Aviation Investigation Final Report

Location:	McKenzie Bridge, Oregon	**Accident Number:**	WPR19FA244
Date & Time:	August 27, 2019, 18:35 Local	**Registration:**	N4108F
Aircraft:	Cessna 172	**Aircraft Damage:**	Destroyed
Defining Event:	Collision during takeoff/land	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

After flying over mountainous terrain, the pilot attempted an approach into an airport with a 2,600-ft-long grass runway bordered by tall trees. Witnesses near the center of the runway described the airplane flying east over the runway about 5 ft above ground level when it came into their view. One witness stated that he could not hear any noise as the airplane came into view but that its wings rocked; he said he heard the engine power increasing and that the airplane may have started to climb when it reached his center of vision. A second witness stated that she heard the engine running and that the airplane began a slow climb and then disappeared from her view behind trees at a slightly higher altitude. About 15 minutes later, they saw smoke coming from the accident site. Impact signatures indicated that the airplane contacted treetops during the climbout; it then impacted the ground and came to rest inverted about 615 ft east of the departure end of the runway.

The witness statements support that the airplane was developing power when it began the climb. The propeller signatures were inconsistent with the engine producing power at the time of the impact; however, it is unknown if the pilot reduced power before impact. Rotational continuity of the engine and valve train could not be achieved because the engine crankcase and accessories were damaged by postcrash fire and the oil sump was destroyed. Although the crankshaft, camshaft, connecting rods, and piston were mostly damaged by postcrash fire, an examination of these components and the interior engine case revealed no indications of catastrophic engine failure.

Calculations based on takeoff and climb performance charts from the pilot's operating handbook showed that the airplane required a total takeoff distance of about 1,330 ft to clear a 50-ft obstacle at the end of the runway. However, the chart did not account for the 134 ft of rising terrain and 120-ft-tall trees at the end of the runway or the ambient temperature of about 98°F. The calculated density altitude on the day of the accident was 4,481 ft, which would have reduced the airplane's climb performance. Given these conditions, it is unlikely that the airplane was capable of clearing the rising terrain and tall trees at the end of the runway on the day of the accident.

Review of the pilot's logbook showed that he had not performed landings or takeoffs at mountain airports. Thus, he had insufficient experience to attempt a landing or takeoff at a short mountain airport runway bordered by trees on a day with a density altitude over 2,800 ft higher than the airport elevation. While it is unknown if the pilot had intended to perform a full-stop landing, a touch-and-go maneuver, or overfly the runway at a low altitude, he had selected a runway that was not recommended for takeoffs but was recommended for landing. The pilot likely misjudged the runway length needed and the airplane's performance when he chose to begin a climb about midfield in high density altitude conditions with rising terrain and 120-ft obstacles at the end of the runway.

Probable Cause and Findings

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

The pilot's delayed climb and misjudgment of the airplane's performance and the runway distance needed to clear obstacles at the end of the runway, which resulted in a collision with trees and subsequent impact with terrain. Contributing to the accident was the pilot's insufficient experience landing and taking off at mountain airports.

Findings

Personnel issues	Decision making/judgment - Pilot
Personnel issues	Aircraft control - Pilot
Personnel issues	Delayed action - Pilot
Environmental issues	Mountainous/hilly terrain - Contributed to outcome
Environmental issues	Tree(s) - Contributed to outcome
Personnel issues	Total experience - Pilot

Factual Information

History of Flight

Takeoff	Miscellaneous/other
Takeoff	Collision during takeoff/land (Defining event)

HISTORY OF FLIGHT

On August 27, 2019, about 1835 Pacific daylight time, a Cessna 172 airplane, N4108F, was destroyed when it was involved in an accident near McKenzie Bridge, Oregon. The pilot and the passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

According to the airplane owner, the pilot rented the accident airplane from 1730 to 1930 on the day of the accident. He indicated that he warned the pilot before departure of the high-density altitude that day and the potential for reduced airplane performance due to the high ambient temperatures. The pilot's exact departure time from Lebanon, Oregon (S30) was unknown.

A 16-second video file extracted from the pilot's mobile phone captured the accident flight about 10 minutes before the accident and showed the airplane flying through mountainous terrain at a low altitude. Toward the end of the video, the airplane made a slight right turn and then immediately began a left turn, at which point the video ended. The engine sounded smooth and continuous.

Several witnesses located under a tree canopy about midfield at McKenzie Bridge State Airport (00S), McKenzie Bridge, Oregon, saw the accident airplane as it flew into 00S. According to two of the witnesses, the airplane was about 5 ft above ground level (agl) flying east above runway 6 when it came into their view. One witness stated that he could not hear any noise as the airplane came into view and that the wingtips were rocking. Immediately after, he heard the sound of the engine power increasing, and the wings continued to rock. He indicated the airplane may have started to climb by the time it reached his center of vision, and about 1-2 seconds later it disappeared from his view. The second witness stated that she heard the engine running and that the wings rocked; the airplane then began a slow climb and disappeared from her view behind trees about 15-20 ft agl. A third witness, a helicopter mechanic, reported that the airplane appeared to be slow and was “way too low.” He said the engine sounded continuous at a low power setting. He stated that the airplane banked hard from side to side and then disappeared from his view behind trees. About 15 minutes later, two of the witnesses saw smoke coming from the accident site.

Pilot Information

Certificate:	Private	**Age:**	23,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	September 27, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	July 29, 2019
Flight Time:	69 hours (Total, all aircraft), 69 hours (Total, this make and model), 40 hours (Pilot In Command, all aircraft), 30 hours (Last 90 days, all aircraft), 7.5 hours (Last 30 days, all aircraft)		

According to the pilot's flight logbook, he began flight training in September 2018 and had 69.4 total flight hours by August 24, 2019, which was the final logbook entry. Most of his accumulated flight time was in the accident airplane make and model. The pilot's logbook did not contain any entries to indicate the pilot had accrued any experience with takeoffs and landings at mountain airports.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N4108F
Model/Series:	172 Undesignat	**Aircraft Category:**	Airplane
Year of Manufacture:	1958	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	46008
Landing Gear Type:	Tricycle	**Seats:**	4
Date/Type of Last Inspection:	August 25, 2019 100 hour	**Certified Max Gross Wt.:**	2299 lbs
Time Since Last Inspection:	4 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	4836.8 Hrs at time of accident	**Engine Manufacturer:**	Continental
ELT:	Installed	**Engine Model/Series:**	O-300-A
Registered Owner:	On file	**Rated Power:**	145 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:	373 ft msl	**Distance from Accident Site:**	48 Nautical Miles
Observation Time:	18:54 Local	**Direction from Accident Site:**	270°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	330°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.73 inches Hg	**Temperature/Dew Point:**	37°C / 8°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lebanon, OR (S30)	**Type of Flight Plan Filed:**	None
Destination:	Lebanon, OR (S30)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Local weather information was retrieved from a website operated by the University of Utah from a station located about 3 nautical miles west of the accident site. The station's 1806 weather entry showed wind 2 mph with gusts to about 8 mph from the northeast, temperature 98.4°F, and dewpoint 41°F.

The calculated density altitude at 00S was about 4,481 ft mean sea level about the time of the accident.

Airport Information

Airport:	Mc Kenzie Bridge State 00S	**Runway Surface Type:**	Dirt;Grass/turf
Airport Elevation:	1620 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	06	**IFR Approach:**	None
Runway Length/Width:	2600 ft / 90 ft	**VFR Approach/Landing:**	Unknown

Runway 6 was an upslope runway with 134-ft-tall rising terrain and 120-ft-tall trees beyond the departure end. According to the Federal Aviation Administration chart supplement that was current at the time of the accident, the airport remarks section indicated, "land east-takeoff west." Airport signage along the runway stated, "DEPARTURES FROM THIS END [the west end] NOT RECOMMENDED."

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	Unknown
Total Injuries:	2 Fatal	**Latitude, Longitude:**	44.182498,-122.07833

The airplane came to rest inverted in a wooded area about 615 ft east of the departure end of runway 6. The initial impact point (IIP) was marked by a tree about 120 ft tall with a severed top. (See Figure 1) A section of the left wingtip was found about 40 ft southwest of the IIP and displayed a depression in the leading edge of the wingtip. An intermediate impact point was observed along the debris path and marked by several broken tree branches at the top of a tree about 120 ft tall, about 75 ft southeast of the IIP. The main wreckage was located about 150 ft from the IIP and was mostly consumed by the postcrash fire but comprised all major structural components of the airplane.

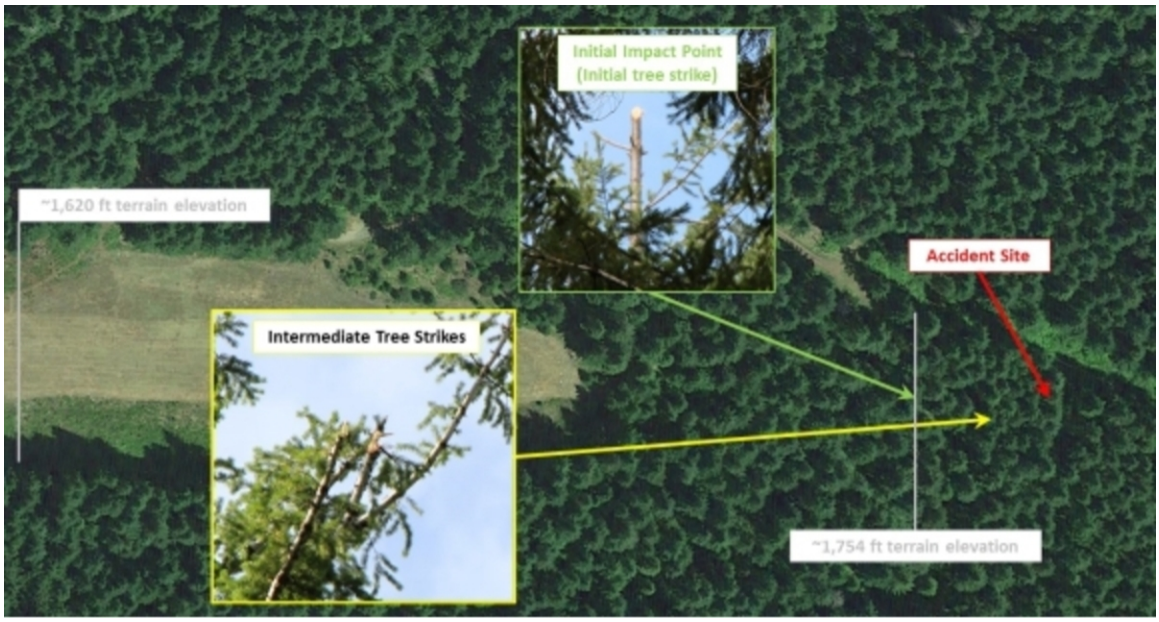

Figure 1: Wreckage Path Diagram

Figure 2: Terrain Elevations along Flight Path

Most of the flight control linkages remained attached to their respective control surfaces. and control continuity was traced from the rudder, elevator, and aileron to the cockpit. The elevator trim actuator measured 1.2 inches, consistent with a neutral trim setting.

The propeller was thermally damaged and remained attached to the engine crankshaft. One propeller blade was separated near the blade root with a slight aft bend but did not display any striations, nicks, or gouges; the other propeller blade remained attached and did not display any damage.

Rotational continuity of the engine and valvetrain could not be achieved because the engine crankcase and accessories were damaged by postcrash fire and the oil sump was destroyed. Although the crankshaft, camshaft, connecting rods, and piston were mostly damaged by postcrash fire, an examination of these components and the interior engine case revealed no indications of catastrophic engine failure.

Medical and Pathological Information

The Oregon State Medical Examiner's Office, Clackamas, Oregon, performed an autopsy of the pilot. The pilot's cause of death was blunt force injuries and immolation due to light plane crash. No significant natural disease was identified.

The FAA's Forensics Sciences Laboratory performed toxicology testing on the pilot's tissue samples, which detected no evidence of ethanol or drugs of abuse.

Tests and Research

The airplane's takeoff performance was calculated using the takeoff and climb charts from the pilot's operating handbook for the airplane’s make and model. A postaccident weight and balance calculation used the pilot's weight at his last medical examination of 134 lbs, an estimated passenger weight of 170 lbs, and fuel weight of 108 lbs; the airplane's gross weight was calculated to be about 1,700 lbs and the moment was about 66,000-inch lbs, which placed the airplane in the utility envelope. The takeoff distance chart assumed that flaps were retracted, and the takeoff was being conducted on a hard surface runway. According to calculations based on data in the takeoff chart, the airplane would have required a ground run of 744 ft and a total takeoff distance of about 1,330 ft to clear a 50-ft obstacle at a field elevation of 5,000 ft and an ambient temperature of 41°F. The chart showed that had the airplane been operating at its maximum gross weight of 2,200 lbs, it would have required a total takeoff distance of 2,455 ft at the same field elevation and ambient temperature to clear a 50-ft obstacle.

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Darren Vaughn; Federal Aviation Administration; Portland, OR Casey Love; Textron Aviation; Wichita, KS Christopher Lang; Continental Aerospace Technologies; Mobile, AL
Original Publish Date:	June 1, 2021
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=100155