



AVIATION



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# Aviation Investigation Final Report

<b>Location:</b>	Shreveport, Louisiana	<b>Accident Number:</b>	CEN19FA088
<b>Date &amp; Time:</b>	February 28, 2019, 10:40 Local	<b>Registration:</b>	N428CD
<b>Aircraft:</b>	Piper PA46	<b>Aircraft Damage:</b>	Substantial
<b>Defining Event:</b>	Loss of control in flight	<b>Injuries:</b>	2 Fatal
<b>Flight Conducted Under:</b>	Part 91: General aviation - Personal		

## Analysis

The instrument-rated private pilot and passenger departed into instrument meteorological conditions with a 600-ft cloud ceiling in an airplane that was about 550 lbs over gross weight. Air traffic control data showed the airplane in a climbing left turn that continued beyond the assigned heading. After reaching 1,400 ft msl, the airplane continued turning left and its altitude and speed began to vary. The airplane continued in a left spiral, completing more than two full circles, then decelerated in a right turn and rapidly descended until impact with terrain.

Examination of the flight control system revealed no evidence of mechanical malfunctions and downloaded engine data indicated normal engine operation. Downloaded data from the autopilot system revealed three in-flight error codes. The first error code, which likely occurred about 1 minute after takeoff, would have resulted in the autopilot, if it was engaged at the time, disengaging. The subsequent error codes likely occurred during the erratic flight profile, with the autopilot disengaged.

Before the accident flight, the pilot had informed a mechanic, who is also a pilot, of intermittent issues with the autopilot system and that these issues were unresolved. The mechanic had flown with the accident pilot previously and assessed his instrument flying skills as weak. The flight instructor who provided initial flight training for the turbine engine transition stated the pilot's instrument flying proficiency was poor when he was hand flying the airplane.

Toxicology testing revealed that the pilot had used marijuana, and his girlfriend stated the pilot would take a marijuana gummy before bedtime to sleep more soundly. However, given that no psychoactive compounds were found in blood specimens, it is unlikely that the pilot was impaired at the time of the accident.

The instrument conditions at the time of the accident, the airplane's erratic flightpath, and the pilot's reported lack of instrument proficiency when flying by hand support the likelihood that the pilot experienced spatial disorientation sometime after takeoff. In addition, given the reports of the intermittently malfunctioning autopilot that had not been fixed, it is likely the pilot experienced an

increased workload during a critical phase of flight that, in combination with spatial disorientation, led to the pilot's loss of airplane control.

## Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The pilot's conduct of a departure into instrument meteorological conditions (IMC), which resulted in spatial disorientation and subsequent loss of airplane control. Contributing to the accident was the pilot's poor instrument flying skills and his decision to depart into IMC with an unresolved autopilot maintenance issue.

### Findings

<b>Personnel issues</b>	Aircraft control - Pilot
<b>Personnel issues</b>	Spatial disorientation - Pilot
<b>Personnel issues</b>	Recent instrument experience - Pilot
<b>Personnel issues</b>	Decision making/judgment - Pilot
<b>Environmental issues</b>	Below VFR minima - Effect on operation
<b>Personnel issues</b>	Decision making/judgment - Pilot
<b>Aircraft</b>	Autopilot system - Inoperative
<b>Personnel issues</b>	Use of automation - Pilot
<b>Personnel issues</b>	Aeronautical knowledge - Pilot

# Factual Information

## History of Flight

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

On February 28, 2019, about 1040 central standard time, a Piper PA46-350P airplane, N428CD, was substantially damaged when it was involved in an accident near Shreveport Downtown Airport (DTN), Shreveport, Louisiana. The private pilot and passenger were fatally injured. The airplane was operated as a Title 14 *Code of Federal Regulations* Part 91 personal flight.

The pilot and passenger were flying to Vernon, Texas, for a hunting trip. According to air traffic control (ATC) information, the airplane departed runway 32 about 1037. After climbing to 600 ft mean sea level (msl), the pilot was instructed to turn left to a heading of 270° and climb to 12,000 ft msl. According to recorded weather information, the sky condition was overcast clouds at 600 ft above ground level (agl). Radar data indicated the airplane entered a climbing left turn that continued beyond the assigned heading of 270°. The controller issued a revised heading of 140°, and the pilot responded "standby."

After climbing to 1,400 ft msl, the airplane's altitude and airspeed began to fluctuate as it continued in a tightening left spiral (see figure 1). About 35 seconds after transmitting "standby," the pilot stated, "we're in trouble up here." The airplane subsequently made a decelerating right turn then rapidly descended. The last ATC data recorded for the flight indicated a groundspeed of 31 knots at 575 ft msl.

Onboard data showed the airplane's altitude, vertical velocity, and speed oscillated several times and the turn rate increased during the last minute of the flight. From 10:39:25 to 10:39:58, the airplane's altitude varied from 1,987 to 822 to 1,980 ft msl and the vertical velocity fluctuated from -6,001 to +5,834 ft per minute (fpm). The last data captured at 10:40:07 was 1217 ft msl and -6818 fpm.

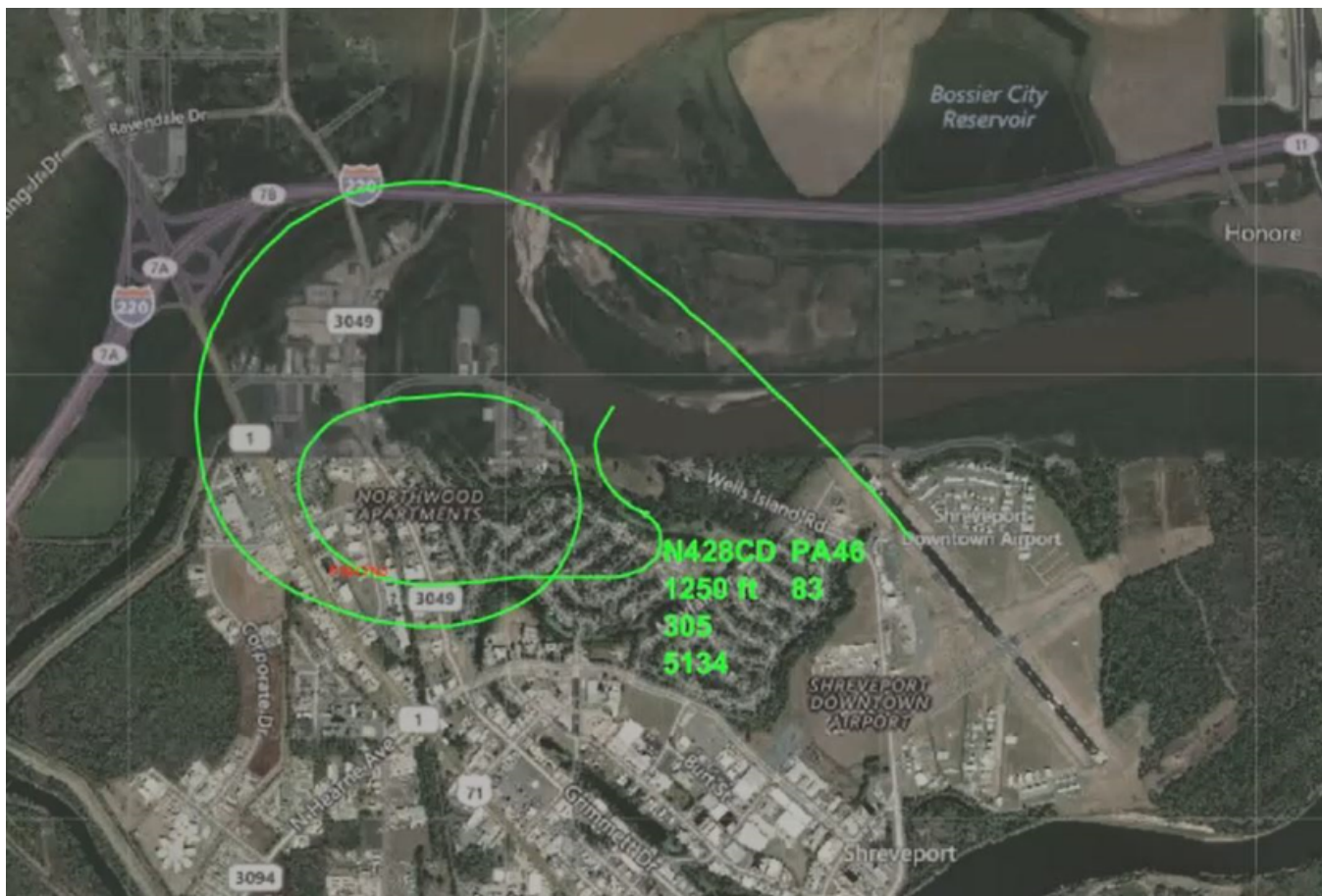


Figure 1 - Air Traffic Control Flight Track of N428CD

## Pilot Information

<b>Certificate:</b>	Private	<b>Age:</b>	61, Male
<b>Airplane Rating(s):</b>	Single-engine land	<b>Seat Occupied:</b>	Left
<b>Other Aircraft Rating(s):</b>	None	<b>Restraint Used:</b>	3-point
<b>Instrument Rating(s):</b>	Airplane	<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>	None	<b>Toxicology Performed:</b>	Yes
<b>Medical Certification:</b>	Class 3 With waivers/limitations	<b>Last FAA Medical Exam:</b>	November 22, 2017
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	May 4, 2018
<b>Flight Time:</b>	(Estimated) 1393 hours (Total, all aircraft), 323 hours (Total, this make and model), 17 hours (Last 90 days, all aircraft), 7 hours (Last 30 days, all aircraft), 0 hours (Last 24 hours, all aircraft)		

## Passenger Information

<b>Certificate:</b>		<b>Age:</b>	56, Male
<b>Airplane Rating(s):</b>		<b>Seat Occupied:</b>	Right
<b>Other Aircraft Rating(s):</b>		<b>Restraint Used:</b>	3-point
<b>Instrument Rating(s):</b>		<b>Second Pilot Present:</b>	No
<b>Instructor Rating(s):</b>		<b>Toxicology Performed:</b>	No
<b>Medical Certification:</b>		<b>Last FAA Medical Exam:</b>	
<b>Occupational Pilot:</b>	No	<b>Last Flight Review or Equivalent:</b>	
<b>Flight Time:</b>			

A review of ForeFlight and FlightAware data revealed that the pilot typically flew about three flights per month during the 12 months before the accident.

The pilot completed initial turbine transition ground and flight training in February 2016 and accomplished recurrent ground and flight training in May 2018. The flight instructor for the pilot's initial flight training stated the pilot flew well with the autopilot turned on but that his hand-flying skills during instrument training were weak; the flight instructor also indicated that he stressed to the pilot the importance of getting "recurrent [training] often" for hand flying.

## Aircraft and Owner/Operator Information

<b>Aircraft Make:</b>	Piper	<b>Registration:</b>	N428CD
<b>Model/Series:</b>	PA46 350P	<b>Aircraft Category:</b>	Airplane
<b>Year of Manufacture:</b>	1999	<b>Amateur Built:</b>	
<b>Airworthiness Certificate:</b>	Normal	<b>Serial Number:</b>	4636232
<b>Landing Gear Type:</b>	Retractable - Tricycle	<b>Seats:</b>	6
<b>Date/Type of Last Inspection:</b>	March 29, 2018 Annual	<b>Certified Max Gross Wt.:</b>	4299 lbs
<b>Time Since Last Inspection:</b>	113 Hrs	<b>Engines:</b>	1 Turbo prop
<b>Airframe Total Time:</b>	1901 Hrs as of last inspection	<b>Engine Manufacturer:</b>	Pratt & Whitney
<b>ELT:</b>	C126 installed, activated, aided in locating accident	<b>Engine Model/Series:</b>	PT6A-35
<b>Registered Owner:</b>		<b>Rated Power:</b>	750 Horsepower
<b>Operator:</b>	On file	<b>Operating Certificate(s) Held:</b>	None

The airplane underwent a JetProp DLX conversion in 2016 and was equipped with a Pratt & Whitney PT6-35 engine, and a composite MTV-16 propeller. Avionics on the airplane included a Garmin G500 primary flight display (PFD) and multifunction display (MFD), a dual Garmin GTN 750/650 GPS, an Avidyne EX600 MFD, L3 ESI-500 backup instrument system, and a King KFC 225 autopilot.

Based on pilot and passenger weights provided by the coroner, a fuel load of 120 gallons, and baggage weights from the wreckage examination, the airplane's ramp weight was estimated to be 4,906 lbs and the center of gravity was about 145.41 inches. The maximum ramp weight is 4,358 lbs and the allowable center of gravity range was 143.3 to 147.2 inches. The pilot had been informed by Rocket Engineering Corp. of ongoing efforts that were underway with the Federal Aviation Administration (FAA) to increase the maximum ramp weight to 4,518 lbs.

### Meteorological Information and Flight Plan

<b>Conditions at Accident Site:</b>	Instrument (IMC)	<b>Condition of Light:</b>	Day
<b>Observation Facility, Elevation:</b>	KDTN, 179 ft msl	<b>Distance from Accident Site:</b>	1 Nautical Miles
<b>Observation Time:</b>	10:53 Local	<b>Direction from Accident Site:</b>	131°
<b>Lowest Cloud Condition:</b>		<b>Visibility</b>	4 miles
<b>Lowest Ceiling:</b>	Overcast / 600 ft AGL	<b>Visibility (RVR):</b>	
<b>Wind Speed/Gusts:</b>	8 knots /	<b>Turbulence Type Forecast/Actual:</b>	None / None
<b>Wind Direction:</b>	320°	<b>Turbulence Severity Forecast/Actual:</b>	N/A / N/A
<b>Altimeter Setting:</b>	30.09 inches Hg	<b>Temperature/Dew Point:</b>	7°C / 5°C
<b>Precipitation and Obscuration:</b>	Moderate - None - Mist		
<b>Departure Point:</b>	Shreveport, LA (DTN )	<b>Type of Flight Plan Filed:</b>	IFR
<b>Destination:</b>	Vernon, TX (F05 )	<b>Type of Clearance:</b>	IFR
<b>Departure Time:</b>	10:37 Local	<b>Type of Airspace:</b>	Class C

### Airport Information

<b>Airport:</b>	Shreveport Downtown DTN	<b>Runway Surface Type:</b>	Asphalt
<b>Airport Elevation:</b>	179 ft msl	<b>Runway Surface Condition:</b>	Wet
<b>Runway Used:</b>	32	<b>IFR Approach:</b>	None
<b>Runway Length/Width:</b>	5018 ft / 150 ft	<b>VFR Approach/Landing:</b>	None

### Wreckage and Impact Information

<b>Crew Injuries:</b>	1 Fatal	<b>Aircraft Damage:</b>	Substantial
<b>Passenger Injuries:</b>	1 Fatal	<b>Aircraft Fire:</b>	None
<b>Ground Injuries:</b>	N/A	<b>Aircraft Explosion:</b>	None
<b>Total Injuries:</b>	2 Fatal	<b>Latitude, Longitude:</b>	32.54861, -93.76139

The airplane came to rest inverted about 17 ft below the surface of the Red River. A post recovery



examination revealed the left and right wings were fractured and remained attached to the fuselage, which was deformed with aft buckling. The vertical and horizontal stabilizers were attached to the empennage, and the elevator and trim tab were attached to the vertical stabilizer. The rudder, left aileron, left flap, portions of the right flap, and nose baggage door were separated from the airplane and not recovered.

Examination of the flight control system found the aileron cables remained attached to the control sectors, and cable continuity was established to the cabin controls. Rudder and elevator cable continuity was established through the cabin to their respective control surfaces and the elevator trim cables showed broom-straw separations aft of the pressure bulkhead. The pitch trim indicator pointed to the full nose-down position and the pitch trim barrel was in a position correlating to full nose down.

A vacuum-operated attitude indicator (AI) was mounted on the far-right side of the instrument panel. The AI was removed from the panel and disassembled; the rotor and housing showed no obvious rotational scoring.

The fuel selector was positioned between the left and right tanks, the landing gear selector was down, the flap selector was up, and the standby vacuum pump was on. The throttle, speed, and condition levers remained attached. The throttle lever was set at "INCR," the speed lever was fully forward, and the condition lever was located at a mid-travel position.

The engine remained attached to the firewall, and the exhaust section was crushed. The propeller, the propeller flange, and part of the reduction gearbox were separated and not recovered. An Electronics International MVP-50T engine data monitor (EDM); Appareo Stratus GPS receiver; autopilot; and the pitch, roll, and yaw servos were recovered from the wreckage for further examination.

EDM data captured included torque, fuel flow, fuel/oil pressures, and engine rotational speeds. No anomalies were observed during the taxi, takeoff, climb, or turning oscillations. Postaccident examination did not reveal any preaccident malfunctions or failures with the airplane or engine that would have precluded normal operation.

### **Additional Information**

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The mechanic who performed the airplane's last annual inspection stated that the pilot told him that he was having intermittent issues with the autopilot system, such as it not following a selected heading or course. The airplane was scheduled in November 2018 for work on this issue, but the appointment was not kept. In January 2019, the pilot told the mechanic that the autopilot issue had not yet been fixed.

About 2 years before the accident, the pilot asked the mechanic to install a "round dial" turn coordinator because the pilot had inadvertently entered an unusual attitude during a previous flight and wanted to have a turn coordinator available in addition to the attitude information displayed on the "glass panel" avionics. The mechanic, who was also a pilot, had flown with the accident pilot and thought his instrument flying skills were deficient.

The pilot's girlfriend, who flew with the pilot on several flights during the months leading up to the accident, stated the autopilot would frequently not engage after takeoff. When this occurred, the pilot

would focus on getting the autopilot to operate during the departure. On one of these flights, she became concerned when the airplane entered an unusual attitude.

## Medical and Pathological Information

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According to the Louisiana State University Health Sciences Center, Department of Pathology, Shreveport, Louisiana, Medical Examiner autopsy report, the pilot's cause of death was multiple blunt force injuries.

The FAA Forensic Sciences Laboratory toxicology testing detected tetrahydrocannabinol's (THC) psychoactive metabolite (11-hydroxy-delta-9-THC) in the pilot's urine but not in his blood. THC's non-psychoactive metabolite, carboxy delta-9 THC (THC-COOH), was detected in the pilot's urine and blood. However, THC was not detected in the pilot's blood or urine. The metabolite 11-hydroxy-delta-9-THC is as psychoactive as marijuana but is rapidly metabolized to THC-COOH, which can be found in urine days to weeks after the last use of the drug. Thus, positive test results for THC metabolites in both blood and urine do not reflect recent marijuana use and cannot be used to determine that the user was under the influence of the drug at the time of testing.

Toxicology testing also detected tetrahydrozoline, an over-the-counter eye drop medication commonly marketed as Visine, in the pilot's urine but not in his blood. It is not considered to be impairing.

According to the pilot's girlfriend, the pilot was physically and mentally healthy. He routinely played active sports and had no issues with dizziness or vertigo. She reported he had been using a continuous positive airway pressure machine over the last year to help him sleep soundly and that, over the last several months, he had been sleeping well. She thought he was well rested for the flight. Other than his cholesterol medication, the pilot reportedly took a marijuana gummy in the evening to help him sleep.

## Tests and Research

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The autopilot system was examined at the manufacturer's facility. Testing of the three servos and mounts revealed out-of-tolerance measurements; however, they should not have affected proper function.

Three error codes were logged during the accident flight: manual electric trim (MET) fail, roll monitor fail, and yaw fail. The MET fail code indicated that a possible latent failure of the manual electric trim switches had been detected during flight. According to the maintenance manual, when a MET fail is detected, manual electric trim is disabled, and the autopilot is automatically disengaged. The autopilot remains unavailable until a successful preflight test occurs. All flight director modes remain active.

According to the maintenance manual, a roll monitor fail is logged when the aircraft experiences roll rates in excess of +/- 14 degrees per second or a roll attitude of +/- 45 degrees. The autopilot



automatically disconnects when the roll monitor is tripped, and all flight director modes are disengaged.

According to the maintenance manual, the yaw fail is logged when a yaw rate in excess of 12 degrees per second exists. When yaw fail is logged, yaw damper mode becomes inactive without affecting other autopilot modes.

Any of the three error codes may or may not have been logged because of a hardware failure not related to the flight computer, and the autopilot did not have to be engaged for an error code to be logged. As an example, the maintenance manual recommended checking the control wheel for a physically stuck trim switch following a MET fail error.

If the autopilot had received electrical power via the avionics power switch immediately after engine start, the MET error code, roll monitor fail code, and yaw fail code occurred 29, 41, and 67 seconds after takeoff, respectively. Based on the pilot activating the avionics power switch 30 seconds after engine start, the MET error code likely occurred about 60 seconds after takeoff. The first altitude oscillation recorded on the EDM occurred about 105 seconds after takeoff.

## Administrative Information

<b>Investigator In Charge (IIC):</b>	Folkerts, Michael
<b>Additional Participating Persons:</b>	John Shamblin; Flight Standards District Office; Baton Rouge, LA Kathryn Whitaker; Piper Aircraft Inc; Vero Beach, FL Bill Gill; Honeywell Aerospace; Olathe, KS
<b>Original Publish Date:</b>	May 19, 2020
<b>Note:</b>	The NTSB traveled to the scene of this accident.
<b>Investigation Docket:</b>	<a href="https://data.nts.gov/Docket?ProjectID=99035">https://data.nts.gov/Docket?ProjectID=99035</a>

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available [here](#).