Aviation Investigation Final Report

Location:	Broomfield, Colorado	**Accident Number:**	CEN19FA022
Date & Time:	November 2, 2018, 11:51 Local	**Registration:**	N287BM
Aircraft:	MUSTANG II	**Aircraft Damage:**	Substantial
Defining Event:	Turbulence encounter	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The private pilot and his passenger were returning from a local flight. According to GPS data, the airplane overflew the airport and entered a midfield left downwind leg for the landing runway before turning to the base leg. Multiple witnesses observed the airplane fly at a high speed and a low altitude before it banked sharply, descended toward the ground, and impacted terrain.

The damage to the airplane was consistent with the airplane impacting the ground in a nose-low, wings-level attitude. Postaccident examination of the airframe and engine revealed no mechanical anomalies that would have precluded normal operations.

Two AIRMETs that were valid for the accident location and time warned of moderate turbulence and low-level wind shear conditions. Various weather products, including computer model simulations and satellite images, depicted conditions consistent with moderate-to-severe turbulence that were conducive for mountain wave activity near the airport. In addition, multiple pilot reports in the area indicated moderate-to-severe turbulence. The observed wind speeds at the airport directly before and after the accident time were weaker than what was encountered by the accident flight due to the inversion likely staying in place longer at the airport. A weather simulation indicated that the accident airplane was in an area of downdrafts with magnitudes between 200 and 1,000 fpm and updrafts with magnitudes between 300 and 1,500 fpm. The airplane was in an area with horizontal wind magnitudes between 20 and 30 knots.

No evidence indicated that the pilot obtained a weather briefing for the intended route of flight; however, even if the pilot had obtained a weather briefing, no weather products at the time of the accident would have specifically mentioned the potential for mountain wave activity.

The accident flight likely encountered mountain wave and rotor conditions while on final approach to the airport with wind gusting between 30 to 50 knots and updrafts and downdrafts with magnitudes between 500 and 1,500 ft per minute. The pilot was most likely not able to maintain airplane control due

to this encounter.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's inability to maintain airplane control following an encounter with mountain wave turbulence.

Findings

Environmental issues	Terrain induced turbulence - Effect on equipment
Aircraft	Descent/approach/glide path - Attain/maintain not possible
Personnel issues	Aircraft control - Pilot

Factual Information

History of Flight

Approach-VFR pattern final	Turbulence encounter (Defining event)
Approach-VFR pattern final	Loss of control in flight
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On November 2, 2018, about 1150 mountain daylight time, an amateur-built Mustang II airplane, N287BM, was substantially damaged when it impacted terrain near Broomfield, Colorado. The private pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight. Visual meteorological conditions prevailed at the time of the accident, and no flight plan had been filed for the local flight, which departed EIK about 1055.

Data from a Garmin GPSMAP 496 showed that, after departure, the airplane proceeded to the east and northeast before it turned back toward EIK. The last few minutes of data depicted the airplane crossing over runway 15/33 about midfield at an altitude of 6,130 ft mean sea level (msl) or about 1,000 ft above ground level (agl) and a groundspeed of 93 knots. The airplane continued on a left downwind leg and then a left base leg at an altitude of 5,878 ft msl and a ground speed of 93 knots. The airplane's last recorded position was at 1149:47 at an altitude of 5,417 ft msl and a ground speed of 93 knots.

Multiple witnesses south of EIK reported that the airplane flew from west to east at a low altitude and made a "steep" bank to the north, and the nose of the airplane then "dropped." One witness stated that the bank angle was about 90°. Witnesses located south of the accident site reported strong surface winds at the time of the accident, with one witness reporting that the wind was from the west between 35 and 40 mph (30 and 35 knots). The airplane impacted a grassy area and trees in a park near Anthem Ranch about 0.4 mile south of the approach end of runway 33 at EIK.

Pilot Information

Certificate:	Private	**Age:**	58,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	4-point
Instrument Rating(s):	None	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	January 11, 2015
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	July 19, 2018
Flight Time:	1152.1 hours (Total, all aircraft), 128.5 hours (Total, this make and model), 18 hours (Last 90 days, all aircraft), 3.5 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	MUSTANG	**Registration:**	N287BM
Model/Series:	II	**Aircraft Category:**	Airplane
Year of Manufacture:	2003	**Amateur Built:**	Yes
Airworthiness Certificate:	Experimental (Special)	**Serial Number:**	287
Landing Gear Type:	Tailwheel	**Seats:**	2
Date/Type of Last Inspection:	June 3, 2018 Condition	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	46 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	874 Hrs at time of accident	**Engine Manufacturer:**	Lycoming
ELT:	C91A installed, not activated	**Engine Model/Series:**	O3-20-E2A
Registered Owner:		**Rated Power:**	150 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:	KEIK,5119 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	11:54 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	None / Terrain-Induced
Wind Direction:	300°	**Turbulence Severity Forecast/Actual:**	Moderate / Severe
Altimeter Setting:	29.94 inches Hg	**Temperature/Dew Point:**	16°C / -2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Erie, CO (EIK)	**Type of Flight Plan Filed:**	None
Destination:	Erie, CO (EIK)	**Type of Clearance:**	None
Departure Time:	10:55 Local	**Type of Airspace:**	Class E

The observation taken at 1212 recorded wind from 310° at 10 knots, gusting to 15 knots. Weather observations from two airports located near the foot of the mountains showed the following: at Boulder Municipal Airport, Boulder, Colorado (located 8 miles west of the accident site), at 1130 recorded wind from 290° at 24 knots, gusting to 34 knots; at Rocky Mountain Metropolitan Airport, Denver, Colorado (located 7 miles southwest of the accident site), at 1150 recorded wind from 270° at 26 knots, gusting to 35 knots.

The National Weather Service (NWS) Surface Analysis Chart for 1200 depicted a stationary front across

northeastern Colorado. The station models depicted clear skies over the region with temperatures between 40° and 50° Fahrenheit (F), dew point temperatures in the low 30s, and west wind about 10 knots. No significant weather or precipitation was reported over the route of flight.

A High-Resolution Rapid Refresh model sounding for the accident site at 1200 depicted an unstable environment from the surface to 6,000 ft msl with a conditionally unstable environment from 6,000 to 10,000 ft msl. The sounding also indicated a 10-knot surface wind from the west northwest, increasing to 37 knots by 10,000 ft. The sounding further indicated the possibility of light low-level wind shear between the surface and 5,500 ft msl and light-to-moderate clear air turbulence above 6,500 ft msl. In addition, the sounding supported updrafts and downdrafts up to 1,214 ft per minute (fpm).

A Weather Research and Forecasting Model simulation indicated that the accident airplane was in an area of downdrafts with magnitudes between 200 and 1,000 fpm and updrafts with magnitudes between 300 and 1,500 fpm. The airplane was in an area with horizontal wind magnitudes between 20 and 30 knots.

The Geostationary Operational Environmental Satellite-16 imagery depicted no cloud cover over the accident site about the time of the accident. The imagery indicated wave-like cloud features over the mountains and drier air were noted west of the accident site.

A search of pilot reports (PIREPS) within 80 miles of the accident site revealed numerous reports (including two urgent pilot reports) of moderate-to-severe turbulence between the altitudes of 6,600 and 23,000 ft msl on the morning of the accident. Several urgent pilot reports noted moderate to severe turbulence.

AIRMETs Tango and Zulu were issued at 0845 on the day of the accident and were valid for the accident location at the time of the accident. The AIRMETs warned of moderate turbulence below flight level 180 and low-level wind shear conditions.

A search of the contract Automated Flight Service Station (AFSS) provider Leidos and the Direct User Access Terminal Service (DUATS), revealed that the accident pilot did not request an official weather briefing through either of these sources.

Airport Information

Airport:	Erie Muni EIK	**Runway Surface Type:**	Concrete
Airport Elevation:	5119 ft msl	**Runway Surface Condition:**	
Runway Used:	33	**IFR Approach:**	None
Runway Length/Width:	4700 ft / 60 ft	**VFR Approach/Landing:**	Traffic pattern

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	39.997501,-105.045829(est)

The accident site was in an open park vegetated by grass and coniferous trees. The accident site was at an elevation of 5,170 ft msl, and the airplane's initial impact point was oriented along a magnetic heading of about 330°. The initial impact point was a long narrow ground scar that was about 15 ft long and about 15 inches at its widest point. This ground scar intersected with a second scar that was 7 ft long, 3 ft wide, and 8 inches deep (with an east/west orientation). The second ground scar contained pieces of the engine cowling and a fragmented/splintered propeller blade. A third ground scar intersected with the second scar and continued 10 ft to the main wreckage.

The main wreckage included the right wing, left wing, instrument panel, fuselage, and empennage. The engine separated from the airplane and came to rest 18 ft to the north of the main wreckage. The left main landing gear tire separated and came to rest 150 ft north of the main wreckage.

Both wings exhibited aft accordion crushing along their entire leading edge. Flight control continuity was confirmed for both ailerons and the rudder. The elevator control tube was impact separated at the junction just aft of the cabin. The control tube was continuous from that point forward to the control sticks in the cabin. The separation features were consistent with impact damage and overload.

No preaccident mechanical malfunctions or failures were found with the airframe or engine that would preclude normal operation.

Additional Information

FAA Advisory Circular (AC) 00-6B, Aviation Weather, section 17.2.2.1, describes mountain wave conditions and the associated aviation hazards. The guidance in this section stated the following:

A mountain wave…is an atmospheric wave disturbance formed when stable air flow passes over a mountain or mountain ridge. Mountain waves are a form of mechanical turbulence which develop above and downwind of mountains. The waves remain nearly stationary while the wind blows rapidly through them…. Mountain waves frequently produce severe to extreme turbulence.

Additional information on the hazardous weather and wind conditions in mountainous terrain appears in FAA Advisory Circular 00-57, Hazardous Mountain Winds and Their Visual Indicators. The guidance in this AC stated the following in section 3.3:

Aircraft that engage in low-level flight operations in mountainous terrain in the presence of strong wind (20 kt or greater at ridge level) can expect to encounter moderate or greater turbulence, strong up- and

downdrafts, and very strong rotor and shear zones. This is particularly true for general aviation aircraft.

Medical and Pathological Information

The Office of the Coroner for Adams and Broomfield Counties, Brighton, Colorado, performed an autopsy on the pilot. The pilot's cause of death was multiple blunt force injuries.

Toxicology testing performed at the Federal Aviation Administration (FAA) Forensic Sciences Laboratory were negative for carbon monoxide, ethanol, and all drugs tested.

Administrative Information

Investigator In Charge (IIC):	Rodi, Jennifer
Additional Participating Persons:	Joseph Chavez; Federal Aviation Administration; Denver, CO Troy Helgeson; Lycoming Engines; PA
Original Publish Date:	May 19, 2020
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=98588