Aviation Investigation Final Report

Location:	Billings, Montana	**Accident Number:**	WPR20FA063
Date & Time:	January 11, 2020, 18:01 Local	**Registration:**	N736YU
Aircraft:	Cessna TR182	**Aircraft Damage:**	Destroyed
Defining Event:	Controlled flight into terr/obj (CFIT)	**Injuries:**	4 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The pilot departed with three passengers to the northwest on a flight at night, without any clouds and good visibility at the pilot's planned cruise altitudes. The airplane leveled off about 4,792 ft mean sea level (msl) and maintained a similar altitude and height above terrain between 1,400 ft and 2,100 ft above ground level (agl) for most of the flight. The terrain elevation increased in the airplane's final 40 seconds of flight. The airplane was about 65 ft agl (4,809 ft msl) when it impacted a tower. All occupants were fatally injured, and the airplane was destroyed.

Postaccident examination of the airplane and engine revealed no mechanical malfunctions or anomalies that would have precluded normal operation. The airplane's primary flight display (PFD) reported barometric altitude adjustable by altimeter setting, and its two multifunction displays (MFDs) reported GPS altitude based on satellite geometry. The flight data showed that the barometric altitude (shown on the PFD) about the time of the accident was 207 ft higher than the GPS altitude (displayed on the MFD at the center of the instrument panel). The pilot, who was also a certified flight instructor, had every opportunity to observe the difference between the GPS and barometric altitudes during his instrument scan. The airplane's relatively consistent cruise flight altitude during the accident leg suggests that autopilot was engaged. It is unclear from available evidence whether the pilot would have used barometric altitude or GPS altitude to set the autopilot or whether the MFD provided a terrain alert before the accident occurred. However, data from previous flights showed that the pilot had extensive knowledge of the area and had intentionally circumvented this tower at a similar altitude during a flight a few days prior.

The tower did not meet the Federal Aviation Administration's (FAA) 200-ft minimum height requirement to be lit or placed on an aviation chart. However, the FAA sectional chart, which was available to the accident pilot for this flight, showed the height of the plateau beneath the tower. The pilot instead relied on the MFD terrain map for topographical features and obstacles. A review of the terrain map before the accident flight or during cruise flight would have led a conscientious pilot to maintain a safe distance from terrain by climbing to a higher cruise altitude, consistent with the

minimum safety altitudes provided in Federal Aviation Regulations. Thus, despite having a preexisting knowledge of the area topography and obstacles, the pilot exercised poor decision making in operating at a cruise altitude less than the minimum safe altitudes specified in regulations.

Probable Cause and Findings

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

The pilot's failure to maintain clearance due to poor decision making in selecting an unsafe altitude during cruise flight.

Findings

Personnel issues	Decision making/judgment - Pilot
Personnel issues	Monitoring environment - Pilot
Personnel issues	Use of equip/system - Pilot
Aircraft	Altitude - Not attained/maintained
Environmental issues	Tower/antenna (incl guy wires) - Response/compensation
Environmental issues	Dark - Effect on operation

Factual Information

History of Flight

Enroute	Controlled flight into terr/obj (CFIT) (Defining event)

On January 11, 2020, at 1801 mountain standard time, a Cessna TR182 airplane, N736YU, was destroyed when it was involved in an accident near Billings, Montana. The pilot and three passengers were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* (*CFR*) Part 91 instructional flight.

The pilot's wife reported that her husband planned to fly about 1630 and was expected to return to his home about 1730. According to Automatic dependent surveillance-broadcast (ADS-B) data, following its departure from Billings Logan International Airport (BIL), Billings, Montana, the airplane landed at Big Horn County Airport (00U), Hardin, Montana about 1715 and subsequently departed about 1740. Flight data retrieved from a multi-function display (MFD) on the airplane showed that the airplane began an immediate climb after it departed 00U and established its cruise altitude, about 4,796 ft msl at 1747:43 and maintained a similar altitude and a height above terrain (between 1,400 and 2,100 ft agl) for the remainder of the flight.

According to ADS-B data, the airplane then flew a straight track northwest towards Roundup, Montana (about 269° magnetic) until about 1753:53 when the airplane made a slight left turn to 257° and continued along this heading for the remainder of the recording. MFD data showed rising terrain about 40 seconds before the airplane crashed. The airplane was at an altitude of 4,954 ft msl (35 ft agl) when the data ended at 1801:22 about 1/2 nautical mile from the airplane's initial impact point. The pilot's wife contacted local law enforcement about 2000 when he did not return home.

According to the participants who flew with the accident pilot, he normally flew about 1,000 ft agl level over terrain and would use the autopilot "altitude hold" function for many flights. They also observed that he did not fly with a Federal Aviation Administration sectional chart as he relied mostly on the map on his MFD for terrain and chart information.

According to the accident pilot's business partner, based on a photograph taken by one of the rear seat passengers that had been sent to her during the accident flight, the accident pilot was in the right seat of the airplane during the accident flight. According to those who flew with the pilot, during these flights he would allow his passengers to fly the airplane from the left seat if they chose to and they would typically fly anywhere between 4,000 and 5,000 ft msl to destinations south, east, and north of the airport.

A passenger who flew with the accident pilot about one week prior to the accident reported that they flew to 00U, but then flew south and circled a landmark before returning to BIL. During the flight, they maintained an altitude of about 1,000 ft agl and used the autopilot for one leg of the flight. A review of

other flight data retrieved from the MFD showed that the pilot typically flew at altitudes between about 1,000 and 2,000 ft agl during these flights.

The MFD flight data also showed that the pilot completed a leg from 00U to Roundup Airport (RPX), Roundup, Montana, several days before the accident. This track showed the airplane depart 00U about 1653 and flew a similar course as the accident flight. During cruise flight, the airplane passed within 0.3 nautical mile of the 185-ft radio tower that it impacted on the day of the accident. This part of the flight occurred at 1716 during cruise flight at an altitude of 4,680 ft msl (580 ft agl). The flight landed at RPX about 15 minutes later.

Pilot Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	69,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	Glider; Helicopter	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	August 7, 2018
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	13800 hours (Total, all aircraft)		

The co-owner of the accident airplane, who knew the accident pilot for 47 years, stated that the pilot started flying in 1972, that he did most of his flying and flight instructing in Billings, and was familiar with the area.

According to the pilot's wife, the pilot was well rested on the day of the accident and did not exhibit any abnormal behavior that day or in the days that preceded the accident.

Aircraft and Owner/Operator Information

Aircraft Make:	Cessna	**Registration:**	N736YU
Model/Series:	TR182 No Series	**Aircraft Category:**	Airplane
Year of Manufacture:	1978	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	R18200792
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	January 3, 2019 Annual	**Certified Max Gross Wt.:**	3100 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:	3101.6 Hrs	**Engine Manufacturer:**	Lycoming Engines
ELT:	Installed	**Engine Model/Series:**	O-540-L3C5D
Registered Owner:	Marginal Aviation LLC	**Rated Power:**	235 Horsepower
Operator:	Marginal Aviation LLC	**Operating Certificate(s) Held:**	None

The airplane was equipped with an Aspen Evolution primary flight display (PFD and a Garmin GTN750 MFD. The Aspen Evolution was installed in front of the left seat occupant and drew barometric altitude information from its own internal air data computer, displaying that information on a digital tape on the right side of the display. The barometric altitude was adjustable by altimeter setting, which was displayed below the altitude tape. According to the Aspen installation manual, the altitude tape display should be within 40 ft of the calibrated test altitude. The altimeter setting at the time of the accident could not be determined as the Aspen unit did not record data. An Aspen MFD was located next to the PFD that was mounted to the instrument panel in front of the left seat occupant. Likewise, this unit did not record data.

The GTN750 was a touchscreen MFD mounted on the center instrument panel that was equipped with an obstacle range option and topography overlay available on the unit's map page. According to a representative of the MFD manufacturer, the GPS altitude or "GSL" altitude, which is computed by satellite geometry, would have been displayed in the top left corner of the MFD's map page. According to the Garmin pilot's guide, the obstacle range could display unlighted obstacles below 1,000 ft agl. A representative from Garmin stated that the obstacle range would not have displayed obstructions below 200 ft agl.

The GTN750 also recorded pressure altitude and barometric altitude that was taken from the Aspen air data computer. The last data point recorded showed the barometric altitude was 4,954 ft msl and the GPS altitude was 4,747 ft GSL about the time of the accident.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	3662 ft msl	**Distance from Accident Site:**	27 Nautical Miles
Observation Time:	17:53 Local	**Direction from Accident Site:**	180°
Lowest Cloud Condition:	Few / 12000 ft AGL	**Visibility**	10 miles
Lowest Ceiling:	Broken / 16000 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	14 knots / None	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.65 inches Hg	**Temperature/Dew Point:**	-1°C / -10°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Hardin, MT (00U)	**Type of Flight Plan Filed:**	None
Destination:	Roundup, MT (RPX)	**Type of Clearance:**	VFR flight following
Departure Time:	17:40 Local	**Type of Airspace:**	Class E

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	3 Fatal	**Aircraft Fire:**	None
Ground Injuries:		**Aircraft Explosion:**	None
Total Injuries:	4 Fatal	**Latitude, Longitude:**	46.232498,-108.36555

The airplane wreckage was located in mountainous terrain at an elevation of about 4,252 ft msl. All major sections of the airplane were accounted for at the accident site. The initial impact point was marked by several bent cross members and a broken guy wire about 65 ft high (4,809 ft msl) on an about 185-ft-tall radio tower, which was located on a peak with a field elevation of about 4,744 ft msl. Several sections of the outboard left wing (not shown in figure 1) were located about 100 ft north of the tower, and two pieces displayed longitudinal signatures consistent with impacting a wire. The remaining section of the left wing was found in the debris path about 350 ft from the main wreckage. Several airframe and engine fragments were distributed along the energy path, which was oriented on a heading of about 295º. The main wreckage was found about 1,450 ft northwest of the initial impact point in a coulee and included the right wing, fuselage, empennage, and engine. A 5-ft intermediate ground scar was located about 250 ft beyond the main wreckage.

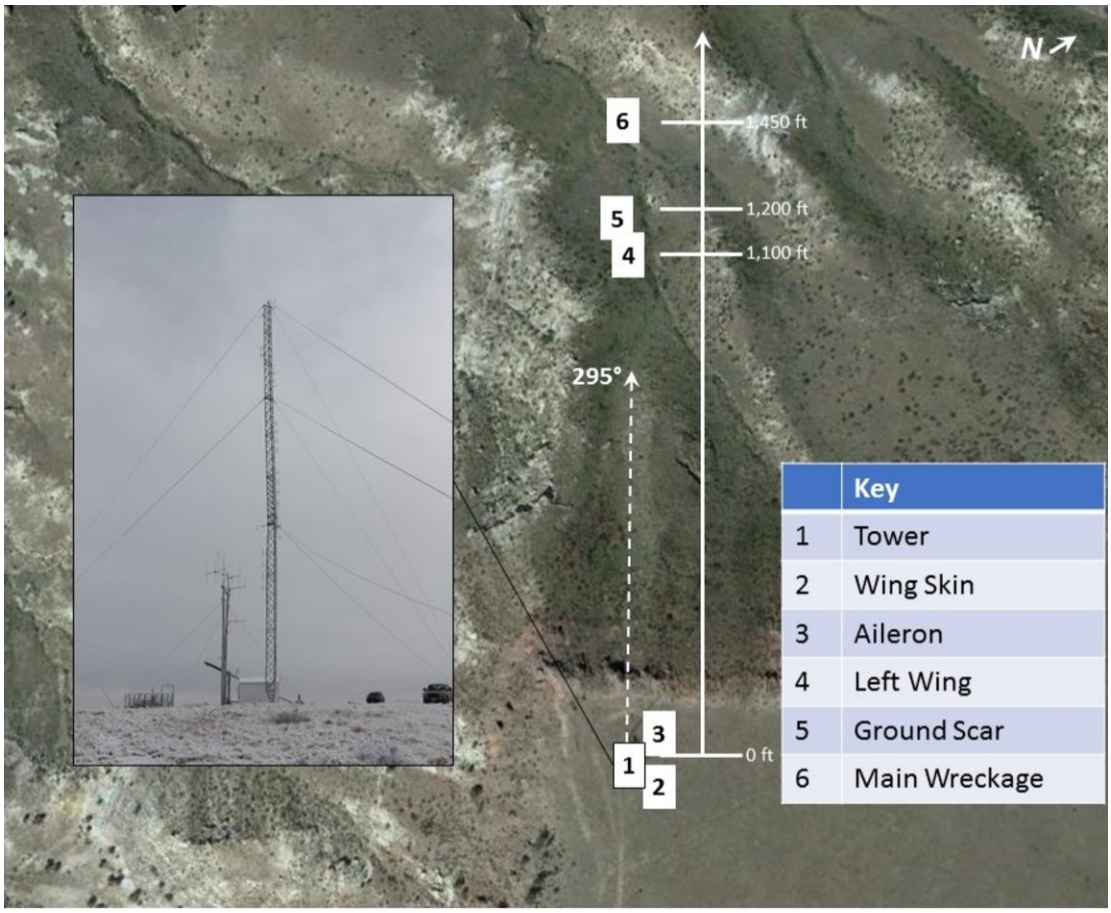

Figure 1: Wreckage diagram and photograph of impacted tower

The left wing was fragmented, and some sections were found near the tower. The control cables to the rudder, aileron, and elevator were recovered but exhibited multiple overload failures. The flap motor actuator measured 0.1 inch, consistent with a retracted flap position.

The engine crankshaft could only be partially rotated due to damage sustained during the impact. The ignition system displayed signatures consistent with normal operation and wear. Internal inspection of the case did not reveal any indications of oil starvation. The cylinder combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion or detonation.

Additional Information

Tower

According to FAA Advisory Circular 70/7460-1L, under Chapter 2.1 "Structures to be Marked or Lighted":

"Any temporary or permanent structure, including all appurtenances, that exceeds an overall height of 200 feet above ground level or exceeds any obstruction standard contained in 14 CFR Part 77 should be marked and/or lighted. However, an FAA aeronautical study may reveal that the absence of marking and/or lightning will not impair aviation safety. Conversely, the object may present such an extraordinary hazard potential that higher standards may be recommended for increased conspicuity to ensure aviation safety."

The excerpt continues to describe FAA action on structures that are less than 200 ft agl: "The FAA may also recommend marking and/or lighting a structure that does not exceed 200 ft above ground level or 14 *CFR* Part 77 standards because of its particular location."

An FAA sectional chart valid from September 12, 2019, to March 26, 2020, did not list the tower as an obstacle. The FAA sectional chart legend lists the lowest obstruction marked on the sectional chart as "above 200 ft agl." The maximum elevation figure for the sector of the sectional chart where the accident occurred was 5,100 ft msl.

Regulations for Obstructions and Minimum Safe Altitudes

According to 14 *CFR* 97.17, which contains the obstruction standards for navigable airspace:

"An existing object…would be an obstruction to air navigation if it is of greater height than any of the following heights or surfaces… (2) A height that is 200 ft AGL or above the established airport elevation…"

Title 14 *CFR* 91.119 provides the general minimum safe altitudes for operating an aircraft. According to the regulation:

"Except when necessary for takeoff and landing, no person may operate an aircraft below the following altitudes… (c) Over other than congested areas. An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicles, or structure."

Administrative Information

Investigator In Charge (IIC):	Stein, Stephen
Additional Participating Persons:	Troy McClanahan; Federal Aviation Administration; Helena, MT Andrew Hall; Textron Aviation; Wichita, KS Troy Helgeson; Lycoming Engines; Williamsburg, PA
Original Publish Date:	March 9, 2022
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=100799