Aviation Investigation Final Report

Location:	Julian, California	**Accident Number:**	WPR18FA139
Date & Time:	May 10, 2018, 20:31 Local	**Registration:**	N803FC
Aircraft:	Beech 76	**Aircraft Damage:**	Destroyed
Defining Event:	Controlled flight into terr/obj (CFIT)	**Injuries:**	3 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

During the 2-hour nighttime visual flight rules instructional cross-country flight, radar data identified the airplane on an easterly flight track when the first of two maneuvers over mountainous terrain was initiated. The first maneuver was a left turn from about a 48° course heading to about a 176° course heading. Throughout the turn, the airplane's altitude remained about 5,600 ft mean sea level (msl), and the groundspeed decreased to 55 knots. At the completion of the turn, the groundspeed increased to about 67 knots, and the airplane began to climb to 6,600 ft msl while continuing to the southwest on a course heading of about 195°. The airplane then made a right turn course reversal and resumed the easterly heading for about 10 miles.

The radar data then depicted the airplane initiated a second left 180° turn maneuver at an altitude of 6,200 ft msl and a groundspeed of about 121 knots. At the apparent apex of the turn, the airplane was at 6,100 ft msl and a groundspeed of 50 knots. The airplane then began to descend, and the groundspeed increased to 74 knots and then decreased to 50 knots. The last radar return showed the airplane at an altitude of 5,700 ft msl and a groundspeed of 67 knots near the accident site. Radar data revealed that both maneuvers were similar except that the second maneuver began over higher elevation terrain. The airplane's separation from the terrain during the second maneuver was as low as 1,200 ft above ground level (when the airplane was at an altitude of 6,100 ft and was over terrain that was 4,900 ft) before radar contact was lost.

Weather reporting in the aera of the accident site indicated extreme turbulence and severe up and downdrafts during high wind conditions. Although there is evidence of strong wind in the area at the time of the second maneuver, there is no consensus among the available wind data. However, the upset occurred immediately downwind of relatively high terrain and inside of a temperature inversion, which can promote wave action and turbulence. Thus, the airplane likely encountered a downdraft and the pilot was unable to recover, resulting in the airplane's subsequent impact with terrain.

The operator reported that the instructor was newly hired to the flight school and that the accident flight was his first instructional flight with the company. The course syllabus for the flight identified that several tasks were to be accomplished. A representative of the operator reported that maneuvers were usually performed to facilitate a 2-hour flight. All flight was prohibited below 500 ft agl and minimum cruise altitude of 2,000 ft agl in mountainous terrain. No flight plan had been filed for the nighttime flight, and any en route flight planning documentation was destroyed in the postimpact fire; thus it could not be determined if the pilot or the flight instructor were aware of the weather conditions or terrain elevations while performing the maneuvers.

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 sufficient altitude above mountainous terrain while maneuvering during night conditions in an area prone to turbulence, which resulted in a collision with terrain. Contributing to the accident was the flight instructor's decision to conduct maneuvers over mountainous terrain at night, and failure to ensure that the maneuver was conducted with sufficient separation from terrain.

Findings

Personnel issues	Flight planning/navigation - Student/instructed pilot
Aircraft	Altitude - Not attained/maintained
Personnel issues	Decision making/judgment - Instructor/check pilot
Environmental issues	Mountainous/hilly terrain - Effect on equipment
Environmental issues	Dark - Effect on operation
Environmental issues	Terrain induced turbulence - Effect on operation

Factual Information

History of Flight

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

On May 10, 2018, about 2031 Pacific daylight time, a Beech BE76 airplane, N803FC, collided with mountainous terrain while maneuvering near Julian, California. The flight instructor, pilot receiving instruction, and passenger were fatally injured. The airplane was destroyed by a postimpact fire. The airplane was registered to and operated by Scandinavian Aviation Academy of El Cajon, California, as a Title 14 *Code of Federal Regulations* (*CFR*) Part 91 instructional flight. Night visual meteorological conditions prevailed for the cross-country flight, and no flight plan was filed. The flight originated from Apple Valley Airport (APV), Apple Valley, California, about 1932 and was destined for Gillespie Field Airport (SEE), El Cajon, California.

The purpose of the flight was for the pilot receiving instruction to complete two back-to-back cross-country flights of at least 2 hours in duration, and a total straight line distance of more than 100 nautical miles (nm) each. The first 2-hour flight was to be accomplished under daytime conditions, and the second 2-hour flight was to be conducted under nighttime conditions. The flight to APV was conducted during the day, and the return flight to SEE was to be conducted at night. The course syllabus for the 2 flights identified several tasks that were to be accomplished during the flights. A representative of the operator reported that maneuvers are usually performed to facilitate a 2-hour flight. All flight is prohibited below 500 ft above ground level (agl) and minimum cruise altitude of 2,000 ft agl in mountainous terrain.

Review of Federal Aviation Administration (FAA) radar data identified the airplane near Ramona Airport (RMN), Ramona, California, about 2009. The radar track showed that the airplane traveled east and climbed to an altitude of about 5,600 ft mean sea level (msl) with the groundspeed varying from 116 to 133 knots for about 14 miles. The airplane then began to slow, and it made a left turn maneuver from about a 48° course heading to about a 176° course heading. Throughout the turn, the airplane's altitude remained about 5,600 ft msl, and the groundspeed decreased to 55 knots. At the completion of the turn, the groundspeed increased to about 67 knots, and the airplane began to climb to 6,600 ft msl while continuing to the southwest on a course heading of about 195°. The airplane then made a right turn course reversal to an easterly heading and proceeded in that direction for about 10 miles.

The radar data then depicted the airplane initiated a second left 180° turn maneuver at an altitude of 6,200 ft msl and a groundspeed of about 121 knots. At the apparent apex of the turn, the airplane was at 6,100 ft msl and a groundspeed of 50 knots. The airplane then began to descend, and the groundspeed increased to 74 knots and then decreased to 50 knots. The last radar return, which was recorded about 2031, showed the airplane at an altitude of 5,700 ft msl and a groundspeed of 67 knots near the accident site. Figure 1 shows the flight tracks for both maneuvers, and figures 2 and 3 show the flight track for the first and second maneuvers, respectively, along with relevant airplane and terrain information.

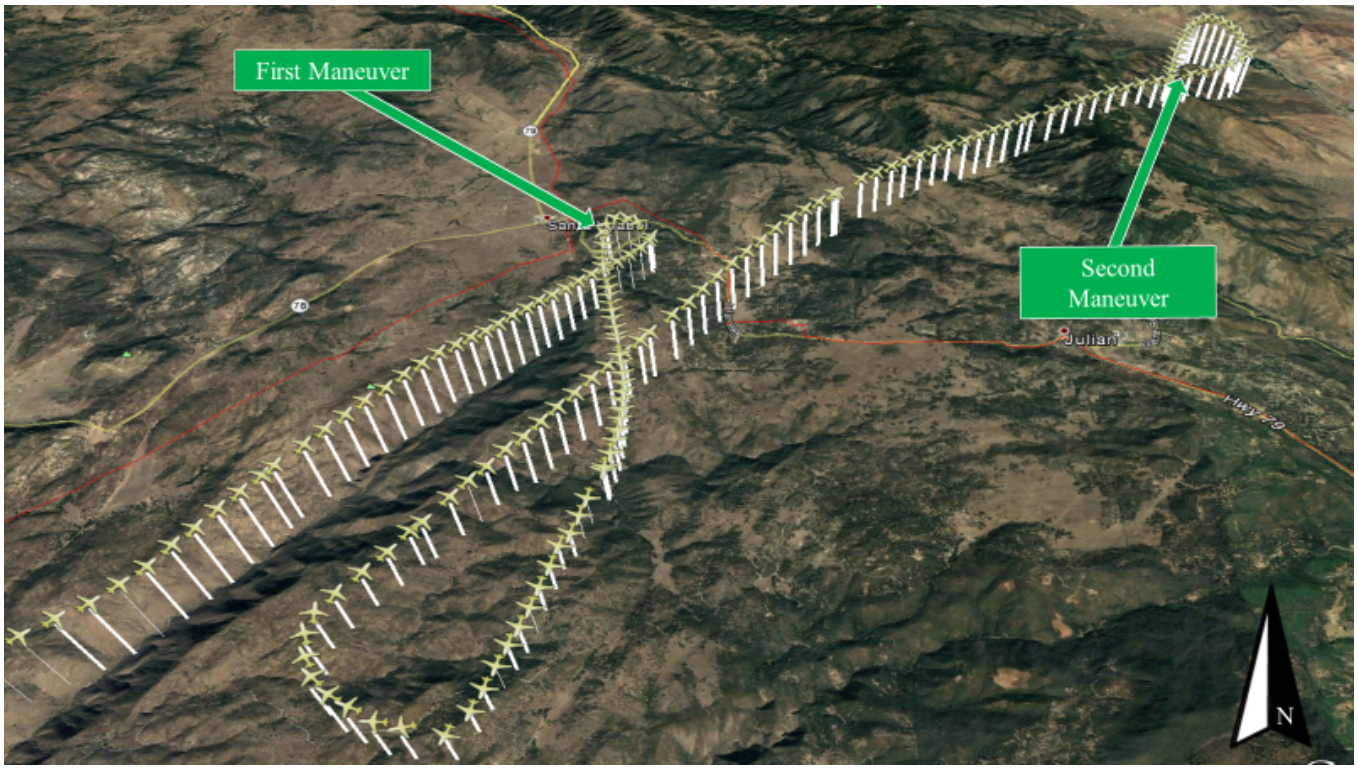

Figure 1. First and second maneuver.

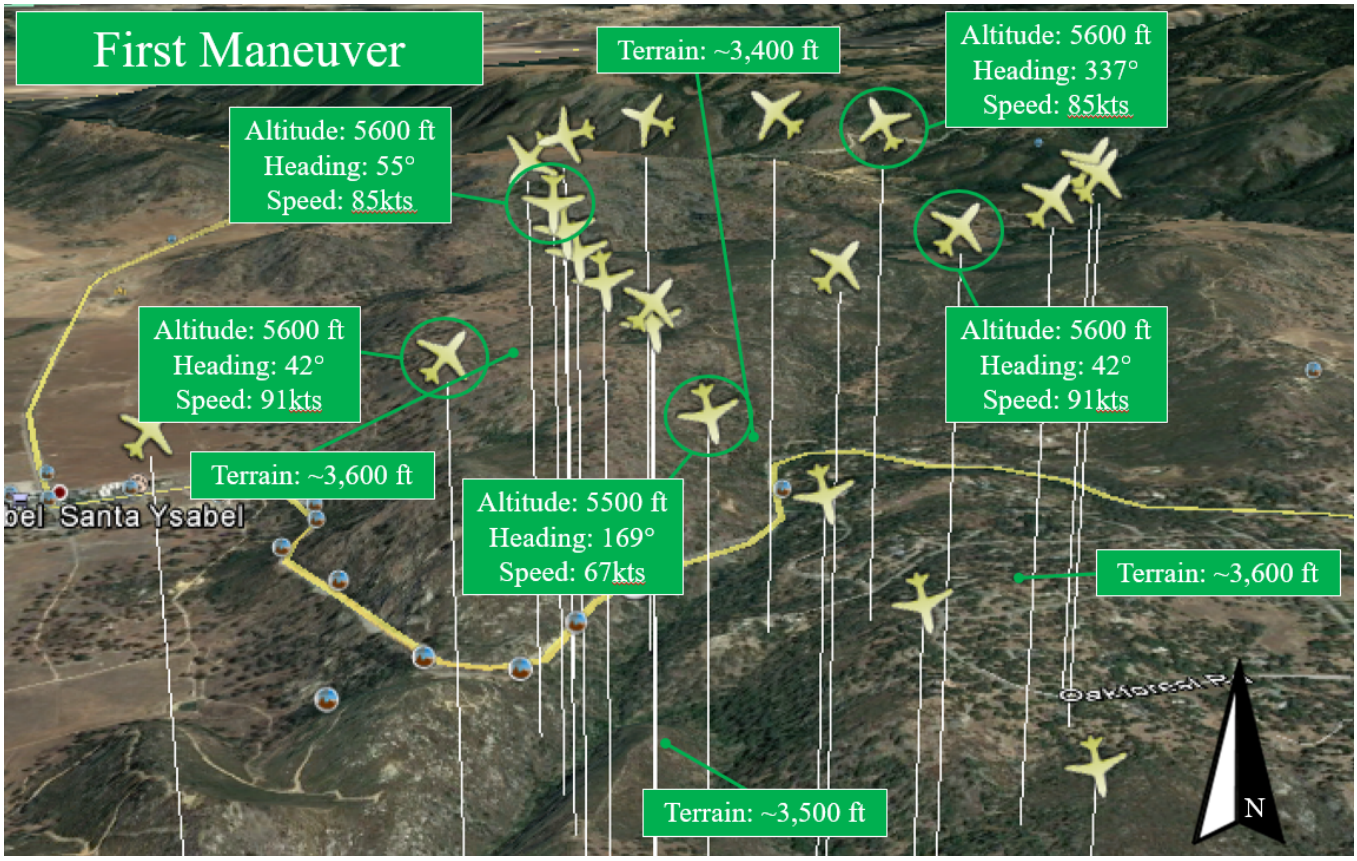

Figure 2. Radar track for the first maneuver along with relevant airplane and terrain information.

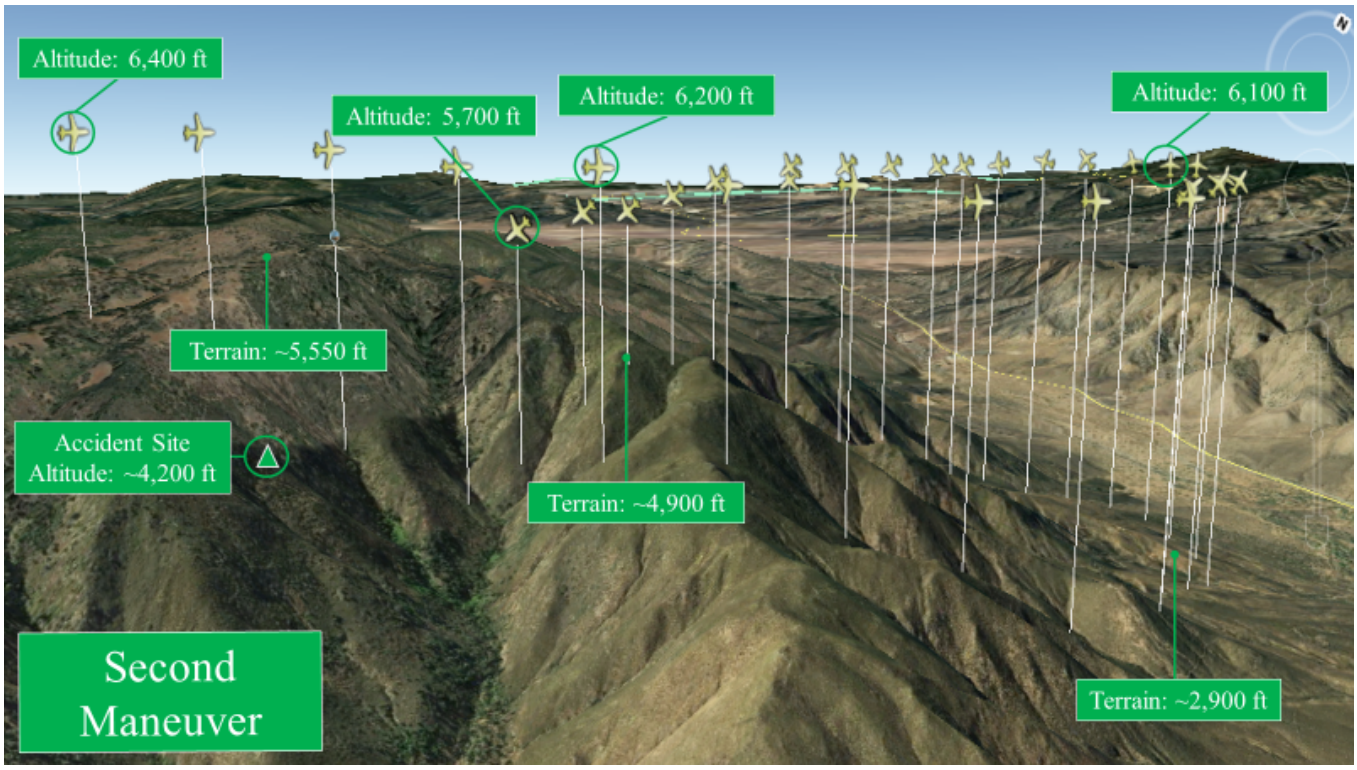

Figure 3. Radar track for the second maneuver along with relevant airplane and terrain information.

Flight instructor Information

Certificate:	Airline transport; Commercial; Flight instructor	**Age:**	28,Male
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Right
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine; Instrument airplane	**Toxicology Performed:**	Yes
Medical Certification:	Class 1 Without waivers/limitations	**Last FAA Medical Exam:**	May 10, 2018
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 2000 hours (Total, all aircraft), 1500 hours (Pilot In Command, all aircraft)		

Student pilot Information

Certificate:	Private	**Age:**	24,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 Without waivers/limitations	**Last FAA Medical Exam:**	February 24, 2017
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	April 9, 2018
Flight Time:	(Estimated) 190 hours (Total, all aircraft), 7 hours (Total, this make and model), 87 hours (Pilot In Command, all aircraft), 50 hours (Last 90 days, all aircraft), 8 hours (Last 30 days, all aircraft)		

Flight Instructor

The flight instructor, age 28, held an airline transport pilot certificate with a rating for airplane multiengine land and a commercial pilot certificate with privileges for single-engine land. He also held a flight instructor certificate with ratings for airplane single engine, multiengine and instrument airplane. He held an FAA first-class medical certificate dated May 10, 2018, with no limitations.

According to a resume provided by the operator, the flight instructor reported 2,000 hours of total flight experience, including 1,500 hours as pilot-in command, 150 hours in multiengine airplanes, 170 hours of instrument flight, and 125 hours at night. The instructor's flight logbook was not located. The operator reported that the instructor was newly hired, and that the accident flight was his first instructional flight with the company.

Pilot Receiving Instruction

The pilot receiving instruction, age 24, held a private pilot certificate with airplane single-engine land and instrument airplane ratings. The pilot received his instrument airplane rating on April 9, 2018. He held an FAA second-class medical certificate dated February 24, 2017, with no limitations. According to the operator, the pilot had 190 hours of total flight experience, including 7 hours in multiengine airplanes, 7 hours in the accident airplane make and model, and 13 hours at night. In the preceding 90 days, the pilot logged a total of 50 flight hours, including 7 hours in the accident airplane make and model and 2 hours at night.

Aircraft and Owner/Operator Information

Aircraft Make:	Beech	**Registration:**	N803FC
Model/Series:	76 NO SERIES	**Aircraft Category:**	Airplane
Year of Manufacture:	1979	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	ME-150
Landing Gear Type:	Retractable - Tricycle	**Seats:**	4
Date/Type of Last Inspection:	March 3, 2018 Annual	**Certified Max Gross Wt.:**	3916 lbs
Time Since Last Inspection:	13 Hrs	**Engines:**	2 Reciprocating
Airframe Total Time:	14150.9 Hrs as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	C91A installed, not activated	**Engine Model/Series:**	O-360-A1G6D
Registered Owner:		**Rated Power:**	180 Horsepower
Operator:	On file	**Operating Certificate(s) Held:**	Pilot school (141)

Review of the maintenance logbook records revealed that the most recent annual inspection was completed on March 3, 2018, at a recorded tachometer time of 2,130.1 hours and an airframe total time of 14,150.9 hours.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Night
Observation Facility, Elevation:	KRNM,1393 ft msl	**Distance from Accident Site:**	18 Nautical Miles
Observation Time:	02:53 Local	**Direction from Accident Site:**	251°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	7 knots /	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	290°	**Turbulence Severity Forecast/Actual:**	/ N/A
Altimeter Setting:	29.86 inches Hg	**Temperature/Dew Point:**	16°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	APPLE VALLEY, CA (APV)	**Type of Flight Plan Filed:**	None
Destination:	SAN DIEGO/EL CAJON, CA (SEE)	**Type of Clearance:**	VFR flight following
Departure Time:	19:32 Local	**Type of Airspace:**	Class G

The 1953 automated weather observation from RMN, located about 18 miles northwest of the accident site, included winds from 290° at 7 knots, visibility of 10 statute miles, clear sky, temperature 16°C, dew point 13°C, and an altimeter setting of 29.86 inches of mercury.

An active AIRMET, issued at 1945, indicated moderate turbulence below 12,000 ft for the region where the accident occurred. Also, the National Weather Service Area Forecast discussed the following gusty surface wind conditions for the mountains/deserts in the region where the accident occurred: "Gusty west winds through 08Z Friday from 15-25 mph gusting 35-45 mph." In addition, High-Resolution Rapid Refresh model data for the period surrounding the accident time identified wind magnitudes of about 35 knots from the west-southwest near 6,100 ft. Notably at 6,100 ft, resided near the top of a temperature inversion present in the lower altitudes. The upset occurred immediately downwind of relatively high terrain, inside of the temperature inversion. Temperature inversions can promote wave action and turbulence.

A review of the Los Angeles sectional chart, which was valid through June 21, 2018, revealed a caution block near the Julian VOR that read, "Caution: Extreme turbulence and severe up and down drafts during high wind conditions."

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:	1 Fatal	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	3 Fatal	**Latitude, Longitude:**	33.134445,-116.57833(est)

The accident site was located less than 1 mile southeast of the Julian VOR in mountainous terrain near the bottom of a draw at an elevation of about 4,200 ft. The elevation of the terrain within a 2-mile radius of the accident site ranged from 3,700 to 5,300 ft. The initial impact was in a westerly direction and the wreckage debris was in a path to the east. The wreckage was contained within about a 150-ft circumference around the initial impact point. The piece of wreckage located the farthest (downslope) from the initial impact was the right propeller. All structural components were located at the accident site. The airframe and engines were examined at the facilities of Air Transport, Phoenix, Arizona.

Fuselage

The fuselage, empennage, and wings were destroyed by the postimpact fire. Flight continuity was established for all flight controls. All flight control system cables were either cut during recovery or exhibited tension overload-type separations. Both elevator trim tab actuators and the rudder trim tab actuator exhibited extensive thermal damage, precluding a determination of the trim tab settings. The flap actuator was observed in the fully extended position, which, according to the manufacturer, is the flaps retracted position.

Engines

Left Engine

The engine remained attached to the airframe firewall by the engine mount. The engine and attached components had sustained severe thermal damage.

The single drive-dual magneto, carburetor, fuel pump and a significant section of the accessory case and oil sump had been consumed by the fire. Impact damage and deformation was noted at the right upper section of the engine encompassing the No. 1 cylinder fins, exhaust pushrod and rocker cover.

The spark plugs were secure at each position and displayed extensive impact and thermal damage.

The various fuel supply lines at the engine and firewall were subjected to the forces of impact energy and the thermal effects of the post impact fire. There was no fuel observed.

The carburetor had been partly consumed by the thermal effects of the post impact fire. The throttle/mixture controls were found securely attached at their respective control arms of the carburetor.

Rotation of the crankshaft was precluded due to impact damage to the engine case and crankshaft at the nose of the engine. The rocker covers were removed. The complete valve train within the rocker box areas remained intact and appeared to be free of any preaccident mechanical malfunction. The combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion. The valves were intact and undamaged. There was no evidence of valve to piston face contact observed. The gas path and combustion signatures observed at the spark plugs, combustion chambers and exhaust system components displayed coloration consistent with normal operation. There was no oil residue observed in the exhaust system gas path.

Holes were drilled through the engine case material in various locations and in-line with the rotational plane of each connecting rod. A lighted borescope was inserted to visualize each connecting rod, crankshaft and camlobes at the respective cylinder position. There was no evidence of lubrication depravation or contamination found. The crankshaft and attached connecting rods remained free of heat distress. The camshaft was intact and each of the camlobes appeared normal in their shape.

Right Engine

The engine remained attached to the airframe firewall by the engine mount. The engine and attached components had sustained extensive thermal damage. The single drive-dual magneto, carburetor, fuel pump and a significant section of accessory case had been consumed by the fire.

The spark plugs were secure at each position and had been subjected to impact and thermal damage.

Rotation of the crankshaft was precluded due to impact damage to the engine case and crankshaft at the nose of the engine. The No 4. aluminum cylinder head was separated from the barrel threads. The rocker covers were removed. The complete valve train within the rocker box areas appeared to be free of any preaccident mechanical malfunction. The combustion chamber of each cylinder was examined through the spark plug holes utilizing a lighted borescope. The combustion chambers remained mechanically undamaged, and there was no evidence of foreign object ingestion. The valves were intact and undamaged. There was no evidence of valve to piston face contact observed. The gas path and

combustion signatures observed at the spark plugs, combustion chambers and exhaust system components displayed coloration consistent with normal operation. There was no oil residue observed in the exhaust system gas path.

Holes were drilled through the engine case material in-line with the rotational plane of each connecting rod. A lighted borescope was inserted to visualize each connecting rod, crankshaft and camlobes at the respective cylinder position. There was no evidence of lubrication depravation or contamination found. The crankshaft and attached connecting rods remained free of heat distress. There were no signatures or conditions observed consistent with any preaccident catastrophic mechanical malfunction. The camshaft was intact and each of the camlobes appeared normal in their shape.

Propellers

The two bladed constant speed propellers along with the attached crankshaft flange were displaced from the engine. The crankshaft fracture surface exhibited signatures consistent with torsional overload. The propeller blades remained attached at the hub.

Both blades on both propellers had fractured pitch change knobs as well as counterweight punctures in the cylinder. Impact marks on the preload plates indicated blade angles were at or near the low pitch stop of about 12°. The bearing races were found fractured with ball bearing imprints. Both the left and right side propeller blades displayed similar damage, including leading edge gouges, chordwise/rotational scoring, and bending opposite rotation.

Medical and Pathological Information

Autopsies for the flight instructor and the pilot receiving instruction were performed by County of San Diego Medical Examiner's Department, San Diego, California. The autopsies found that the cause of death for both pilots was multiple blunt force and thermal injuries.

Toxicology testing performed at the FAA Forensic Sciences Laboratory for both pilots was negative for drugs and alcohol.

Preventing Similar Accidents

Controlled Flight Into Terrain in Nighttime Visual Conditions

Controlled flight into terrain (CFIT) by both instrument flight rules (IFR)-rated and visual flight rules (VFR) pilots operating under visual flight conditions at night in remote areas have occurred, in many of these cases, when the pilots were in contact with air traffic controllers at the time of the accident and receiving radar service. The pilots and controllers involved all appear to have been unaware that the aircraft were in danger. Increased altitude awareness and better preflight planning would likely prevent these types of accidents.

CFIT accidents are best avoided through proper preflight planning. Terrain familiarization is critical to safe visual operations at night. Use sectional charts or other topographic references to ensure that your altitude will safely clear terrain and obstructions all along your route. In remote areas, especially in overcast or moonless conditions, be aware that darkness may render visual avoidance of high terrain nearly impossible and that the absence of ground lights may result in loss of horizon reference. A global positioning system-based terrain awareness unit can improve your safety of flight.

When planning a nighttime VFR flight, follow IFR practices such as climbing on a known safe course until well above surrounding terrain. Choose a cruising altitude that provides terrain separation similar to IFR flights (2,000 feet above ground level in mountainous areas and 1,000 feet above the ground in other areas.)

When receiving radar services, do not depend on air traffic controllers to warn you of terrain hazards. Although controllers will try to warn pilots if they notice a hazardous situation, they may not always be able to recognize that a particular VFR aircraft is dangerously close to terrain. When issued a heading along with an instruction to "maintain VFR," be aware that the heading may not provide adequate terrain clearance. If you have any doubt about your ability to visually avoid terrain and obstacles, advise ATC immediately and take action to reach a safe altitude if necessary. ATC radar software can provide limited prediction and warning of terrain hazards, but the warning system is configured to protect IFR flights and is normally suppressed for VFR aircraft. Controllers can activate the warning system for VFR flights upon pilot request, but it may produce numerous false alarms for aircraft operating below the minimum instrument altitude-especially in en route center airspace.

For improved night vision, the FAA recommends the use of supplemental oxygen for flights above 5,000 feet. If you fly at night, especially in remote or unlit areas, consider whether a global positioning system-based terrain awareness unit would improve your safety of flight.

See http://www.ntsb.gov/safety/safety-alerts/documents/SA_013.pdf for additional resources

The NTSB presents this information to prevent recurrence of similar accidents. Note that this should not be considered guidance from the regulator, nor does this supersede existing FAA Regulations (FARs).

Administrative Information

Investigator In Charge (IIC):	Vanover, Jackie
Additional Participating Persons:	Roger Messick; FAA; San Diego, CA Andrew Hall; Textron; Wichita, KS Mark Platt; Lycoming; Phoenix, AZ Les Doud; Hartzell; Piqua, OH
Original Publish Date:	August 11, 2020
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=97237