National Transportation Safety Board
Aviation Accident Final Report

Location:	Forest City, Iowa	**Accident Number:**	CEN10FA119
Date & Time:	February 12, 2010, 13:55 Local	**Registration:**	N250TT
Aircraft:	Piper PA-31T	**Aircraft Damage:**	Substantial
Defining Event:	Loss of control in flight	**Injuries:**	1 Fatal
Flight Conducted Under:	Part 91: General aviation		

Analysis

A witness reported that the multi-engine turboprop airplane was on final approach to land when it suddenly veered to the left and entered a rapid descent. The witness stated that he heard the "whine of the engines" before the airplane impacted terrain about 1/2 mile south of the runway threshold. In the days preceding the accident flight, the airplane had been at a maintenance facility to resolve a vibration in the rudder system while the autopilot system was engaged. There were no anomalies reported with the autopilot system during a test flight completed immediately before the accident flight. However, anomalies with the rate gyro were noted by a mechanic who recommended replacing it, but the pilot departed on the accident flight without the recommended repair having been completed.
Further, examination of the autopilot annunciator panel indicated that the autopilot was likely not engaged at the time of impact, likely because the airplane was on a short final approach for landing. Accordingly, any existing autopilot faults would not have affected the flight as the autopilot system was likely not in use. There were no failures identified with the primary flight controls, engines, or propellers that would have prevented the pilot from maintaining control of the airplane manually. Toxicological testing revealed the presence of Zolpidem in the pilot's blood (Zolpidem, the trade name for Ambien, is used for short-term treatment of insomnia); however, the reported levels would likely not have resulted in any impairment.

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 airplane control during final approach.

Findings

Personnel issues	Aircraft control - Pilot
Aircraft	(general) - Not attained/maintained

Factual Information

HISTORY OF FLIGHT

On February 12, 2010, at 1355 Central Standard Time, a Piper PA-31T (Cheyenne II) turboprop airplane, N250TT, impacted terrain while on final approach to runway 33 at the Forest City Municipal Airport (FXY), Forest City, Iowa. The pilot was fatally injured. The airplane was registered to and operated by Mayes Aviation, LLC, under the provisions of 14 Code of Federal Regulations Part 91, while on an instrument flight plan. Visual meteorological conditions prevailed for the business flight, which departed the Spirit of St. Louis Airport (SUS), St. Louis, Missouri, at 1223.

On the afternoon of February 9, 2010, the accident airplane arrived at FXY carrying passengers. Following that flight, the pilot reported to several individuals that he had experienced a vibration in the rudder system while the autopilot system was engaged. After a phone conversation with his mechanic, the pilot decided to reposition the airplane to SUS in order to have the autopilot system evaluated at a maintenance facility. The pilot told the airport manager at FXY that he would return on February 12, 2010, to retrieve his passengers. According to a flight tracking website, the airplane was repositioned from FXY to SUS later that same afternoon. The autopilot system was then examined by Aero Charter Jet Center (Aero Charter) over the next several days. According to statements provided by Aero Charter employees and the associated work order paperwork, the source of the rudder vibration was attributed to a faulty rate gyro which required the replacement of the device. However, due to inclement weather conditions, the replacement rate gyro was not delivered to Aero Charter by the morning of February 12, 2010. The pilot decided that he would fly the airplane without the rate gyro being replaced. The pilot signed a work declined form indicating that the rate gyro had not been repaired. The form also stated that the faulty rate gyro had an open signal path to the output-hi pin connector. Before departing the St. Louis area, the pilot and an Aero Charter avionic technician completed a test flight. The avionic technician reported that there were no anomalies with the autopilot system during the test flight. Following the uneventful test flight, the pilot requested that the airplane be topped-off with JET-A fuel and was observed in the pilot's lounge preparing for the accident flight.

According Federal Aviation Administration (FAA) Air Traffic Control (ATC) documents, the pilot obtained an instrument flight rules (IFR) clearance to FXY. After departure, the flight was cleared to SCHMD intersection before resuming the OZARK 3 departure procedure. The flight was eventually cleared to flight level (FL) 240 and to proceed direct to FXY. At 1249, the pilot reported being level at FL240. At 1306, the controller approved the pilot's request to fly direct SCHUM intersection, which was an initial approach fix (IAF) for the area navigation (RNAV)/GPS Runway 33 instrument approach into FXY. At 1318, the flight was cleared to descend to FL200. At 1920, the flight was cleared to descend at the pilot's discretion to 12,000 feet mean sea level (msl). At 1327, the pilot established radio communications with Minneapolis Air Route Traffic Control Center (ARTCC) and advised that he had the current weather observation report for FXY. At 1330, the controller cleared the flight to 5,000 feet msl. At 1333, the controller approved the pilot's request to temporarily go-off the assigned ARTCC radio frequency. About one minute later the pilot reestablished radio contact with the controller and reported descending through 7,700 feet msl for 5,000 feet msl. At 1336, the controller approved the pilot's request for an altitude block between 7,000 and 9,000 feet msl in order to perform "a little autopilot correction." At 1339, the pilot reported descending through 7,000 for 5,000 feet msl. The

controller then cleared the flight for the RNAV/GPS Runway 33 instrument approach into FXY and to continue the descent to 4,000 feet msl. At 1343, the airplane descended below available ATC radar coverage at 4,300 feet msl. The final radar return associated with the accident airplane was recorded at 1343:37 about 26 miles south-southeast of FXY. No additional flight track information was recorded for the remainder of the flight because the airplane remained below the available radar coverage for the area. At 1345, the pilot reported being established on the inbound approach and requested to descend to 3,000 feet. The controller approved the flight to descend to 3,000 feet and to change to the destination airport's common traffic advisory frequency (CTAF). The pilot replied that he had already checked in with the FXY CTAF and requested to remain on the ARTCC frequency so that he could cancel the flight plan with the controller before landing. At 1353, the pilot reported having the destination airport in sight. The controller cleared the flight for the visual approach into FXY; however, the pilot did not acknowledge that clearance or make any additional radio transmissions on the assigned ATC frequency.

The airport manager at FXY was a witness to the accident. He reported that about 12 minutes before the accident, the pilot established radio contact on the common traffic advisory frequency (CTAF) and was provided the current weather and runway conditions at the airport. About 9 minutes later, the airport manager observed the accident airplane on final approach to runway 33. He stated that the airplane was on a "normal approach" when it suddenly "veered sharply left, making a rapid descent." He reported that he heard the "whine of the engines" and then a "loud thud." The airplane impacted terrain about 1/2 mile south of the runway threshold.

PERSONNEL INFORMATION

According to FAA records, the pilot, age 66, held an airline transport pilot certificate, issued on February 22, 2007, with single and multi-engine land airplane and instrument airplane ratings. The single-engine land airplane rating was limited to commercial privileges. The pilot was type-rated for the Cessna 500 (Citation) business jet. The pilot also held a flight instructor certificate, issued on February 5, 2008, with airplane single and multi-engine land ratings. His last aviation medical examination was completed on April 21, 2009, when he was issued a second-class medical certificate with a restriction for corrective lenses. A search of FAA records showed no previous accidents, incidents, or enforcement proceedings.

The most recent pilot logbook entry was dated January 11, 2010. At that time, the pilot had accumulated 10,352 hours total flight time, of which 8,160 hours were as pilot-in-command. The logbook indicated that he had accumulated 3,189 hours in single-engine airplanes, 6,602 hours in multi-engine airplanes, 2,141 hours at night, and 1,306 hours in actual instrument conditions. The pilot had flown 253 hours during the past year, 144 hours during the prior 6 months, and 57 hours during previous 90 days. He flew an additional 34 hours in the accident airplane since the last logbook entry, according to an airplane flight log that was located in the wreckage. The pilot's most recent flight review and instrument competency check were completed in February 2008.

The pilot received specialized instruction in the accident airplane, including 10 hours of flight instruction, when the airplane was acquired by his employer in October 2009. According to available information, he had flown 113 hours in the accident airplane since it had been purchased.

AIRCRAFT INFORMATION

The accident airplane was a 1978 Piper PA-31T (Cheyenne II) turboprop airplane, serial number (s/n) 31T-7820050. Two Pratt & Whitney model PT6A-28 turbine engines powered the airplane. The airplane was equipped with two constant speed, full feathering, McCauley model 4HFR34C766/94LNA-2 propellers. The pressurized airplane had a certified maximum takeoff weight of 9,050 pounds and was equipped for operation under instrument flight rules.

The accident airplane was issued a standard airworthiness certificate on April 26, 1978. Mayes Aviation, LLC, purchased the airplane in October 2009. The recording HOBBS meter indicated 896.1 hours at the accident site. The airframe had accumulated a total service time of 9,047.6 hours at the time of the accident. The left engine (s/n PCE-51665), right engine (s/n PCE-51654), left propeller (s/n 960990), and right propeller (s/n 960993) accumulated 1,023.3 hours since being overhauled in spring 2005.

The airplane was maintained under the provisions of a manufacturer inspection program. The last event inspection of the airplane was completed on February 3, 2010, at 9,038.7 total airframe hours. The static system, altimeter system, automatic pressure altitude reporting system, and transponder were last tested on October 13, 2009.

Aircraft fueling records indicated that the airplane was topped-off with 293 gallons of Jet-A fuel before the accident flight departed SUS.

METEOROLOGICAL INFORMATION

The nearest aviation weather reporting station was located at the destination airport (FXY), about 1/2 mile north of the accident site. At 1355, the FXY automated surface observing system (ASOS) reported: wind from 110 degrees at 3 knots, visibility 2-1/2 miles, overcast ceiling at 4,600 feet above ground level, temperature -6 degrees Celsius, dew point -8 degrees Celsius, and an altimeter setting of 30.01 inches of mercury. At 1345, the ASOS system reported that the ground visibility varied between 1-1/2 and 4 miles due to light snow in the area.

AIDS TO NAVIGATION

The flight had been cleared for the RNAV/GPS Runway 33 instrument approach into FXY. The flight proceeded direct to SCHUM intersection, an initial approach fix. The inbound course was 332 degrees from SCHUM. Aircraft are to maintain at or above 3,000 feet msl until crossing SCHUM on the final approach course inbound. After crossing SCHUM, aircraft are allowed to descend to 2,900 feet msl until crossing the final approach fix (NIVIY). After crossing NIVIY, aircraft are allowed to descend to the final minimum descent altitude (MDA) of 1,520 feet msl. The runway 33 threshold is located 5.1 nautical miles from NIVIY intersection. The missed approach point is the end of runway 33.

The flight was ultimately cleared for a visual approach to runway 33 after the pilot reported having the airport in sight. A visual approach allows pilots to proceed by visual reference to the runway/airport; however, the pilot must, at all times, remain clear of any clouds and keep the airport environment or the preceding aircraft in sight until landing.

AIRPORT INFORMATION

The Forest City Municipal Airport (FXY) was located about 2 miles south of Forest City, Iowa. The airport had two runways: 15/33 (5,796 feet by 100 feet, asphalt) and runway 9/27 (2,707 feet by 60 feet,

asphalt). The general airport elevation was listed as 1,229 feet msl. The elevation of the runway 33 threshold was listed as 1,203 feet msl. A two-light precision approach path indicator (PAPI) was installed for runway 33.

FLIGHT RECORDERS

The accident airplane was not equipped, nor was it required to be equipped, with a cockpit voice recorder or flight data recorder. A handheld GPS device was recovered from the wreckage; however, the device did not contain any track data for the accident flight. No additional data sources were located at the accident site or in the recovered wreckage.

WRECKAGE AND IMPACT INFORMATION

The initial point-of-impact was about 1/2 mile south of the runway 33 threshold in an open field of deep snow. There were three trees located near the initial impact point; however, there was no evidence of the trees having been struck by the airplane during the accident sequence. A wreckage debris path originated from the initial point-of-impact on a 290 degree heading and measured 220 feet long.

All airframe structural components and flight control surfaces were located along the wreckage debris path or amongst the main wreckage. The nose landing gear and both propellers were located along the wreckage debris path. The main wreckage site consisted of the entire fuselage structure, empennage, right and left wings, and both engines. All observed structural component failures were consistent with overstress separation. All observed flight control cable separations were consistent with overstress or were cut to facilitate wreckage recovery and/or examination.

The fuselage had separated into two major sections, about mid-cabin, forward of the main cabin emergency exit window. The forward fuselage section, including the cockpit, was fragmented, consistent with impact damage. The aft fuselage section, including a majority of the main cabin and the empennage, remained intact. The left wing had completely separated from the fuselage at the wing root. The entire left wing leading edge exhibited fragmentation, consistent with impact damage. The left aileron was separated from its support mounts. The left wing flap was separated from the wing mounts and in multiple sections. The left main landing gear strut and wheel assembly had separated from the wing structure. The left inboard gear door was in the closed position, consistent with the landing gear being extended. The right wing remained partially attached to the fuselage primarily through aileron flight control cables that were cut during wreckage recovery. The right aileron remained partially attached to its wing supports. The right flap remained attached to the wing supports and was in an extended position. The right main landing gear was extended, with its inboard gear door closed. All wing fuel cells were breached and contained no recoverable fuel; however, there was a strong smell of Jet-A fuel at the accident site. Both wing tip fuel tanks had separated from their respective wings and exhibited impact damage. The empennage remained attached to the aft fuselage structure. The rudder remained attached to the vertical stabilizer and the rudder trim tab remained attached to the rudder. The elevator remained attached to the horizontal stabilizer and the elevator trim tab remained attached to the elevator.

Both engines remained attached to their respective wing nacelle mounts and exhibited impact deformation to their external housings, consistent with impact damage. Disassembly and examination of both engines revealed circumferential rubbing and scoring of several internal components, including the

compressor turbine guide vane ring, compression turbine shroud, compressor turbine, power turbine vane ring, interstage baffle, power turbine shroud, and power turbine. The observed circumferential rubbing and scoring was consistent with both engines operating at the time of impact. Both propellers had separated from their respective engines and exhibited S-shape spanwise bending and blade twisting.

MEDICAL AND PATHOLOGICAL INFORMATION

On February 13, 2010, an autopsy was performed on the pilot at the Mercy Medical Center located in Mason City, Iowa. The pilot's cause of death was attributed to multiple blunt force injuries sustained during the accident.

The FAA's Civil Aerospace Medical Institute (CAMI) in Oklahoma City, Oklahoma, performed toxicology tests on samples obtained during the pilot's autopsy. No carbon monoxide or cyanide was detected in blood samples. No ethanol was detected vitreous samples. Zolpidem was detected in liver samples and 0.039 ug/ml of Zolpidem was detected in blood samples.

On the evening of February 10, 2013, the pilot called Aero Charter Jet Center to request that his overnight bag be delivered to his hotel. The pilot stated that he needed the bag because it contained "time sensitive medication." A flight line employee delivered the overnight bag to the pilot around 2215 that same evening. The following day, the pilot had lunch with a receptionist at Aero Charter Jet Center who reported that other than a dry cough the pilot did not appear sick, nor did he mention any health related issues.

The pilot's overnight bag was recovered from the airplane following the accident. The bag contained two prescription medications, Zolpidem and Benzonatate, and several over-the-counter remedies. Zolpidem, trade name Ambien, is indicated for the short-term treatment of insomnia characterized by difficulties with sleep initiation. Benzonatate, trade name Tessalon, is indicated to control coughs. The pilot reported that he was not taking any prescription medication when he applied for his latest aviation medical certificate.

TEST AND RESEARCH

The airplane was equipped with a Bendix King Model KFC-300 three-axis autopilot system. The components of the autopilot system were removed from the wreckage for additional examination and testing. The annunciator panel contained filament light bulbs that backlit a translucent faceplate containing a label for each autopilot function/mode. While the autopilot was engaged, the individual lights provided a visual indication of the active autopilot functions/modes. The individual bulbs were examined using a microscope to determine if there was any noticeable elongation of their respective filament wires. No filament elongation was identified during the examination, which would be consistent with the autopilot not being engaged at the time of impact. The annunciator panel was operational when bench tested. The pitch, roll, and yaw axis servos were functional when bench tested. None of the servomotor clutch discs exhibited any visible impact-related markings.

The yaw servo exhibited an intermittent tach feedback output that, according to the manufacturer, can cause a servo to become overactive and oscillate at a one-hertz rate. This oscillation could be perceived as a vibration in the rudder controls (similar to what the pilot had previously reported). Resistance measurements of the yaw rate gyro revealed an open signal path to the output-hi pin connector (the same error/fault that the avionic shop diagnosed before the accident flight). Examination of the wire harness

revealed that a short wire splice was missing for the output-hi wire; however, photographs taken of the rate gyro before it was removed from the wreckage confirmed that the output-hi wire was present at the time of the accident. The rate gyro rotor did not initially spin when power was applied to the device. Further examination of the rotor revealed that it was misaligned and in contact with the rotor housing. The rate gyro functioned as designed after the rotor was realigned. Additional information concerning the autopilot component testing can be found with the docket material associated with this investigation.

History of Flight

Approach-VFR pattern final	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

Pilot Information

Certificate:	Airline transport; Flight instructor	**Age:**	66
Airplane Rating(s):	Single-engine land; Multi-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Unknown
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	Airplane multi-engine; Airplane single-engine	**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	April 21, 2009
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	February 1, 2008
Flight Time:	10352 hours (Total, all aircraft), 8160 hours (Pilot In Command, all aircraft), 57 hours (Last 90 days, all aircraft), 34 hours (Last 30 days, all aircraft), 1 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N250TT
Model/Series:	PA-31T	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	31T-7820050
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	February 3, 2010 Continuous airworthiness	**Certified Max Gross Wt.:**	9050 lbs
Time Since Last Inspection:	9 Hrs	**Engines:**	2 Turbo prop
Airframe Total Time:	9048 Hrs at time of accident	**Engine Manufacturer:**	P&W
ELT:	C91A installed, activated, aided in locating accident	**Engine Model/Series:**	PT6A-28
Registered Owner:		**Rated Power:**	620 Horsepower
Operator:		**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	FXY,1229 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	13:55 Local	**Direction from Accident Site:**	360°
Lowest Cloud Condition:		**Visibility**	2 miles
Lowest Ceiling:	Overcast / 4600 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	3 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	110°	**Turbulence Severity Forecast/Actual:**	/ Unknown
Altimeter Setting:	30.01 inches Hg	**Temperature/Dew Point:**	-6°C / -8°C
Precipitation and Obscuration:	Light - None - Snow		
Departure Point:	St. Louis, MO (SUS)	**Type of Flight Plan Filed:**	IFR
Destination:	Forest City, IA (FXY)	**Type of Clearance:**	IFR
Departure Time:	12:23 Local	**Type of Airspace:**	Class G

Airport Information

Airport:	Forest City Municipal Airport FXY	**Runway Surface Type:**	Asphalt
Airport Elevation:	1229 ft msl	**Runway Surface Condition:**	Dry
Runway Used:	33	**IFR Approach:**	Global positioning system
Runway Length/Width:	5796 ft / 100 ft	**VFR Approach/Landing:**	Straight-in

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:**	43.234722,-93.624168(est)

Administrative Information

Investigator In Charge (IIC):	Fox, Andrew
Additional Participating Persons:	Terence T Carr; Federal Aviation Administration - Des Moines FSDO; Ankeny, IA Ronald Maynard; Piper Aircraft, Inc.; Vero Beach, FL Thomas A Berthe; Pratt & Whitney Canada Corp.; South Burlington, VT Bill Gill; Honeywell; Olathe, KS
Original Publish Date:	February 3, 2014
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=75359

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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.