Aviation Investigation Final Report

Location:	Helenwood, Tennessee	**Accident Number:**	ANC18FA022
Date & Time:	January 30, 2018, 13:45 Local	**Registration:**	N9378Y
Aircraft:	Beech 35 A33	**Aircraft Damage:**	Substantial
Defining Event:	Fuel starvation	**Injuries:**	1 Fatal, 1 Serious
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot and passenger were conducting a cross-country personal flight. About 1 hour 35 minutes after departing from an intermediary fuel stop, while in level cruise flight about 6,800 ft GPS altitude, the engine lost all power. The pilot stated that the engine gauges did not indicate any sign of overheating or other mechanical problems. He followed the emergency checklist and attempted to restart the engine without success. He subsequently broadcast a "mayday" call three times on the 121.5-MHz frequency but received no response. He attempted to glide the airplane to the nearest airport, but when he realized the airplane could not reach the airport, he conducted an emergency landing to a logging road in mountainous terrain, which resulted in substantial damage to wings and fuselage.

Postaccident examination of the airplane revealed that the left auxiliary fuel tank was intact but empty. The left main fuel tank was intact, and between about 5 to 7 gallons of fuel were recovered from the left main fuel tank. The fuel pickup was separated at the wing root due to impact damage. Both the right auxiliary and right main fuel tanks were breached. About 7 to 10 gallons of fuel were recovered from the right main wing fuel tank. No fuel was present in the right auxiliary fuel tank. The electric auxiliary fuel pump switch was found in the "ON" position, and the fuel selector valve was found in the "AUX TANK" position, which was not the correct position for the air start procedure outlined in the Pilot Operating Handbook and FAA Approved Flight Manual. No fuel was present in either the fuel inlet line or the fuel return line. The fuel line between the fuel metering unit and the fuel manifold valve was removed at the throttle body, and about a teaspoon of fuel was recovered. Postaccident examination of the airframe and engine and an engine test-run revealed no evidence of any preimpact mechanical malfunctions or failures that would have precluded normal operation.

Given the lack of fuel in the fuel lines forward of the engine firewall; the fuel present in the main fuel cells; and no evidence of any preimpact mechanical malfunctions or failures with the airframe, engine, or its systems, it is likely that the pilot mismanaged the available fuel, which resulted in a total loss of engine power due to fuel starvation. In addition, given that the fuel selector was found in the "AUX

TANK" position, it is likely that the pilot did not follow the approved air start procedure in the Pilot Operating Handbook and FAA Approved Airplane Flight Manual.

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. Contributing to the accident was the pilot's failure to follow the air start checklist.

Findings

Personnel issues	Use of equip/system - Pilot
Aircraft	Fuel - Fluid management
Personnel issues	Use of checklist - Pilot

Factual Information

History of Flight

Enroute-cruise	Fuel starvation (Defining event)
Emergency descent	Collision with terr/obj (non-CFIT)

HISTORY OF FLIGHT

On January 30, 2018, about 1345 eastern standard time, a Beech 35-A33 airplane, N9378Y, sustained substantial damage during a forced landing following a total loss of engine power near Helenwood, Tennessee. The private pilot sustained serious injuries, and the passenger sustained fatal injuries. The airplane was registered to the pilot who was operating the airplane as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed near the accident site, and no flight plan was filed for the cross-country flight.

The airplane departed from Venice, Florida, about 0748 destined for Urbana, Ohio, with a planned intermediate fuel stop. A Garmin GPS unit was found at the wreckage location. A review of the unit's data logs revealed that, after departing Venice, the airplane landed at Barrow County Airport (WDR), Winder, Georgia, at 1146:45 (about 4 hours later), and then departed for Urbana at 1205:30. After departure, the airplane proceeded northeast before turning north at a cruising GPS altitude that varied between about 8,291 and 6,558 ft. According to the pilot, prior to departing WDR the airplane was refueled and departed with 70 gallons of fuel onboard. After departure, while in level cruise flight, the engine "sputtered," followed by a total loss of engine power. The pilot stated that the engine gauges did not indicate any sign of overheating or other mechanical problems. He followed the emergency engine restart checklist in an attempt to restart the engine to no avail. He broadcast a "mayday" call three times on the 121.5-megahertz (MHz) frequency but received no response. He then attempted to glide the airplane to the nearest airport, but he realized the airplane could not reach it, so he conducted an emergency landing to a logging road in mountainous terrain. The last fully recorded in-flight data point was at 1345:22 when the airplane was at a GPS altitude of 2,418 ft and 74 knots ground speed.

When the airplane failed to arrive at the destination airport on time, a family member contacted local law enforcement, and they initiated a search for the missing airplane. The Federal Aviation Administration (FAA) issued an alert notice at 2003, and extensive search operations were initiated. Search operations were conducted by personnel from the Tennessee Wing of the Civil Air Patrol, Scott County Sheriff's Office, Scott County Rescue Squad, the U.S. Department of Agriculture, and multiple local fire departments. A 121.5-MHz emergency locater transmitter (ELT) signal was received in the early morning hours of January 31. Initially search personnel were unable to locate the airplane due to dark night conditions; however, about 0956, search personnel located the wreckage, and found that the passenger had died.

PERSONNEL INFORMATION

The pilot held a private pilot certificate with an airplane single-engine land rating. His most recent BasicMed application was on April 27, 2017.

According to the pilot's logbook, as of January 25, 2018, he had accumulated 207.5 hours of total flight experience, including 150.6 hours as pilot-in-command and 14.1 hours of total flight experience in the accident airplane.

AIRCRAFT INFORMATION

The airplane was manufactured in 1961 and had a total time in service of 3,508.34 flight hours.

The airplane was equipped with a 225-horsepower Continental Motors IO-470-J engine. At the time of the accident, the engine had accumulated 553.86 total hours since overhaul. A review of the airplane maintenance records revealed that the most recent annual inspection of the airframe and engine was completed on July 26, 2017, 33.04 hours before the accident.

Shoulder Harnesses

The airplane was not equipped, nor was it required to be equipped, with shoulder harnesses in any of the occupant seats.

Fuel System

The airplane was equipped with an optional 63-gallon usable (70-gallon total) fuel system. The system consisted of a rubber fuel cell located in each wing leading edge, which contained 22 gallons of usable fuel (25-gallon total), and was equipped with a flush-type filler cap. The system had two auxiliary fuel cells located outboard of the wheel wells in each wing. The auxiliary cells contained 9.5 gallons of usable fuel (10-gallons total). The fuel selector valve was located on the left cockpit sidewall panel, forward of the pilot's seat. The fuel selector could be selected to "OFF," the left main tank ("LH TANK"), the auxiliary tanks ("AUX TANK"), and the right main tank ("RH TANK"). Both auxiliary fuel cells were connected to a common port at the fuel selector valve so that both fed simultaneously when the fuel selector was set to "AUX TANK."

The fuel injection system returned about 10 gallons of excess fuel per hour. Fuel lines were routed through the fuel selector valve to each main fuel cell. Except for the auxiliary cells, fuel was returned to the cell from which it was drawn. The auxiliary cells returned fuel to the left main cell only. According to the Pilot's Operating Handbook (POH), to provide space for the returned fuel, "the left main cell should be used to approximately half full before switching to auxiliary."

Fuel Quantity Indication System

Fuel quantity was measured by float-operated sensors located in each fuel cell. The sensors transmitted electrical signals to the main and auxiliary fuel quantity indicators located in the center of the instrument panel. Fuel quantity for each main or auxiliary fuel tank could be read by positioning either of the two fuel gauge selector switches which were placarded "MAIN FUEL" and "AUX FUEL", and located on the left instrument subpanel, to either right or left.

METEOROLOGICAL INFORMATION

The closest official weather observation station to the accident site was Scott Municipal Airport, Oneida, Tennessee, located about 5 miles northwest of the accident site. At 1353, a METAR was reporting, in part, wind, light and variable; visibility, 10 statute miles; clouds and sky condition, clear; temperature, 37°F; dew point 18°F; and an altimeter setting of 30.40 inches of mercury.

WRECKAGE AND IMPACT INFORMATION

The accident site was in a steep hilly area of brush- and rock-covered terrain with sparsely populated trees at an elevation of about 1,241 ft msl. A broken 25-ft-tall tree was the initial impact point. After the initial impact, the wreckage traveled northwest along a magnetic heading of about 297° for about 143 ft before coming to rest upright, left wing low, in a rock-covered gully on an approximate 321° magnetic heading.

All the airplane's major components were located at the main wreckage site. The cockpit area exhibited impact damage. The engine, firewall, and instrument panel were displaced aft. The throttle was found in the near full-forward position, and the mixture and propeller were found in the full-forward position. The electric auxiliary fuel pump switch was found in the "ON" position. The fuel selector was found in the "AUX" position, and the fuel gauge selector switches were found in the main fuel – "LEFT", and auxiliary fuel – "LEFT" positions.

The fuel selector valve was removed and rotated through its full range of operation. Operation was smooth without excessive play, and its detents were confirmed. The fuel selector valve sump was drained, and about 2 tablespoons of light blue fluid, consistent with 100LL fuel, were recovered. The fluid was bright, free of debris, and tested negative for water.

The right auxiliary and right main fuel tank caps were on and secure. Both the right auxiliary and right main fuel tanks were breached. About 7 to 10 gallons of light blue fluid, consistent with 100LL fuel, were recovered from the right main wing tank. No fuel was present in the right auxiliary tank. Fuel was observed leaking from under the right wing.

The left auxiliary and left main fuel tank caps were on and secure. The left auxiliary fuel tank was intact. The left main fuel tank was intact, but the fuel pickup had separated at the wing root due to impact damage. About 5 to 7 gallons of light blue fluid, consistent with 100LL fuel, was recovered from the left main wing tank. No fuel was present in the left auxiliary fuel tank.

The fuel inlet line was removed from the fuel pump and the fuel return line was removed from the firewall fitting, and no fuel was present in either fuel line. About a teaspoon of light blue fluid, consistent with 100LL fuel, was recovered from the fuel line between the fuel metering unit and fuel manifold valve.

The fuselage exhibited extensive accordion-style crushing near fuselage station 151. The right wing remained attached to the fuselage but exhibited leading edge crushing damage about midspan. The right aileron and right wing flap remained attached to their respective attachment points and were relatively undamaged.

The left wing remained attached to the fuselage. An elliptical impact area was found on the leading edge at the wing root, and tree bark was present in the damaged area. The outboard portion of the left wing exhibited leading edge crushing damage from about wing station 137 outboard to the tip. The leading

edge was partially separated about wing station 137. The left aileron remained attached to its respective attachment points but exhibited crushing damage about midspan. The left wing flap remained attached to its respective attachment points and was relatively undamaged.

The left and right horizontal stabilizers, elevators, vertical stabilizer and rudder, and both left and right elevator trim tabs remained attached to their respective attachment points and were relatively undamaged.

Flight control continuity was verified from all the primary flight control surfaces to the cockpit.

The examination of the airframe revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

The engine remained attached to the airframe, and its underside exhibited impact damage. An examination of the engine, including its accessories, cylinders, pistons, valve train, crankshaft, and other internal components revealed no contamination and no evidence of any mechanical malfunctions or failures that would have precluded normal operation.

An engine test-run was conducted after replacing impact- and recovery-damaged components. The engine started normally on the first attempt without hesitation or stumbling in observed rpm. A 20-minute warm-up sequence was conducted, during which the engine rpm was advanced in steps before the engine throttle was advanced to the full-open position and held for 5 minutes to stabilize. Throughout the test phase, the engine accelerated normally and produced rated horsepower. The engine throttle was rapidly advanced multiple times from idle to full throttle without any hesitation, stumbling, or interruption in power. During the engine test-run, the magnetos were checked, and the left magneto rpm decreased 136 rpm, and the right magneto rpm dropped 100 rpm.

The propeller remained attached to the crankshaft, and both propeller blades remained attached to the propeller hub assembly. One blade was bent aft about midspan, and the other blade was bent slightly aft. The spinner remained in place and exhibited a dent on one side with no rotational scoring.

A subsequent wreckage examination revealed no additional evidence of any mechanical malfunctions or failures that would have precluded normal operation.

SURVIVAL ASPECTS

The airplane was equipped with a legacy 121.5-MHz ELT, not a digital 406-MHz ELT that transmits a distress signal to search and rescue satellites and alerts rescue personnel within minutes of the location of the crash site.

Starting on February 1, 2009, satellite monitoring of analog 121.5-MHz ELTs was terminated for several reasons, including the congestion of the 121.5-MHz frequency and numerous associated false signals, the inherent inaccuracy of the 121.5-MHz signal, and the slow receipt of a target location compared to the much faster and more accurate digital 406-MHz ELTs. According to the National Oceanic and Atmospheric Administration (NOAA) Satellite and Information Service, "NOAA, along with the U.S. Coast Guard, United States Air Force, and NASA (the four Federal Agencies who manage, operate, and use the SARSAT [Search and Rescue Satellite Aided Tracking system] are strongly

advising users of 121.5/243 MHz beacons to make the switch to 406." However, the installation of a 406-MHz ELT in lieu of a 121.5-MHz ELT has not been mandated.

On September 4, 2007, the National Transportation Safety Board issued Safety Recommendation A-07-51 to the FAA, and reiterated the recommendation on January 8, 2013, which stated, in part, that the FAA:

Seek authority from Congress to require the installation of Technical Standard Order C126 [406 megahertz (MHz)] emergency locator transmitters (ELTs) in all applicable aircraft at the earliest possible opportunity. Further, the Federal Aviation Administration should strongly consider establishing a compliance date for upgrading to 406-MHz ELTs on or before the date that COSPAS-SARSAT will cease satellite processing of 121.5-MHz signals.

On April 22, 2013, the FAA responded to the NTSB's recommendation and stated in part:

The FAA will neither seek authority from Congress nor require the installation and maintenance of 406-MHz ELTs. The cost of equipping the general aviation and air taxi fixed-wing aircraft fleet is approximately $.5 billion, which is too burdensome. We continue to find that voluntary equipage and the use of other new technologies best address this recommendation. We carefully reconsidered our actions and we continue to find that our response to this recommendation reflects the best interests of aviation safety. Accordingly, we will take no further action in direct response to this recommendation.

On January 8, 2013 the NTSB classified Safety Recommendation A-07-51 CLOSED — UNACCEPTABLE ACTION.

ADDITONAL INFORMATION

POH Loss of Engine Power Emergency Procedure

The BEECHCRAFT Debonair 35-A33 and 35-B33 Pilot Operating Handbook and FAA-Approved Airplane Flight Manual, Section III, "Emergency Procedures," stated, in part, the following:

Condition: LOSS OF ENGINE POWER

1. Fuel Pressure/Flow Gage – Check

If fuel pressure is abnormally low:

a. Mixture – FULL RICH

b. Auxiliary Fuel Pump – On (Lean as required)

c. Auxiliary Fuel Pump – Off if performance does not improve in a few moments.

2. Fuel Quantity Indicator – Check for supply in tank being used.

If tank being used is empty:

Fuel Tank Selector Valve – SELECT ANOTHER FUEL TANK (feel for detent)

Air Start Procedure

a. Fuel Selector Valve – SELECT MAIN TANK MORE NEARLY FULL (check to feel detent)

b. Throttle – RETARD

c. Mixture – FULL RICH

d. Auxiliary Fuel Pump – ON until power is regained then OFF. (Leave on if engine driven pump is inoperative.)

e. Throttle – ADVANCE to desired power

f. Mixture – LEAN as required

FAA Advisory Circular 91-65

FAA Advisory Circular 91-65, "Use of Shoulder Harness in Passenger Seats," stated, in part

The [National Transportation Safety Board] found that 20 percent of the fatally injured occupants in these accidents could have survived with shoulder harnesses (assuming the seat belt fastened) and 88 percent of the seriously injured could have had significantly less severe injuries with the use of shoulder harnesses. Energy absorbing seats could have benefited 34 percent of the seriously injuries. The safety board concluded that shoulder harness use is the most effective way of reducing fatalities and serious injuries in general aviation accidents.

Additionally, the FAA issued policy statement, ACE-00-23.561-01, which addressed acceptable methods of approval for retrofitting shoulder harness installations in small airplanes.

Pilot Information

Certificate:	Private	**Age:**	50,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Lap only
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	No
Medical Certification:	BasicMed	**Last FAA Medical Exam:**	
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	January 6, 2018
Flight Time:	377.4 hours (Total, all aircraft), 14.1 hours (Total, this make and model)		

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N9378Y
Model/Series:	35 A33 NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1960	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	CD-270
Landing Gear Type:	Retractable - Tricycle	**Seats:**	
Date/Type of Last Inspection:	July 25, 2017 Annual	**Certified Max Gross Wt.:**	3003 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	3475.3 Hrs as of last inspection	**Engine Manufacturer:**	CONT MOTOR
ELT:	C91 installed, activated, aided in locating accident	**Engine Model/Series:**	IO-470-J
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:	KSCX	**Distance from Accident Site:**	
Observation Time:	18:53 Local	**Direction from Accident Site:**	
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	/	**Turbulence Type Forecast/Actual:**	/
Wind Direction:		**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.39 inches Hg	**Temperature/Dew Point:**	3°C / -8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Winder, GA (WDR)	**Type of Flight Plan Filed:**	VFR
Destination:	Urbana, OH (I74)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Wreckage and Impact Information

Crew Injuries:	1 Serious	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal, 1 Serious	**Latitude, Longitude:**	36.4025,-84.515274(est)

Preventing Similar Accidents

Emergency Locator Transmitters (SA-030)

The Problem

Emergency Locator Transmitters (ELTs) can save pilots' and passengers' lives by helping search and rescue (SAR) personnel locate a downed aircraft after an accident and even minimize risk to SAR personnel during SAR operations. However, these lifelines can be rendered inoperative if the switch position is improperly set or if the ELT becomes detached from the aircraft.

In 2013, about 180,000 general aviation aircraft were equipped with ELTs that had 121.5-megahertz (MHz) transmitters, which are less effective than 406-MHz transmitters. Only about 38,000 general aviation aircraft were equipped with 406-MHz ELTs.

What can you do?

- Confirm that the ELT unit is “armed” and properly installed in the aircraft.
- Follow manufacturer instructions for properly securing the ELT and inspecting the fasteners.
- Remember that ELTs secured to the aircraft via Velcro-style mounting mechanisms can be susceptible to strap looseness and misalignment during installation and inspection. Further, the retention straps may degrade over time due to wear, vibration, temperature, or contamination, and they may not properly restrain the ELT during an accident.

- Consider upgrading to a 406-MHz ELT, which the NTSB has long recommended be mandatory due to its superior position accuracy reporting, timeliness of alerts, and ability to provide aircraft identification and other information.

See https://www.ntsb.gov/Advocacy/safety-alerts/Documents/SA-030.pdf for additional resources.

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Banning, David
Additional Participating Persons:	Nicole L Charnon; Continental Motors; Mobile, AL Neil Thorne ; Federal Aviation Administration; Nashville, TN Don Williams; Federal Aviation Administration; Nashville, TN Ricardo Asensio; Textron Aviation; Wichita, KS
Original Publish Date:	November 6, 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=96681