Aviation Investigation Final Report

Location:	Whiteville, North Carolina	**Accident Number:**	ERA18FA012
Date & Time:	October 31, 2017, 10:02 Local	**Registration:**	N293GC
Aircraft:	Beech 35C33	**Aircraft Damage:**	Substantial
Defining Event:	Fuel starvation	**Injuries:**	1 Fatal, 1 Minor
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

On the morning of the cross-country flight, during the preflight inspection of the airplane, the pilot and pilot-rated passenger confirmed that the total amount of fuel onboard was sufficient for the planned flight of that was to be about 2 hours in length. After departure, they flew with the fuel selector in the right tank position for 1 hour 25 minutes. When they were about 40 minutes from the airport where they intended to refuel, the pilot switched the fuel selector to the left tank position.

During the final approach to the runway, when the airplane was at an altitude about 700 ft mean sea level, the pilot switched the fuel selector back to the right tank; the landing checklist required the selector to be selected to the fullest tank for approach and landing. The pilot-rated passenger noticed that the left fuel tank gauge indicated 1/4 full, and the right fuel tank gauge indicated 1/2 full. He then advised the private pilot that could not be correct, as they had been operating on the right tank for most of the flight. The nose of the airplane then dropped, and the pilot-rated passenger advised the pilot that the airplane had lost engine power. The pilot-rated passenger then noticed the pilot twisting the vernier-type throttle, and he told him again that the engine was not producing any power. The pilot then reached down and switched the fuel selector to the left tank. As the pilot leaned forward, his torso pushed against the control wheel assembly and the airplane pitched sharply downward. The airplane impacted trees about 2,000 ft from the threshold of the runway.

Examination of the accident site revealed evidence of cut tree limbs; an indication of the engine regaining power moments before impact, and/or the propeller rotating at high rpm at the moment of impact. Examination of the wreckage revealed no evidence of any preimpact failure or malfunction of the engine and review of data from an installed engine data monitoring system indicated that the engine was functioning normally until it lost power when the pilot selected the right wing tank in preparation for landing.

About 16 gallons of fuel was drained from the left tank, and about 0.5 gallon was drained from the right tank. Postaccident functional testing of the fuel quantity indicating system showed that when the right fuel tank quantity transmitters were actuated to full, the right fuel tank quantity gauge responded

accordingly. When the right fuel tank quantity transmitters were actuated to empty, the right fuel tank quantity gauge still indicated approximately 3/4 full, indicating that the right fuel quantity transmitters were malfunctioning.

Review of airplane maintenance records revealed that in the years since its manufacture, multiple repairs and replacements of fuel system components had occurred, including installation of a new fuel transmitter in the left wing. There was no record of the right-wing fuel transmitters having been replaced.

According to the pilot-rated passenger the pilot specifically knew about the right fuel tank's fuel quantity indication problem. Thus, based on the fuel usage during the flight and the right tank's fuel quantity indication problem, the pilot should have recognized that the right tank contained less fuel than the left tank and should not have relied on the fuel gauge.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's mismanagement of the available fuel, which resulted in a total loss of engine power due to fuel starvation, and his delayed reaction to the loss of engine power, which led to impact with trees as he was attempting to switch fuel tanks. Contributing to the accident was pilot's decision to operate the airplane with a malfunctioning fuel quantity indication system.

Findings

Aircraft	Fuel - Fluid management
Aircraft	Fuel - Fluid level
Personnel issues	Use of equip/system - Pilot
Personnel issues	Delayed action - Pilot
Personnel issues	Decision making/judgment - Pilot
Aircraft	Fuel quantity sensor - Damaged/degraded
Aircraft	Fuel quantity sensor - Malfunction
Aircraft	Fuel quantity sensor - Not serviced/maintained

Factual Information

History of Flight

Prior to flight	Sys/Comp malf/fail (non-power)
Approach	Fuel starvation (Defining event)
Approach	Loss of engine power (total)
Emergency descent	Attempted remediation/recovery
Emergency descent	Loss of engine power (partial)
Emergency descent	Collision with terr/obj (non-CFIT)

On October 31, 2017, about 1002 eastern daylight time, a Beech 35-C33 airplane, N293GC, was substantially damaged when it was involved in an accident near Whiteville, North Carolina. The pilot was fatally injured, and the passenger sustained minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the pilot-rated passenger, the pilot had initially intended to fly from Cannon Creek Airport (15FL), Lake City, Florida, to Lake City Gateway Airport (LCQ), Lake City, Florida, for fuel, but the fixed-base-operator there was closed, so they decided to refuel at Columbus County Municipal Airport (CPC), Whiteville, North Carolina, and then at Leesburg Executive Airport (JYO), Leesburg, Virginia, on their way to their final destination of Westerly State Airport (WST), Westerly, Rhode Island.

The pilot-rated passenger stated that, on the morning of the accident, during the preflight inspection of the airplane, he and the pilot noticed that the fuel level was about 1/2 inch above the tabs in both fuel tanks; the pilot told the passenger that the airplane's engine would consume about 11.5 gallons per hour in cruise flight. After departing 15FL, they flew with the fuel selector in the right tank position for 1 hour 25 minutes. When they were about 40 minutes from CPC, the pilot switched the fuel selector to the left tank position.

The pilot-rated passenger stated that, during the final approach to runway 6 at CPC, when the airplane was about 700 ft mean sea level , the pilot switched the fuel selector to the right tank, as the landing checklist required the selector to be selected to the fullest tank for approach and landing. The pilot-rated passenger noticed that the left fuel tank gauge was indicating 1/4 full, and the right fuel tank gauge was indicating 1/2 full. The nose of the airplane then dropped, and the pilot-rated passenger advised the pilot that the airplane had lost engine power. The pilot-rated passenger then noticed the pilot twisting the vernier-type throttle, and the pilot-rated passenger told him again that the engine was not producing any power.

The pilot then reached down and switched the fuel selector to the left tank. The airplane was not equipped with shoulder harnesses and the pilot-rated passenger noticed that as the pilot leaned forward, his torso pushed against the throw-over control wheel assembly; the airplane pitched sharply downward. The pilot-rated passenger noticed the airplane was approaching trees; he yelled at the pilot who then looked up just as the airplane's left wing struck a tree. After the airplane came to rest, the pilot-rated

passenger egressed from the airplane and called 911.

According to automatic dependent surveillance-broadcast (ADS-B) data, the airplane continuously descended on the approach to runway 6 at CPC. The last data point was recorded at 1002, about 2,000 ft from the threshold of Runway 6.

Pilot Information

Certificate:	Private	**Age:**	65,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	Helicopter	**Restraint Used:**	Lap only
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	February 22, 2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	November 3, 2016
Flight Time:	(Estimated) 3797 hours (Total, all aircraft), 3603 hours (Pilot In Command, all aircraft)		

According to FAA airman and pilot records, the pilot held a private pilot certificate with ratings for airplane single-engine land, and rotorcraft-helicopter. His most recent FAA third-class medical certificate was issued on February 22, 2016. He had accrued about 3,797 total hours of flight experience, about 2,403 hours of which, were in single engine airplanes.

According to FAA airman records, the pilot-rated passenger, held a private pilot certificate with ratings for airplane single-engine land, and instrument-airplane. His most recent FAA third-class medical certificate was issued on September 19, 2016. He reported on that date, that he had accrued about 1,330 total hours of flight experience.

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N293GC
Model/Series:	35C33 UNDESIGNAT	**Aircraft Category:**	Airplane
Year of Manufacture:	1966	**Amateur Built:**	
Airworthiness Certificate:	Utility	**Serial Number:**	CD-1035
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	March 4, 2017 Annual	**Certified Max Gross Wt.:**	3053 lbs
Time Since Last Inspection:	70 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	5812.72 Hrs at time of accident	**Engine Manufacturer:**	CONT MOTOR
ELT:	C91 installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-470-K
Registered Owner:	On file	**Rated Power:**	225 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	CPC,99 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	10:05 Local	**Direction from Accident Site:**	48°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	4 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	190°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	30.18 inches Hg	**Temperature/Dew Point:**	14°C / 7°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	LAKE CITY, FL (15FL)	**Type of Flight Plan Filed:**	None
Destination:	Whiteville, NC (CPC)	**Type of Clearance:**	VFR flight following
Departure Time:	07:35 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	COLUMBUS COUNTY MUNI CPC	**Runway Surface Type:**	Asphalt
Airport Elevation:	99 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	06	**IFR Approach:**	None
Runway Length/Width:	5500 ft / 75 ft	**VFR Approach/Landing:**	Straight-in

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Minor	**Latitude, Longitude:**	34.263889,-78.726943

Examination of the accident site revealed that the airplane came to rest in a heavily wooded area near an open field off the approach end of Runway 6 at CPC. The airplane came to rest upright, in a 38° nose down attitude, facing opposite the direction of travel.

Examination of the airplane revealed substantial damage to the outboard left wing.

The throttle was in the full position, the propeller control was in the high rpm (fine pitch) position, the mixture control was in the full rich position, and the fuel boost pump switch was on. The wing flaps were in the 30° extended position and the landing gear was down. The fuel selector valve was in the left tank position.

The left fuel tank contained about 16 gallons of fuel, and the right fuel tank contained about 0.5 gallon of fuel. Both the left fuel tank and right fuel tank quantity transmitters were checked with an ohmmeter; the resistance levels were variable and moved in concert with the floats. When power was applied to the electrical system, the left fuel tank quantity gauge indicated about 1/2 full and the right fuel tank quantity gauge indicated about 3/4 full.

When the left fuel tank quantity transmitters were actuated to full and to empty, the left fuel tank quantity gauge responded accordingly.

When the right fuel tank quantity transmitters were actuated to full, the right fuel tank quantity gauge responded accordingly. When the right fuel tank quantity transmitters were actuated to empty, the right fuel tank quantity gauge still indicated approximately 3/4 full.

The engine did not exhibit physical impact damage. Oil was present in the oil sump, galleries, and rocker boxes. The engine oil dipstick indicated that the oil sump contained about 5.5 quarts of oil. All six upper spark plugs exhibited normal wear patterns, were dry, and exhibited a light color consistent

with a lean combustion mixture. Examination of the piston domes, cylinder walls, exhaust valves, and intake valves with a lighted borescope, did not reveal any anomalies. Continuity was established with the cockpit engine controls and the associated engine components. The throttle and mixture control arms remained attached and secured.

Drivetrain continuity was established, thumb compression and suction were achieved on all six cylinders, and rocker arm motion was observed on all valves. Spark was produced by the magnetos to each ignition lead, and the impulse couplers were heard to release. The fuel control inlet screen was clean, and the engine driven fuel pump gear and drive coupling were intact. The fuel pump rotated smoothly, and fuel was expelled when manually rotated. The oil pump appeared normal, and the vacuum pump drive coupling was intact.

Examination of the two-bladed propeller revealed that one propeller blade exhibited S-bending, twisting, and leading-edge paint erosion, with smearing of the red paint that was on the blade tip. The other blade was bent aft around the left side of the engine; the blade was twisted, and the tip was curled aft. Freshly cut sections of tree limbs, about 5 inches in diameter and approximately 15 inches long were observed at the accident site. One section exhibited a red paint transfer mark.

Flight recorders

The airplane was not equipped with a flight data recorder nor was it required to be. However, the airplane was equipped with a J. P. Instruments EDM-700, a panel mounted engine data monitor (EDM) that can monitor and record up to 24 engine operating parameters. The unit contained recorded data at a sample rate of once every 6 seconds. The data were timestamped based on an internal clock setting that had to be manually entered. The data downloaded from the accident device was consistent with the duration and description of the accident flight, though the time stamps did not correlate to the actual flight time (indicating that the device clock had not been set to the correct time prior to the accident). Review of the last 30 minutes of flight recorded by the EDM indicated that about 0948 device time, exhaust gas temperature (EGT) and cylinder head temperature (CHT) began to decrease. About 0951 device time, battery voltage rapidly dropped along with oil temperature as the EGT and CHT rapidly dropped. The last recorded data point was at 1007 device time.

Medical and Pathological Information

The North Carolina Department of Health and Human Services, Office of the Chief Medical Examiner, Raleigh, North Carolina, performed an autopsy on the pilot. The cause of death was blunt force trauma.

The FAA Forensic Sciences Laboratory conducted toxicological testing on specimens from the pilot. The toxicological testing results for the pilot were negative for carbon monoxide, ethanol, and drugs of abuse.

Additional Information

Fuel System Information

The airplane was equipped with a 74-gallon usable (80-gallon total capacity) optional fuel system that consisted of a rubber fuel cell in each wing leading edge with a flush type filler cap. A visual measuring tab was attached to the filler neck. The bottom of the tab indicated 27 gallons of usable fuel in the wing tank and the detent on the tab indicated 32 gallons of usable fuel in the wing tank provided the wings were level.

Fuel quantity was measured by the float operated transmitters, located in each wing tank system. These would transmit electrical signals to the individual indicators that indicated fuel remaining in the tank. There were two transmitters located in each wing tank system connected to the individual wing tank indicator.

The fuel selector valve handle was located forward and to the left of the pilot's seat. According to the Beechcraft C33 Debonair Pilot's Operating Handbook (POH), takeoffs and landings should be made using the tank that is more nearly full. If the engine stops because of insufficient fuel it stated to refer to the EMERGENCY PROCEDURES Section for the Air Start procedures.

The POH advised that it was the pilot's responsibility to ascertain that the fuel quantity indicators were functioning and maintaining a reasonable degree of accuracy, to be certain of ample fuel for a flight. It cautioned that an inaccurate indicator could give an erroneous indication of fuel quantity.

Published Maintenance Guidance

Review of the airplane manufacturers' published maintenance guidance revealed that instructions for fuel transmitter replacement did exist, and were available to owners, operators, and maintenance personnel. These were contained in the Beechcraft Debonair 33 Series Shop Manual, as well as in the Beechcraft Service Instructions for replacement of fuel transmitters and gauges. The required parts were also listed in the Beechcraft Bonanza C33 Illustrated Parts Catalog.

Review of Airplane Maintenance Records

Review of FAA airworthiness and airplane maintenance records revealed that the pilot purchased the airplane on December 18, 2015. In the years since its manufacture, multiple repairs and replacements of fuel system components had occurred, including installation of a new fuel transmitter in the left wing on October 7, 1983. However, there was no record of the right-wing fuel transmitters having been replaced

since the airplane was originally manufactured.
According to the pilot rated passenger, the pilot had been aware of the right fuel tank's fuel quantity indication problem for some time.

Administrative Information

Investigator In Charge (IIC):	Gunther, Todd
Additional Participating Persons:	Clinton Festa; FAA / FSDO; Greensboro, NC Peter J Basile; Textron Aviation; Wichita, KS Michael H Council; Continental Motors; Mobile, AL
Original Publish Date:	September 23, 2020
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=96265