Aviation Investigation Final Report

Location:	Riverside, California	**Accident Number:**	WPR17FA066
Date & Time:	February 27, 2017, 16:41 Local	**Registration:**	N1246G
Aircraft:	Cessna T310Q	**Aircraft Damage:**	Destroyed
Defining Event:	Aerodynamic stall/spin	**Injuries:**	4 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The airline transport pilot and four passengers planned to make a 300-nautical-mile cross-country flight in the airplane to return home. They arrived at the airport about noon and loaded their bags into the airplane. The pilot made an unsuccessful attempt to start the engines, and the occupants deplaned and waited for some time. During a second attempt to begin the flight, a ground controller informed the pilot that he was required to file an instrument flight rules (IFR) flight plan before departure. After the occupants deplaned a second time, they went to the airport terminal where the pilot asked a flight school employee to provide instructions for filing an IFR flight plan. According to the flight school employee, the pilot appeared rushed, and the passengers were anxious to complete the flight. According to the surviving passenger, after one of the other passengers started to make ground transportation arrangements, the pilot's wife insisted they would fly the passengers home. The pilot filed an IFR flight plan, and the pilot and passengers boarded the airplane for the third time.

At the time of the accident, IFR conditions prevailed at the departure airport with a visibility of 2 miles in light precipitation and mist, scattered clouds at 600 ft above ground level (agl) and an overcast ceiling at 4,200 ft agl. It could not be determined when the pilot had last flown in instrument meteorological conditions or when he had last completed an instrument competency check. However, it is likely that the pilot was not instrument current as he was unfamiliar with basic instrument flight planning procedures and had to be coached through the readback of his IFR clearance.

The airplane departed normally and entered a climb. Seconds later, the airplane entered a cloud and began a turn, at which time it began to shake violently as the stall warning horn sounded, consistent with an aerodynamic stall. The airplane descended from about 900 ft above ground level and impacted multiple residences about 1 nautical mile from the departure airport. Examination of the airframe and engines revealed no evidence of any preimpact mechanical malfunctions that would have precluded normal operation. The blades of both propellers displayed rotational damage signatures that were consistent with the engines producing power at impact.

Toxicology results indicated that the pilot was not impaired by carbon monoxide or drugs. Although the pilot's autopsy showed that he had coronary artery disease and was at increased risk of incapacitation from a cardiac event, the surviving passenger reported that the pilot was manipulating the controls during the descent to impact. Therefore, pilot impairment or incapacitation likely did not contribute to the accident. The pilot's decision to complete the flight despite the IFR weather conditions was likely driven by his own self-induced pressure, influenced by the passengers' need to return home and his wife's insistence that the departure would proceed as originally planned.

Calculations indicated that the airplane was loaded over its maximum gross takeoff weight by about 300 pounds. Additionally, the airplane's center of gravity (CG) was forward of the forward limit for its maximum gross weight. Although CGs that are forward but within the approved envelope generally result in more favorable stall characteristics, the airplane was loaded outside of published limits, and its performance under these conditions was unpredictable.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's failure to maintain airplane control upon entering instrument meteorological conditions, which resulted in the airplane exceeding its critical angle of attack and an aerodynamic stall. Contributing to the accident was the pilot's personal pressure to complete the flight despite the weather conditions.

Findings

Aircraft	(general) - Capability exceeded
Personnel issues	Aircraft control - Pilot
Environmental issues	Personal pressure - Effect on operation
Aircraft	Maximum weight - Capability exceeded

Factual Information

History of Flight

Enroute-climb to cruise	Aerodynamic stall/spin (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)
Post-impact	Fire/smoke (post-impact)

On February 27, 2017, about 1641 Pacific standard time, a Cessna T310Q, N1246G, was destroyed when it collided with multiple residences after departure from Riverside Municipal Airport (RAL), Riverside, California. The airline transport pilot and three passengers were fatally injured; one passenger received serious injuries. The airplane was registered to the pilot who operated the airplane under the provisions of Title 14 *Code of Federal Regulations* Part 91. Instrument meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan was filed for the personal cross-country flight that was destined for Norman Y. Mineta San Jose International Airport (SJC), San Jose, California.

According to the surviving passenger, she was invited by an acquaintance to fly in the airplane to southern California as both their daughters were scheduled to participate in a competition. On February 24, 2017, the group completed an uneventful flight from SJC to RAL. According to receipts and witnesses, on February 25, 2017, the pilot returned to RAL and had the airplane fully refueled; the pilot also purchased several terminal instrument procedure charts and en route low altitude charts.

The group returned to RAL about 1200 on the day of the accident and loaded the airplane with their bags. According to the surviving passenger, they boarded the airplane, and the pilot started the right engine but was unable to start the left engine. They deplaned and went into the airport terminal. After waiting for some time, they again tried to depart but had to return to the terminal. The passenger was not sure if the problem was "not being able to start the engine or the weather is bad." The surviving passenger inquired about the problem with the pilot's wife, who was also a passenger on the airplane; the wife became anxious and started to put pressure on the pilot to depart. After the surviving passenger offered to rent a car, the pilot's wife insisted that they would return to SJC in the airplane.

According to an airport operations employee, he saw the pilot and passengers walk to the airplane and then heard the pilot on the RAL ground control frequency requesting a visual flight rules (VFR) clearance to SJC. The operations employee reported that he heard an air traffic controller cancel the pilot's VFR flight plan and ask the pilot to file an IFR flight plan. The operations employee observed the pilot and passengers exit the airplane and return to the terminal.

The pilot asked an employee of a flight school that had an office in the terminal building if he could help him file an IFR flight plan. The flight school employee instructed the pilot to call "1-800-wxbrief," and the pilot wrote down the number. According to the flight school employee, the pilot appeared rushed. After the pilot left his office and exited the building, the flight school employee went into the hallway where the passengers were sitting and spoke with them. The passengers were "anxious to get home," and one of the passengers said that she needed to be at work the following morning. During this time, another passenger began making alternate transportation arrangements. The pilot then contacted a flight

service station and filed an IFR flight plan.

The pilot and passengers boarded the airplane for the third time, and the pilot started the engines and contacted the ground controller. About 1602, the pilot requested and was granted an IFR clearance to SJC; he did not read back the entire clearance and advised the ground controller that he was not familiar with the airport obstacle departure procedure. The ground controller reissued the IFR clearance, and the pilot requested to standby. About 7 minutes later, the pilot made a request to taxi for departure, and the ground controller prompted him to read back the IFR clearance. After the ground controller again reissued the IFR clearance, the pilot read back the clearance correctly.

About 1615, the ground controller issued taxi instructions, which the pilot read back incorrectly. After the controller reissued the taxi instructions slowly, the pilot read them back correctly. At 1632, while in the run-up area, the pilot read back the obstacle departure procedure correctly and subsequently advised the tower controller that he was ready for departure. The tower controller then issued holding instructions to await the airplane's IFR release, and the pilot acknowledged the communication without repeating the hold short instructions. At 1638, the pilot received a takeoff clearance from the tower controller.

The airport operations employee saw the airplane's departure and reported that, after an uneventful liftoff and initial climb, the airplane began a left turn as it entered the clouds (reported ceiling 600 ft). Radar data captured the airplane at 1639:50, just beyond the runway's midfield point at an altitude of about 1,100 ft mean sea level (msl) or about 300 ft above ground level (agl). At 1640:08 and at an altitude of 1,300 ft msl, the airplane turned left to a heading of 070° magnetic. The airplane maintained the same heading until radar contact was lost at 1640:27 at an altitude of 1,700 ft msl (about 900 ft agl). No distress calls were received from the pilot.

The surviving passenger recalled that the airplane shook during climb out, but she could hear the engines running continuously. The airplane entered a cloud and then began to vibrate violently as it started to descend. The vibration was accompanied by a horn sound, which the surviving passenger later identified as the airplane's stall warning horn after hearing an exemplary one. The surviving passenger reported that although she was not focused on the engines for the remainder of the flight, she did not recall any interruptions in power. Further, she observed the pilot manipulating the controls during the descent to impact.

The end of the flight was captured by a surveillance video camera located about 800 ft north of the accident site. The video showed the airplane descending rapidly towards the ground in a slight left wing-low attitude. The airplane's nose attitude could not be determined due to the quality of the video. The airplane disappeared behind a residence, immediately thereafter fire and smoke appeared.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	83,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	October 13, 2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:			

The 83-year-old pilot held an airline transport pilot certificate with a rating for airplane single-engine land and commercial privileges for airplane multi-engine land. He also held a flight instructor certificate with ratings for airplane single-engine land, airplane multi-engine land, and instrument airplane. The pilot's most recent second-class medical certificate was issued on October 13, 2016, and included the restriction that he must wear corrective lenses. At the time of the exam, the pilot reported that he had accumulated 9,600 hours of flight experience of which 21 hours were in the previous 6 months. An excerpt of the pilot's personal flight record, which covered 2008, was furnished by the family. His most recent flight logbooks were not recovered. It could not be determined when the pilot had last flown in instrument meteorological conditions or when he had last completed an instrument competency check.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N1246G
Model/Series:	T310Q Q	**Aircraft Category:**	Airplane
Year of Manufacture:	1974	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	310Q1097
Landing Gear Type:	Retractable - Tricycle	**Seats:**	5
Date/Type of Last Inspection:	February 1, 2017 Annual	**Certified Max Gross Wt.:**	5500 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	4830.5 Hrs as of last inspection	**Engine Manufacturer:**	Continental Motors, Inc.
ELT:	Installed	**Engine Model/Series:**	TSIO-520 J
Registered Owner:	On file	**Rated Power:**	310 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

According to Federal Aviation Administration (FAA) records, the airplane was manufactured in 1974 and registered to the pilot and his wife on September 25, 2007. The airplane was powered by two Continental TSIO-520 J, turbocharged, direct-drive, air-cooled, 310-horsepower engines. A review of the airplane's maintenance logbooks revealed that the most recent annual inspection was completed on February 1, 2017, at an accumulated flight time of 4,830 hours. At the time of annual inspection, both the left and right engines had accrued about 1,265.1 flight hours since their most recent overhauls.

The airplane was equipped with two main wing fuel tanks with a total capacity of 102 gallons and two auxiliary wingtip tanks with a total capacity of 63 gallons. According to a fuel station attendant who worked for the fixed base operator at RAL, on February 25, 2017, he fueled the airplane at the pilot's request. The attendant topped off each of the airplane's four fuel tanks adding a total of 54 gallons of 100LL aviation gasoline. A fuel sample taken by an FAA inspector from the fuel truck that was used to refuel the airplane did not show any evidence of water or debris contamination.

Weight and Balance

An airplane weight and balance estimate was computed using occupant weights from the autopsy reports and from the surviving passenger. The baggage weight was determined by weighing an assortment of personal effects and baggage recovered from the accident site. The computed total weight was 5,812 pounds (lbs), which was 312 lbs over the airplane's maximum allowable gross weight of 5,500 lbs. The manufacturer does not provide center of gravity (CG) limits for weights above gross weight; the computed CG of 36.82 inches was forward of the forward limit of 38.67 inches at gross weight. Figure 1 shows the airplane weight and balance estimate plotted on the manufacturer's published CG moment envelope diagram from the pilot's operating handbook (POH).

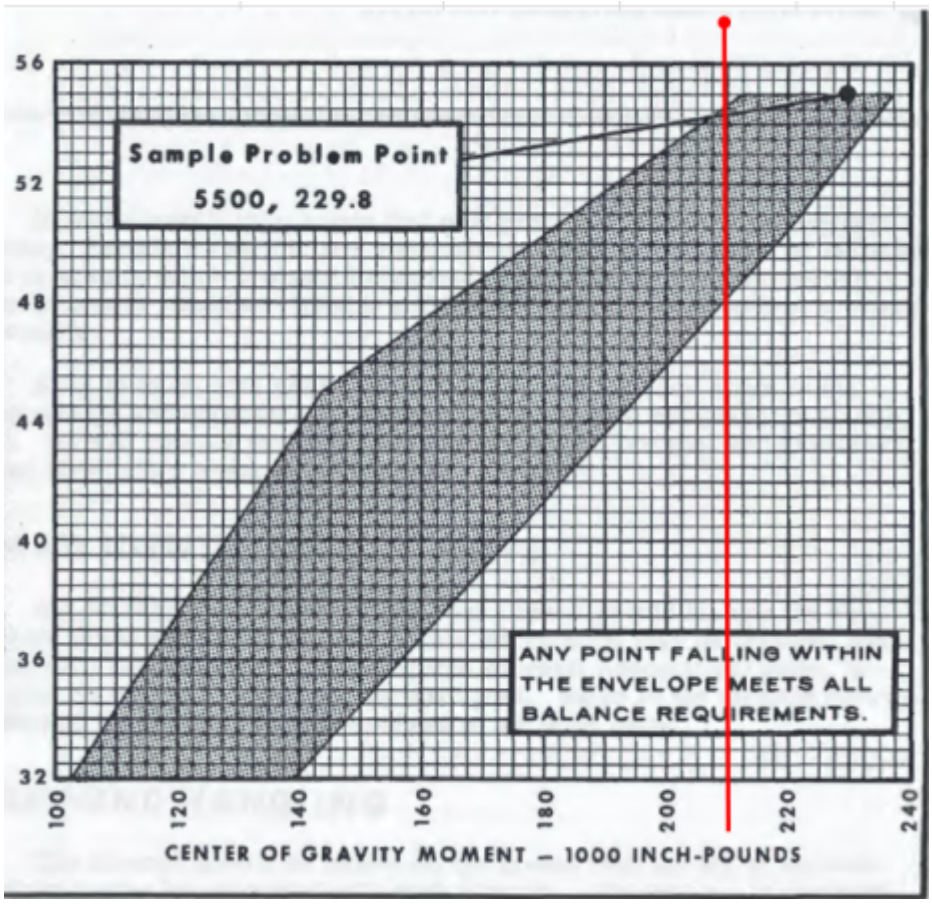

Figure 1 - Airplane Center of Gravity Moment Envelope Plotted with Main & Auxiliary Tanks at Full Capacity

According to the FAA Airplane Flying Handbook (FAA-H-8083-3B), the flight characteristics of a multi-engine airplane will vary significantly with shifts of the CG within the approved envelope. At forward CGs within the envelope, the airplane will be more stable, with a slightly higher stalling speed, a slightly lower cruising speed, and favorable stall characteristics. However, the airplane's performance outside the performance envelope cannot be predicted.

Stall Characteristics

According to the POH, the airplane's stall speed was 75 knots with no bank and 78 knots with 20° of bank.

Fuel Consumption

Climb and endurance performance computations performed using the airplane POH indicated that the airplane would have burned about 12 gallons of fuel during a climb to 12,000 ft, which was the pilot's filed cruising altitude, and contained enough fuel to fly about 790 nautical miles (nm) at the pilot's reported cruise airspeed of 160 kts. The distance from RAL to SJC was about 300 nm.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	RAL,818 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	16:37 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Scattered / 600 ft AGL	**Visibility**	2 miles
Lowest Ceiling:	Overcast / 4200 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.81 inches Hg	**Temperature/Dew Point:**	11°C / 11°C
Precipitation and Obscuration:	Moderate - None - Mist		
Departure Point:	RIVERSIDE, CA (RAL)	**Type of Flight Plan Filed:**	IFR
Destination:	SAN JOSE, CA (SJC)	**Type of Clearance:**	IFR
Departure Time:	16:40 Local	**Type of Airspace:**	

In the hours before the accident, IFR conditions prevailed at RAL due to low visibilities and ceilings. A review of the RAL weather observations indicated that rain began at 1152 and continued through 1653, with very light precipitation and mist about the time of the accident. Review of weather radar imagery showed that a small area of precipitation associated with very light intensity echoes was present at 1640 immediately north of the accident site.

The 1600 recorded weather observation at RAL included wind calm, visibility 2 miles in light rain and mist, ceiling overcast at 700 ft agl, temperature and dew point 11°C, and an altimeter setting of 29.83 inches of mercury.

The 1637 recorded weather observation at RAL included wind calm, visibility 2 miles in light rain and mist, scattered clouds at 600 ft agl, overcast ceiling at 4,200 ft agl, temperature and dew point 11°C, and an altimeter setting of 29.82 inches of mercury.

A terminal aerodrome weather forecast for Ontario International Airport (ONT), Ontario, California, located about 10 nm southeast of RAL, was issued at 1302 and was valid for a 27-hour period beginning at 1300. The forecast valid for the time of the accident expected marginal VFR conditions to prevail with light and variable winds at 4 knots or less, visibility of 5 miles in light rain showers and mist, with scattered clouds at 1,500 ft agl, and a ceiling broken at 2,500 ft. The next scheduled forecast for ONT was issued at 1537 and continued to expect marginal VFR conditions to prevail with light and variable winds, visibility 3 miles in light rain and mist, with a ceiling overcast at 1,000 ft agl.

Records obtained from a private industry flight service station indicated that when the pilot filed his IFR flight plan, he was in possession of adverse weather information indicating that he had already acquired the information through personal means. The pilot's personal weather source was not determined.

Airport Information

Airport:	RIVERSIDE MUNI RAL	**Runway Surface Type:**	
Airport Elevation:	818 ft msl	**Runway Surface Condition:**	Unknown
Runway Used:		**IFR Approach:**	None
Runway Length/Width:		**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	3 Fatal, 1 Serious	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	4 Fatal, 1 Serious	**Latitude, Longitude:**	33.953887,-117.418609

The accident site was located in a residential area about 1 nm northeast of RAL at an elevation of about 800 ft. The initial impact point (IIP) was identified by a broken chimney and a section of airframe located on the roof of house No. 1 (H-1 in the wreckage diagram located in the NTSB public docket). Multiple airplane fragments were found along the debris path, which was oriented on a heading of about 345° magnetic. House No. 2 (H-2) was located about 50 ft from the IIP and was consumed by postcrash fire. The airplane's main wreckage was found in a bedroom on the southwest end of house No. 3 (H-3) about 100 ft from the IIP. The main wreckage was comprised of the cabin, both engines, portions of the left and right wings, and the left propeller, which was underneath the main wreckage, which was consumed by postcrash fire.

The aileron flight controls were traced from the control column to the right-wing bell crank, where the cables had separated. Both push/pull tubes were continuous from the right-wing bell crank to the right aileron. Left aileron continuity was traced from the cockpit to the left-wing root where the cable had separated and displayed signatures consistent with overload separation. An intermediate segment of left aileron control cable was not recovered. The push/pull tubes remained attached to the bell crank but had separated from the left aileron.

Rudder control was traced from the rudder pedals to the aft fuselage, where the rudder cables had been cut by recovery personnel. The remaining cables were traced from the forward empennage to the rudder bell crank. Elevator control was confirmed from the cockpit to the elevator push/pull tubes, which had separated from both elevator control surfaces. The flap system was continuous from the flap chain to the right- and left-wing bell cranks. Measurement of the elevator trim tab actuator showed that about 1.75 inches of the rod was exposed, consistent with 5° tab up deflection.

The left engine's crankshaft rotated freely, and the valves moved normally with the exception of the exhaust valve on cylinder No. 6, which had sustained crush damage. Thumb compression was achieved on all cylinders in firing order with the exception of cylinder No. 6. A borescope inspection revealed no

mechanical deformation on the valves, cylinder walls, or internal cylinder heads. The spark plug center electrodes were elliptical in shape, which corresponded to worn out normal according to the Champion Aviation Check-A-Plug AV-27 Chart. Both magnetos sustained thermal damage; the left magneto was charred, and two posts were partially consumed by postcrash fire. The right magneto produced spark at all posts when rotated with a power tool. The wet vacuum pump vanes were intact and moved freely when the rotor was operated by hand. The oil sump and oil pickup tube exhibited vertical crush damage, and the pickup tube was clean and open. The oil filter sustained thermal damage and did not show any contamination within the folds. Both the oil pump gears and internal housing were unremarkable.

The engine-driven fuel pump drive gear was undamaged; the internal components were unremarkable; and the pump rotated freely by hand. The fuel distributor valve's rubber diaphragm was thermally damaged, and the valve's screen was clean.

The right engine's crankshaft rotated freely, and the valves moved normally. A borescope inspection revealed no mechanical deformation on the valves, cylinder walls, or internal cylinder heads. The spark plug center electrodes were elliptical in shape and gray in color, consistent with worn out normal according to the Champion Aviation Check-A-Plug AV-27 Chart. Both magnetos sustained thermal damage and could not be tested. The wet vacuum pump vanes were intact and moved freely when the rotor was operated by hand. The oil sump was not breached and contained a sludge in the bottom with visible magnetic particles. The oil sump screen appeared undamaged; the governor screen was clean; and the oil filter did not display any visible contaminants within the folds. The engine-driven fuel pump drive gear was undamaged; the internal components were unremarkable; and the pump rotated freely by hand. The fuel distributor valve's rubber diaphragm was partially consumed by fire, and the visible portions of the screen were clean.

Cabin Heater Examination

Examination of the cabin heater assembly showed that the unit's outer shroud was damaged by postcrash fire. The heater fan was also thermally damaged but turned continuously when power was applied to the unit. The heater did not leak when submerged in water and a continuous supply of air was directed into the combustion chamber to pressurize the unit.

Propeller Examinations

The right and left propellers were examined at the manufacturer's facility in Wichita, Kansas. The blades of both 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; the left propeller exhibited a dent in the cylinder near the feather end; these signatures were consistent with the blades operating on or near the low pitch stop position at impact.

Medical and Pathological Information

The Sheriff-Coroner of the County of Riverside, Perris, California, conducted an autopsy on the pilot.

The cause of death was listed as "multiple blunt impact injuries." The autopsy described an enlarged heart with 70% narrowing of the left anterior descending and right coronary arteries and 40% narrowing of the left circumflex artery. A blood sample taken by the coroner's office detected no drugs of abuse, alcohol, or carbon monoxide.

The FAA's Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicology testing on specimens from the pilot, the front right seat passenger, and another passenger. The testing did not identify any drugs or ethanol in the samples that were provided for the pilot's toxicology, and the specimen provided was not sufficient for carbon monoxide analysis. The right front seat passenger's toxicology did not detect carbon monoxide. The other passenger's toxicology detected 21% carbon monoxide; the reason for the passenger's high carbon monoxide level is unknown.

Tests and Research

Right Engine Oil Analysis

A laboratory examination of a sample of the oil sludge found in the right engine revealed the presence of lead and bromine. According to an industry specialist, 100LL aviation gasoline (AVGAS) contains a compound known as tetraethyl lead (TEL), which acts as an octane booster for fuel. TEL decomposes to form lead oxide when the fuel is burned. To prevent electrically conductive lead oxide deposits from forming on the spark plugs, the lead scavenging agent ethylene dibromide is added to AVGAS and reacts with the lead oxide to form lead bromide. The lead bromide remains in the gas phase and exits the cylinder with the exhaust gas. It subsequently enters the oil with the blow-by gas and solidifies, thereby making up the sludge commonly found in aircraft engines.

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Anthony Wood; Federal Aviation Administration; Riverside, CA Ricardo Hernandez; Federal Aviation Admnistration; Riverside, CA Mike Council; Continental Motors, Inc.; Mobile, AL Ricardo Asensio; Textron Aviation; Wichita, KS
Original Publish Date:	March 18, 2019
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=94780