Aviation Investigation Final Report

Location:	Lake Hughes, California	**Accident Number:**	WPR17FA055
Date & Time:	January 12, 2017, 09:05 Local	**Registration:**	N6201N
Aircraft:	Mooney M20J	**Aircraft Damage:**	Substantial
Defining Event:	VFR encounter with IMC	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation - Personal		

Analysis

The instrument-rated private pilot/owner regularly used the airplane to commute for work between his home airport and an airport located about 80 miles to the south. On the day of the accident, the pilot departed his home airport and, about 5 minutes after takeoff, established the airplane on a direct course towards an aeronautical navigation beacon that was located on a mountain peak about 28 nautical miles south of the airport, at an elevation of 5,793 ft mean sea level (msl). After takeoff, the airplane initially climbed to about 7,300 ft msl, then descended to about 6,500 ft msl, before ultimately descending to about 5,750 ft msl, where it remained for the last several minutes of the flight.

The pilot was not in radio communication with any air traffic control (ATC) facility during the flight, and had not filed a flight plan, but the airplane had been tracked by ground-based ATC radar. The ATC radar track data ended near the accident site. Both radar and the data from the pilot's onboard GPS device showed that the airplane remained in about straight and level flight for at least 8 minutes before the impact. The wreckage was located about 70 ft below the mountain peak. Ground scars and airplane damage indicated that the airplane was in level flight, with significant engine power, at the time of impact. Examination of the airframe and engine did not reveal any evidence of pre-impact mechanical deficiencies or failures that would have precluded normal operation. Available medical information revealed no evidence of pilot incapacitation.

Meteorological conditions at an airport near the accident location suggested that an overcast ceiling of about 4,750 ft msl was present near the accident site. That ceiling would have obscured the peak, and would have been about 1,000 ft lower than the impact point elevation. It is likely that the pilot flew into instrument meteorological conditions (IMC), which obscured the peak from his view as he attempted to cross the mountain range. The investigation was unable to determine whether the pilot entered IMC intentionally or unintentionally, or how long the airplane was operating in IMC before impact.

The investigation was unable to determine why the pilot was operating on a track at an altitude that did not provide terrain clearance, even if he did intentionally enter IMC without operating under instrument flight rules. Because the ATC radar and GPS altitudes for the flight were congruent, altimetry

malfunctions and errors can be eliminated as causal factors. The pilot's GPS unit was capable of providing both visual and aural terrain/obstacle alerts, but the terrain and alert configuration settings of the GPS were not able to be determined. It is possible that the pilot either ignored or deactivated those features, and thereby deprived himself of those protection capabilities. Such a deactivation could have been the result of the pilot's comfort level with flying in that region, or it could have been inadvertent. Although the investigation could not determine what assumptions, tools, or methods the pilot used to ensure adequate terrain clearance for the accident flight, the pilot had sufficient and accurate information available, or potentially available, to enable him to avoid terrain.

All elements of this accident are consistent with a controlled flight into terrain (CFIT) event. Although the specific underlying reasons for the CFIT event could not be determined, it is likely that the pilot's comfort with the route, combined with his determination to complete the flight to reach work, caused him to enter IMC. That entry into IMC, coupled with an improper route and altitude combination, resulted in the collision with the peak.

Probable Cause and Findings

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

The pilot's controlled flight into mountainous terrain while attempting to operate under visual flight rules in instrument meteorological conditions (IMC).

Findings

Personnel issues	Decision making/judgment - Pilot
Environmental issues	Clouds - Decision related to condition
Environmental issues	Below VFR minima - Decision related to condition
Environmental issues	Mountainous/hilly terrain - Contributed to outcome

Factual Information

History of Flight

Enroute-cruise	VFR encounter with IMC (Defining event)
Enroute-cruise	Loss of visual reference
Enroute-cruise	Controlled flight into terr/obj (CFIT)

On January 12, 2017, about 0905 Pacific standard time (PST), a Mooney M20J, N6201N, was destroyed when it impacted terrain during cruise flight near the Lake Hughes Very High Frequency Omnirange (LHS VOR) navigation beacon. The private pilot was fatally injured. The airplane was owned by the pilot and operated under the provisions of 14 *Code of Federal Regulations* Part 91. Instrument meteorological conditions were likely present at the accident site about the time of the accident; no flight plan was filed. The personal flight departed Tehachapi Municipal Airport (TSP), Tehachapi, California, about 0849, and was destined for Zamperini Field Airport (TOA), Torrance, California.

The airplane was the subject of a Federal Aviation Administration (FAA) Alert Notice (ALNOT), issued on January 17, indicating that the airplane was missing. In response to the ALNOT, members of the Air Force Rescue Coordination Center (AFRCC) and the Civil Air Patrol (CAP) began a telephonic search for information about the pilot and his possible whereabouts. That search yielded a conclusion that the pilot's last known flight date was January 12, which then resulted in detailed examination of air traffic control (ATC) radar data for that day and geographic locale. A radar track with a transponder code of 1200, originating southeast of TSP and terminating at the LHS VOR, was identified as likely being that of the missing airplane. On the morning of January 18, an aerial search by the CAP located the wreckage of the airplane a few hundred feet from the LHS VOR.

The pilot based the airplane at TSP and lived in the local area. According to several people who knew the pilot, he worked three days a week (Tuesday, Wednesday, and Thursday) in Torrance and used the airplane to commute on each of those days between TSP and TOA. One of the pilot's coworkers typically picked him up at TOA on those workday mornings and dropped him off there after work. According to that coworker, the pilot rarely canceled any of those flights for weather-related reasons. On the morning of the accident, which was a Thursday, the coworker did not hear from the pilot but was not concerned. About January 16, a friend of the pilot realized that the pilot's truck was parked at the airport but that no one had seen the pilot for several days; his and others' actions determined that the pilot and airplane were missing, which led to the issuance of the ALNOT.

Pilot Information

Certificate:	Private	**Age:**	56,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
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:**	February 1, 2016
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 2500 hours (Total, all aircraft)		

The pilot held a private pilot certificate with airplane single- and multi-engine land, and instrument ratings. His most recent FAA third-class medical certificate was issued in February 2016. The pilot's personal flight logs were not located. However, in his report to the NTSB regarding a June 16, 2016 landing accident in a different airplane make and model, the pilot reported that he had 2,500 total hours of flight experience, including 2,300 hours in single-engine airplanes, and 100 hours of "actual" instrument flight time.

In addition to the accident airplane, the pilot concurrently owned another airplane, a Grumman AA-1 "Yankee," which he also based at TSP. The pilot held an FAA mechanic certificate with airframe and powerplant ratings. That certificate was issued in March 2012.

Aircraft and Owner/Operator Information

Aircraft Make:	Mooney	**Registration:**	N6201N
Model/Series:	M20J NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1978	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	24-0590
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	Unknown	**Certified Max Gross Wt.:**	2899 lbs
Time Since Last Inspection:		**Engines:**	1 Reciprocating
Airframe Total Time:		**Engine Manufacturer:**	LYCOMING
ELT:	C126 installed, not activated	**Engine Model/Series:**	IO360 SER
Registered Owner:	On file	**Rated Power:**	0 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	None

The four-seat, low-wing, retractable landing gear airplane was manufactured in 1978. It was equipped with a Lycoming IO-360-series engine and a constant speed propeller.

The pilot purchased the airplane in July 2005, and the engine was overhauled in December 2016.

NTSB-requested searches of the pilot's home and hangar for the airplane maintenance records were unsuccessful. Two acquaintances of the pilot reported that the recent engine overhaul was due to the presence of "metal" in the oil and/or oil filter.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Unknown	**Condition of Light:**	Day
Observation Facility, Elevation:	WJF,2351 ft msl	**Distance from Accident Site:**	23 Nautical Miles
Observation Time:	08:56 Local	**Direction from Accident Site:**	65°
Lowest Cloud Condition:		**Visibility**	10 miles
Lowest Ceiling:	Overcast / 2400 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	10 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	240°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.92 inches Hg	**Temperature/Dew Point:**	9°C / 7°C
Precipitation and Obscuration:	Light - None - Rain		
Departure Point:	Tehachapi, CA (TSP)	**Type of Flight Plan Filed:**	None
Destination:	Torrance, CA (TOA)	**Type of Clearance:**	None
Departure Time:	08:48 Local	**Type of Airspace:**	

The 0835 TSP automated weather observation included calm wind, visibility 10 miles, broken cloud layer at 7,500 ft, overcast layer at 8,000 ft, temperature 5°C, dew point 2°C, and an altimeter setting of 29.90 inches of mercury. The 0855 observation included calm wind, visibility 10 miles, overcast layer at 6,000 ft, temperature 6°C, dew point 2°C, and an altimeter setting of 29.91 inches of mercury.

General William J. Fox Airfield (WJF), Lancaster, California, was located in the Mojave desert, about 15 miles east of the accident flight track at an elevation of 2,351 ft. The 0856 WJF automated weather observation included winds from 240^{o} at 10 knots, visibility 10 miles in light rain, overcast layer at 2,400 ft, temperature 9°C, dew point 7°C, and an altimeter setting of 29.92 inches of mercury.

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Fatal	**Latitude, Longitude:**	34.683887,-118.576385(est)

LHS VOR is on a leveled-off peak in the aforementioned southern mountain range at an elevation of 5,793 ft. The wreckage was located on the north slope of that peak, about 70 ft below, and 380 ft from, the VOR antenna. Review of topographic data and the airplane flight track revealed that the impacted mountain was the highest topographical feature along the flight track, and that the underlying terrain rose rapidly as the airplane flew beyond the Mojave Desert to cross the mountain range that forms the desert flatlands' southern boundary.

The airplane first struck low (up to about 10 ft high) scrub vegetation, then grassy earth, before impacting the heavy scrub vegetation where it came to rest. Vegetation and ground scars were consistent with the airplane striking the ground in a wings-level, right-side-up attitude on a horizontal flight path.

The forward fuselage exhibited severe crush and fracture damage. The single (right side) cabin door, pilot seat, and some other cabin items were found about 20 ft ahead of the wreckage. Portions of the cabin sidewalls, floor, and roof were found strewn among the vegetation forward of the main wreckage. The instrument panel was severely disrupted, and only about half of the instruments remained attached to the panel. Damage precluded obtaining any relevant information regarding instrument or control positions at impact. The main landing gear condition and position was consistent with the gear being retracted at the time of impact

The engine was partially separated from the airframe and came to rest on its left side. The engine exhibited significant damage to its forward and lower sides, but all cylinders remained attached and intact. Some engine accessories and components were fracture-separated from the engine. No evidence of any pre-impact catastrophic failures was evident. The three-blade propeller and hub assembly was fracture-separated from the engine. Two full-length blades remained in the hub, and these blades exhibited moderate twisting and/or bending deformation. The other blade was fracture-separated at its root. The stub of that blade, about 3 inches long, remained in the hub.

Both wings were found swept aft about 75°, and exhibited extensive, full-span crush damage to their leading edges. The right wing was rotated leading edge down. Both flaps remained attached to their respective wings. The left flap appeared to be retracted, but the right flap was free to travel through its entire range, consistent with a fractured link in the system. Both ailerons remained attached to their respective outboard wing sections, and both retained their balance weights. The ailerons were only moveable through a small range of their normal travel, consistent with postaccident deformation and resultant system binding.

The aft fuselage came to rest upright with the empennage nearly intact. The left and right horizontal stabilizers remained attached to the empennage. The left and right elevators remained attached to their respective stabilizers and to one another. The vertical stabilizer remained attached to the empennage. The rudder remained attached to the vertical stabilizer. The balance weights for the rudder and the two elevators remained attached to their respective control surfaces. Fuselage disruption forward of the aft cabin wall precluded any determination of control continuity.

There was no fire. No evidence of any pre-impact mechanical failures or malfunctions of the propeller, engine, or airframe was observed.

Communications

No records of any communications between the airplane and air traffic control facilities for the accident flight were located.

Medical and Pathological Information

The Los Angeles County (California) Department of Medical Examiner-Coroner autopsy report indicated that the cause of death was "multiple blunt force traumatic injuries." Forensic toxicology examinations on blood from the pilot indicated that no ethanol or any screened drugs were detected.

The FAA Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma, also conducted forensic toxicology examinations on specimens from the pilot, and reported that no carbon monoxide, ethanol, or any screened drugs were detected.

Additional Information

Witness Observations

According to a pilot/mechanic based at TSP, the pilot performed his own maintenance on the two airplanes he owned. That person also witnessed the accident flight departure, and reported that the weather at the time was "not good," with mist, light snow, and a low ceiling.

Emergency Locator Transmitter (ELT) Information

No ELT signals were received from the accident airplane. However, about 3 weeks after the accident, two FAA inspectors returned to the site to retrieve the ELT, and, upon removal from the wreckage, the ELT began to transmit. The inspectors noted that the ELT would transmit when the switch was placed in the "ON" position but would not transmit while in the "ARM" position. They also noted that a sticker on the front of the ELT indicated that the ELT batteries were due for replacement by "3/2015," about 19 months before the accident.

The ELT was an AMERI-KING CORP Model AK-450, which is listed as an FAA Unapproved Part per FAA Document No. 2016-2013NM460018 (dated March 1, 2016).

Onboard GPS Devices

A Garmin GPSMap 496 device was recovered intact, and the remnants of what appeared to be another Garmin portable GPS were also located in the wreckage. Both devices were sent to the NTSB Recorders Laboratory for possible data downloads. The data extracted from the GPSMap 496 included 60 recording sessions from September 2012 through February 2013. The accident flight was not recorded on that device.

The other unit, a Garmin Aera 796, contained the accident flight as well as multiple previous recent flights.

The Aera 796 GPS device incorporated a "Terrain" function that, when active, displays terrain and obstruction altitudes relative to the aircraft position and altitude using an integral terrain and obstacle database. According to the device's Pilot's Guide, it "provides the horizontal position and altitude of the aircraft. Aircraft GPS altitude is derived from satellite position. GPS altitude is then converted to a mean sea level (MSL)-based altitude (GPS-MSL altitude) and is used to determine terrain and obstacle proximity. GPS-MSL altitude accuracy is affected by satellite geometry, but is not subject to variations in pressure and temperature that normally affect pressure altitude sensors. GPS-MSL altitude does not require local altimeter settings to determine MSL altitude."

The guide continued with, "Terrain and obstacle databases are referenced to MSL. Using the GPS position and altitude, the Terrain feature portrays a 2-D picture of the surrounding terrain and obstacles relative to the position and altitude of the aircraft. GPS position and GPS-MSL altitude are used to calculate and predict the aircraft's flight path in relation to the surrounding terrain and obstacles. In this way, the pilot can view predicted dangerous terrain and obstacle conditions." Display of terrain information was user-selectable, both in terms of format, and whether the information was presented or not.

The GPS was equipped to provide both visual and aural terrain/obstacle alerts. These alerts were user-selectable in terms of mode and clearance thresholds. In addition, like the terrain display itself, the device could be configured by the user so that no alerts were provided.

The Pilot's Guide contained multiple explicit warnings about the limitations of the altitude information and alerts, including:

Terrain and obstacle information should be used as an aid to situational awareness. They should never be used to navigate or maneuver around terrain.

Navigation and terrain separation must NOT be predicated upon the use of the terrain function. The aera 795/796 Terrain Proximity feature is NOT intended to be used as a primary reference for terrain avoidance and does not relieve the pilot from the responsibility of being aware of surroundings during flight.

The displayed minimum safe altitudes (MSAs) are only advisory in nature and should not be relied upon as the sole source of obstacle and terrain avoidance information. Always refer to current aeronautical

charts for appropriate minimum clearance altitudes.

The altitude calculated by aera 795/796 GPS receivers is geometric height above Mean Sea Level and could vary significantly from the altitude displayed by pressure altimeters. Always use pressure altitude displayed by the aircraft altimeter when determining or selecting aircraft altitude.

The GPS "data session" for the accident flight began as the airplane taxied for departure. However, the investigation was unable to determine where the GPS was situated in the cockpit or how the pilot used it during the flight. The investigation did not determine the terrain display or alert setting configurations for the device for the accident flight.

Air Traffic Control Radar Track

The majority of the accident flight was captured by FAA ATC ground-based tracking radar, even though the flight was not being controlled by, or in communication with, ATC.

The first radar return from the airplane was acquired at 0851:36. At that time, the airplane was about 2 miles south of TSP, on an approximate track of 128° true, and in a climb at an indicated altitude of 5,675 ft. About 0854, when it was climbing through 7,200 ft, the airplane began a turn to a track of 210° true, a track it maintained for the remainder of the flight. The climb continued until 0856:00, when the airplane reached a maximum altitude of 7,675 ft. The airplane then began descending, and about 0857:24, it leveled off at an approximate altitude of 6,600 ft. About 0858:36, the airplane began a slight climb, and then descended and leveled off about 5,800 ft. About 90 seconds before the end of the radar data, the airplane began a slight, irregular climb to about 6,000 ft. The final radar return was received at 0904:59, with an indicated altitude of 6,000 ft. The last return was about 0.3 miles north-northeast of LHS VOR.

Aera 796 Flight Tracks

The recovered Aera 796 data contained 17 trips (not including the accident flight) between TSP and TOA from December 20, 2016, to January 11, 2017 (the day before the accident).

Eight of the 17 flights (some with intermediate stops) between TSP and TOA (either direction) depicted track deviations or circling. One trip departed from TSP, flew south to the mountain range, and then returned to TSP.

The recovered data contained 8 non-stop flights from TSP to TOA, and 6 from TOA to TSP. Virtually all of those 14 flights were along different ground tracks, sometimes differing by several miles. None of the flight tracks appeared to be aligned with any charted navigation facilities or waypoints.

Further, the flights all crossed east of the LHS VOR, and cleared the underlying terrain by at least 1,000 ft.

Aera 796 Accident Flight Track

The Aera 796 GPS data session for the accident flight began at 0845:31 PST on January 12, 2017, and

the last session data point had a time tag of 0903:26. The airplane began its takeoff roll from runway 29 about 0848:50. About 0849:44, at an altitude about 400 ft above ground level (agl) and about 0.4 nautical miles (nm) beyond the runway 11 threshold, the airplane began an approximate 100° left turn to the southwest. About 50 seconds later, the airplane began a 90° left turn to the southeast (approximating the downwind leg of an airport traffic pattern), while continuing its climb. The airplane maintained that downwind leg track for about 4 nm before beginning a slow arcing turn to the right (south). About 0854:20, when the airplane was climbing through about 7,300 ft msl, it began a 45° (track) normal-rate right turn to its final on-course track of about 210° true, on which it remained until it struck the mountainside about 10 minutes later. As the airplane entered the 45° turn, it ceased climbing, and began a descent to about 6,500 ft msl where it leveled off.

The 6,500 ft altitude was consistent with the FAA 'hemispheric rule' for visual flight rules (VFR) flight altitudes. About 2 minutes later, the airplane began a 600 to 700 ft per minute descent to about 5,750 ft, where it leveled off and remained for the rest of the recovered GPS dataset. The 5,750 ft altitude was not consistent with the hemispheric rule for that segment of the flight.

The GPS flight track ended 3.2 miles before the accident/impact location. This is likely due to the user-defined data capture settings and the non-volatile memory buffering characteristics of the GPS device. Straight-line extrapolation of the ground track led directly to the impact site.

Controlled Flight into Terrain

FAA Advisory Circular 61-134 states that controlled flight into terrain (CFIT) occurs when an airworthy aircraft is flown, under the control of a qualified pilot, into terrain with inadequate awareness on the part of the pilot of the impending collision. The advisory circular also states:

…some pilots, including some with instrument ratings, continue to fly VFR in conditions less than that specified for VFR. The result is often a CFIT accident when the pilot tries to continue flying or maneuvering beneath a lowering ceiling and hits an obstacle or terrain or impacts water….

Administrative Information

Investigator In Charge (IIC):	Huhn, Michael
Additional Participating Persons:	Frank L Motter; FAA; Van Nuys, CA Mark Platt; Lycoming Engines; Williamsport, PA
Original Publish Date:	March 14, 2018
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=94625