



AVIATION



HIGHWAY



MARINE



RAILROAD



PIPELINE

Aviation Investigation Final Report

Location:	Litchfield, Maine	Accident Number:	ERA23FA346
Date & Time:	August 22, 2023, 17:40 Local	Registration:	N55RP
Aircraft:	Beech C-99	Aircraft Damage:	Destroyed
Defining Event:	Sys/Comp malf/fail (non-power)	Injuries:	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The newly hired pilot and an experienced flight instructor were conducting the third flight of the pilot's initial training. After conducting an instrument approach in visual meteorological conditions, they conducted a missed approach and the airplane proceeded to a holding pattern at 3,000 ft, consistent with a normal training profile. As the airplane was completing the first turn in the holding pattern, it pitched over and accelerated. The airplane impacted wooded terrain in a nose-down attitude in excess of 20°, a slight right bank, and at an airspeed exceeding 250 knots. No distress calls were heard from the crew, who were not communicating with air traffic control at the time and were not required to.

The highly fragmented wreckage was indicative of a high-energy impact. The engines and propellers were separated during the impact sequence and showed evidence of operation at high power. All structural components of the airframe were found within the confines of the debris field.

The airplane was equipped with a dual electric horizontal stabilizer trim system. The horizontal stabilizer was driven concurrently by two arms (cylinder rods) on the horizontal stabilizer actuator, mounted in the aft fuselage. An examination of the wreckage revealed that the right-side cylinder rod end became disconnected before the accident; the connecting bolt, nut, and washers were missing. This hardware also secured the control rod for the motion-indicating gearbox (MIG) that provided the pilots with aural and visual indications in the cockpit of stabilizer movement and takeoff trim position; disconnection of the MIG would have resulted in missing or incorrect reporting of the stabilizer and trim positions to the flight crew.

Although either actuator cylinder rod was capable of independently operating the stabilizer trim, the airplane manufacturer considered operation with only one cylinder rod a "limited

emergency operation” mode. The horizontal stabilizer trim was likely near the full-nose-down position at impact. The investigation was not able to determine the effects of the pitch trim operating with only one cylinder rod attached for an undetermined but possibly extended duration. Functional testing of the components was not possible due to impact damage.

A pilot receiving instruction and flight instructor in another airplane performing maneuvers near the holding pattern reported observing the accident airplane make an abrupt turn to their right, which they described as a near-miss. The investigation reviewed flight track data from both flights to evaluate the possibility that the abrupt maneuver performed in response to the near-miss was related to the accident; however, of the accident airplane’s flight track showed the airplane maintaining the holding pattern for another 8 miles after the near-miss and before the descent and collision with terrain.

Probable Cause and Findings

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

A horizontal stabilizer pitch trim anomaly that was not identified in the available evidence.

Findings	
Aircraft	Stabilizer control system - Unknown/Not determined

Factual Information

History of Flight

Enroute-cruise	Unknown or undetermined
Enroute-cruise	Sys/Comp malf/fail (non-power) (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On August 22, 2023, about 1740 eastern daylight time, a Beech C-99 airplane, N55RP, was destroyed when it was involved in an accident near Litchfield, Maine. The commercial pilot receiving instruction and a flight instructor were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 instructional flight.

ADS-B data revealed that the flight departed Auburn/Lewiston Municipal Airport (LEW), Auburn, Maine, about 1708. The flight proceeded to the southwest and the crew flew either an instrument landing system or localizer approach to runway 4 at LEW. The crew performed a missed approach and proceeded to the northeast, toward the MOYER missed approach fix, where they entered a left holding pattern at 3,000 ft mean sea level (msl). While completing the first turn of the holding pattern, the airplane entered a steep descent and subsequently impacted terrain.

A witness reported that he was working on a project in his driveway when he observed an airplane about 3,000 to 4,000 ft, heading north. He recognized the airplane as a “Beech 99.” The engines sounded “very smooth.” He watched the airplane proceed over his house and looked away for a few seconds. When he looked up again, the airplane was in a “steep dive.” From that moment on, he did not see the airplane alter its course or attitude. As it descended, the wings remained level and the engines still sounded smooth. The airplane disappeared behind tree before he heard a “loud boom.”

As the accident airplane was established in the holding pattern for the runway 4 approach, at about 3,000 feet msl, another airplane, a Beech C23, was airborne in the vicinity. A pilot receiving instruction and a flight instructor were practicing maneuvers at the time. As the C23 was turning east, both pilots observed another airplane flying in their direction at about the same altitude. They observed the other airplane make an abrupt turn to their right. They described the encounter as a “near miss.” They did not observe the airplane again and heard no distress calls. A review of ADS-B track data revealed that the C23 and accident airplane came within 0.38 nm laterally, with about 250 ft vertical separation. A further review of accident airplane’s flight track showed the airplane maintaining the holding pattern for another 8 miles after the event and before the descent and collision with terrain (see figure 1).

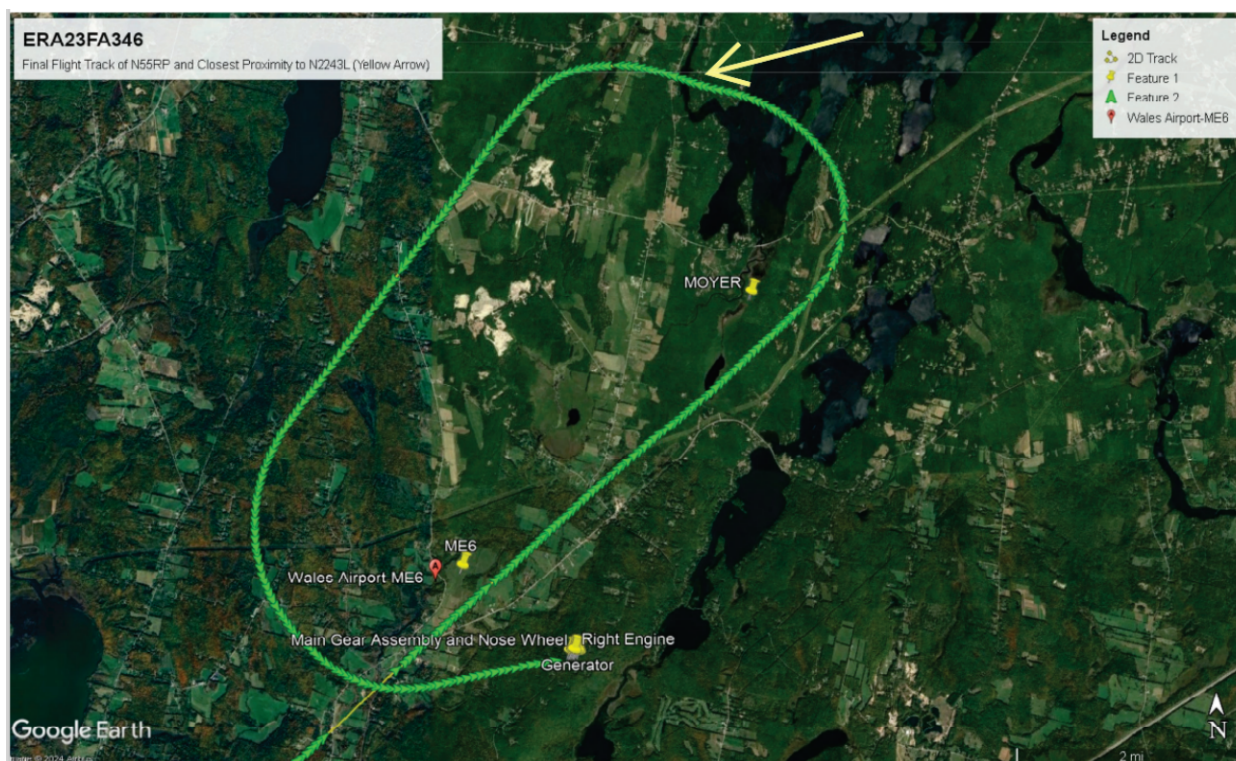


Figure 1 –Flight track of the accident airplane in the holding pattern. The yellow pin at the end of the track shows the accident site. The yellow arrow shows where the reported near-miss occurred.

An NTSB vehicle performance engineer produced animations using the available ADS-B data to simulate the final seconds of the accident flight. A review of the animation revealed the airplane in the holding pattern, executing a left turn and maintaining about 3,000 ft altitude. The bank angle varied between 22° and 30° and the airspeed was about 185-190 knots. As the airplane began to roll out of the bank, the nose pitched over to about 30° nose-low and the airspeed increased. Shortly before ground impact, there was a slight wing rock to the right. The final data points indicated a right bank angle of about 20°, a nose-down pitch attitude of greater than 20°, and an airspeed about 250 knots.

Flight instructor Information

Certificate:	Airline transport; Commercial; Flight instructor	Age:	69,Male
Airplane Rating(s):	Single-engine land; Single-engine sea; Multi-engine land	Seat Occupied:	Right
Other Aircraft Rating(s):	None	Restraint Used:	4-point
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	Toxicology Performed:	Yes
Medical Certification:	Class 2 With waivers/limitations	Last FAA Medical Exam:	September 19, 2022
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	March 20, 2023
Flight Time:	(Estimated) 14700 hours (Total, all aircraft), 1342 hours (Total, this make and model)		

Pilot Information

Certificate:	Commercial	Age:	37,Male
Airplane Rating(s):	Single-engine land; Single-engine sea	Seat Occupied:	Left
Other Aircraft Rating(s):	None	Restraint Used:	3-point
Instrument Rating(s):	Airplane	Second Pilot Present:	Yes
Instructor Rating(s):	None	Toxicology Performed:	Yes
Medical Certification:	Class 1 Without waivers/limitations	Last FAA Medical Exam:	May 23, 2023
Occupational Pilot:	Yes	Last Flight Review or Equivalent:	
Flight Time:	(Estimated) 1302 hours (Total, all aircraft), 4 hours (Total, this make and model)		

The pilot in the left seat had been recently hired by the operator and was undergoing initial training. His total logged flight time was about 1,302 hours. The accident flight was his third training flight with the operator. The operator reported his total time in the C-99 as 4 hours.

The flight instructor in the right seat had been employed by the operator for several years. The operator's chief pilot reported that he was safety-conscious and was always looking for safer ways to do things. He also reported that the flight instructor acted as a mentor for other pilots at the company.

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	Registration:	N55RP
Model/Series:	C-99	Aircraft Category:	Airplane
Year of Manufacture:	1982	Amateur Built:	
Airworthiness Certificate:	Normal	Serial Number:	U-198
Landing Gear Type:	Retractable - Tricycle	Seats:	2
Date/Type of Last Inspection:	August 20, 2023 AAIP	Certified Max Gross Wt.:	11300 lbs
Time Since Last Inspection:		Engines:	2 Turbo prop
Airframe Total Time:	30258 Hrs as of last inspection	Engine Manufacturer:	Pratt & Whitney Canada
ELT:	C91A installed	Engine Model/Series:	PT6A-36
Registered Owner:	UAS TRANSERVICES INC	Rated Power:	750 Horsepower
Operator:	Wiggins Airways	Operating Certificate(s) Held:	On-demand air taxi (135)
Operator Does Business As:		Operator Designator Code:	AXSA

A review of the airframe records did not reveal evidence of any recent maintenance on the horizontal stabilizer actuator or its fastening hardware.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	Condition of Light:	Day
Observation Facility, Elevation:	KLEW, 288 ft msl	Distance from Accident Site:	14 Nautical Miles
Observation Time:	17:56 Local	Direction from Accident Site:	241°
Lowest Cloud Condition:	Clear	Visibility	10 miles
Lowest Ceiling:	None	Visibility (RVR):	
Wind Speed/Gusts:	10 knots / None	Turbulence Type Forecast/Actual:	None / None
Wind Direction:	350°	Turbulence Severity Forecast/Actual:	N/A / N/A
Altimeter Setting:	30.05 inches Hg	Temperature/Dew Point:	23°C / 9°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lewiston, ME (LEW)	Type of Flight Plan Filed:	None
Destination:	Lewiston, ME (LEW)	Type of Clearance:	VFR flight following
Departure Time:	17:08 Local	Type of Airspace:	Class G

Airport Information

Airport:	Auburn/Lewiston Municipal LEW	Runway Surface Type:	
Airport Elevation:	287 ft msl	Runway Surface Condition:	
Runway Used:		IFR Approach:	None
Runway Length/Width:		VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	N/A	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	2 Fatal	Latitude, Longitude:	44.16407,-70.00038(est)

The airplane crashed on private, densely wooded property. The accident site consisted of partially cleared timber with most of the wreckage within the forested area. The points of initial impact were the tops of several 50 ft-tall oak trees. The airplane then impacted soft soil about 140 ft east of the first tree strikes. The impact and trees strikes were consistent with an airplane descent angle of about 20° and a bank angle of about 10° right-wing-low. The wreckage path heading was about 095° magnetic. The wreckage was heavily fragmented and there was no fire. The entire wreckage path was about 424 ft long and about 100 ft wide.

The cockpit was highly fragmented and no useful indications were captured on the flight and performance instruments.

Both wings and associated control surfaces were highly fragmented. Both wing tips were located within the confines of the debris field. Aileron control continuity could not be established due to numerous cable fractures; all breaks on the cables exhibited signatures consistent with overload. The flap actuators were recovered and their jackscrew extensions were measured; all flaps appeared to be at the 5° extended positions.

All rubber bladder fuel tanks were breached and fragmented. No residual fuel was found. There was a heavy odor consistent with Jet A fuel within the confines of the debris field.

Flight control cable continuity was confirmed from the rudder and elevator bell cranks to the cabin bell cranks. The rudder was separated from the fragmented vertical stabilizer and the rudder trim was measured at the 15° left tab position.

All three landing gear separated from the fuselage during the impact sequence. The landing gear actuators were found in the retracted (gear-up) positions.

Both engines separated during ground impact and displayed heavy impact damage. External examination of both engines showed damage consistent with rotation at impact.

Both propeller assemblies separated from the engines during impact. The left propeller blades remained attached to the hub. All three blades exhibited blade twisting, chordwise scratching, surface paint abrasion, and leading-edge damage. One of the right propeller blades remained attached to the hub, and the other two blades were separated. All of the right propeller blades exhibited blade twisting, chordwise scratching, surface paint abrasion, and leading-edge damage.

The airplane was equipped with a dual electric horizontal stabilizer trim system. In normal use, the system was activated by a pedestal-mounted switch and operated by dual pitch trim switches on each yoke in the cockpit. In the standby mode, the trim was operated by dual toggle switches on the pedestal. The moveable horizontal stabilizer was driven concurrently by two arms on the horizontal stabilizer actuator, mounted in the aft fuselage.

During the on-scene wreckage examination, the right-side horizontal stabilizer actuator cylinder rod end was found disconnected from the right-side clevis fitting. The fitting was spread open, and the attaching nut, bolt, and washers were missing. The left-side actuator cylinder fractured from the motor housing and the rod end remained connected to the left-side clevis fitting on the stabilizer.

The control rod to the MIG was also found disconnected. The MIG control rod uses the same hardware that is used to secure the right actuator cylinder rod to the horizontal stabilizer. During normal operation, the MIG provides aural and visual cockpit indications to the flight crew for takeoff trim position and trim movement. The MIG is an indicating system only; it does not control operation of the horizontal stabilizer actuator.

An examination of the recovered components of the horizontal stabilizer system revealed witness marks and scrapes consistent with the attaching hardware for the right actuator and MIG control rod being missing at some point during the accident flight. Figure 2 shows the recovered components of the horizontal stabilizer trim system.

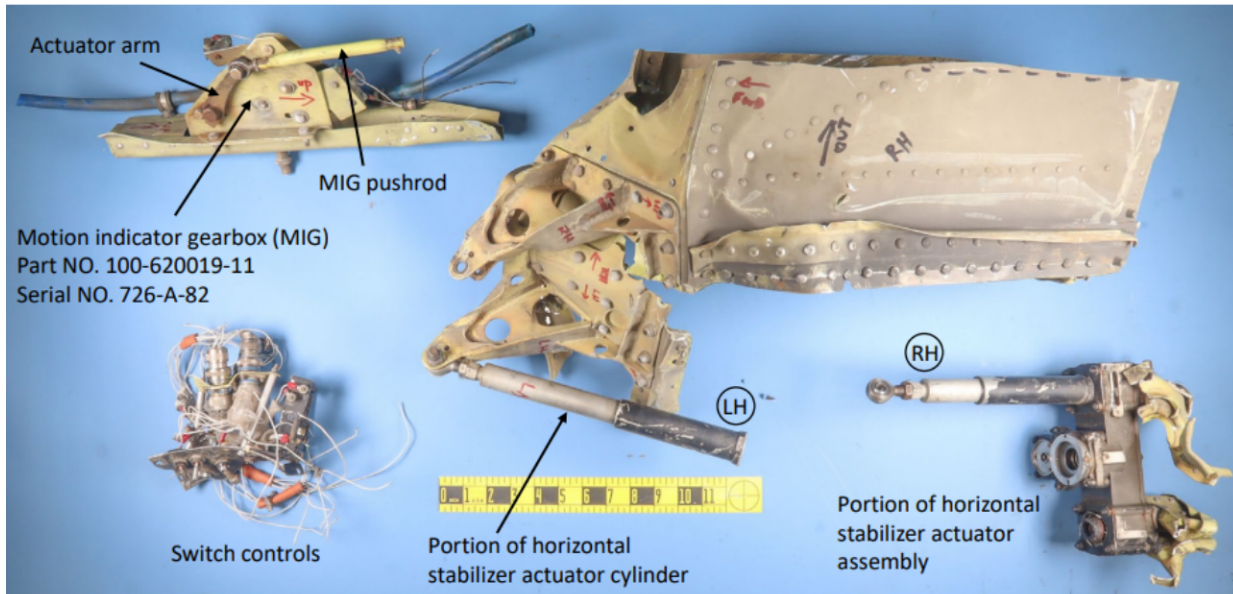


Figure 2 – Recovered components of the horizontal stabilizer trim system

The extension of the right-side horizontal stabilizer actuator cylinder was measured at 4.25 inches, which equated to a horizontal stabilizer position of 3.5° leading edge up (nose down). The nose-down travel limit for the stabilizer was 4.25°. The nose up travel limit was 4°.

A review of engineering data provided by the airframe manufacturer revealed that, with only the left actuator cylinder rod connected to the horizontal stabilizer, the arm would be operating in the “limited emergency operation” mode. The limited operation period is not known and unspecified by the manufacturer. The consequences of operating in this mode for an extended time are also unknown.

An examination of the pedestal-mounted main trim motor (S1) and standby trim motor (S2) switches was performed at the NTSB Materials Laboratory to determine their positions before the accident. Damage to the switch hardware was consistent with the S1 switch being in the ON position and the S2 switch being in the OFF position (the normal operating configuration).

Due to extensive damage to all the stabilizer trim components, functional testing could not be accomplished.

Medical and Pathological Information

The State of Maine Office of the Chief Medical Examiner (OCME) performed the flight instructor's autopsy. According to the autopsy report, his cause of death was blunt force injuries and his manner of death was accident.

Postmortem toxicological testing by the FAA Forensic Sciences Laboratory detected minoxidil in the flight instructor's muscle tissue. Minoxidil can be used as a prescription oral medication for treatment-resistant high blood pressure, or (at low doses) for hair loss. There are some potential safety concerns with oral minoxidil use, and the drug carries a warning that its use in high blood pressure should be reserved for certain cases where multiple other medications have been ineffective. However, minoxidil also is commonly used in topical products available over the counter to promote hair growth. When used as directed topically, minoxidil is absorbed into circulation to a low extent only, and is not typically impairing. According to the FAA medical case review for this accident, minoxidil is acceptable for pilots if the underlying condition is acceptable.

The State of Maine OCME performed the pilot receiving instruction's autopsy. According to the autopsy report, his cause of death was blunt force injuries and his manner of death was accident.

Postmortem toxicological testing by the FAA Forensic Sciences Laboratory detected pheniramine in the pilot's muscle tissue. Pheniramine is a sedating antihistamine medication that is available over the counter in oral products for cold and allergy symptom relief, as well as in eye drops for allergy-related eye redness and itching. Oral pheniramine products typically carry a warning that users should use caution when driving a motor vehicle or operating machinery. The FAA states that, after a pilot uses any drug with that warning (including any sedating antihistamine), the pilot should observe a waiting period for the drug to be cleared from circulation before flying.

Administrative Information

Investigator In Charge (IIC):	Hicks, Ralph
Additional Participating Persons:	Tom Cote; FAA/FSDO; Portland, ME Ricardo Asensio; Textron Aviation; Wichita, KS David Normandeau; Wiggins Airways; Manchester, NH Les Doud; Hartzell Propeller; Piqua, OH Mathieu Renaud; Pratt & Whitney Canada; Saint-Hubert, Quebec , OF Beverly Harvey; TSB
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Investigation Class:	Class 3
Note:	
Investigation Docket:	https://data.nts.gov/Docket?ProjectID=192925

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