



# Aviation Investigation Final Report

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<b>Location:</b>	Palestine, Texas	<b>Accident Number:</b>	CEN21LA151
<b>Date &amp; Time:</b>	March 6, 2021, 12:17 Local	<b>Registration:</b>	N3394V
<b>Aircraft:</b>	Beech 35	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Fuel starvation	<b>Injuries:</b>	1 Fatal, 1 Serious
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

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## Analysis

The airplane was recently purchased by the copilot. The day before the accident, a mechanic performed a pre-buy/annual inspection on the airplane, which had not been inspected in over 8 years, with no issues annotated in the maintenance records. On the day of the accident, the pilot and copilot departed for the cross-country flight of about 200 nautical miles to the copilot’s home airport. The copilot reported a total of 54 gallons of fuel between the three fuel tanks (17 gallons each in the left and right tanks and 20 gallons in the auxiliary tank) at departure. He also reported that the generator was inoperative, and the flight was made with the retractable landing gear in the extended position. About 43 minutes into the flight, the fuel in the left-wing fuel tank was “depleted,” and the crew switched to the right-wing fuel tank with no issues. The pilot suggested they switch to the auxiliary fuel tank, and when the copilot switched to the auxiliary fuel tank, a total loss of engine power occurred.

The copilot switched the fuel selector to its “opposite position” and then switched it back to the right fuel tank but power was not restored. The crew attempted to restart the engine several times with no success, and the pilot transferred the flight controls to the copilot for a forced landing. The copilot maneuvered the airplane through a canopy of trees, and the airplane then impacted the ground resulting in substantial damage to both wings and the fuselage.

During postaccident examination, the required fuel selector placard depicting the four selectable positions (RIGHT TANK, LEFT TANK, AUXILIARY TANK, and OFF) was not observed in the wreckage. The fuel selector was found with the handle between the OFF and LEFT TANK positions; in this position, fuel would not pass through the selector. Detents that should have been felt at the four selectable positions were not noted as the handle was rotated through the fuel tank positions. The mechanic reported there were no issues noted with the airplane during the annual inspection performed one day before the accident and the mechanic classified the airplane as “complete.”

None of the three fuel tanks contained observable fuel levels on scene. There was no evidence of fuel spillage, smell, or vegetation blighting at the accident site. The right-wing and auxiliary tanks were not breached. The left-wing bladder was punctured by a fracture in the inboard wing rib that likely occurred during impact.

Although the copilot reported that the fuel selector placard was installed, review of his cell phone records indicated that during the flight, he sent a text message to the previous airplane owner asking what position on the fuel selector was for the auxiliary fuel tank. Therefore, it is likely the fuel selector placard was not installed in the airplane. The text message also indicates the flight crew lacked an understanding of how to properly operate the fuel selector.

According to the copilot, there should have been fuel available when the engine power loss occurred. Based on the examination of the fuel system, the reason for the lack of fuel at the accident site could not be determined. Given that the fuel selector was found in a position where fuel would not pass through it, that the fuel selector placard was not installed, and that the flight crew lacked adequate knowledge of fuel selector operation, it is likely the flight crew incorrectly placed the fuel selector between the fuel tank detents, which resulted in a loss of engine power.

The airframe manufacturer issued a service bulletin 23 years before the accident about adding an updated placard to the fuel selector due to reports of incidents and accidents involving engine failure due to pilots incorrectly positioning the fuel selector between fuel tank detents. The service bulletin stated that a no-flow condition exists between the fuel tank detents. The airplane maintenance records did not show that this service bulletin was complied with, nor was it required to be complied with.

Based on autopsy findings, the pilot had severe atherosclerotic disease in his left anterior descending coronary artery. Although this condition placed him at an increased risk for a sudden incapacitating event, including a heart attack, stroke, or arrhythmia that could cause acute symptoms without leaving evidence on autopsy, his autopsy did not show any evidence of an acute event. Additionally, the surviving copilot did not report that the pilot had experienced an impairing or incapacitating event, and they were both making efforts to correct the power loss and land the airplane. The autopsy also noted evidence of medical intervention on the fatally injured pilot. Atropine, a drug used for resuscitation that was detected on toxicology testing, was likely administered in life-saving efforts. Thus, the pilot's cardiovascular condition would not have contributed to this accident, and the detection of atropine was from postaccident treatment.

## **Probable Cause and Findings**

The National Transportation Safety Board determines the probable cause(s) of this accident to be:

A total loss of engine power due to the flight crew incorrectly placing the fuel selector between fuel tank detents, which resulted in fuel starvation. Contributing to the accident was the lack of

a placard on the fuel selector, the lack of obvious fuel tank detents in the fuel selector, and the flight crew's lack of understanding of proper fuel selector operation.

## Findings

<b>Aircraft</b>	(general) - Failure
<b>Aircraft</b>	Fuel selector/shutoff valve - Malfunction
<b>Aircraft</b>	Fuel selector/shutoff valve - Incorrect use/operation
<b>Aircraft</b>	Fuel selector/shutoff valve - Not serviced/maintained
<b>Personnel issues</b>	Use of equip/system - Flight crew

## Factual Information

### History of Flight

<b>Enroute</b>	Fuel starvation (Defining event)
<b>Enroute</b>	Loss of engine power (total)
<b>Enroute</b>	Attempted remediation/recovery
<b>Enroute</b>	Off-field or emergency landing
<b>Landing</b>	Collision during takeoff/land

On March 6, 2021, about 1217 central standard time, a Beech 35 airplane, N3394V, sustained substantial damage when it was involved in an accident near Palestine, Texas. The private pilot sustained fatal injuries, and the private copilot sustained serious injuries. The airplane was operated as a Title 14 *Code of Federal Regulations (CFR)* Part 91 personal flight.

The airplane was recently purchased by the copilot. The pilot traveled from out of state to help the copilot fly the airplane from Chambers County Airport (TOO), Anahuac, Texas, to the copilot's hangar at Airpark East Airport (1F7), Dallas, Texas, a distance of about 200 nautical miles. The day before the accident, a pre-buy/annual inspection was performed by a mechanic on the airplane with no issues annotated in the maintenance records. The copilot reported that the generator was not functioning, and the placard on the fuel selector was present. The airplane was topped off with 100 low lead fuel. According to the copilot, the left fuel tank contained 17 gallons, the right fuel tank contained 17 gallons, and the auxiliary fuel tank in the baggage compartment contained 20 gallons for a total of 54 gallons.

On the day of the accident, the pilot and copilot performed traffic pattern maneuvers, and no issues were noted with the airplane except for the inoperative generator. They then departed for 1F7. The flight was conducted with the retractable landing gear extended. During the flight, both pilots flew the airplane. The copilot reported that the fuel gauges "worked normally," that the carburetor heat was not on during the flight, and that they were running the engine "rich" during the flight "in order to keep the engine cylinders cool." About 43 minutes into the flight, the fuel in the left fuel tank was "depleted," and the crew switched to the right fuel tank with no issues. The pilot was concerned about "maximizing" the airplane's fuel capacity and suggested using the auxiliary fuel tank. The copilot switched to the auxiliary fuel tank, and a total loss of engine power occurred.

The copilot then switched the fuel selector to its "opposite position," but the engine did not regain power. The copilot switched back to the right fuel tank with no change noted. The crew then initiated the emergency restart procedure, and they used the hand fuel pump as they attempted to restart the engine five or six times with no success.

The pilot transferred the flight controls to the copilot for the forced landing. The copilot maneuvered the airplane through the canopy of several trees, and the airplane came to rest upright on a grass field on a ranch. The copilot egressed from the airplane and contacted first responders with a cellular phone.

Examination of the copilot’s cellular phone at the National Transportation Safety Board’s (NTSB’s) Vehicle Records Laboratory revealed that during the accident flight at 1203, the copilot sent a text message to the previous airplane owner asking what position on the fuel selector was for the auxiliary fuel tank. Starting at 1213, the co-pilot received three text messages from the mechanic describing three positions for the fuel selector.

### Co-pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	61, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>	None	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	
<b>Medical Certification:</b>	Class 3 Without waivers/limitations	<b>Last FAA Medical Exam:</b>	April 3, 2017
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 1300 hours (Total, all aircraft), 0.3 hours (Total, this make and model), 1998 hours (Pilot In Command, all aircraft)		

### Pilot Information

<b>Certificate:</b>	Flight instructor	<b>Age:</b>	65, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>	Glider	<b>Restraint Used:</b>	Lap only
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	Yes
<b>Instructor Rating(s):</b>	Airplane single-engine	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 3 With waivers/limitations	<b>Last FAA Medical Exam:</b>	August 7, 2013
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>	(Estimated) 1207 hours (Total, all aircraft)		

The personal flight logs of the copilot and the pilot were not available for review during the investigation.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Beech	<b>Registration:</b>	N3394V
<b>Model/Series:</b>	35 Undesignated Series	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1947	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	D869
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	4
<b>Date/Type of Last Inspection:</b>	March 5, 2021 Annual	<b>Certified Max Gross Wt.:</b>	2550 lbs
<b>Time Since Last Inspection:</b>	1.5 Hrs	<b>Engines:</b>	1 Reciprocating
<b>Airframe Total Time:</b>	3036.9 Hrs at time of accident	<b>Engine Manufacturer:</b>	Continental Motors
<b>ELT:</b>	C91 installed, activated, did not aid in locating accident	<b>Engine Model/Series:</b>	E-185-8
<b>Registered Owner:</b>	On file	<b>Rated Power:</b>	205 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None
<b>Operator Does Business As:</b>	On file	<b>Operator Designator Code:</b>	None

The limitations section of the Beech 35 Pilot's Operating Handbook (POH), which contained the limitations required by regulation, discussed the airplane fuel system and stated that the standard fuel system was two 20-gallon wing fuel tanks with a total of 35 gallons of usable fuel. The optional fuel system, which was installed in the airplane, consisted of the two 20-gallon wing tanks and one 20-gallon auxiliary fuel tank installed in the baggage compartment that added 19 gallons of usable fuel to the system. The limitations section of the POH also stated, "when operating fuel selector, feel for detent position," and it included a diagram showing the placard that was required to be installed on the fuel selector valve. The placard showed four positions for the fuel selector: right main tank at 3 o'clock, off at 6 o'clock, left tank at 9 o'clock, and auxiliary tank at 12 o'clock.

A review of the airplane's maintenance records revealed that the most recent work performed before the pre-buy/annual inspection on the day before the accident was an annual inspection in August 2012. The mechanic reported there were no issues noted with the airplane during the annual inspection performed one day prior to the accident and the mechanic classified the airplane as "complete." Before August 2012, annual inspections were performed in October 2010 and April 1994.

Raytheon Aircraft Company issued Service Bulletin 2760, titled "Placards and Markings – Installation of Fuel Selector Placard," in May 1998. This document was applicable to the accident airplane and stated in part:

*This Service Bulletin is being issued to add placards to the fuel selector because Raytheon Aircraft Company has received reports of incidents and accidents involving Beech piston airplanes in which engine stoppage may have been caused by incorrectly positioning the fuel selector between tank detents.*

A review of the airplane’s maintenance records did not reveal any references to Service Bulletin 2760, which Raytheon Aircraft Company classified as mandatory. The Federal Aviation Administration (FAA) does not mandate compliance with service bulletins for 14 CFR Part 91 operations.

The FAA issued Airworthiness Directive (AD) 99-05-13 in April 1999, which was applicable to the accident airplane, and stated, in part:

*This AD requires installing a placard on the fuel tank selector to warn of the no-flow condition that exists between the fuel tank detents. This AD is the result of reports of engine stoppage on the affected airplanes where the cause was considered to be incorrect positioning of the fuel selector. The actions specified by this AD are intended to help prevent a lack of fuel flow to the engine caused by incorrect positioning of the fuel selector, which could result in loss of engine power.*

The FAA later withdrew the AD in July 2000. The maintenance records did not show a record of this AD being complied with while it was active.

## Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Visual (VMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KPSN,423 ft msl	<b>Distance from Accident Site:</b>	4 Nautical Miles
<b>Observation Time:</b>	12:15 Local	<b>Direction from Accident Site:</b>	341°
<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>	11 knots /	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>	60°	<b>Turbulence Severity Forecast/Actual:</b>	N/A / N/A
<b>Altimeter Setting:</b>	30.32 inches Hg	<b>Temperature/Dew Point:</b>	16°C / 3°C
<b>Precipitation and Obscuration:</b>	No Obscuration; No Precipitation		
<b>Departure Point:</b>	Anahuac, TX (T00)	<b>Type of Flight Plan Filed:</b>	None
<b>Destination:</b>	Dallas, TX (1F7)	<b>Type of Clearance:</b>	None
<b>Departure Time:</b>	10:45 Local	<b>Type of Airspace:</b>	Class G

According to FAA Special Airworthiness Information Bulletin CE-09-34 Carburetor Icing Prevention, at the time of the accident, the airplane was likely operating in conditions conducive to the formation of serious icing at glide power.



The estimated density altitude for the accident site was 194 ft above mean sea level.

### Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal, 1 Serious	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	N/A	<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	1 Fatal, 1 Serious	<b>Latitude, Longitude:</b>	31.713756,-95.677195(est)

A postaccident examination was performed on the airframe and engine. Flight control continuity was established. Examination of the engine revealed no evidence of any preimpact mechanical malfunctions or failures that would have precluded normal operation. The fuel selector was found with the handle between the OFF and LEFT positions and pulled up in the hand pump position about 1/4 inch. Air could not be passed through any of the fuel selector ports in this position. The fuel selector placard depicting the position selection and operation of the fuel selector was not observed in the wreckage. During the follow-up wreckage examination, the valve functioned properly when air was passed through each port as the handle was rotated through each position. Detents were not noted as the handle was rotated through the fuel tank positions.

Neither wing fuel tank contained observable fuel levels on scene. An auxiliary fuel tank that was installed in the baggage compartment also contained zero fuel and was not breached. There was no evidence of fuel spillage, smell, or vegetation blighting at the accident site. Both wing fuel tank bladders were leak checked using water. The right-wing bladder was not breached. The fuel drain valve leaked at a rate of about 1 drop every 5 seconds. The left-wing bladder was punctured by a fracture in the inboard wing rib. The puncture was roughly in the lower one-third between the upper and lower surfaces of the bladder and 2 to 3 inches from the aft wall of the bladder. The puncture measured approximately 1/2 inch in length and produced a steady and noticeable stream of water during the leak test.

The fuel lines appeared to be intact through the cabin to the firewall. No evidence of external fuel leaks was observed on the skin of the airplane. The rubber fuel caps were dry and brittle. The seats of the filler openings were corroded. The left fuel vent was obstructed at the tube bend of the outboard vent tube at the anti-siphon wye; the inboard portion of the tubing contained fuel.



## Medical and Pathological Information

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According to the Forensic Medical of Texas, Tyler, Texas, autopsy report, the cause of the pilot's death was blunt force injuries, and the manner of death was accident. There was evidence of medical intervention. Except for 95% stenosis of the left anterior descending coronary artery, no significant natural disease was identified.

The FAA Forensic Sciences Laboratory toxicology testing detected atropine in the pilot's heart blood. This medication is not considered impairing and is used in resuscitation efforts when there is a very slow heart rate. Testing of the pilot's heart blood did not detect any tested-for drugs; testing of the pilot's femoral blood was negative for alcohol.

## Additional Information

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The Textron Aviation Pilot Safety and Warning Supplements publication issued in September 2018 discussed fuel management and stated in part:

*Pilots should be thoroughly familiar with the airplane fuel system and tank switching procedures.*

The FAA Airplane Flying Handbook (FAA-H-8083-3B) discussed preflight procedures and stated in part:

*Checking the fuel tank vent is an important part of a preflight assessment. If outside air is unable to enter the tank as fuel is drawn into the engine, the eventual result is fuel starvation and engine failure. During the preflight assessment, the pilot should look for signs of vent damage and blockage. Some airplanes utilize vented fuel caps, fuel vent tubes, or recessed areas under the wings where vents are located. The pilot should use a flashlight to look at the fuel vent to ensure that it is free from damage and clear of obstructions. If there is a rush of air when the fuel tank cap is cracked, there could be a serious problem with the vent system.*

The NTSB published Safety Alert 021, Is Your Aircraft Talking to You? Listen! This document encouraged pilots to pay adequate attention to indications of aircraft mechanical problems and stated in part:

*Resist the temptation to let external pressures, such as the desire to save time or money, influence you to fly an aircraft that shows signs of a potential problem. Safety should take precedence over all other considerations.*

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Hodges, Michael
<b>Additional Participating Persons:</b>	Louis Vargo; FAA North Texas FSDO; Irving, TX Casey Love; Textron Aviation; Wichita, KS
<b>Original Publish Date:</b>	August 16, 2022
<b>Last Revision Date:</b>	
<b>Investigation Class:</b>	<a href="#">Class 3</a>
<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=102723">https://data.nts.gov/Docket?ProjectID=102723</a>

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating every civil aviation accident in the United States and significant events in other modes of transportation—railroad, transit, highway, marine, pipeline, and commercial space. We determine the probable causes of the accidents and events we investigate, and issue safety recommendations aimed at preventing future occurrences. In addition, we conduct transportation safety research studies and offer information and other assistance to family members and survivors for each accident or event we investigate. We also serve as the appellate authority for enforcement actions involving aviation and mariner certificates issued by the Federal Aviation Administration (FAA) and US Coast Guard, and we adjudicate appeals of civil penalty actions taken by the FAA.

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, “accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties ... and are not conducted for the purpose of determining the rights or liabilities of any person” (Title 49 *Code of Federal Regulations* section 831.4). Assignment of fault or legal liability is not relevant to the NTSB’s statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report (Title 49 *United States Code* section 1154(b)). A factual report that may be admissible under 49 *United States Code* section 1154(b) is available [here](#).