Aviation Investigation Final Report

Location:	Kirksville, Missouri	**Accident Number:**	CEN14FA042
Date & Time:	November 5, 2013, 19:12 Local	**Registration:**	N408DM
Aircraft:	Piper PA-32R-301	**Aircraft Damage:**	Destroyed
Defining Event:	Loss of control in flight	**Injuries:**	2 Fatal
Flight Conducted Under:	Part 91: General aviation - Instructional		

Analysis

The flight instructor accompanied the private pilot on a business flight to provide instrument flight instruction. Dark night instrument meteorological conditions prevailed with a 15-knot headwind that was gusting to 20 knots. The pilots were cleared for an instrument approach and instructed to change to the local advisory frequency. Recorded radar data indicated that the airplane was tracking the inbound course to the airport. One of the pilots contacted the airport on the local advisory frequency and gave two position reports; the last one reported the airplane was 5 miles from the airport. There was no other communication with the pilots. It could not be determined which pilot was flying the airplane when the accident occurred.

The wreckage was located about 3.5 miles north of the airport, and the initial tree impact was about 0.4 mile east of the last radar contact. The location of the accident site was consistent with the airplane turning left away from the inbound course and descending rapidly after the last radar contact. Given the dark night instrument meteorological conditions, the most likely explanation for the turn and rapid descent is that the flying pilot experienced spatial disorientation and lost control of the airplane. Examination of the accident site indicated that the airplane was in a nose-up attitude when it contacted the trees on the up sloping terrain, and it continued to climb, clearing the crest of the hill and continuing down the other side, before it came to rest. The wreckage path was consistent with a possible attempt to recover from the descent just before impacting the trees, but by then there was insufficient altitude to avoid the accident. Examination of the airplane and engine found no evidence of preimpact mechanical malfunctions or failures that would have precluded normal operation.

A commuter airline pilot who landed at the airport 15 minutes before the accident stated that the weather conditions were such that the lights from the radio antenna towers along the approach course illuminated the clouds around him with a white flashing light similar to airplane anti-collision lights or runway end identifier lights. If similar conditions were present during the accident airplane's approach, this phenomenon could have distracted the pilots. However, there is insufficient information to determine

either the presence of this phenomenon during the accident airplane's approach or its role in this accident.

The pilots began their first flight of the day about 0804, and the accident occurred on their third flight of the day at 1912. Assuming the pilots woke up about 2 hours before they began the first flight, they had been awake about 13 hours when the accident occurred. The combined flights totaled about 5 hours 46 minutes of flight time. The cumulative flight time in conjunction with the extended time since awakening most likely resulted in the pilots experiencing some level of fatigue at the time of the accident.

Although the instructor's autopsy revealed that he had severe coronary artery disease, it could not be determined whether this contributed to the accident. The private pilot's toxicology results were positive for diphenhydramine, a sedating antihistamine, and impairment from this over-the-counter medication likely contributed to the accident whether he was actively flying or observing the instructor fly the approach at the time of the loss of control.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: A loss of control due to spatial disorientation. Contributing to the accident were the private pilot's impairment due to a sedating antihistamine and both pilots' fatigue.

Findings

Environmental issues	Low ceiling - Effect on personnel
Personnel issues	Spatial disorientation - Instructor/check pilot
Personnel issues	Spatial disorientation - Student/instructed pilot
Personnel issues	Aircraft control - Pilot
Personnel issues	OTC medication - Student/instructed pilot

Factual Information

History of Flight

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

On November 5, 2013, about 1912 central standard time (cst), a Piper PA-32R-301, N408DM, registered to RFG LLC and operated by Wisconsin Aviation, collided with trees and the terrain during an instrument approach to the Kirksville Regional Airport (IRK), Kirksville, Missouri. The certificated flight instructor (CFI) and private pilot were fatally injured. The airplane was destroyed. The business/instructional flight was being operated under 14 Code of Federal Regulations Part 91. The airplane was operating in instrument meteorological conditions (IMC) shortly before the accident and an instrument flight plan was filed. The flight originated from the Centennial Airport (APA), Denver, Colorado, about 1543.

According to the operator of the airplane the private pilot had flown to Denver for a business trip and was receiving instrument flight instruction from the CFI during the trip as part of the Pilot Mentor Program.

The pilots' initial departure airport on the day of the accident was in Kearney, Nebraska. They departed the Kearney Regional Airport (EAR) at 0804 cst and flew to the Sterling Municipal Airport (STK), Sterling, Colorado where they landed at 0832 mountain standard time (mst). They departed STK at 0907 mst en route to APA where they landed at 0956 mst. Fixed base operator (FBO) personnel at APA reported the pilots requested that the airplane be "topped" off with fuel. The pilots then left the airport in a rental car and returned later in the day. FBO personnel reported that they did not notice anything unusual with either the pilots or the airplane.

At 1305 mst, the pilots received a weather briefing through the CSC Direct User Access Terminal Service (DUATS) for a flight from APA to the Quincy Regional Airport (UIN), Quincy, Illinois. At 1349 mst, the CFI contacted the Prescott Contracted Flight Service Station and requested to cancel a previously filed flight plan to UIN, and to file a new flight plan to IRK. The CFI stated they were going back to Wisconsin, but were going to stop at IRK for fuel. The CFI reported they had 6 hours of fuel on board for the 3 hour 45 minute flight. The briefer asked if he wanted a weather briefing, adverse weather information, or notice to airmen information and the instructor replied "no" and that he had been looking at those all morning. The airplane departed APA at 1443 mst en route to IRK.

Radar data indicated the airplane flew a direct route from APA to IRK. The airplane was in contact with the Kansas City Air Route Traffic Control Center when they were cleared for the area navigation (RNAV) global positioning system (GPS) RWY 18 approach. The controller then cleared the airplane to switch to the common traffic advisory frequency at IRK. A FBO employee at IRK stated the pilot of N408DM checked in on the common frequency stating they were 7 miles from the airport and landing on runway 18. A second radio call was received from the airplane stating they were 5 miles away. The

FBO employee radioed the wind and altimeter information to the airplane. The pilot did not reply, but had keyed the radio several times to turn on the pilot controlled airport lighting. When the airplane did not land, the FBO employee attempted to contact the airplane to no avail. Airport personnel then received a call from the Kansas City air traffic control center inquiring about the airplane. Local authorities searched for the airplane which was subsequently located about two hours later in a wooded area four miles north-northeast of the airport. The last radar contact was about .4 miles west of the initial tree impact at an altitude of 1,900 feet.

One witness who lived a half mile south of the accident site reported hearing an airplane near his house around 1900 and a short time later he heard a loud noise. This witness stated the engine sounded normal.

PERSONNEL INFORMATION

The CFI held a commercial pilot certificate with airplane single-engine land, multi-engine land, and instrument airplane ratings. His CFI certificate, which was renewed on May 18, 2012, contained airplane single-engine land, multi-engine land, and instrument airplane ratings. In addition, he held a ground instructor certificate with an advanced rating. The CFI held a Federal Aviation Administration (FAA) second-class medical certificate issued on July 16, 2013. The medical certificate contained the limitations "Must have available glasses for near vision. Not valid for any class after 1/31/2014."

The CFI's most current logbook was marked as "Book 6" and it contained entries from July 5, 2013, through October 22, 2013. The instructor's total flight time was 10,367.5 hours. The logbook contained 10 flights in the accident airplane totaling 19.1 hours of flight time. The instructor's actual instrument flight time was listed as 359.3 hours and his simulated instrument time was 134.9 hours. The instructor's last flight review was on October 24, 2013.

The private pilot was issued his private pilot certificate with an airplane single-engine land rating on September 23, 2011. He was issued a FAA third-class medical certificate on September 30, 2013. The medical certificate contained the restriction that the pilot must have glasses available for near vision.

The private pilot's logbook was not located during the investigation. On the application for his last medical certificate, the pilot reported having 365 hours of total flight time with 55 hours of that time having been flown in the last 6 months. The CFI's last logbook contained information for a flight on October 7, 2013, in the accident airplane. The remarks for this entry contained the private pilot's name along with the annotation "BFR" indicating the private pilot had a flight review on that date. There were no other remarks containing the private pilot's name in the CFI's logbook dated July 5, 2013, through October 22, 2013.

According to Wisconsin Aviation, the private pilot had been receiving instrument flight instruction from the accident CFI; however, it is unknown how much instruction he had received.

AIRCRAFT INFORMATION

The accident airplane was a Piper PA-32R-301, serial number 32R-8113012. It was a six-place, low-wing, single-engine airplane with retractable landing gear. Wisconsin Aviation purchased the airplane on March 21, 2012. RFG, LLC, the private pilot's LLC, purchased the airplane from Wisconsin Aviation on April 26, 2012. The private pilot leased the airplane back to Wisconsin Aviation who used it as a rental airplane and for training.

Maintenance records show the last annual inspection on the airframe was completed on May 15, 2013, at an aircraft total time of 3,057.7 hours and a tachometer time of 171.2. A 100-hour inspection was completed on October 30, 2013, at an aircraft total time of 3,157.0 hours and a tachometer time of 270.5 hours. The tachometer time at the time of the accident was 282.1 hours.

The airplane was equipped with a 300- horsepower, Lycoming IO-540-K1G5D engine, serial number L-19436-48A. On April 16, 2013 the engine was removed from the airplane following a propeller strike. The engine was inspected, repaired, and reinstalled on the airplane on May 15, 2013. An annual inspection was completed at the same time. The engine logbook showed the engine had a total time of 3,547.9 hours and a tachometer time of 171.2 hours when it was reinstalled. A 100-hour inspection was completed on October 30, 2013, at an engine total time of 3,647.2 hours.

The airplane was equipped with a Hartzell propeller model HC-C3YR-1RF, serial number PA638B, which was installed on the airplane on April 15, 2013. An annual inspection was completed on May 15, 2013, and the last 100-hour inspection was completed on October 30, 2013.

The airplane was topped off with 42 gallons of fuel prior to departing APA.

METEOROLOGICAL INFORMATION

The weather conditions reported by the IRK Automated Surface Observation System (AWOS) at 1855 were: wind from 170 at 15 knots, gusting to 20 knots; visibility 9 miles with mist; ceiling 800 overcast; temperature 14 degrees Celsius; dew point 13 degree Celsius, and altimeter 29.92 inches of mercury.

Three Airmen's Meteorological Information notices (AIRMETS) were current for the area encompassing IRK. AIRMET ZULU called for icing conditions between the freezing level and 25,000 feet. The freezing level was above 5,000 feet. AIRMET SIERA warned of instrument conditions with ceilings below 1,000 feet and visibility below 3 statute miles with precipitation. AIRMET TANGO called for moderate turbulence below 10,000 feet.

A Cape Air pilot who flew the GPS 18 approach and landed at IRK 15 minutes prior to the accident stated there was a strong wind from the south gusting in excess of 20 knots while on the approach. He stated his ground speed was 25 to 35 knots lower than his indicated airspeed. He stated the weather conditions were IMC including light to moderate rain, and continuous light to occasional moderate turbulence during the approach. He stated he broke out of the clouds at 1,600 feet above mean sea level (msl).

WRECKAGE AND IMPACT INFORMATION

The wreckage was located about 3.5 miles north of IRK. The terrain elevation at the initial tree impact was about 925 feet. The airplane initially contacted a 70 foot tall tree on the upslope side of a rolling hill. The airplane continued up the hill, over the crest of the hill, and down the other side of the heavily wooded hill, prior to coming to rest. The total wreckage path was about 790 feet long. The outboard sections of both wings were located near the initial tree impact followed by the right aileron and an inboard section of the right wing. Sections of the wings, empennage, and fuselage were scattered along the wreckage path. The first visible impact with the ground was located outside of the wooded area between two wooden power poles. The main portion of the fuselage came to rest inverted at the edge of

a bean field. The airplane traveled about 650 feet through the wooded area and an additional 140 feet once it exited the wooded area prior to coming to rest.

Examination of the airframe revealed the fuselage was separated into several sections which were found along the wreckage path. The roof of the cabin was separated from the lower portion of the cabin. The left front seat, along with the flooring beneath the seat, was separated from the remainder of the fuselage. The right seat was in place with the seat frame being bent rearward. The seatbelt and shoulder harnesses for both front seats remained attached to their respective attach points. The belt and harnesses were buckled. The seat belt webbing was stretched.

The fuel selector valve was separated from the structure, but remained attached to the fuselage. The fuel valve was positioned to the left main tank. The fuel sump bowl was fractured. No debris was noted in either the bowl or filter.

The flap handle and linkage sustained impact damage and the position of the handle could not be determined.

Both wings were separated from the fuselage at the wing root. In addition, the wings were separated into numerous pieces which were found scattered along the wreckage path. The ailerons and flaps were separated from their respective wings and found along the wreckage path. The aileron control cables were secured at to the bellcranks in each wing and were intact up to the wing root section. The separation at each wing root was broomstrawed, indicative of an overload separation. The cockpit end of the aileron cables were secured to the control wheel chain. The flap positions could not be determined. The landing gear was in the extended position. The fuel system was compromised due to impact forces.

The left side of the horizontal stabilator sustained impact damage and remained attached to the aft fuselage. The right side of the horizontal stabilator, including the pitch trim tab, was separated from the aft fuselage and located along the wreckage path. The pitch trim cables were separated and exhibited broomstraw separations. The trim drum was fully extended upward to the full nose up trim position. This most likely occurred during the impact sequence. The stabilator control cables were attached to the balance bar. The cables were separated between the cockpit and the control surface. The separated ends of the cables exhibited broomstraw signatures. The cables were attached to the control wheel T-bar in the cockpit.

The vertical stabilizer was separated from the empennage and the rudder was separated from the vertical stabilizer. The rudder control cables remained attached to the rudder bellcrank which remained in place. The cables were separated between the rudder and the cockpit. The separated ends of the cables exhibited broomstraw signatures.

Examination of the engine revealed all accessories remained attached to the back of the engine. All of the spark plugs were in good conditions with normal wear signatures with the exception of the #1 top plug which was impact damaged. The dual magneto was turned by hand and spark was noted on all of the spark plug leads. The engine driven fuel pump was intact and it squirted fuel when pumped by hand. Compression was achieved on all cylinders when the propeller was rotated by hand. The engine driven vacuum pump rotated smoothly when the shaft was turned by hand. The pump was disassembled and the vanes and block were intact. The standby electric vacuum pump was disassembled and it was noted that

the vanes and rotor were intact. The fuel servo and oil pickup screens were clean. The fuel injector nozzles were clean. The fuel flow divider was opened and the plunger and diagram were intact.

The propeller remained attached to the crankshaft propeller flange and all three blades were secured in the hub. All three blades were bent rearward to varying degrees. The blades contained gouges and chordwise scratching. The tip of one blade was missing. Two pieces of tree limbs were found along the wreckage path that contained 45 degree cuts.

No anomalies were identified with the engine, the engine components, or the propeller that would have prevented their normal operation.

MEDICAL AND PATHOLOGICAL INFORMATION

Autopsies were performed on the CFI and private pilot by the Boone/Callaway County Medical Examiner's Office on November 7, 2013. The death of both pilots was attributed to injuries sustained in the accident.

Toxicology testing for the pilots was performed by the FAA Civil Aerospace Medical Institute.

Private Pilot

The private pilot did not report any chronical medical conditions or medications when his last FAA medical certificate was issued. No significant natural diseases were identified in the autopsy report.

Toxicological test results showed the following:

0.109 (ug/ml, ug/g) Diphenhydramine detected in blood

Diphenhydramine detected in urine

Diphenhydramine is a sedating antihistamine used to treat colds, allergy symptoms, and as a sleep aid. It is available over the counter under various trade names including Benadryl and Unisom. Diphenhydramine carries the following warning: may impair mental and/or physical ability required for the performance of potentially hazardous tasks (e.g., driving, operating heavy machinery). The therapeutic range for diphenhydramine is 0.0250 to 0.1120 ug/ml.

Compared to other antihistamines, diphenhydramine causes marked sedation. Altered mood and impaired cognitive and psychomotor performance may also be observed.

CFI

A review of FAA medical records show the CFI had a 17 year history of coronary artery disease that began with a heart attack. The pilot underwent recurrent procedures in 1996 to open a clogged artery including placement of a stent in the right coronary artery. A cardiac catheterization in 2001, indicated the stent was occluded but had active collaterals supplying blood flow to the distal portions of the right coronary artery and no ischemic on a nuclear stress test. The FAA granted him a special issuance second class medical certificate. Following that, a routine stress test imaging study did not identify ischemia.

According to the autopsy, the CFI had moderate to severe coronary stenosis of the left main (50%) and severe stenosis of the left anterior descending artery (70-90%) at the time of the accident.

Test results for the CFI showed the following:

Dextromethorphan detected

Dextromethorphan in urine

Dextromethorphan detected in blood (cavity)

Dextrorphan detected in urine

Dextrorphan detected in blood (cavity)

Metoprolol detected in urine

Metoprolol detected in blood (cavity)

715.8 (ug/ml, ug/g) Salicylate detected in urine

Dextromethorphan is a cough suppressant available in many over the counter cough and cold medications. Dextrorphan is a metabolite of dextromethorphan. Metoprolol is a beta-blocker used to treat hypertension and to reduce the risk of death and recurrent heart attacks in patients who have already had one heart attack. Salicylate is a metabolite of aspirin.

ADDITIONAL INFORMATION

The Cape Air pilot who landed at IRK approximately 15 minutes prior to the accident stated that while approaching the final approach fix (WOGED), the clouds around him were illuminated by a white flashing light similar to anti-collision lights or runway end identifier lights (REILS). He stated he knew he was not close to the airport so the lights could not have been the REILS. He verified his anti-collision lights were off and double checked his navigational aids to verify his position. He stated he was still about 2 miles from WOGED at 2,500 feet msl. The pilot reported there was no lightning in the area and that the rate of the flashing was too regular and consistent to have been lightning. He stated that after about 5 seconds the flashing was gone. He attributed the flashing to the radio/antenna towers below him near the approach course. The pilot stated the flashing lights were not disorienting, but slightly confusing. However, since he was familiar with the approach he knew the flashing light was from the towers.

Another pilot who routinely flew in and out of IRK and who landed about an hour after the accident reported the flashing light was from the tower can be distracting, but he did not notice the light on the night of the accident when he landed.

A damaged iPad was recovered from the accident site. The iPad was sent to the National Transportation Safety Board Vehicle Recorder Division for examination. No data could be recovered from the device due to the amount of damage.

Pilot Information

Certificate:	Commercial; Flight engineer	**Age:**	66
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 2 With waivers/limitations	**Last FAA Medical Exam:**	July 16, 2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	October 24, 2013
Flight Time:	10368 hours (Total, all aircraft), 19.1 hours (Total, this make and model), 174.3 hours (Last 90 days, all aircraft), 53 hours (Last 30 days, all aircraft)		

Pilot Information

Certificate:	Private	**Age:**	64
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	None	**Second Pilot Present:**	Yes
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With waivers/limitations	**Last FAA Medical Exam:**	September 30, 2013
Occupational Pilot:	No	**Last Flight Review or Equivalent:**	October 7, 2013
Flight Time:	(Estimated) 365 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Piper	**Registration:**	N408DM
Model/Series:	PA-32R-301	**Aircraft Category:**	Airplane
Year of Manufacture:	1981	**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	32R-8113012
Landing Gear Type:	Retractable - Tricycle	**Seats:**	6
Date/Type of Last Inspection:	October 30, 2013 100 hour	**Certified Max Gross Wt.:**	3600 lbs
Time Since Last Inspection:	12 Hrs	**Engines:**	1 Reciprocating
Airframe Total Time:	3157 Hrs as of last inspection	**Engine Manufacturer:**	Lycoming
ELT:	Installed, activated, did not aid in locating accident	**Engine Model/Series:**	IO-540-K1G5D
Registered Owner:	RFG LLC	**Rated Power:**	160 Horsepower
Operator:	RFG LLC	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Instrument (IMC)	**Condition of Light:**	Night/dark
Observation Facility, Elevation:	KIRK,966 ft msl	**Distance from Accident Site:**	4 Nautical Miles
Observation Time:	18:55 Local	**Direction from Accident Site:**	13°
Lowest Cloud Condition:		**Visibility**	9 miles
Lowest Ceiling:	Overcast / 800 ft AGL	**Visibility (RVR):**	
Wind Speed/Gusts:	15 knots / 20 knots	**Turbulence Type Forecast/Actual:**	/ None
Wind Direction:	170°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	29.92 inches Hg	**Temperature/Dew Point:**	14°C / 13°C
Precipitation and Obscuration:	N/A - None - Mist		
Departure Point:	Denver, CO (APA)	**Type of Flight Plan Filed:**	IFR
Destination:	Kirksville, MO (IRK)	**Type of Clearance:**	IFR
Departure Time:	15:43 Local	**Type of Airspace:**	Class E

Airport Information

Airport:	Kirksville Regional Airport IRK	**Runway Surface Type:**	Concrete
Airport Elevation:	966 ft msl	**Runway Surface Condition:**	Wet
Runway Used:	18	**IFR Approach:**	Global positioning system
Runway Length/Width:	6005 ft / 100 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	2 Fatal	**Aircraft Damage:**	Destroyed
Passenger Injuries:		**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	2 Fatal	**Latitude, Longitude:**	40.145832,-92.528335(est)

Administrative Information

Investigator In Charge (IIC):	Sullivan, Pamela
Additional Participating Persons:	Tom Bartels; FAA; Kansas City, MO Michael McClure; Piper; Vero Beach, FL Troy Helgeson; Lycoming; Williamsport, PA
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