



National Transportation Safety Board Aviation Accident Final Report

Location:	Cleveland, OH	Accident Number:	CEN17FA072
Date & Time:	12/29/2016, 2257 EST	Registration:	N614SB
Aircraft:	CESSNA 525	Aircraft Damage:	Destroyed
Defining Event:	Loss of control in flight	Injuries:	6 Fatal
Flight Conducted Under:	Part 91: General Aviation - Personal		

Analysis

The airplane entered a right turn shortly after takeoff and proceeded out over a large lake. Dark night visual conditions prevailed at the airport; however, the airplane entered instrument conditions shortly after takeoff. The airplane climb rate exceeded 6,000 fpm during the initial climb and it subsequently continued through the assigned altitude of 2,000 ft mean sea level. The flight director provided alerts before the airplane reached the assigned altitude and again after it had passed through it. The bank angle increased to about 62 degrees and the pitch attitude decreased to about 15 degrees nose down, as the airplane continued through the assigned heading. The bank angle ultimately decreased to about 25 degrees. During the subsequent descent, the airspeed and descent rate reached about 300 knots and 6,000 fpm, respectively. The enhanced ground proximity warning system (EGPWS) provided both "bank angle" and "sink rate" alerts to the pilot, followed by seven "pull up" warnings.

A postaccident examination of the recovered wreckage did not reveal any anomalies consistent with a preimpact failure or malfunction.

It is likely that the pilot attempted to engage the autopilot after takeoff as he had been trained. However, based on the flight profile, the autopilot was not engaged. This implied that the pilot failed to confirm autopilot engagement via an indication on the primary flight display (PFD). The PFD annunciation was the only indication of autopilot engagement. Inadequate flight instrument scanning during this time of elevated workload resulted in the pilot allowing the airplane to climb through the assigned altitude, to develop an overly steep bank angle, to continue through the assigned heading, and to ultimately enter a rapid descent without effective corrective action. A belief that the autopilot was engaged may have contributed to his lack of attention.

It is also possible that differences between the avionics panel layout on the accident airplane and the airplane he previously flew resulted in mode confusion and contributed to his failure to engage the autopilot. The lack of proximal feedback on the flight guidance panel might have contributed to his failure to notice that the autopilot was not engaged.

The pilot likely experienced some level of spatial disorientation due to the dark night lighting conditions, the lack of visual references over the lake, and the encounter with instrument meteorological conditions. It is possible that once the pilot became disoriented, the negative learning transfer due to the differences between the attitude indicator display on the accident airplane and the airplane previously flown by the pilot may have hindered his ability to properly apply corrective control inputs.

Available information indicated that the pilot had been awake for nearly 17 hours at the time of the accident. As a result, the pilot was likely fatigued which hindered his ability to manage the high workload environment, maintain an effective instrument scan, provide prompt and accurate control inputs, and to respond to multiple bank angle and descent rate warnings.

Probable Cause and Findings

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

Controlled flight into terrain due to pilot spatial disorientation. Contributing to the accident was pilot fatigue, mode confusion related to the status of the autopilot, and negative learning transfer due to flight guidance panel and attitude indicator differences from the pilot's previous flight experience.

Findings

Personnel issues	Spatial disorientation - Pilot (Cause)
	Alertness/Fatigue - Pilot (Factor)
	Monitoring equip/instruments - Pilot (Factor)
	Total experience w/ equipment - Pilot (Factor)

Factual Information

History of Flight

Initial climb	not used
	Navigation error
	Other weather encounter
	Collision avoidance alert
	Loss of control in flight (Defining event)
Uncontrolled descent	Collision with terr/obj (non-CFIT)

On December 29, 2016, at 2257 eastern standard time, a Cessna 525C (Citation CJ4) airplane, N614SB, was destroyed during an in-flight collision with Lake Erie shortly after takeoff from runway 24R (6,604 feet by 150 feet, asphalt) at the Burke Lakefront Airport (BKL), Cleveland, Ohio. The pilot and five passengers were fatally injured. The airplane was registered to Maverick Air LLC and operated by the pilot under the provisions of Title 14 *Code of Federal Regulations* Part 91 as a personal flight. Night visual meteorological conditions prevailed for the flight, which was operated on an instrument flight rules (IFR) flight plan. The intended destination was the Ohio State University Airport (OSU), Columbus, Ohio.

The pilot and passengers departed OSU about 1730 and arrived at BKL about 1800. The pilot checked in at the fixed base operator (FBO) at 1812. The pilot and passengers attended a local sporting event before returning to the airport about 2230.

A review of the air traffic control (ATC) communications transcript, the cockpit voice recorder (CVR) transcript, automated dependent surveillance – broadcast (ADS-B) data, and full authority digital engine control (FADEC) unit data revealed the following:

At 2255, the pilot was cleared for takeoff. He was instructed to turn right to a heading of 330° and maintain 2,000 feet mean sea level (msl) after departure. The pilot acknowledged the clearance. At 2256:33, the engine power increased for takeoff, and 15 seconds later the airplane became airborne. At 2257:09, an automated voice annunciated "altitude." A second "altitude" annunciation followed 14 seconds later. At 2257:25, a sound similar to a decrease in engine power was recorded. Two seconds later, the enhanced ground proximity warning system (EGPWS) provided an excessive bank angle warning. At 2257:29, about 2 seconds after the bank angle warning, the tower controller instructed the pilot to contact departure control. The pilot replied, "to departure six one four sierra bravo;" however, that communication was not received by the tower controller suggesting that the pilot did not have the microphone push-to-talk button depressed.

At 2257:37, the controller again attempted to contact the pilot. Two seconds after the controller's transmission, the EGPWS provided a "sink rate" warning to the pilot. The pilot again responded, "six one four sierra bravo," but this was not received by the tower controller. Beginning at 2257:43, the EGPWS provided 7 "pull up" warnings at 1.6-second intervals until the end of the CVR recording. During that time, a sound similar to the overspeed warning

began, which continued until the end of the recording. The CVR recording ended at 2257:58.

The tower controller's continued attempts to contact the pilot were unsuccessful, and he subsequently initiated search and rescue procedures.

A summary of the operational factors associated with the accident, including a detailed history of flight, is included in the docket associated with the investigation.

Pilot Information

Certificate:	Private	Age:	45, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	Seat Occupied:	Left
Other Aircraft Rating(s):	Helicopter	Restraint Used:	5-point
Instrument Rating(s):	Airplane	Second Pilot Present:	No
Instructor Rating(s):	None	Toxicology Performed:	No
Medical Certification:	Class 3 Without Waivers/Limitations	Last FAA Medical Exam:	10/15/2015
Occupational Pilot:	No	Last Flight Review or Equivalent:	12/08/2016
Flight Time:	1205 hours (Total, all aircraft), 56 hours (Total, this make and model), 919 hours (Pilot In Command, all aircraft), 56 hours (Last 90 days, all aircraft), 22 hours (Last 30 days, all aircraft), 0.5 hours (Last 24 hours, all aircraft)		

The pilot's Cessna 525 single-pilot type rating was added December 8, 2016, after he successfully completed the prescribed Federal Aviation Administration (FAA) practical test (checkride). His initial Cessna 525 training was completed in the accident airplane. The pilot subsequently completed a simulator-based recurrent training course at FlightSafety International on December 17, 2016.

The pilot had accumulated a total of 56.5 hours in Cessna 525 airplanes. Of that time, 8.7 hours were as pilot-in-command which included the practical test. His most recent logged flight was on December 17 from Orlando International (MCO) to OSU. The pilot owned a Cessna 510 (Mustang) for about 2 years before purchasing the accident airplane. He had logged 372.9 hours total time in Cessna 510 airplanes. Interviews with the pilot's instructor confirmed that the pilot was trained to consistently use the autopilot after takeoff.

Available information indicated that the pilot had been awake for nearly 17 hours at the time of the accident.

Aircraft and Owner/Operator Information

Aircraft Make:	CESSNA	Registration:	N614SB
Model/Series:	525	Aircraft Category:	Airplane
Year of Manufacture:	2012	Amateur Built:	No
Airworthiness Certificate:	Commuter	Serial Number:	525C0072
Landing Gear Type:	Retractable - Tricycle	Seats:	11
Date/Type of Last Inspection:	12/17/2016, AAIP	Certified Max Gross Wt.:	17110 lbs
Time Since Last Inspection:	1 Hours	Engines:	2 Turbo Fan
Airframe Total Time:	861.5 Hours at time of accident	Engine Manufacturer:	Williams International
ELT:	C126 installed, activated, did not aid in locating accident	Engine Model/Series:	FJ44-4A
Registered Owner:	Maverick Air LLC	Rated Power:	3621 lbs
Operator:	On file	Operating Certificate(s) Held:	None

FAA records revealed that the airplane was issued a standard airworthiness certificate in January 2012 and was subsequently exported to Brazil. The airplane was imported to the United States and purchased by the owner in October 2016. An FAA standard airworthiness certificate was issued at that time.

According to the airplane maintenance records, the most recent inspection was completed on October 3, 2016, at 812.7 hours airframe total time. Compliance with all current airworthiness directives and mandatory service bulletins was confirmed at that time. Additional maintenance work was completed on October 14, 2016, at 814.1 hours total airframe time. The most recent maintenance work occurred on December 17, 2016, at 860.7 hours total airframe time.

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	Condition of Light:	Night/Dark
Observation Facility, Elevation:	BKL, 584 ft msl	Distance from Accident Site:	2 Nautical Miles
Observation Time:	2300 EST	Direction from Accident Site:	135°
Lowest Cloud Condition:	Scattered / 1500 ft agl	Visibility	9 Miles
Lowest Ceiling:	Broken / 2300 ft agl	Visibility (RVR):	
Wind Speed/Gusts:	22 knots / 31 knots	Turbulence Type Forecast/Actual:	/
Wind Direction:	260°	Turbulence Severity Forecast/Actual:	/
Altimeter Setting:	29.74 inches Hg	Temperature/Dew Point:	1°C / -2°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Cleveland, OH (BKL)	Type of Flight Plan Filed:	IFR
Destination:	Columbus, OH (OSU)	Type of Clearance:	IFR
Departure Time:	2256 EST	Type of Airspace:	Class D

The observations from BKL and Cleveland Hopkins International (CLE) indicated that marginal visual conditions prevailed at the time of the accident. Precipitation was reported in the one-minute observations at BKL until 2251, with no precipitation reported at the surface until 2342. While the surface temperature remained above freezing after the airplane landed at BKL and about the accident time, the dew point temperature remained below freezing the entire time with precipitation occurring on and off in the snow shower activity.

Airport Information

Airport:	Burke Lakefront (BKL)	Runway Surface Type:	Asphalt
Airport Elevation:	584 ft	Runway Surface Condition:	Wet
Runway Used:	24R	IFR Approach:	None
Runway Length/Width:	6604 ft / 150 ft	VFR Approach/Landing:	None

Wreckage and Impact Information

Crew Injuries:	1 Fatal	Aircraft Damage:	Destroyed
Passenger Injuries:	5 Fatal	Aircraft Fire:	None
Ground Injuries:	N/A	Aircraft Explosion:	None
Total Injuries:	6 Fatal	Latitude, Longitude:	41.554722, -81.703333

The accident site was located in Lake Erie about 2 miles northwest of BKL. The depth of the lake at that location was about 40 feet. Search and recovery efforts were hampered by weather and lake conditions. Airplane debris, including the cockpit voice recorder, was located beginning on January 5. The recovery operations were conducted over the following 2 weeks as lake conditions permitted.

A postaccident examination of the recovered wreckage did not reveal any anomalies consistent with a preimpact failure or malfunction.

Medical And Pathological Information

An autopsy and toxicology testing were not performed due to the limited remains recovered.

Additional Information

Flight Guidance Panel

The flight guidance panel (FGP), located on the glareshield, allows the pilot to select manual or autopilot guidance for airplane control. The autopilot button is located on the upper row of button controls near the right side of the panel. Autopilot engagement is indicated in the flight control system display area along the upper portion of the primary flight display (PFD). There is no indication of the autopilot status on or near the autopilot button on the flight guidance panel.

A comparison of the Cessna 525 systems and those of the airplane previously flown by the pilot, a Cessna 510, revealed that the autopilot engagement button on the Cessna 510 is located in a slightly different location on the Automatic Flight Control System (AFCS) panel. In the Cessna 510, autopilot engagement is indicated along the upper portion of the PFD similar to the accident airplane. In addition, an indicator light adjacent to the autopilot button on the AFCS panel is illuminated when the autopilot is engaged.

Primary Flight Display

The attitude indicator presented by the PFD on the Cessna 525 was an ego-centric ("inside out") type display. An "inside out" perspective involves a fixed aircraft symbol and moving

horizon similar to what a pilot sees when looking outside of the aircraft. On the other hand, the Cessna 510 utilizes an exo-centric ("outside in") display. An "outside in" perspective involves a fixed horizon and a moving aircraft symbol.

Spatial Disorientation

The FAA Civil Aeromedical Institute's publication, "Introduction to Aviation Physiology," defines spatial disorientation as a loss of proper bearings or a state of mental confusion as to position, location, or movement relative to the position of the earth. Factors contributing to spatial disorientation include changes in acceleration, flight in IMC, frequent transfer between visual meteorological conditions (VMC) and IMC, and unperceived changes in aircraft attitude.

The FAA's Airplane Flying Handbook (FAA-H-8083-3A) describes some hazards associated with flying when the ground or horizon are obscured. The handbook states, in part: "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."

Administrative Information

Investigator In Charge (IIC):	Timothy Sorensen	Report Date:	07/16/2018
Additional Participating Persons:	Vincent A Yerace; FAA Flight Standards; North Olmsted, OH Andrew Hall; Textron Aviation; Wichita, KS James Boyle; Williams International; Walled Lake, MI Robert Haug; Rockwell Collins; Cedar Rapids, IA		
Publish Date:	07/16/2018		
Note:	The NTSB traveled to the scene of this accident.		
Investigation Docket:	http://dms.nts.gov/pubdms/search/dockList.cfm?mKey=94545		

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