



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

# Aviation Investigation Final Report

<b>Location:</b>	Blum, Texas	<b>Accident Number:</b>	CEN18LA287
<b>Date &amp; Time:</b>	July 21, 2018, 11:55 Local	<b>Registration:</b>	N3611Y
<b>Aircraft:</b>	Cessna 210C	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Fuel related	<b>Injuries:</b>	1 None
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

## Analysis

The pilot stated that she was about 20 minutes into a cross-country flight with the airplane at a cruise altitude of 3,500 ft mean sea level (msl) when the engine started to run roughly. The pilot suspected vapor lock because of the hot weather conditions and attempted to restore engine power. She switched the fuel selector positions from the right to the left fuel tank, but when the roughness worsened, she switched the selector back to the right tank. She selected the boost pump to LOW and then HIGH, and retarded throttle control, all of which had no effect on engine operation. The engine began to lose power rapidly and then quit; the propeller windmilled.

The pilot began an approach for a forced landing on a field with flaps at 30° and the landing gear retracted. She said that it would take her about 3 minutes to manually pump the landing gear down and that she did not have enough time to lower the landing gear due to the airplane's altitude. The landing on the field was "firm," and the airplane quickly slid to a stop and sustained substantial damage during the gear-up landing.

The airplane emergency checklist for a forced landing after a complete engine failure required extension of the landing gear if the landing surface is smooth and hard and does not mention the need to extend the landing gear using manual extension; the windmilling engine would provide power to the hydraulic pump to operate the flaps and also to extend the landing gear normally. Postaccident examination of the field showed that the surface was hard and in good condition to perform a landing; however, the pilot stated that she could not determine this when she was 2 miles from the field when she decided to land there.

The density altitude near the departure airport was about 3,500 ft msl, which would have required full rich fuel mixture at takeoff.

Postaccident examination of the airplane revealed that the left and right fuel tanks were each about half full, the throttle and propeller controls were in the full forward positions, and the mixture control was

near the idle cutoff position. The pilot stated she did not remember advancing the mixture control to full rich when the engine roughness occurred and did not change the mixture control position after landing. Advancement of the mixture control to full rich would have increased fuel flow to mitigate restrictions to fuel flow, if present. There were no anomalies noted during the postaccident test run of the engine. Thus, it is likely that the pilot leaned the fuel mixture too much when the airplane reached cruise altitude, which resulted in the subsequent loss of engine power.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's excessive leaning of the fuel mixture, which resulted in a loss of engine power, and the pilot's failure to extend the landing gear in accordance with the airplane emergency checklist, which resulted in a gear-up landing.

### Findings

<b>Personnel issues</b>	Incomplete action - Pilot
<b>Aircraft</b>	Fuel - Not specified

# Factual Information

## History of Flight

Enroute-cruise	Fuel related (Defining event)
Enroute-cruise	Attempted remediation/recovery
Approach	Off-field or emergency landing
Landing	Miscellaneous/other
Landing	Collision with terr/obj (non-CFIT)

On July 21, 2018, at 1155 central daylight time, a Cessna 210C, N3611Y, was substantially damaged during a forced landing to a field near Blum, Texas. The airline transport pilot was uninjured. The airplane was registered to and operated by the pilot under Title 14 *Code of Federal Regulations* Part 91 as a personal flight that was not operating on a flight plan. Day visual meteorological conditions prevailed at the time of the accident. The flight departed from Granbury Regional Airport (GDJ), Granbury, Texas, and was destined to Hilltop Lakes Airport (0TE4), Hilltop Lakes, Texas.

The pilot stated that she completed a preflight inspection during which she sumped the fuel system. The fuel sump samples did not contain water or contaminant. She said that her first attempt to start the engine was unsuccessful, so she waited about 30 minutes for the starter to cool before attempting another start. Upon the second start attempt, the engine started and "ran normally," and the subsequent engine run-up was "normal".

After takeoff, the airplane departed GDJ traffic pattern and proceeded on course at a cruise-climb airspeed; all "engine indications were "normal". Upon reaching a cruise altitude of 3,500 ft mean sea level, engine power and speed were set to 22 inches of manifold pressure and 2,200 rpm, and the mixture was set to 13 gallons per hour. About 20 minutes after departure, the engine began to run "rough" and because of the hot weather conditions the pilot suspected vapor lock. She switched the fuel selector position from the right to the left fuel tank, but the engine roughness worsened so she switched the selector back to the right fuel tank. She then selected the boost pump to LOW and then HIGH, but those selections had no effect on the engine roughness. The engine began to lose power rapidly. The pilot retarded the throttle control but that did not affect the engine.

About 1,000 ft above ground level, the pilot selected a field for a forced landing. She said that she complied with the aircraft manufacturer's procedure and landed on the field with landing gear retracted because the engine driven hydraulic pump was being powered by a windmilling engine. She selected flaps to 30 degrees and advanced the throttle control to silence the gear warning horn. On short final to the field, she turned the ignition switch OFF. She said that the landing touchdown was "firm," and the airplane slid to a stop very quickly. She estimated that 2 minutes elapsed from the onset of engine roughness to landing.

The National Transportation Safety Board (NTSB) Investigator-in-Charge (IIC) asked the pilot why she did not lower the landing gear for the forced landing; she said the airplane checklist stated that the

landing gear was not to be lowered, and that it would take her about 3 minutes to manually pump the landing gear down. She said it would take her about 3 minutes to manually pump the landing gear down during landing gear swing tests that she did during the airplane's maintenance. She said the 3 minutes was without air loads on the airplane because it was a gear swing test with the airplane on jacks. She said that she would rather focus on flying the airplane rather than pumping the landing gear during the approach for the forced landing. She said that the outcome landing with the landing gear partially extended would have been worse than landing with the gear retracted. She said she did not have enough time to lower the landing gear due to the altitude the airplane was at during the approach to a field. She said there is no way to tell if a field is rough while the airplane is 2 miles away from the field.

When the pilot was asked on separate occasions by the NTSB IIC and the FAA inspector whether she advanced the mixture control to the full rich position when the engine roughness occurred; she said that she did not remember. She said that she did not change the mixture control position after the forced landing. The pilot later stated that the mixture was only slightly leaned because of the low cruise altitude. She said it's normal while flying the accident airplane to start leaning as climb power is set, or even during takeoff from high elevation airports. She said that at some point in trying to restart the engine, she thought that she moved the mixture to full rich, but it wasn't much of a move. She said the time available to attempt a restart was very short.

## Pilot Information

<b>Certificate:</b>	Airline transport; Flight engineer; Flight instructor	<b>Age:</b>	76,Female
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	Glider	<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	Airplane multi-engine; Airplane single-engine; Glider; Instrument airplane	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	March 9, 2017
<b>Occupational Pilot:</b>	Yes	<b>Last Flight Review or Equivalent:</b>	April 20, 2017
<b>Flight Time:</b>	2598.3 hours (Total, all aircraft), 605.2 hours (Total, this make and model), 2206.6 hours (Pilot In Command, all aircraft), 1.1 hours (Last 90 days, all aircraft), 1.1 hours (Last 30 days, all aircraft), 0.5 hours (Last 24 hours, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N3611Y
<b>Model/Series:</b>	210C	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1962	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	21058111
<b>Landing Gear Type:</b>	Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	September 1, 2017 Annual	<b>Certified Max Gross Wt.:</b>	2998 lbs
<b>Time Since Last Inspection:</b>		<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	1547.3 Hrs at time of accident	<b>Engine Manufacturer:</b>	Continental
<b>ELT:</b>	Installed, not activated	<b>Engine Model/Series:</b>	IO-470-S2
<b>Registered Owner:</b>		<b>Rated Power:</b>	260 Horsepower
<b>Operator:</b>		<b>Operating Certificate(s) Held:</b>	None

The airplane was equipped with a Continental IO-470-S2, serial number CS-102886-3-A-I, engine that was last overhauled at the time of installation onto the airframe, dated January 15, 1976. At the time of the accident, the time since overhaul of the engine was 474.45 hours.

The pilot held an airframe and powerplant mechanic certificate and performed maintenance on the airplane. The pilot stated she owned the airplane since its new purchase in 1962 and was last flown in 2003. In 2004 she decided to begin flying the airplane. The airplane received its last annual inspection in September 2018. She suspected that the loss of engine power occurred at the time of the accident was due to vapor lock because of two prior occurrences of power losses that occurred on hot days, as follows:

On May 29, 2003 from a flight from Mineral Wells Airport (MLW), Mineral Wells, Texas to Horseshoe Bend Airport (F78), Weatherford, Texas the airplane experienced an engine power loss occurred during landing rollout when the engine was at idle and would not restart. She said the idle speed was adjusted "slightly" and subsequent engine starts and ground runs were normal "once the engine had cooled."

On July 19, 2003, while en route from F78 to Easterwood Field Airport (CLL), College Station, Texas, the engine ran rough and subsequently quit. The engine was restarted after the throttle was retarded rapidly to idle from where it had been set for cruise. The engine ran from there until landing at Marlin Airport (T15), Marlin, Texas and died again on landing rollout. The following day the engine started and ran normally through a full-power ground run. An airframe and power plant mechanic with inspection authorization helped her in draining every sump, checking every vent, and checking every fuel filter that we could access. Nothing out of the ordinary was found.

The pilot stated that following the engine power loss on July 19, 2003, all the fuel lines in the engine compartment were replaced. She said that the airplane electric boost pump was modified after both losses of engine power due to a sticking solenoid valve in the fuel/vapor return line between the engine driven fuel pump and fuel selector. The removal of the solenoid valve and replacement of two electrically-driven fuel boost pumps with one fuel boost pump was completed through a major repair

and alteration dated September 2, 2004, to modify the fuel boost pump system to the configuration installed in Cessna 210D airplanes.

The 1963 Cessna 210C Owner's Manual stated that flaps are operated hydraulically by the same system that operated the landing gear. The airplane retractable tricycle landing gear is extended and retracted by hydraulic actuators, powered by an engine-driven hydraulic pump.

The Owner's Manual Forced Landing (Complete Engine Failure) procedure stated, in part, "(5) If field is smooth and hard, extend the landing gear within gliding distance of field. (6) If engine is windmilling, extend flaps as necessary within gliding distance of field." The Owner's Manual does not require manual extension of the landing gear following engine power loss.

### Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	CPT,854 ft msl	<b>Distance from Accident Site:</b>	15 Nautical Miles
<b>Observation Time:</b>	11:30 Local	<b>Direction from Accident Site:</b>	360°
<b>Lowest Cloud Condition:</b>	Clear	<b>Visibility</b>	10 miles
<b>Lowest Ceiling:</b>	None	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	7 knots /	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>	240°	<b>Turbulence Severity Forecast/Actual:</b>	N/A / N/A
<b>Altimeter Setting:</b>	29.98 inches Hg	<b>Temperature/Dew Point:</b>	36°C / 17°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Granbury, TX (GDJ )	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Hilltop Lakes, TX (0TE4)	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	11:00 Local	<b>Type of Airspace:</b>	Class E

### Wreckage and Impact Information

<b>Crew Injuries:</b>	1 None	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>		<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 None	<b>Latitude, Longitude:</b>	32.054443,-97.308609(est)

A post-accident examination of the accident site by a Federal Aviation Administration inspector revealed that the airplane was resting on a flat and dry dirt field with the landing gear retracted and the flaps extended to the full flap, 30-degree position. The FAA inspector stated that it had not rained for about six weeks and the surface was hard and its surface was in a condition as some turf airstrips. The master switch, ignition key switch, boost pump switch, and the fuel selector were in the OFF positions.

The throttle and propeller controls were in the full forward positions. The mixture control was near the idle cutoff position. The left and right fuel tanks were each about ½ full of liquid consistent with 100 low lead aviation fuel. The fuselage was wrinkled.

Following the recovery of the airplane to a salvage facility, the engine with the airframe were secured to a trailer and the propeller replaced in preparation for and engine test run under the supervision of a NTSB Air Safety Investigator. The fuel supply to the engine was plumbed into the left wing tank fuel lines. The top spark plugs were removed and exhibited features consistent with normal operation. The plugs were then reinstalled. The engine was primed using the electric boost pump and started immediately and allowed to warm up. The propeller was cycled at an engine speed of 1,000 rpm. A magneto check was performed at an engine speed of 1,800 rpm and the corresponding reduction in speed was approximately 125 rpm. There were no anomalies when engine power was increased to full power. The external fuel supply was then plumbed into the right wing fuel tank lines and a second test run was performed with similar results. Both test runs were about 5-6 minutes in duration. There were no fuel system leaks noted during the test runs.

The fuel selector was removed, and its examination revealed no blockage and no mechanical anomalies that would have precluded normal operation.

The fuel pump, fuel servo, and manifold valve were removed for subsequent flow testing at Continental Motors under the supervision of an NTSB Air Safety Investigator. Testing of the fuel pump revealed that the pump produced adequate fuel flow and pressure for an IO-470 engine. Bench testing of the fuel servo and the manifold valve yielded results that did not meet factory specifications for a new part; fuel injection systems must be set up and adjusted to each individual engine and airframe combination. The throttle body/metering unit had a leak during bench testing. The leak during bench testing emanated from an internal O-ring. There were no leaks from the throttle body/metering unit during the engine test run.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Gallo, Mitchell
<b>Additional Participating Persons:</b>	Brad Holt; Federal Aviation Administration; North Texas FSDO; Irving, TX Gary Watson; Federal Aviation Adminstion; North Texas FSDO; Irving, TX Christopher Lang; Continental; Mobile, AL Jennifer Barlay; Textron Aviation, Inc.; Wichita, KS
<b>Original Publish Date:</b>	June 8, 2020
<b>Note:</b>	The NTSB did not travel to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=97849">https://data.nts.gov/Docket?ProjectID=97849</a>

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](#).