National Transportation Safety Board
Aviation Accident Final Report

Location:	Lanai City, HI	**Accident Number:**	WPR14FA124
Date & Time:	02/26/2014, 2130 HST	**Registration:**	N483VA
Aircraft:	PIPER PA31	**Aircraft Damage:**	Substantial
Defining Event:	Controlled flight into terr/obj (CFIT)	**Injuries:**	3 Fatal, 3 Serious
Flight Conducted Under:	Part 135: Air Taxi & Commuter - Non-scheduled		

Analysis

The airplane departed during dark (moonless) night conditions over remote terrain with few ground-based light sources to provide visual cues. Weather reports indicated strong gusting wind from the northeast. According to a surviving passenger, shortly after takeoff, the pilot started a right turn; the bank angle continued to increase, and the airplane impacted terrain in a steep right bank. The accident site was about 1 mile from the airport at a location consistent with the airplane departing to the northeast and turning right about 180 degrees before ground impact. The operator's chief pilot reported that the pilot likely turned right after takeoff to fly direct to the navigational aid located southwest of the airport in order to escape the terrain-induced turbulence (downdrafts) near the mountain range northeast of the airport. Examination of the airplane wreckage revealed damage and ground scars consistent with a high-energy, low-angle impact during a right turn. No evidence was found of preimpact mechanical malfunctions or failures that would have precluded normal operation.

It is likely that the pilot became spatially disoriented during the right turn. Although visual meteorological conditions prevailed, no natural horizon and few external visual references were available during the departure. This increased the importance for the pilot to monitor the airplane's flight instruments to maintain awareness of its attitude and altitude. During the turn, the pilot was likely performing the additional task of engaging the autopilot, which was located on the center console below the throttle quadrant. The combination of conducting a turn with few visual references in gusting wind conditions while engaging the autopilot left the pilot vulnerable to visual and vestibular illusions and reduced his awareness of the airplane's attitude, altitude, and trajectory.

Based on toxicology findings, the pilot most likely had symptoms of an upper respiratory infection but the investigation was unable to determine what effects these symptoms may have had on his performance. A therapeutic level of doxylamine, a sedating antihistamine, was detected, and impairment by doxylamine most likely contributed to the development of spatial disorientation.

Probable Cause and Findings

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

The pilot's spatial disorientation while turning during flight in dark night conditions and terrain-induced turbulence, which resulted in controlled flight into terrain. Contributing to the accident was the pilot's impairment from a sedating antihistamine.

Findings

Personnel issues	Spatial disorientation - Pilot (Cause)
	Aircraft control - Pilot (Cause)
	OTC medication - Pilot (Factor)
Environmental issues	Terrain induced turbulence - Effect on operation
	Dark - Effect on personnel

Factual Information

HISTORY OF FLIGHT

On February 26, 2014, about 2130 Hawaii standard time, a Piper PA-31-350, N483VA, collided with terrain shortly after departure from the Lanai Airport (PHNY), Lanai City, Hawaii. The commercial pilot and two passengers were fatally injured, and three other passengers were seriously injured. The airplane was substantially damaged and was partially consumed by postimpact fire. The airplane was registered to Maui Aircraft Leasing, LLC, and operated by Maui Island Air under the provisions of 14 Code of Federal Regulations Part 135 on demand air taxi flight. Visual meteorological conditions prevailed for the flight, which operated on a visual flight rules flight plan. The flight had a planned destination of Kahului Airport, Kahului, Hawaii.

The National Transportation Safety Board (NTSB) investigator-in-charge (IIC) interviewed one of the survivors 6 days after the accident. The survivor reported that after the airplane departed the runway, he could see the lights of Lanai City and the Big Dipper star constellation off the left side of the airplane as it started its right banking turn. As he pointed out the constellation to the passenger seated to his right, he felt the sensation of G-loading in his seat. Shortly after, he said simultaneously his legs were forced towards the left side of the airplane and his upper body towards the isle. While trying to regain his position, he said he looked up, and saw the pilot leaning his upper body towards the right; it appeared that he was looking to the right, as if out the forward right cabin window. He said the airplane was in a steep right bank when he saw the ground impact the forward side of the airplane. He recalls that there was no realization that there was an emergency situation and that he had flown rougher [turbulent] flights before in this airplane.

PERSONNEL INFORMATION

A review of Federal Aviation Administration (FAA) airman records revealed that the 66-year-old-pilot held a commercial pilot certificate with ratings for airplane multiengine land and instrument airplane, and private privileges for airplane single-engine land. His second-class medical certificate was issued in March of 2013, with the limitation that he must wear corrective lenses for near and distant vision.

According to the pilot's last medical application, the pilot reported a total flight experience of 4,570 total hours, and 1 hour in the last six months.

The passengers onboard were Maui County employees on a business trip.

AIRCRAFT INFORMATION

The 10-seat, low-wing, retractable-gear airplane, serial number 31-7552124, was manufactured in 1975. It was powered by Lycoming model TIO-540-J2BD and LTIO-540-J2BD engines. The airplane was also equipped with Hartzell model HC-E3YR-2ALTF and HC-E3YR-2ATF constant speed propellers. The airplane was on an FAA Approved Aircraft Inspection Program

(AAIP). Review of the maintenance logbook records showed an inspection [event inspection number #3] was completed December 1, 2013, at a total airplane time of 12,172.4 hours. A total airplane time at the accident site was undetermined due to damage.

Fueling records at Air Service Hawaii established that the airplane was last fueled on February 26, 2014, at 1559, with the addition of 27 gallons of 100LL-octane aviation fuel.

METEOROLOGICAL INFORMATION

A review of recorded data from PHNY, automated weather observation station revealed at 2056 conditions were wind 050 degrees at 21 knots, with gusts to 25 knots, visibility 10 statute miles, clear sky, temperature 18 degrees C, dew point 16 degrees C, and an altimeter setting of 30.03 inches of mercury.

According to the Astronomical Applications Department at the United States Naval Observatory, the official moonset was at 1611, and the official end of civil twilight was at 1853. The phase of the moon on the day of the accident was waning crescent, with 9 percent of the moon's visible disk illuminated.

COMMUNICATIONS

A VFR flight plan was filed, and no ATC communications took place.

AIRPORT INFORMATION

The FAA Digital Airport/Facility Directory indicated that PHNY Airport had an Automated Surface Observation System (ASOS), which broadcast on frequency 118.375.

The FAA Digital Airport/Facility Directory indicated that runway 03 was 5,001 feet long, 150 feet wide, and the runway surface was asphalt. The airport has an instrument landing system (ILS), and distance measuring equipment (DME) instrument approaches.

WRECKAGE AND IMPACT INFORMATION

An initial examination of the accident site by the IIC, revealed that the airplane impacted terrain southeast of the airport, about 1 mile perpendicular to the arrival end of runway 03. The debris field was about a 640-foot-long, and stretched from the first identified point contact (FIPC) to an engine component near the main wreckage. The FIPC was a ground scar that stretched about 160-feet-in-length and about 1-foot in width. Charring vegetation was observed about 100 feet down the ground scar from the FIPC, and fanned out on either side of the debris path for about 260 feet; it was about 50 feet in width at its widest point. The majority of the wreckage debris was found in the last 2/3 of the debris field. The main wreckage was mostly consumed by postimpact fire. Both wings separated from the main wreckage outboard of the engine nacelles. The tail section including the left and right side elevators; the rudder surface and vertical stabilator remained attached to the empennage.

A follow-up examination of the accident site was conducted on May 13, 2014, due to additional ground scars found in an aerial photograph of the accident site. During the follow-up

examination, an FAA inspector and the IIC found the additional ground scar, which was about 360 feet in length about 270 feet, east-northeast from the original FIPC and was consistent with a right wing impact. Wing tip fairing sections and wing tip light assembly components were found near the mid-section of the ground scar. A plexiglas light cover was found near the east-north east end of the ground scar. The debris field had a total length of 1,270 feet with a magnetic heading of 250 degrees. See the Wreckage Diagram in the docket of this accident for further information.

The examination of the recovered airframe and flight control system components revealed no evidence of preimpact mechanical malfunction. Examination of the engines and propellers revealed that they separated from their nacelles with sections of the engine mounting assembly bent and attached. The propellers remained attached to the engines. Examination of both recovered engines and system components revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation.

The attitude indicator was found onsite after the initial examination of the accident site. An examination of the recovered attitude indicator revealed no evidence of mechanical malfunctions or failures that would have precluded normal operation. The attitude indicator had minor damage to its housing, and the instrument face indication would not move freely when the instrument was tumbled by hand. The instrument was disassembled, and the gyro and surrounding housing revealed no mechanical rubbing.

MEDICAL AND PATHOLOGICAL INFORMATION

An autopsy of the pilot was conducted by the Maui Memorial Medical Center, Wailuku, Hawaii. According to the autopsy report, the cause of death was multiple blunt force injuries sustained in an aircraft crash.

Toxicology testing was performed at the request of the coroner by NMS laboratories identified caffeine, dextromethorphan and its metabolite dextrorphan, pseudoephedrine and its metabolite norpseudoephedrine, as well as doxylamine in the pilot's blood.

Toxicology testing was also performed on specimens from the pilot by the FAA Forensic Toxicology Research Team, Oklahoma City, Oklahoma. The toxicology report was negative for carbon monoxide, cyanide, and ethanol. The toxicology report identified dextromethorphan, its metabolite dextrorphan, pseudoephedrine, ephedrine, trimethoprim, doxylamine, and montelukast in blood and liver.

Review of the FAA medical certification file, autopsy report and toxicology tests, was conducted by the NTSB Medical Officer. Documents revealed that the pilot reported to the FAA that he had hay fever and childhood asthma. At the time of the accident, the pilot's medical certificate was limited by the need for corrective lenses. Mild enlargement of the heart and mild coronary artery disease was identified on autopsy. Postaccident toxicology testing in two laboratories identified caffeine, dextromethorphan and its metabolite dextrorphan, pseudoephedrine and its metabolite norpseudoephedrine, ephedrine, trimethoprim, doxylamine, and montelukast. The doxylamine was quantified at 120 and 62 ng/ml in the two laboratories.

For further information, see the Medical Factual Report within the public docket for this accident.

TEST AND RESEARCH

Spatial Disorientation

According to the FAA Airplane Flying Handbook (FAA-H-8083-3), "Night flying is very different from day flying and demands more attention of the pilot. The most noticeable difference is the limited availability of outside visual references. Therefore, flight instruments should be used to a greater degree.... Generally, at night it is difficult to see clouds and restrictions to visibility, particularly on dark nights or under overcast. The pilot flying under VFR must exercise caution to avoid flying into clouds or a layer of fog." The handbook described some hazards associated with flying in airplanes under VFR when visual references, such as the ground or horizon, are obscured. "The vestibular sense (motion sensing by the inner ear) in particular tends to confuse the pilot. Because of inertia, the sensory areas of the inner ear cannot detect slight changes in the attitude of the airplane, nor can they accurately sense attitude changes that occur at a uniform rate over a period of time. On the other hand, false sensations are often generated; leading the pilot to believe the attitude of the airplane has changed when in fact, it has not. These false sensations result in the pilot experiencing spatial disorientation."

According to the FAA Instrument Flying Handbook (FAA-H-8083-15), a rapid acceleration "...stimulates the otolith organs in the same way as tilting the head backwards. This action creates the somatogravic illusion of being in a nose-up attitude, especially in situations without good visual references. The disoriented pilot may push the aircraft into a nose-low or dive attitude." The FAA publication Medical Facts for Pilots (AM-400-03/1), described several vestibular illusions associated with the operation of aircraft in low visibility conditions. Somatogyral illusions, those involving the semicircular canals of the vestibular system, were generally placed into one of four categories, one of which was the "graveyard spiral." According to the text, the graveyard spiral, "...is associated with a return to level flight following an intentional or unintentional prolonged bank turn. For example, a pilot who enters a banking turn to the left will initially have a sensation of a turn in the same direction. If the left turn continues (~20 seconds or more), the pilot will experience the sensation that the airplane is no longer turning to the left. At this point, if the pilot attempts to level the wings this action will produce a sensation that the airplane is turning and banking in the opposite direction (to the right). If the pilot believes the illusion of a right turn (which can be very compelling), he/she will reenter the original left turn in an attempt to counteract the sensation of a right turn. Unfortunately, while this is happening, the airplane is still turning to the left and losing altitude. Pulling the control yoke/stick and applying power while turning would not be a good idea–because it would only make the left turn tighter. If the pilot fails to recognize the illusion and does not level the wings, the airplane will continue turning left and losing altitude until it impacts the ground."

ADDITIONAL INFORMATION

During a conversation with the NTSB IIC, the Chief Pilot of Maui Island Air reported that when they normally depart from runway 3 at PHNY, "it's like flying into a black hole" with no distant

lights for situational awareness. He thought that the airplane could have hit down drafts off the mountain north of the airport during the right turn, and more than likely the pilot would have gone direct to the VHF omni directional radio range and a tactical air navigation system (VORTAC) located 1.6 miles southwest of the PHNY to escape the downdrafts. He stated that he would normally engage the autopilot once the airplane was established at 3,500 feet mean sea level (msl). He explained by leaning slightly to the right and reaching down with his right hand where the autopilot would be located as if positioned in the pilot seat. The autopilot unit is located below the throttle quadrant.

History of Flight

Initial climb	Controlled flight into terr/obj (CFIT) (Defining event)

Pilot Information

Certificate:	Commercial; Private	**Age:**	66
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Unknown
Other Aircraft Rating(s):	None	**Restraint Used:**	3-point
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):	None	**Toxicology Performed:**	Yes
Medical Certification:	Class 3 With Waivers/Limitations	**Last FAA Medical Exam:**	03/31/2013
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	4570 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	PIPER	**Registration:**	N483VA
Model/Series:	PA31 350	**Aircraft Category:**	Airplane
Year of Manufacture:	1975	**Amateur Built:**	No
Airworthiness Certificate:	Normal	**Serial Number:**	31-7552124
Landing Gear Type:	Retractable - Tricycle	**Seats:**	10
Date/Type of Last Inspection:	12/01/2013, AAIP	**Certified Max Gross Wt.:**	4573 lbs
Time Since Last Inspection:		**Engines:**	2 Reciprocating
Airframe Total Time:	12172.4 Hours as of last inspection	**Engine Manufacturer:**	LYCOMING
ELT:	Installed, not activated	**Engine Model/Series:**	TIO-540 SER
Registered Owner:	MAUI AIRCRAFT LEASING LLC	**Rated Power:**	310 hp
Operator:	Maui Island Air	**Operating Certificate(s) Held:**	On-demand Air Taxi (135)
Operator Does Business As:	Maui Island Air	**Operator Designator Code:**	

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Night
Observation Facility, Elevation:	PHNY, 1308 ft msl	**Distance from Accident Site:**	1 Nautical Miles
Observation Time:	2056 HST	**Direction from Accident Site:**	346°
Lowest Cloud Condition:	Clear	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	21 knots / 25 knots	**Turbulence Type Forecast/Actual:**	/ Terrain-Induced
Wind Direction:	50°	**Turbulence Severity Forecast/Actual:**	/ Light
Altimeter Setting:	30.03 inches Hg	**Temperature/Dew Point:**	18°C / 16°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Lanai City, HI (LNY)	**Type of Flight Plan Filed:**	VFR
Destination:	KAHULUI, HI (OGG)	**Type of Clearance:**	VFR
Departure Time:	2130 HST	**Type of Airspace:**	Class E

Airport Information

Airport:	LANAI AIRPORT (LNY)	**Runway Surface Type:**	Asphalt
Airport Elevation:	1308 ft	**Runway Surface Condition:**	Dry
Runway Used:	03	**IFR Approach:**	None
Runway Length/Width:	5001 ft / 150 ft	**VFR Approach/Landing:**	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	2 Fatal, 3 Serious	**Aircraft Fire:**	On-Ground
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	3 Fatal, 3 Serious	**Latitude, Longitude:**	20.773056, -156.944444 (est)

Administrative Information

Investigator In Charge (IIC):	Andrew L Swick	**Report Date:**	10/21/2015
Additional Participating Persons:	Herman Rios; FAA-FSDO; Honolulu, HI Mark Platt; Lycoming Engines; Phoenix, AZ Charles Little; Piper Aircraft, Inc.; Los Angeles, CA Les A Doud; Hartzell Propeller Inc.; Piqua, OH		
Publish Date:	11/08/2016		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.ntsb.gov/pubdms/search/dockList.cfm?mKey=88851		