



# National Transportation Safety Board Aviation Accident Final Report

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<b>Location:</b>	Ocean Ridge, Florida	<b>Accident Number:</b>	NYC08LA255
<b>Date &amp; Time:</b>	July 22, 2008, 13:50 Local	<b>Registration:</b>	N3990C
<b>Aircraft:</b>	Cessna 402B	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Loss of engine power (partial)	<b>Injuries:</b>	1 Serious
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

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## Analysis

The commercial pilot, who was also the former owner of the twin-engine airplane, stated that the purpose of the flight was to reposition the airplane to an airport approximately 22 miles south of the departure airport. Just prior to the flight, he purchased 10 gallons of fuel for each of the two main tanks. The pilot reported that about 5 minutes after takeoff, at an altitude of approximately 1,000 feet, he experienced a "loss of engine power." However, his three separate accounts of the event were inconsistent with respect to which engine had a problem, or the specific nature of the problem. The pilot reported that the airplane started to lose altitude "rapidly," and that he attempted to "wag the wings" in order to "get all the fuel to be useable." The airplane struck a building and terrain approximately 8 miles south of the departure airport. The pilot sustained serious injuries, but there was no fire. Damage to the left engine and propeller was consistent with the engine running at impact, and precluded an attempt to run the left engine in a test cell. Damage to the right engine and propeller was consistent with low or no power at impact. The right engine was subsequently successfully run in a test cell. No evidence of any pre-accident anomalies that could have contributed to the accident was noted with the airframe, engines, or propellers. The fuel selector valve placards did not accurately depict the fuel system configuration. The fuel quantity and its distribution in the tanks, either at the beginning of the flight or at the time of the accident, could not be determined.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A partial loss of engine power due to fuel starvation. Contributing to the accident was the pilot's decision to add only a limited amount of fuel prior to the flight, and the fuel selector valve placards' inaccurate depiction of the airplane fuel tank configuration.

## Findings

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Personnel issues	Fuel planning - Pilot
Aircraft	Fuel - Fluid level
Aircraft	Fuel - Fluid management
Aircraft	Fuel distribution - Related operating info

## Factual Information

### HISTORY OF FLIGHT

On July 22, 2008, about 1350 eastern daylight time, a Cessna 402B, N3990C, was substantially damaged when it impacted a building and the ground in Ocean Ridge, Florida. The certificated commercial pilot, the sole occupant, was seriously injured. The personal flight was operated under the provisions of Title 14 Code of Federal Regulations Part 91. Visual meteorological conditions prevailed for the flight, and no flight plan was filed.

The pilot stated that the purpose of the flight was to reposition the airplane from Palm Beach County Park Airport (LNA), West Palm Beach, Florida, to Pompano Beach Airpark (PMP), Pompano Beach, Florida, for future maintenance. PMP was located approximately 22 miles south of LNA. Statements provided by line personnel at LNA indicated that the pilot purchased 20 gallons of fuel just prior to the accident flight, and that the fuel was dispensed evenly into the two tip tanks of the accident airplane.

In interviews with Federal Aviation Administration (FAA) inspectors, the pilot stated that he took off from LNA and kept the airplane's landing gear extended for the flight. He was aware of a problem with the landing gear, and thought that if he retracted the gear, he would not be able to successfully re-extend it for landing. After departing LNA, the pilot flew south over the Atlantic Intracoastal Waterway at an altitude of between 800 and 1,000 feet, enroute to PMP.

The pilot reported that about 5 minutes into the flight, he experienced a "loss of engine power." In one interview with FAA inspectors, he stated that he had problems with the left engine, but during a subsequent interview, he stated that the right engine malfunctioned. In a written statement that the pilot provided to the Ocean Ridge Police Department, dated 6 days after the accident, the pilot did not specify which engine malfunctioned. Instead, he reported only that he attempted to "identify and verify which engine(s) were causing trouble." In the same statement, the pilot reported that he started to lose altitude "rapidly," and attempted to "wag the wings" side to side in order to "get all the fuel to be useable." He stated that he "must have blanked out," because the last thing he remembered about the accident was seeing the top of the town hall building just prior to impact. The airplane struck the Ocean Ridge town hall building, located approximately 8 miles south of LNA.

Several witnesses reported that the airplane was traveling north to south, was flying slowly with the landing gear extended, and that the wings were "rocking." Many witnesses also reported that the engines were operating.

### PERSONNEL INFORMATION

According to FAA records, the pilot, age 50, held a commercial pilot certificate with airplane single-engine land, multi-engine land, and instrument ratings. In 2004, the pilot reported that he had 1,560 total hours of flight experience. His most recent FAA second-class medical certificate was issued in February, 2008. Despite multiple requests, the pilot did not provide his personal logbook or other information requested by National Transportation Safety Board

(NTSB).

## AIRCRAFT INFORMATION

The accident airplane was an all-metal, twin-engine, low-wing monoplane, with retractable landing gear. According to FAA records, the airplane was manufactured in 1975. It was powered by two Continental TSIO-520 series engines, each equipped with a three-bladed, constant-speed propeller. The airplane was previously owned by the pilot, but he sold it to another individual in September 2007, and the FAA airplane registration form was issued to that individual in January, 2008. The individual who owned the airplane at the time of the accident did not hold any pilot certificates.

## METEOROLOGICAL INFORMATION

The 1347 surface weather observation at an airport located 6 miles south of the accident site included winds from 160 degrees at 8 knots, visibility 10 miles, scattered clouds at 2,500 feet, temperature 30 degrees C, dew point 25 degrees C, and an altimeter setting of 30.08 inches of mercury.

## COMMUNICATIONS

No air traffic control voice communications or ground radar tracking data regarding this flight were able to be located.

## WRECKAGE AND IMPACT INFORMATION

After it struck the building, most of the airplane came to rest inverted on the ground, against a concrete utility pole. There was no post-impact fire. The left wing was separated from the fuselage, and the left tip tank was separated from the left wing. The right wing and fuselage were on opposite sides of a concrete utility pole, and were structurally separated from one another, but remained attached by wires and control cables. The outboard section of the right wing, including the tip tank, was separated from the inboard wing. The fuselage was fractured just aft of the pilots' seats. The horizontal stabilizer was separated from the fuselage. The left engine was found approximately 25 feet from the main wreckage, and the left propeller was separated from the left engine. The right engine remained attached to the airframe, and the right propeller remained attached to the right engine. All three landing gear were found in their respective down and locked positions. The left landing gear, left engine nacelle and a portion of the left inboard wing were found on the roof of the building.

## ADDITIONAL INFORMATION

### Maintenance Records Examination

A review of the airframe and engine maintenance records that dated back to February 2002 revealed that only three annual inspections were recorded over the 6 year period. An annual inspection was completed in February 2002, when the airplane had accrued a total

time (TT) in service of 7,135 hours. The corresponding Hobbs meter entry in each engine logbook (only one Hobbs meter was installed in the airplane) indicated that each engine had accrued 856.2 hours since major overhaul (SMOH). The next annual inspection was completed in March 2004, when the airplane had accrued a TT of 7,145.8 hours, and the Hobbs meter reading was recorded as 866.4 hours. The most recent annual inspection was completed in March 2006, when the airplane had accrued a TT of 7,221.9 hours, and the Hobbs meter reading was recorded as 942.5 hours. The March 2006 annual inspection was the most recent entry in the airframe, engine and propeller maintenance records.

### Detailed Airframe Examinations

Recovery personnel had separated the fuselage into two pieces, and they had also detached the right wing. On August 5, 2008, personnel from the FAA, Cessna Aircraft, and Teledyne Continental Motors (TCM) and the NTSB examined the airplane at the recovery facility in Boynton Beach, Florida. On March 10, 2010, NTSB personnel re-examined selected portions of the fuel system.

The cockpit area and instrument panel were relatively intact, with some crush and deformation damage. The cockpit throttle, propeller, and mixture controls were all found at or near their full-forward positions. The two magneto switches for the left engine, and the left magneto switch for the right engine, were in their respective "On" positions. The right magneto switch for the right engine was in the "Off" position. The "L Alt" and "Batt" master switches were in their respective "On" positions, and the "R Alt" master switch was in the "Off" position. The two guarded emergency power switches were found in different positions. The "Alt Field" cover was down (stowed), while the "Avionics Bus" cover was up, with its switch in the up/forward position. Numerous circuit breakers on the left side circuit breaker panel, including "Turn & Bank 1, L Fuel Pump, Comm 3, ADF, DME, Audio Amp, Xpndr 1, and Radar" were in the activated (circuit disabled) position. The Hobbs hour meter in the cockpit indicated 969.1 hours, and a placard below it stated "Total Time Add 6279.4 Hrs."

The landing gear handle was found in the gear-retracted position, but the positions or configurations of most other landing gear linkage and components, including the gearbox, were consistent with the landing gear in the extended position.

All flight control surfaces were present, and control continuity was established for all primary and secondary flight controls. The elevator trim indicator in the cockpit was found at the extreme airplane-nose-down position. The elevator trim actuator extension was 1.9 inches, which was beyond its normal travel limit, in a tab-up (airplane-nose-down) direction. The aileron trim indicator in the cockpit was found in the right-wing-down position. The left wing aileron trim actuator extension was 1.9 inches, which equated to approximately 15 degrees tab down, and which would result in a left-wing-down rolling moment. The rudder trim indicator in the cockpit was found in the airplane-nose-left position. The rudder trim actuator extension was 2.3 inches, which equated to a neutral (zero degrees) tab deflection. The cockpit flap selector handle was positioned to 30 degrees, and the flap deflection indicator was positioned between the 0 and 15 degree deflection markings. The extension of the flap hydraulic actuator was deemed to be unreliable for the purpose of determining flap position.

All three blades remained in the right propeller hub. Two blades appeared undamaged, and one blade was bent slightly aft. The spinner sustained some crush damage in the aft direction, with straight scoring in the fore-aft direction. The left propeller hub was fractured, and one blade had separated from the hub. The separated blade exhibited spanwise scoring and some aft bending. One blade that remained in the hub was bent slightly aft, and the other blade in the hub exhibited significant "S" bending, with moderate chordwise and spanwise scoring.

#### Airplane Fuel System Configuration and Examination

The airplane was equipped with four fuel tanks, including one main (tip) tank, and one auxiliary tank, in each wing. According to Cessna records, the airplane was delivered new with two main fuel tanks and two auxiliary fuel tanks. Each main tank had a usable capacity of 50 gallons, and each auxiliary tank had a usable capacity of 31.5 gallons, for a total usable fuel capacity of 163 gallons. A continuous-duty electric fuel pump was installed in each main tank. According to the airplane manufacturer, the pumps assured "availability of all main tank fuel to the engine supply line during high angles of descent."

A fuel quantity gauge on the instrument panel contained two mirror-image graduated scales, each with a dedicated indicating needle. One scale/needle combination was for the left side tanks, and one was for the right side tanks. According to the airplane manufacturer's guidance, the "fuel quantity indicator continuously indicates fuel remaining in the tanks selected" by the fuel selector knobs and valves. A three-position switch, spring-loaded to the center position, and located near the fuel quantity gauge, permitted display of the fuel quantities in the tanks that were not selected.

The airplane was equipped with two cockpit-floor-mounted fuel selector control knobs, one for each engine. Each knob was designed to rotate on a vertical axis, over an azimuth of 270 degrees in the horizontal plane. Each knob was located at the center of a white "X" that was on a placard in the well of each selector pan; the legs of each "X" divided each placard into four quadrants. Three of the four quadrants on each placard contained text that denoted the selection associated with the quadrant. Three index marks on each placard, one each at the 6 o'clock (aft), 9 o'clock and 3 o'clock positions, respectively corresponded to fuel selector valve settings of off, left main tank, and right main tank.

Each fuel selector knob actuated a wing-mounted fuel selector valve via a gearbox and a push-pull cable. Each of the installed fuel selector valves was configured with four fuel lines. Each valve was plumbed to provide four selection options: off, left main tank, right main tank, and the corresponding auxiliary tank. The left fuel selector valve was plumbed to the left auxiliary tank, and the right fuel selector valve was plumbed to the right auxiliary tank. Feeding an engine from the opposite main tank was also referred to as the "crossover" position/setting. Each of the fuel selector valves was configured with four position detents arranged in an arc; from inboard to outboard, these detents corresponded to the crossover, aux, main, and off settings

According to the airplane manufacturer's illustrated parts catalog (IPC), the left engine fuel selector valve was part number (P/N) 5226005-5, and the right engine fuel selector valve was P/N 5226005-6. The part numbers of the installed fuel selector valves were Shaw Aero P/N

1H13-13, S/N 6W (left engine/wing), and Shaw Aero P/N 1H13-14, S/N 10W (right wing/engine). The representative of the airplane manufacturer stated that the Shaw Aero part numbers "are valid alternate vendor part numbers" for the valves.

According to the IPC, the left engine fuel selector valve placard for airplanes not equipped with auxiliary tanks was P/N 5215081-1, and the right engine fuel selector valve placard was P/N 5215081-2. For airplanes equipped with auxiliary tanks, these numbers were 5215081-3 and 5215081-4. No part numbers were evident on the installed fuel selector placards. Although the airplane was equipped and properly plumbed with auxiliary fuel tanks, the placards did not contain any references to those tanks, and therefore the placards did not accurately depict the fuel system configuration as installed. A maintenance records entry dated May 26, 1993 stated in part "Installed all new interior and exterior placards," but it could not be determined whether the fuel selector placards were replaced at that time. No specific information concerning the fuel selector placards was located in any other maintenance records.

The left engine fuel selector knob was found in the "OFF" position, and the left fuel selector valve was between the two most outboard detent positions, which corresponded to "LEFT MAIN" and "OFF" settings. The right engine fuel selector knob was found between the "OFF" and "LEFT MAIN" (crossover) positions, and the right fuel selector valve was found in the most outboard detent position which corresponded to the "OFF" setting. The left main (tip) tank was breached, while the left auxiliary fuel tank bladder was intact. The right main (tip) tank was intact, and the right auxiliary fuel tank bladder was breached and otherwise damaged. According to a representative of the airplane manufacturer, on August 5, an "unknown quantity" of fuel was found in each main tank. Tests of the fuel with water-detecting paste were negative, indicating that no water was present in the fuel. The electric fuel pump from each main tank was found to be operational when tested. Examination of the airplane, and review of the pilot's testimony, did not enable the determination of the total fuel quantity or its distribution in the tanks, either at the beginning of the flight, or at the time of the accident.

### Engine Examinations

On November 4, 2008, both engines were examined at the TCM facility in Mobile, Alabama. Representatives from TCM, the FAA, and the NTSB were present.

### Left Engine Results

The left engine exhibited significant impact damage, primarily to its front, upper and lower sides. Most intake, exhaust and fuel-delivery components sustained crush and fracture damage, and many were separated from the engine in the accident. Some accessories that attached to the aft side of the engine case, including one magneto, were also fracture-separated from the engine. Investigators determined that the damage was sufficient to preclude a test run of the left engine. The engine was stripped of all accessories and external components, and all were examined individually. Examination and teardown of the components did not reveal any abnormalities that could not be attributed to impact. All engine fuel system components sustained damage that precluded the determination of their pre-accident condition or functionality. Damage signatures on the turbocharger were consistent with turbocharger operation at impact.

The cylinders, pistons and associated hardware were then separated from the engine case, and the engine case was disassembled. All components were examined, and no evidence of any pre-impact failures of the engine case, crankshaft, cylinders, pistons, valve train, lubrication system, or any of their gears, bearings, or associated components, was observed.

### Right Engine Results

All six cylinders were examined with a lighted borescope, and all exhibited combustion deposits in the combustion chambers and on the piston heads. Oil and corrosion were present on all cylinder bores. The cylinder head combustion chambers, intake and exhaust valve faces, piston heads and cylinder bores exhibited signatures consistent with normal engine operation. A dye penetrant inspection was performed on the propeller crankshaft mount flange, and no cracks were detected. The engine was then prepared to be run in a test cell.

For the engine test run, the engine started on the first attempt, with no hesitation or stumbling. The engine rpm was advanced in steps, in preparation for full power operation. The throttle was advanced until the engine achieved 1,200 rpm, and that setting was held for 5 minutes to stabilize the engine. The process was then repeated for 1,600 and 2,450 rpm. The throttle was then advanced to the full open position, and held for 5 minutes. The throttle was retarded, and then advanced to the full throttle position a total of six times. Throughout the test series, the engine accelerated and ran normally, without any hesitation, stumbling or interruption in power, and the engine demonstrated the ability to produce the rated horsepower.

### Airplane Performance

Section VI (Operational Data) of the manufacturer's Owner's Manual provided gross weight, zero wind fuel consumption tables for the airplane. The climb and cruise performance tables each contained data for sea level and 5,000 feet, but no data was provided for any intermediate altitudes. The climb performance table included a "pretakeoff allowance" of 30 pounds, or 5 gallons, and that a climb to 5,000 feet would consume 49 pounds, or approximately 8 gallons. Depending on the engine power settings, cruise performance fuel consumption using "recommended lean mixture" ranged from approximately 108 to 202 pounds per hour, which was equivalent to approximately 21 to 40 gallons per hour. Neither the duration of the flight, nor the engine power settings during the flight, could be accurately determined.

### History of Flight

Prior to flight	Aircraft inspection event
Enroute-cruise	Fuel related
Enroute-cruise	Loss of engine power (partial) (Defining event)
Enroute-cruise	Off-field or emergency landing
Landing	Collision with terr/obj (non-CFIT)

## Pilot Information

<b>Certificate:</b>	Commercial	<b>Age:</b>	51, Male
<b>Airplane Rating(s):</b>	Single-engine land; Multi-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>	Class 2 With waivers/limitations	<b>Last FAA Medical Exam:</b>	July 20, 2004
<b>Occupational Pilot:</b>	UNK	<b>Last Flight Review or Equivalent:</b>	July 10, 2008
<b>Flight Time:</b>	(Estimated) 1565 hours (Total, all aircraft)		

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Cessna	<b>Registration:</b>	N3990C
<b>Model/Series:</b>	402B	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>		<b>Amateur Built:</b>	No
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	402B0857
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	8
<b>Date/Type of Last Inspection:</b>	March 27, 2006 Annual	<b>Certified Max Gross Wt.:</b>	6300 lbs
<b>Time Since Last Inspection:</b>	27 Hrs	<b>Engines:</b>	2 Reciprocating
<b>Airframe Total Time:</b>	7222 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Teledyne Continental
<b>ELT:</b>	Installed, not activated	<b>Engine Model/Series:</b>	TSIO-520
<b>Registered Owner:</b>		<b>Rated Power:</b>	300 Horsepower
<b>Operator:</b>		<b>Operating Certificate(s) Held:</b>	None

## Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	BCT, 13 ft msl	Distance from Accident Site:	6 Nautical Miles
Observation Time:	13:47 Local	Direction from Accident Site:	180°
Lowest Cloud Condition:	Scattered / 2500 ft AGL	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	8 knots /	Turbulence Type Forecast/Actual:	/
Wind Direction:	160°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	30.07 inches Hg	Temperature/Dew Point:	30° C / 25° C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lantana, FL (LNA )	Type of Flight Plan Filed:	None
Destination:	Pompano Beach, FL (PMP )	Type of Clearance:	None
Departure Time:	13:40 Local	Type of Airspace:	

## Wreckage and Impact Information

Crew Injuries:	1 Serious	Aircraft Damage:	Substantial
Passenger Injuries:		Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	1 Serious	Latitude, Longitude:	26.518333, -80.041664

## Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	Barry Byrd; FAA/FSDO; Ft. Lauderdale, FL Ricardo Asensio; Cessna Aircraft Company; Wichita, KS Terry Horton; Teledyne Continental Motors; Mobile, AL
Original Publish Date:	June 17, 2010
Note:	
Investigation Docket:	<a href="https://data.nts.gov/Docket?ProjectID=68493">https://data.nts.gov/Docket?ProjectID=68493</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](#).