B, 210-hp engine and the rear engine was a Continental Motors TSIO-360 AcAB, 210-hp engine. It was also equipped with two McCauley propellers. The airplane's most recent annual inspection was completed on May 1, 2012. Paperwork located in the hangar, which included an FAA form 8130-1, indicated that on January 15, 2013 an engine driven fuel pump was tested and recorded as "tested good set to factory flows."

According to the aircraft Owner's Manual, the airplane had a total fuel capacity of 131 gallons. The fuel system comprised of two main fuel tanks with a capacity of 46 gallons each and two auxiliary tanks with a capacity for 19.5 gallons each. The last located recorded fueling was accomplished on October 28, 2012 at EVB. The airplane had been fueled with 58.09 gallons of fuel.

According to a mechanic who had performed maintenance on the airplane, the most recent work performed was due to the lack of full travel on the rear fuel selector valve. During operation of the selector valve it would only go from the "OFF" position to the "ON" position and would not allow the

use of the auxiliary tank position. The airplane was defueled into clean containers and then the mechanic removed the "Right Hand Selector" valve, sent the valve to a repair facility, which was subsequently returned and reinstalled. The rigging was verified and "Full travel was confirmed and resistance was normal," on the fuel selector valve. In addition, the engine driven fuel pump was removed, repaired and reinstalled on February 11, 2013. According to the mechanic the pilot reported having difficulty starting in the "super rich" position as well as black smoke was reported coming from the rear engine by others that observed it. After the engine driven fuel pump was reinstalled, the mechanic adjusted the continuous flow fuel injection system per the guidance of Teledyne Continental Motors Service Information Directive 97-3E. He stated that he utilized the JPI engine monitor and an external low pressure gauge to set the takeoff fuel flow between 20 and 21 gallons per hour. He further reported that the pilot had the differential gauge as required in the guidance for the adjustment of the continuous fuel flow system; however, they utilized the JPI as well. The mechanic returned the fuel from the containers to the airplane and at that time, the tanks were "about eighty percent full." On the Monday prior to the accident, the pilot and the mechanic operated both engines and the pilot was going to test fly the airplane the following day. On the day prior to the accident, during the run-up, the pilot did not like the run-up on the rear engine and they readjusted the settings until 31 inches of manifold and a fuel burn of 20 gallons per hour was achieved. After the adjustment, the run-up appeared to be normal; however, due to the lateness of the day and the sun setting the pilot elected to "test fly" the airplane the following day.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	EVB,10 ft msl	**Distance from Accident Site:**	
Observation Time:	13:47 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	1500 ft AGL	**Visibility**	7 miles
Lowest Ceiling:	Broken / 1500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	15 knots / 20 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	230°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.86 inches Hg	**Temperature/Dew Point:**	28°C / 18°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	New Smyrna Beach, FL (EVB)	**Type of Flight Plan Filed:**	None
Destination:	New Smyrna Beach, FL (EVB)	**Type of Clearance:**	VFR
Departure Time:	13:12 Local	**Type of Airspace:**	

The 1347 recorded weather observation at EVB, included wind from 230 degrees at 15 knots with gusts to 20 knots, 7 miles visibility, broken clouds at 1500 feet above ground level (agl), temperature 28 degrees C, dew point 18 degrees C; barometric altimeter 29.86 inches of mercury.

Airport Information

Airport:	New Smyrna Beach Municipal Air EVB	**Runway Surface Type:**	
Airport Elevation:	10 ft msl	**Runway Surface Condition:**	
Runway Used:		**IFR Approach:**	Visual
Runway Length/Width:		**VFR Approach/Landing:**	Forced landing

The airport is a publically owned airport and at the time of the accident had an operating control tower. The airport was equipped with three runways designated as runway 7/25, 11/29, and 02/20. The runways were reported as "in fair condition" or "in good condition" at the time of the accident. Runway 7/25 was a 5,000-foot-long by 75-foot-wide runway, runway 11/29 was a 4,319-foot-long by 100-foot-wide, and runway 02/20 was a 4,000-foot-long by 100-foot-wide runway. The airport was 10 feet above mean sea level.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	29.046112,-80.956947

The airplane impacted a tree approximately 60 feet agl, power lines, and then another tree about 25 feet agl prior to coming to a rest in a cow pasture that was approximately 1,000-feet long and 200-feet wide. The accident flight path was oriented on a 076 degree heading and the debris path began just prior to the final tree strike and terminated 227 feet past and was approximately 98 feet wide. The final tree strike was located 186 feet from a power pole and power line which ran nearly perpendicular to the debris path. The accident location was 5,373 feet and 215 degrees from the midfield point of the departure runway. According to local authorities, upon arrival at the accident site the top line of the power line was severed.

Examination of the debris path revealed that the nose gear strut and the right front seatbelt and shoulder harness were imbedded in the tree approximately 25 feet agl. The seat belt remained latched but was separated from the aircraft structure. The left and right wing remained attached to each other via the cross control cable and the roof of the cabin area. Both wings came to rest inverted about 75 feet from the final tree strike. The tail section and rudders were impact separated and came to rest in the immediate vicinity of the final tree strike. The left tail boom structure was located to the left of the debris field and, in close proximity to the final tree strike. The main cabin floor area and main landing gear were located approximately 24 feet from the final tree strike and came to rest upright. The landing gear was found in the down and locked position. The forward engine was located approximately 112

feet along the debris field, from the final tree strike. The furthest located piece was the right rudder counter weight which was located 227 feet from the final tree strike.

Examination of the left wing revealed wire strike marks along the wing's leading edge approximately 32 to 39 inches inboard of the wing tip. The wire strike was oriented at an approximate 45 degree angle to the leading edge. The left wing exhibited extensive crush and impact damage along the entire span. The fuel tanks were breached, devoid of fuel, and the fuel caps remained secured and seated. The left outboard flap was separated from the flap tracks while the left inboard flap remained attached. Flap control cable continuity was confirmed from the flap motor, located in the ceiling of the cabin area, to the bellcranks; however, the cables exhibited numerous tensile overload fractures in the vicinity of the wing roots. The left aileron remained attached and cable continuity was confirmed from the base of the control column to the associated fracture points out to the aileron. The aileron cable exhibited tensile overload at all fracture points. The left aileron was fractured; the inboard section of the aileron remained attached to the wing while the outboard section separated from the structure. The left aileron was equipped with a factory installed ground adjustment trim tab on the trailing edge of the inboard end and no deflection was noted. The left aileron was also equipped with an aftermarket electronic trim tab on the trailing edge near the outboard end of the aileron; the aftermarket trim tab sustained impact damage and was bent downward.

The right wing exhibited impact crush damage. The right outboard flap was impact separated from the flap tracks while the right inboard flap remained attached. Flap control cable continuity was confirmed from the flap motor located in the ceiling of the cabin area to the bellcranks; however, the cables exhibited numerous tensile overload fractures. The right aileron remained attached and cable continuity was confirmed from the base of the control column to the associated fracture points out to the aileron. The aileron cable exhibited tensile overload at all fracture points. The right wing's fuel caps remained attached, seated correctly, and locked in position. Fuel was present in the inboard fuel tank and the outboard fuel tank.

The rudders remained attached to the vertical stabilizers; however, the empennage was impact separated from the tail booms just prior to the up curve on the leading edge. Cable continuity was confirmed from the base of the rudder pedals to the rudders with the right rudder cable overloaded at the aft position in the tail section. The right rudder cable exhibited tensile overload 3 feet forward of the turnbuckle. All separations exhibited tensile overload. The right rudder counter weight was located at the furthest point of the debris path; however, the left rudder counterweight was located in the vicinity of the rudder and the area surrounding the counterweight location appeared to be impact damaged. Elevator cable continuity was confirmed from the base of the control column to the elevator bellcrank although numerous tensile overload fractures were present along the entire span.

The front engine, rear engine, and cockpit exhibited impact crushing and the engines were impacted separated from their associated airframe attach points but remained attached to their respective firewall. Both propellers remained attached to the propeller flange and the spinner remained attached; however, the rear engine's propeller was devoid of S-bending or tip curling except from one blade which exhibited signs similar to a wire strike.

The rear engine was located about 10 feet from the final tree strike and in a small grove of trees. The propeller appeared to have minor damage and exhibited marks similar to a wire strike on one of the

blades. The rear engine's fuel line leading to the fuel manifold had approximately 3 tablespoons of fluid which exhibited a smell similar to aviation fuel.

The forward engine's propeller blade exhibited slight S-bending and was bent in the aft direction. Engine continuity was confirmed from the propeller hub to the rear accessory pad via hand rotation utilizing the propeller. Thumb compression was confirmed on all cylinders during hand rotation. The bottom spark plugs were removed, appeared to be light gray in color, and were normal in wear.

The left shoulder harness and seat belt remained buckled with minor webstretching noted; however, it did not remain attached to the fuselage and was torn near the attach point. The remaining seat belts remained attached to their respective mounting points, except the right rear seat's inside lap belt, which was impact separated. The flap motor and worm gear were located and the exposed threads were measured and indicated 3.26 inches, which correlated to a 10 degree flap setting.

The cockpit exhibited extensive impact and crush damage. The throttle lever associated with the front engine was in the idle position and the throttle lever associated with the rear engine was in the approximate mid range position. The mixture and propeller levers associated with each engine were in the full forward position. However, due to extensive damage the levers were not attached to the associated control cables. The flap handle was located in the 10 degree detent. The cowl flaps for both engines were in the "CLOSED" position. The airplane was equipped with a JPI EDM760 engine monitor system which was removed and sent to the NTSB Recorder Laboratory for download.

Various types of paperwork were located by local authorities following the accident and turned over to the NTSB. Review of the various paper products yielded a hand written note dated February 12, 2013, and indicated that "1800 rpm RE won't idle under 1300 (dies) Mag check R Mag 600 rpm drop, L Mag 400 rpm drop."

Medical and Pathological Information

An autopsy was performed on the pilot on February 14, 2013, by the Office of the Medical Examiner, Daytona Beach, Florida. The autopsy findings included "extensive blunt force injuries," and the report listed the specific injuries.

Forensic toxicology was performed on specimens from the pilot by the FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The toxicology report stated no ethanol or drugs of abuse were detected.

Additional Information

Propeller Examinations

Both propellers were sent to the McCauley Propeller Systems in Wichita, Kansas, and examined on April 24, 2013 with oversight provided by an FAA inspector. According to their report the rear engine propeller was examined and appeared to be either at a low or possibly no power at time of impact and no indication of rotation was present. The propeller blade angle was at low pitch and the propeller blades and internal mechanism exhibited very little damage. The bearings and raceways were intact and appeared normal. In addition, oil integrity was confirmed at the propeller bearing.

The front engine propeller was examined and one of the blades was unable to be removed due to impact damage. The other blade was examined and indicated rotational scoring between the stops in the "normal operating range." The front propeller hub had a mark from a blade counterweight impact during the accident sequence. The position of this mark indicated a propeller blade angle of approximately low pitch/ latch position at impact. The spring and bearings were intact and appeared to have no anomalies that would have precluded normal operation.

A detailed report about the examinations can be found in the "Front and Rear Propeller Examination Report" located in the public docket for this accident.

Engine Data Monitor

An engine data monitor was recovered from the cockpit and forwarded to the NTSB Vehicle Recorders Laboratory, Washington, DC, for download. Review of the downloaded data revealed there were 11 recorded events, which began in October 2012. According to the data, the rear engine fuel flow exhibited an erratic fuel flow beginning on February 11, 2013, which continued through the accident flight. The data readouts are located in the public docket associated with this accident.

Fuel Selector Valves

The left and right wing mounted fuel selector valves were removed from the airplane and examined with the engines at the manufacturing facility in Mobile, Alabama, in May 2013, under the supervision of an NTSB investigator. Compressed air was blown through all of the ports and airflow was noted on the selected detents. The detents were checked and operated normally with no abnormalities noted. The right wing fuel selector valve was mounted on a test stand utilizing a slaved fuel pump, and fuel flowed through the valve unabated.

Engine Examinations

The front engine was examined at the manufacturing facility in Mobile, Alabama, in May 2013, under the supervision of an NTSB investigator. During the examination, several components were removed and replaced to facilitate an engine run. The engine was placed on a test stand, was started and operated at various power settings with no abnormalities or malfunctions that would have precluded normal operation noted.

The rear engine was examined at the manufacturing facility in Mobile, Alabama, in May 2013, under the supervision of an NTSB investigator. The engine was examined and the valve rocker covers were

removed to facilitate examination of the gaskets and the rocker arms. All cylinders appeared normal and the engine was prepared for an engine run in a test cell. The engine was started and smoke was observed coming out of the turbo exhaust while at 1000 rpm. The engine was idled for several minutes then accelerated to 1600 rpm and the fuel flow was high with low fuel pressure according to manufacturing guidelines. The engine was then accelerated to a full power setting but would not produce power above 1800 rpm and the fuel flow remained high with low fuel pressure. A noticeable surge was audibly detected and black smoke was observed continuously exiting the turbo exhaust. The engine was reduced to idle and the surging continued and was captured on a video recording. The rear engine's throttle assembly was removed and the throttle assembly from the front engine was utilized in its place. The engine was operated with the front engine's throttle assembly and was found to operate smoothly; however, was not able to achieve full takeoff power. The engine driven fuel pump was then removed and bench tested. The fuel pump bench test revealed that the fuel would have high flow and low pressure. The adjustment screw was measured at 0.4645 inches. Adjustments were made that equaled three turns of the adjustment bolt, which equaled 0.0675 total inches of adjustment. Then the fuel pump was adjusted to bench test standards and was operated normally. The rear engine would not develop full power at full throttle setting. After removal and testing of the throttle assembly and engine driven fuel pump, scoring was noted between the brass and stainless steel plates within the fuel metering valve inside the throttle assembly indicated the possibility of debris. The spring on the brass plate indicated the possibility of pinching against the sidewall of the fuel metering valve; however, after examination and reassembly of the unit it operated within a normal range.

More details about the examinations can be found in the "Engine Examination Report" in the public docket for this accident.

Cessna T337 Owner's Manual

According to Section IV "Operational Data", after takeoff and during the initial climb, at an airplane weight of 3,700 pounds, the indicated airspeed at 50 feet agl should be 79 mph. In addition, after takeoff and during the initial climb, at an airplane weight of 4,500 pounds, the indicated airspeed at 50 feet agl should be 87 mph. According to the chart "Single Engine Maximum Rate-of-Climb Data" with an aircraft weight of 3,700 pounds, outside air temperature of 82 degrees F [28 degrees C], and sea level, the single engine climb performance with the rear engine inoperative and the propeller feathered is about 540 feet per minute rate of climb. An airplane weight of 4,500 pounds, outside air temperature 82 degrees F [28 degrees C], and sea level, the single engine climb performance with the rear engine inoperative and the propeller feathered is about 275 feet per minute rate of climb. The section further indicated that at a gross weight of 4,500 pounds, the airplane will stall at 74 mph calibrated airspeed with a 0 degrees angle of bank and flaps at one-third. The airplane will stall at 79 mph calibrated airspeed, in a 30-degree angle of bank, with one-third flaps. Then, the airplane will stall at 105 mph calibrated airspeed, in a 60-degree angle of bank, with one-third flaps.

According to Section II "Description and Operating Details," it indicated that the landing gear retraction "is normally not started until one or two hundred feet of altitude have been obtained after take-off. Retraction at very low altitude should be avoided since the landing gear swings downward approximately two feet as it starts the retraction cycle. In addition, the landing gear would extend slowly in the event of an engine-out after take-off, and might not be completely down while a wheels-down landing could still be made on the runway."

Section III "Emergency Procedures" provides an "Engine Out After Takeoff" checklist for airspeed above 85 mph (without sufficient runway ahead) which includes:

1. Throttles – Full forward.
2. Propellers – High RPM (full forward).
3. Determine inoperative engine (from engine RPM).
4. Propeller –
Front Engine Inoperative – Feather propeller if gear is up and locked, or down and locked.
Rear Engine Inoperative – Feather immediately.
5. Wing Flaps – Retract in small increments (if extended).
6. Climb out at 100 MPH (96 mph with obstacles ahead).
7. Landing Gear –
Front Engine Inoperative – Leave extended.
Rear Engine Inoperative – Retract after obstacles are cleared.
8. Cowl Flaps (Operative Engine) – Open to single-engine position.
9. Secure inoperative engine as follows:
a. Ignition Switch – "OFF."
b. Alternator Switch – "OFF."
c. Mixture – Idle cut-off.
d. Cowl Flaps – "CLOSED."
e. Fuel Selector – "FUEL OFF."

Service Information Directive (SID) 97-3E

According to SID 97-3E provided by the engine manufacturer to adjust the continuous flow fuel injection system, "a complete set of tools and test equipment is essential for correct setup of TCM [Teledyne Continental Motors] fuel injection system. Various combinations of these tools and equipment will be used, depending on the engine model. A proper inventory of tools and equipment for fuel system adjustment will include the following:
1. TCM recommends the Model 20 ATM-C Porta Test Unit P/N 630045-20 ATM-C or equivalent to insure the fuel injection system meets all pressure and flow specifications.

An alternative procedure would be to use calibrated gauges.
1. One (1) calibrated 0-60 PSI gauge, graduated in 1 PSI increments. This gauge will be used for unmetered pressure measurement.
2. One (1) calibrated 0-30 PSI gauge, graduated in .2 PSI (maximum) increments. This gauge will be used for metered pressure measurements and verification of aircraft fuel flow gauge indications on normally aspirated engines only.
3. One (1) calibrated differential gauge, 0-30 PSID maximum, graduated in .2 PSI (maximum) increments. This gauge will be used for metered pressure measurements and verification of aircraft fuel flow gauge on turbocharged engines only.

NOTE: Pressure gauges must be accurate within ±1 %. Pressure gauges must be checked for accuracy and, if necessary, calibrated at least once each calendar year."

In addition, the SID provided a warning that the "use of inaccurate gauges will result in incorrect adjustment of the engine fuel system, possible cylinder wear due to lean operation, pre-ignition, detonation, loss of power and severe engine damage."

Administrative Information

Investigator In Charge (IIC):	Etcher, Shawn
Additional Participating Persons:	Rafeal A Dorta-Figueroa; FAA/FSDO; Orlando, FL Peter Basile; Cessna Aircraft Company; Witchita, KS Mike Council; Continental Motors Inc.; Mobile, AL
Original Publish Date:	April 23, 2014
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=86215