Aviation Investigation Final Report

Location:	Marion, Montana	**Accident Number:**	WPR21LA249
Date & Time:	June 27, 2021, 11:15 Local	**Registration:**	N9613M
Aircraft:	Mooney M20F	**Aircraft Damage:**	Substantial
Defining Event:	Collision during takeoff/land	**Injuries:**	1 Minor, 1 None
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot was departing at the time of the accident. At the beginning of the short field takeoff, he held the brakes as he advanced the throttle to 2,650 rpm. He then released the brakes and began the takeoff roll. The airplane was about 1,600 ft down the runway when the pilot attempted to rotate, but the airplane did not accelerate as the pilot had anticipated after he rotated about midfield. A witness observed the airplane in a nose-high attitude about this time.

As it was too late to abort the takeoff, he turned left to avoid a tree-lined hill at the end of the runway and obstacles to the right of the runway. He also engaged the power boost (turbocharger) at this time, which yielded little improvement in the airplane's performance. The airplane was unable to gain sufficient altitude to clear trees so the pilot leveled the wings prior to the impact.

According to the pilot, the airplane had been underpowered during previous takeoffs and exhibited sudden slight drops in rpm; however, postaccident examination of the engine did not reveal any anomalies that could have precluded normal operation. The pilot stated that the engine appeared to function normally on the day of the accident but suggested that the propeller governor may have contributed to a performance deficiency as it had not been serviced for the past 30 years (or since the last major engine overhaul 30 years ago).

A functional test and disassembly of the governor revealed low performance output and excessive leakage due to pitting of the pilot valve. However, the loss in pressure output is not likely to have affected the propeller's pitch attitude during the takeoff attempt.

Performance computations were consistent with the pilot's and demonstrated that a successful rotation and transition into a climb for a midfield takeoff was attainable. A witness observed the airplane in a nose-high attitude after rotation. While the airspeed at which the

pilot rotated is unknown, the airplane's nose-high attitude suggests the airplane was not accelerating, thus inhibiting its transition out of ground effect. The investigation also found that the pilot did not properly engage the power boost (turbocharger) at the beginning of the takeoff as required by the flight manual. As the power boost is recommended at high elevation airports, like the pilot's departure airport, the additional manifold pressure and engine power is likely to have increased the engine's overall performance.

The evidence suggests that the accident was due to the pilot's improper rotation during takeoff, which resulted in a runway overrun and an impact with terrain. Contributing to the accident was the pilot's improper management of the turbocharger during a takeoff from a high-altitude airport, which reduced the engine's maximum performance during the ground run. The airplane also had sufficient distance to stop had the pilot selected an earlier point to abort the takeoff.

Probable Cause and Findings

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

The pilot's improper rotation during takeoff from a high-altitude airport and his failure to abort the takeoff, which resulted in an impact with trees and terrain. Contributing to the accident was the pilot's improper management of the turbocharger, which reduced the engine's maximum performance during the ground run.

Findings

Personnel issues	Decision making/judgment - Pilot
Personnel issues	Use of equip/system - Pilot
Aircraft	Turbocharger - Incorrect use/operation
Environmental issues	High density altitude - Effect on operation
Environmental issues	Tree(s) - Effect on operation

Factual Information

History of Flight

Initial climb	Collision during takeoff/land (Defining event)

On June 27, 2021, about 1115 mountain daylight time, a Mooney M20F airplane, N9613M, was substantially damaged when it was involved in an accident near Marion, Montana. The pilot was not injured, and the passenger received minor injuries. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The accident occurred as the pilot was taking off from the Cabin Creek Landing Airport (97MT). The pilot reported that he computed a takeoff performance based on a 5,000 ft field elevation, 80° F ambient temperature, and a takeoff weight of 2,740 pounds. The actual weight of the airplane at the time of departure was about 2,510 pounds. According to the pilot, the performance figures indicated a required ground run of 1,560 ft and takeoff distance of 2,395 ft to clear a 50 ft obstacle. The pilot reported that his engine run-up was normal and that he did not observe any anomalies with the engine prior to takeoff. He set the brakes and increased the throttle to full power to perform a short field takeoff. The engine rpm was climbing past 2,650 rpm when he released the brakes, and the airplane began the takeoff roll. The pilot recalled that the manifold pressure was above 23 inches Hg and the engine rpm was beyond 2,650 rpm. The takeoff roll was uneventful to this point. He rotated about midfield; 1,700 ft down the runway at 75 mph. He subsequently noticed that the airplane had not accelerated as expected, but realized that it was too late to abort the takeoff.

The pilot retracted the landing gear to gain airspeed, but once the landing gear had retracted, he immediately felt that the airplane was not on a proper trajectory to clear the advancing tree-lined hill at the end of the runway. With an obstacle to his right, he chose to bank left at which time he pushed the turbocharger control knob to the ON position, which closed the manual wastegate and engaged the turbocharger. At this time, he also advanced the mixture to the full rich position and verified the propeller lever was in the full forward position. There was a slight improvement in the airplane's performance, but not as he had experienced during previous flights. The pilot immediately leveled the wings and maintained the airplane's altitude before the airplane impacted trees, which substantially damaged the fuselage.

In a follow-up statement, the pilot reported that he experienced "general underperformance by engine both N/A [normally aspirated] and the Turbo engaged. Plane was making full RPM and had a manifold pressure over 23 inches Hg. The plane accelerated to 75 mph at a rate that seemed correct. Clear underperformance after liftoff that did not allow a climb over terrain."

According to a witness located near the departure end of the runway, he heard the accident airplane's power advance but did not observe the airplane until it was about midfield. Seconds

later, and immediately after the airplane had passed midfield, he observed it transition into a high angle of attack as the nose landing gear lifted off the runway. The main landing gear lifted off the ground about one second later and all three-landing gear were then retracted. The airplane maintained a slow airspeed and high angle of attack as it overflew the departure end of the runway at a low altitude and eventually disappeared from the witness' view. He heard the airplane impact trees about 15 to 30 seconds later. The witness reported that he did not detect any changes in engine rpm during the takeoff attempt.

The pilot further reported that "picking a more conservative abort point on the runway would have allowed me to abort the take off. I believed that I had rotated by the point I picked, but the airport manager said that a witness told him I rotated later than I think I did."

The engine was equipped with a Rajay turbocharged engine system in accordance with Supplemental Type Certificate SA1411WE.

According to the flight manual supplement for the turbocharger system,

> *When taking off from high elevation airfields, the turbocharger may be utilized to obtain 28.5" MAP at 2,700 rpm for 3 minutes during the takeoff. After full throttle is reached, push turbocharger control toward "ON" until 28.5" MAP is attained.*

The pilot reported that he had recently experienced intermittent drops in engine rpm engine had recently been serviced and appeared to function normally during the accident flight. He further reported that the propeller had recently been balanced and after the service he would occasionally observe a rapid drop in power of about 50 rpm. According to the pilot, at his home airport, near sea level with a 2,465 ft long runway, the airplane seemed underpowered when it was loaded to its full weight.

According to his mechanic, the pilot informed him that the airplane appeared underpowered at times during takeoff and had difficulty maintaining 2,700 rpm. The mechanic stated that he did not observe any performance concerns with the airplane when he last serviced it 6 days before the accident. He further remarked that he believed the propeller governor may have caused the decrease in engine rpm, but he did not have a way to test it.

The airplane was equipped with a Hartzell model D-1-6 propeller assembly. A review of the airplane logbooks showed that the propeller governor was last replaced during its last major engine overhaul in 1991.

The propeller governor was removed from the accident airplane and functionally tested at an overhaul facility. Initial observations showed that the propeller governor did not arrive with its coupler. The linkage control lever showed some impact damage, but the lever turned normally, and the spring-loaded mechanism worked as designed. The flyweights were normal in appearance and did not show any indication of sticking and the relief valve and spring were in good condition. Pitting was observed on the pilot valve.

The propeller governor was connected to a test stand designed to test the rpm, output, and internal leakage of the unit. The manufacturer's recommended maximum rpm was 2,300 rpm, the maximum allowable internal leakage was 16 quarts/hr and required pressure output range to the propeller was 290 – 310 psi. The results of the functional checks/tests showed that the propeller governor's maximum rpm was 2,270 rpm, the internal leakage was 50 quarts/hr and the output was 250 psi.

The propeller manufacturer stated that only about 140-160 psi would have been required to start the propeller off in low pitch during the takeoff roll and initial climb phases of the accident flight.

The density altitude at the time of the accident was about 6,400 ft. Computations of the airplane's takeoff performance using the pilot's operating handbook (POH) indicated that the airplane required a ground run of about 1,587 ft. According to landing data derived from the POH, the airplane required a ground roll of about 875 ft to stop, or approximately ¼ of the total runway distance.

Pilot Information

Certificate:	Private	**Age:**	35,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	
Instructor Rating(s):	None	**Toxicology Performed:**	
Medical Certification:	Class 3 Without waivers/limitations	**Last FAA Medical Exam:**	November 21, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	September 23, 2019
Flight Time:	330 hours (Total, all aircraft), 134 hours (Total, this make and model), 256 hours (Pilot In Command, all aircraft), 37 hours (Last 90 days, all aircraft), 12 hours (Last 30 days, all aircraft), 4 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N9613M
Model/Series:	M20F	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	670190
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	October 16, 2020 Annual	**Certified Max Gross Wt.:**	2740 lbs
Time Since Last Inspection:	131.46 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	4023.84 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	C126 installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-360-A1A
Registered Owner:	On file	**Rated Power:**	200
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:	KGPI,2973 ft msl	**Distance from Accident Site:**	21 Nautical Miles
Observation Time:	11:55 Local	**Direction from Accident Site:**	51°
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:	30.22 inches Hg	**Temperature/Dew Point:**	29°C / 14°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Marion, MT	**Type of Flight Plan Filed:**	None
Destination:	Kalispell, MT (S27)	**Type of Clearance:**	None
Departure Time:		**Type of Airspace:**	Class G

Airport Information

Airport:	CABIN CREEK LANDING 97MT	**Runway Surface Type:**	Asphalt
Airport Elevation:	3999 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	02/20	**IFR Approach:**	None
Runway Length/Width:	3400 ft / 50 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 1 None	**Latitude, Longitude:**	48.083111,-114.67182

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Jeff Simmons; Federal Aviation Administration; Helena, MT
Original Publish Date:	February 24, 2023
Last Revision Date:	
Investigation Class:	Class 3
Note:	The NTSB did not travel to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=103359