Aviation Investigation Final Report

Location:	Ainsworth, Nebraska	**Accident Number:**	CEN17FA362
Date & Time:	September 23, 2017, 10:28 Local	**Registration:**	N73MA
Aircraft:	Mitsubishi MU 2B-40	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The instrument-rated private pilot departed on a cross-country flight in instrument meteorological conditions (IMC) with an overcast cloud layer at 500 ft above ground level (agl) and visibility restricted to 1 ¾ miles in mist, without receiving an instrument clearance or opening his filed instrument flight rules flight plan. There was an outage of the ground communications system at the airport and there was no evidence that the pilot attempted to open his flight plan via his cellular telephone. In addition, there was a low-level outage of the radar services in the vicinity of the accident site and investigators were unable to determine the airplane's route of flight before impact.

The airport manager observed the accident airplane depart from runway 35 and enter the clouds. Witnesses located to the north of the accident site did not see the airplane but reported hearing an airplane depart about the time of the accident. One witness reported hearing a low-flying airplane and commented that the engines sounded as if they were operating at full power. The witness heard a thud as he was walking into his home but attributed it to a thunderstorm in the area.

The airplane impacted a field about 3.5 miles to the northeast of the departure end of the runway and off the track for the intended route of flight. The airplane was massively fragmented during the impact and debris was scattered for about 300 ft. The damage to the airplane and ground scars at the accident site were consistent with the airplane impacting in a left wing low, nose low attitude with relatively high energy.

A postaccident examination of the engines and propeller assemblies did not reveal any preimpact anomalies that would have precluded normal operation. Signatures were consistent with both engines producing power and both propellers developing thrust at the time of impact. While the massive fragmentation precluded functional testing of the equipment, there was no damage or failure that suggested preimpact anomalies with the airframe or flight controls.

Several days before the accident flight, the pilot encountered a "transient flag" on the air data attitude heading reference system. The pilot reported the flag to both the co-owner of the airplane and an

avionics shop; however, exact details of the flag are not known. The unit was destroyed by impact forces and could not be functionally tested. If the flag affecting the display of attitude information had occurred with the unit after takeoff, the instrument panel had adequate stand-by instrumentation from which the pilot could have continued the flight. It is not known if this unit failed during the takeoff and investigators were unable to determine what role, if any, this transient issue may have played in the accident.

Based upon the reported weather conditions, the location of the wreckage, and the attitude of the airplane at the time of impact with the ground, it is likely that the pilot experienced spatial disorientation shortly after takeoff which resulted in a loss of control and descent into terrain.

Probable Cause and Findings

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

The pilot's loss of airplane control due to spatial disorientation.

Findings

Aircraft	Heading/course - Not attained/maintained
Aircraft	Pitch control - Not attained/maintained
Aircraft	Lateral/bank control - Not attained/maintained
Personnel issues	Aircraft control - Pilot
Personnel issues	Spatial disorientation - Pilot

Factual Information

History of Flight

Initial climb	Loss of visual reference
Initial climb	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On September 23, 2017, about 1028 central daylight time, a Mitsubishi MU 2B-40 airplane, N73MA, was destroyed when it impacted terrain 3.5 miles northeast of the Ainsworth Regional Airport (ANW), Ainsworth, Nebraska. The private pilot was fatally injured. The airplane was owned by private individuals and operated by the pilot under the provisions of Title 14 *Code of Federal Regulations* Part 91. Instrument meteorological conditions prevailed, and an instrument flight rules (IFR) flight plan had been filed for the flight; however, it had not been activated. The personal flight was originating at the time of the accident and was en route to Bottineau Municipal Airport (D09), Bottineau, North Dakota.

According to Federal Aviation Administration (FAA) records and the pilot's cellular telephone records, the pilot contacted the Flight Service Station (FSS) in Fort Worth, Texas, about 1015 on the morning of the accident to file an IFR flight plan. The pilot stated that he was en route to D09 and requested an altitude of 16,000 ft. The FSS specialist offered to provide adverse weather and route of flight information; the pilot declined.

There were no other telephone calls made to FAA air traffic control (ATC) facilities or FSS, from the pilot's telephone, before the accident. Several notices to airman (NOTAMS) were issued for ANW and were valid on the day of the accident. Specifically, the hazardous inflight weather advisory service outlet and the remote communications outlet on frequencies 122.4 and 121.5 were out of service.

According to the ANW airport manager, the airplane was fueled in a hangar just before the flight because it was raining. The airport manager was in the fixed base operator (FBO) building when he heard the start of both engines; everything sounded normal. He watched the airplane depart from runway 35 (6,824 ft by 110 ft; asphalt) and enter the clouds.

Several witnesses in the area reported hearing an airplane flying from the southwest to the northeast. One witness located north of ANW characterized the sound as if the airplane was lower than usual or buzzing the ground. One witness stated that the visibility was low and that the engines sounded "wound up really tight, full throttle, and very loud." The witness heard a "thud" as he was walking into his house and asked his wife if anything had fallen in the house to which she responded no; he attributed the noise to a thunderstorm in the vicinity.

According to the pilot's family, he was flying to D09 to pick up a dog, who had been at a training camp all summer. He planned to meet a friend, who was training his dog, at D09 around 1200. The airplane was reported missing by the friend of the pilot when the airplane did not arrive at D09 as scheduled. The wreckage was located about 1800.

A search of ATC radar data did not find any primary or secondary radar targets consistent with the accident airplane. The "low altitude radar" was not operational in the area of ANW on the day of the accident. The airplane's exact route of flight after takeoff could not be established.

Pilot Information

Certificate:	Private	**Age:**	69,Male
Airplane Rating(s):	Single-engine land; Multi-engine land; Multi-engine sea	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	May 9, 2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	June 3, 2017
Flight Time:	(Estimated) 3775 hours (Total, all aircraft), 2850 hours (Total, this make and model)		

At the time of medical certificate application, the pilot reported no chronic medical conditions and no medications. The pilot was issued a medical certificate that contained the limitation "must wear corrective lenses for near and distant vision."

The pilot's flight logbook was not located during the investigation. The co-owner of the airplane stated that he had co-owned several MU-2 airplanes with the pilot since 2000, and he estimated that the pilot had logged 2,500 hours in the make and model of the accident airplane. According to the pilot's application for medical certificate, dated May 9, 2016, he estimated his total pilot time was 3,775 hours; 64 of which were logged in the previous 6 months.

According to records provided by SIMCOM Aviation Training, the pilot had completed initial Mitsubishi MU-2B training at Flight Safety in 1999. The pilot's most recent recurrent training was completed on June 3, 2017, at SIMCOM. The pilot also successfully completed an instrument proficiency check at that time. The instrument training included a simulated partial panel instrument landing system (ILS) approach. At the time of the most recent recurrent course, the pilot estimated his time on the prerequisite form as 2,850 hours in MU-2B airplanes.

Aircraft and Owner/Operator Information

Aircraft Make:	Mitsubishi	**Registration:**	N73MA
Model/Series:	MU 2B-40 26A	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	414 SA
Landing Gear Type:	Retractable - Tricycle	**Seats:**	7
Date/Type of Last Inspection:	September 5, 2017 100 hour	**Certified Max Gross Wt.:**	10470 lbs
Time Since Last Inspection:		**Engines:**	2 Turbo prop
Airframe Total Time:	5383.6 Hrs as of last inspection	**Engine Manufacturer:**	Honeywell
ELT:	C91A installed, not activated	**Engine Model/Series:**	TPE331
Registered Owner:	On file	**Rated Power:**	
Operator:	On file	**Operating Certificate(s) Held:**	None

A flight log for the accident airplane, located in the wreckage and dated September 22, 2017, showed the airplane cycles at 1,125, and the hobbs at takeoff as 13,850.0 hours. The hobbs landing and flight time fields were not populated on the form. The departure airport was Kenosha Regional Airport (ENW), Kenosha, Wisconsin, and the destination was ANW.

According to a photograph of the instrument panel provided by the co-owner, the airplane was equipped with a two-screen Chelton Air Data Attitude Heading Reference System (ADAHRS) display in place of the standard 6 primary flight instruments on the pilot-side of the instrument panel. Below the two-screen Chelton display, from left to right, the pilot had an attitude indicator and a turn and slip indicator. A second attitude indicator was mounted on the co-pilot's side of the instrument panel, on the upper right corner.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	KANW,2588 ft msl	**Distance from Accident Site:**	3 Nautical Miles
Observation Time:	10:35 Local	**Direction from Accident Site:**	209°
Lowest Cloud Condition:		**Visibility**	1.75 miles
Lowest Ceiling:	Overcast / 500 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	None / None
Wind Direction:	360°	**Turbulence Severity Forecast/Actual:**	N/A / N/A
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	9°C / 9°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Ainsworth, NE (KANW)	**Type of Flight Plan Filed:**	IFR
Destination:	Bottineau, ND (D09)	**Type of Clearance:**	None
Departure Time:	10:28 Local	**Type of Airspace:**	Class E

A weather study was conducted by the National Transportation Safety Board in support of this accident investigation and the detailed weather study is available in the public docket.

The National Weather Service Surface (NWS) Surface Analysis Chart for 1000 CDT depicted a low-pressure system and an associated stationary front south of the accident site, with the accident site in an area of favorable overrunning conditions for low cloud development. The station models in the vicinity of the accident site, north of the front, indicated northerly winds of 5 to 10 knots, overcast cloud cover, and restricted visibility in fog or mist.

A review of the NWS Composite Reflectivity image taken at 1025 CDT depicted several strong to intense cells between 59 and 75 miles to the east-northeast of ANW and the accident site with no significant echoes in the immediate vicinity of the accident site. The Geostationary Operational Environmental Satellite depicted two bands of clouds with a radiative cloud top temperature consistent with 24,000 ft; the bands were on either side of the accident site. Low stratiform clouds were over the accident site.

The ANW weather observation taken at 1015 CDT reported wind from 360° at 10 knots, visibility 1 3/4 miles in mist, ceiling overcast at 500 ft agl. Temperature 10° Celsius (C), dew point temperature 10 C, and altimeter 30.02 inches of mercury. Similar conditions continued to be reported.

A Convective SIGMET for an area of embedded thunderstorms, a Center Weather Advisory for an area of heavy rain showers, and AIRMET Sierra for an extensive area of IFR conditions, were indicated for the route of flight.

Airport Information

Airport:	Ainsworth Regional KANW	**Runway Surface Type:**	Asphalt
Airport Elevation:	2588 ft msl	**Runway Surface Condition:**	
Runway Used:	35	**IFR Approach:**	None
Runway Length/Width:	6824 ft / 110 ft	**VFR Approach/Landing:**	None

Ainsworth Regional Airport is a public, non-towered airport (Class E airspace) located 6 miles northwest of Ainsworth, Nebraska., at a surveyed elevation of 2,588 ft. The airport had 2 open asphalt runways; runway 17/35 (6,824 ft by 110 ft) and runway 13/31 (5,501 ft by 1,677 ft by 73 ft). Four area navigation (RNAV) (GPS) approaches and 2 VHF omnidirectional range (VOR) approaches were available. Special takeoff minimums of 1 statute mile visibility and obstacles departure procedures due to a fence near the departure end of runway 31 were in place.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	42.536945,-99.959167

The wreckage came to rest in a grazing pasture vegetated with tall grass. The accident site was at an elevation of 2,590 ft msl, and the debris and wreckage path were oriented on a magnetic heading of 270°.

Torn and fragmented remains of the left wing tip tank were located in the initial impact crater. The crater was about 3 ft deep, 10 ft wide, and 8 ft long. A long narrow ground scar extended from the initial impact crater west 6 ft to a second crater. The scar was about 3 ft at its widest point and about 1 ft deep.

The second crater was about 25 ft long, 20 ft at its widest point, and 6 ft deep. The second crater contained the left engine and left propeller assembly. The assembly exhibited signatures consistent with exposure to heat and fire. Two propeller blades separated from the propeller assembly and were embedded in the crater. The outboard 6 inches of two blades separated and were located north of the crater. The crater also contained torn and fragmented metal consistent with the left wing and fuselage, engine tubing and components, and the counter weight for the left horizontal stabilizer.

The right engine was located at the west end of the crater and was embedded in the ground.

A ground scar extended 6 ft west to a third crater. The crater was about 3 ft deep, 8 ft long, and 7 ft at its widest point. The crater contained fragmented metal, tubing, and components. The debris field continued from the third crater west about 23 ft to the main piece of wreckage.

The left main landing gear assembly was located 12 ft north of the main wreckage. The landing gear actuator position was consistent with the landing gear being retracted. The right main landing gear was with the main wreckage.

The main wreckage included flight control cables, electrical wiring, tubing, the vertical stabilizer, rudder, and center and left side of the wing.

Cabin seats, electrical wiring cables, and torn and fragmented metal extended farther west from the main wreckage. The farthest component was located about 280 ft southwest of the wreckage on the adjacent dirt farm road. The right elevator separated and was located 4 ft west of the main piece of wreckage. The right flap was separated and located about 10 ft farther west. The control cables were broken in multiple locations and continuity could not be confirmed. Separated cable ends illustrated broomstraw signatures consistent with overload separation due to impact forces. The fuselage was fragmented. The wing flaps were set at zero based upon the actuator position and was consistent with damage signatures on the cockpit flap selector.

The scope of the examination was limited by fragmentation due to impact damage; however, no anomalies consistent with a preimpact failure or malfunction were observed.

Medical and Pathological Information

The Nebraska Institute of Forensic Sciences, Inc. performed the autopsy on the pilot on September 26, 2017, as authorized by Brown County Nebraska. The autopsy concluded that the cause of death was "multiple blunt force trauma," and the report listed the specific injuries. There was no evidence of recent medical intervention or natural disease that could pose a hazard to flight safety.

The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, performed toxicological tests on specimens that were collected during the pilot's autopsy. Carbon monoxide and cyanide tests were not performed. Results were negative for tested drugs. Testing of the liver revealed 12 mg/dL ethanol; however, no ethanol was detected in the muscle tissue. When ethanol is ingested, it is quickly distributed throughout the body's tissues and fluids fairly uniformly. Ethanol may also be produced in the body after death by microbial activity.

Additional Information

Chelton Air Data Attitude Heading Reference System (ADAHRS)

A Chelton ADAHRS was installed on the airplane in October of 2008 in accordance with the Chelton

Flight Systems supplemental type certificate (STC) SA02203AK. During a flight from Kenosha, Wisconsin, to LaCross, Wisconsin, on the Wednesday before the accident, the pilot encountered a "transient flag" on the Chelton ADAHRS and mentioned it to the co-owner of the airplane. The pilot planned to take the airplane in for avionics work to follow-up on this issue the next week.

The owners of the airplane had avionics work completed at May Day Avionics in Grand Rapids, Michigan; there was no work done on the avionics immediately before the accident flight. According to a manager at May Day Avionics, the pilot left a voice mail on or around September 21 (2 days before the accident), regarding a transient flag he received on the unit. The voicemail stated that the flag was related to ADAHRS, but no further detail was provided. The manager did not speak directly with the pilot about the flag before the accident and could not provide any further details regarding the issue.

The Chelton Flight Systems Manual, Section 3, addresses "Failure Modes" for the system. There are potentially 6 modes with an ADAHRS failure mode or flag. Without further details regarding this transient flag the pilot encountered, it is not possible to factually discuss the impact this failure would have on the information displayed for the pilot. It is not known if the pilot had an issue with the Chelton system at the time of the accident.

The Chelton ADAHRS was fragmented in the accident and could not be functionally tested.

Wreckage Examination

The airplane wreckage was recovered and relocated to a secure facility for further examination.

The right engine exhibited extensive impact damage and was fragmented. Rotational scoring was present on the impeller blades and shroud. The first stage impeller was impact separated and all blades were separated along the hub at the root. The third stage blades were intact and exhibited metal spray. The right engine accessories were impact damaged and separated and could not be functionally tested.

The left engine exhibited extensive impact damage and was fragmented. The first stage impeller was impact damaged and all but two blades separated. The blades of the second stage impeller were bent opposite the direction of rotation with heavy wear signatures. The third stage blades were impact damaged, bent, and exhibited "heavy rub" signatures and metal spray deposits. The left engine accessories were impact damaged and separated and could not be functionally tested.

The left propeller assembly separated from the engine at the propeller flange. Three of the four blades from the left propeller assembly separated. Impact marks in the hydraulic units were consistent with a blade pitch between 26° and 60°. The blades were bowed and twisted and exhibited chordwise/rotational scoring, leading edge polishing, and gouges. The tips of two blades were impact separated.

The right propeller assembly separated from the engine at the propeller flange. Three of the four blades from the right propeller assembly separated. The blades were bowed and twisted and exhibited chordwise/rotational scoring, leading edge polishing, and gouges. The tip of one blade was impact separated.

The damage to both propeller assemblies was similar and symmetric, and the damage to the blades was

consistent with ground impact while the engine was producing power and the propeller blades were producing thrust. No anomalies were noted that would have precluded normal operations.

Spatial Disorientation

The FAA Civil Aeromedical Institute's publication, "Introduction to Aviation Physiology," defines spatial disorientation as a loss of proper bearings or a state of mental confusion as to position, location, or movement relative to the position of the earth. Factors contributing to spatial disorientation include changes in acceleration, flight in IMC, frequent transfer between visual meteorological conditions (VMC) and IMC, and unperceived changes in aircraft attitude.

The FAA's Airplane Flying Handbook (FAA-H-8083-3A) describes some hazards associated with flying when the ground or horizon are obscured. The handbook states, in part:

"The vestibular sense (motion sensing by the inner ear) in particular tends to confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in the attitude of the airplane, nor can they accurately sense attitude changes that occur at a uniform rate over a period of time. On the other hand, false sensations are often generated; leading the pilot to believe the attitude of the airplane has changed when in fact, it has not. These false sensations result in the pilot experiencing spatial disorientation."

Administrative Information

Investigator In Charge (IIC):	Rodi, Jennifer
Additional Participating Persons:	Scott M Olson; Federal Aviation Administration; Lincoln, NE Justin Eddleman; Federal Aviation Administration; Lincoln, NE Robert Markise; Federal Aviation Administration; Lincoln, NE Yoshiaki Asako; Mitsubishi Heavy Industries; Addison, TX Ralph Sorrells; Mitsubishi Heavy Industries; Addison, TX Dana Metz; Honeywell Aerospace; Phoenix, AZ Bill Gill; Honeywell Product Integrity; Olathe, KS Les Doud; Hartzell Propeller; Piqua, OH
Original Publish Date:	February 26, 2019
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=96063